Statens haverikommission
Swedish Accident Investigation Authority

Final report RL 2020:05e

Serious incident at Stockholm/Västerås Airport on 4 September 2019 involving the aeroplane SE-LZF of the type Cessna 172, operated by OSM Aviation Academy, and the aeroplane SE-GVE of the type Piper PA-28, operated by the Voluntary Flying Corps.

File no. L-136/19

15 May 2020

SHK investigates accidents and incidents from a safety perspective. Its investigations are aimed at preventing a similar event from occurring in the future, or limiting the effects of such an event. The investigations do not deal with issues of guilt, blame or liability for damages.

The report is also available on SHK´s web site: 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 no. 3 – © Anders Sjödén/Swedish Armed Forces.

Postadress/Postal address
P.O. Box 6014
SE-102 31 Stockholm
Sweden

Besöksadress/Visitors
Sveavägen 151
Stockholm

Telefon/Phone
+46 8 508 862 00

Fax/Facsimile
+46 8 508 862 90

E-post/E-mail
info@havkom.se

Internet
www.havkom.se

Content

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 are intended to clarify, as far as possible, the sequence of events and their causes, as well as damages and other consequences. The results of an investigation shall provide the basis for decisions aiming at preventing a similar event from occurring in the future, or limiting the effects of such an event. The investigation shall also provide a basis for assessment of the performance of rescue services and, when appropriate, for improvements to these rescue services.

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

SHK does not have any supervisory role and its investigations do not deal with issues of guilt, blame or liability for damages. Therefore, accidents and incidents are neither investigated nor described in the report from any such perspective. These issues are, when appropriate, dealt with by judicial authorities or e.g. by insurance companies.

The task of SHK also does not include investigating how persons affected by an accident or incident have been cared for by hospital services, once an emergency operation has been concluded. Measures in support of such individuals by the social services, for example in the form of post crisis management, also are not the subject of the investigation.

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 24 September 2019 that a serious incident involving two aeroplanes with the registrations SE-LZF and SE-GVE had occurred at Stockholm/Västerås Airport, Västmanland County, on 4 September 2019 at 09:45 hrs.

The incident has been investigated by SHK, represented by Mikael Karanikas, Chairperson, Gideon Singer, Investigator in Charge, Nicolas Seger, Operations Investigator until 31 December 2019, and Håkan Josefsson, Operations Investigator.

David Waller has participated as adviser for the European Union Aviation Safety Agency (EASA).

Magnus Axelsson, Toni Reuterstrand and Marcus Oswaldsson have participated as advisers for the Swedish Transport Agency.

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

Investigation material

Interviews have been conducted with the pilots, the management of the Voluntary Flying Corps (Frivilliga Flygkåren, FFK), OSM Aviation Academy (OSM) and the managing director of the airport.

Sensor data has been obtained from LFV.

A meeting with the interested parties was held on 25 November 2019. At the meeting, SHK presented the facts discovered during the investigation, available at the time.

Limitations

The actions of a third aeroplane, with registration SEK-KHP, in the aerodrome traffic circuit have not had a direct influence on the occurrence and have therefore not been analysed.

Final report RL 2020:05

Time of occurrence	4 September 2019, at 09:45 hrs in daylight Note: All times are given in Swedish daylight saving time (UTC[1] + 2 hours)
Location	Stockholm/Västerås Airport, Västmanland County, (position 5935N 01638E, 460 metres above mean sea level)
Weather	According to SMHI's analysis: wind approx. north 5–10 knots, visibility >10 km, cloud 1–3/8 with ceiling at 1,500–2,000 feet, temperature/dewpoint +9/+7°C, QNH[2] 1012 hPa
Aircraft: A	
Registration, type	SE-LZF, Cessna 172 Series (Skyhawk)
Model	172R
Class, airworthiness	Normal, Certificate of Airworthiness and valid Airworthiness Review Certificate (ARC)[3]
Operator	OSM Aviation Academy
Type of flight	Schooling
Persons on board:	2
Crew members including cabin crew	2
Passengers	None
Injuries to persons	None
Damage to the aircraft	None
Other damage	None
Instructor:	
Age, licence	48 years, CPL[4]
Total flying hours	4,094 hours, of which 3,490 hours on type
Flying hours previous 90 days	85 hours, of which 45 hours on type
Number of landings previous 90 days	48 on type
Student:	
Age, licence	30 years, CPL
Total flying hours	618 hours, of which 587 hours on type
Flying hours previous 90 days	74 hours, of which 73 hours on type
Number of landings previous 90 days	111 on type

[1] UTC – Coordinated Universal Time.
[2] QNH – barometric pressure at mean sea level.
[3] ARC – Airworthiness Review Certificate.
[4] CPL – Commercial Pilot Licence.

Aircraft B:

Registration, type	SE- GVE, PA-28
Model	PA-28-161 (Warrior II)
Class, airworthiness	Normal, Certificate of Airworthiness and valid Airworthiness Review Certificate (ARC)
Owner	In accordance with a decision concerning flight safety conditions
Type of flight	Schooling
Persons on board:	2
Crew members including cabin crew	2
Passengers	None
Injuries to persons	None
Damage to the aircraft	None
Other damage	None
The instructor:	
Age, licence	65 years, PPL[5]
Total flying hours	5,558 hours, of which > 1,000 hours on type
Flying hours previous 90 days	90 hours, of which 48 hours on type
Number of landings previous 90 days	64 on type
Student:	
Age, licence	37 years, PPL
Total flying hours	209 hours, of which 21 hours on type
Flying hours previous 90 days	59 hours, of which 6 hours on type
Number of landings previous 90 days	41

[5] PPL – Private Pilot Licence.

SUMMARY

A near collision occurred on 4 September 2019 in the airspace over the runway at Stockholm/Västerås Airport. The pilots detected each other's aeroplanes at a late stage and performed avoidance manoeuvres. At the time of the incident, the airport was open and the navigation aids were functioning. However, the airport's tower (TWR) was closed and the airspace uncontrolled (class G airspace). AIP Sweden states that the airport's terminal manoeuvring area (TMA) and control area (CTR) are only established during the tower's hours of operation.

One of the aeroplanes, a Cessna 172, was being operated in accordance with an IFR flight plan and was performing repeated instrument NDB[6] approaches to runway 01. The other aeroplane, a Piper PA-28, was being flown in accordance with a VFR flight plan and was on a training flight that encompassed navigation flying to the west of the airport and joined the traffic circuit for landing in accordance with the published VFR procedure.

The fact that the aeroplanes were adhering to different AIP procedures for IFR and VFR approaches, respectively, resulted in their flight paths crossing at the same altitude over the runway. Sensor data shows that both aeroplanes passed close to one another at about the same altitude and with a minimum horizontal separation of 150 metres (0.08 Nm). In addition, sensor data show that the Piper PA-28 made a sharp avoidance manoeuvre to the right just before the paths crossed.

It is SHK's opinion that the incident has demonstrated the risks involved in VFR and IFR approaches taking place at the same time to an uncontrolled aerodrome in uncontrolled airspace where the published approach procedures' flight paths cross one another at the same altitude.

The investigation has also shown that there are differences of opinion as to whether the regulations allow IFR approaches to open instrument aerodromes where the tower is closed, i.e. in uncontrolled airspace. It is SHK's opinion that there is a need to clarify the implications of the regulations in this respect and communicate this in a clear manner to both aerodromes and pilots.

The incident was caused by the aeroplanes adhering to two different approach procedures with flight paths that crossed one another at the same altitude.

Several factors may have contributed to the incident. The window beam of the Cessna may, to a certain extent, have blocked the Cessna pilot's view and may thereby have contributed to late detection of the approaching PA-28. The Cessna pilot, who was flying in accordance with IFR rules, may be presumed to have been concentrating primarily on the flight and navigation instruments and not sufficiently on outward visual observations. Furthermore, the Cessna was below the horizon from the perspective of the PA-28, which may have made it more difficult for the pilot of the PA-28 to detect the Cessna earlier.

[6] NDB – Non Directional Beacon.

Another contributing factor may have been that the crew of the PA-28 did not fully understand the intentions of the Cessna because they did not have valid instrument ratings and therefore did not have knowledge of the format of the IFR procedures at the airport.

Safety recommendations

The Swedish Transport Agency is recommended to:

- In consultation with the EASA, clarify the prerequisites for IFR flights to uncontrolled instrument aerodromes and take action to ensure this is communicated to all parties concerned. *(RL 2020:05 R1)*

1. FACTUAL INFORMATION

1.1 History of the flight

1.1.1 Circumstances

A near collision occurred on 4 September 2019 in the airspace above the runway at Stockholm/Västerås Airport. At the time of the incident, the airport was open and the navigation aids were functioning. However, the tower (TWR) was closed.

One of the aeroplanes, a Cessna 172 with the call sign Scavac1W, was operated by OSM Aviation Academy. The flight was being performed in accordance with an IFR[7] flight plan and involved repeated instrument NDB approaches to runway 01. During each approach, a go-around was initiated in accordance with the instrument missed approach procedure, after which the aeroplane climbed to 1,500 feet, followed by a right turn back for a new NDB approach (see Figure 1). The purpose of the flight was to provide flight training to one of the school's instructors in order for them to qualify as an instrument rating instructor (IRI[8]). The commander who was instructing sat in the left seat and acted as student, while the instructor being trained sat in the right seat and acted as instructor. The instrument approach was performed without any visual screening being used in the cockpit.

[7] IFR – Instrument Flight Rules.
[8] IRI – Instrument Rating Instructor.

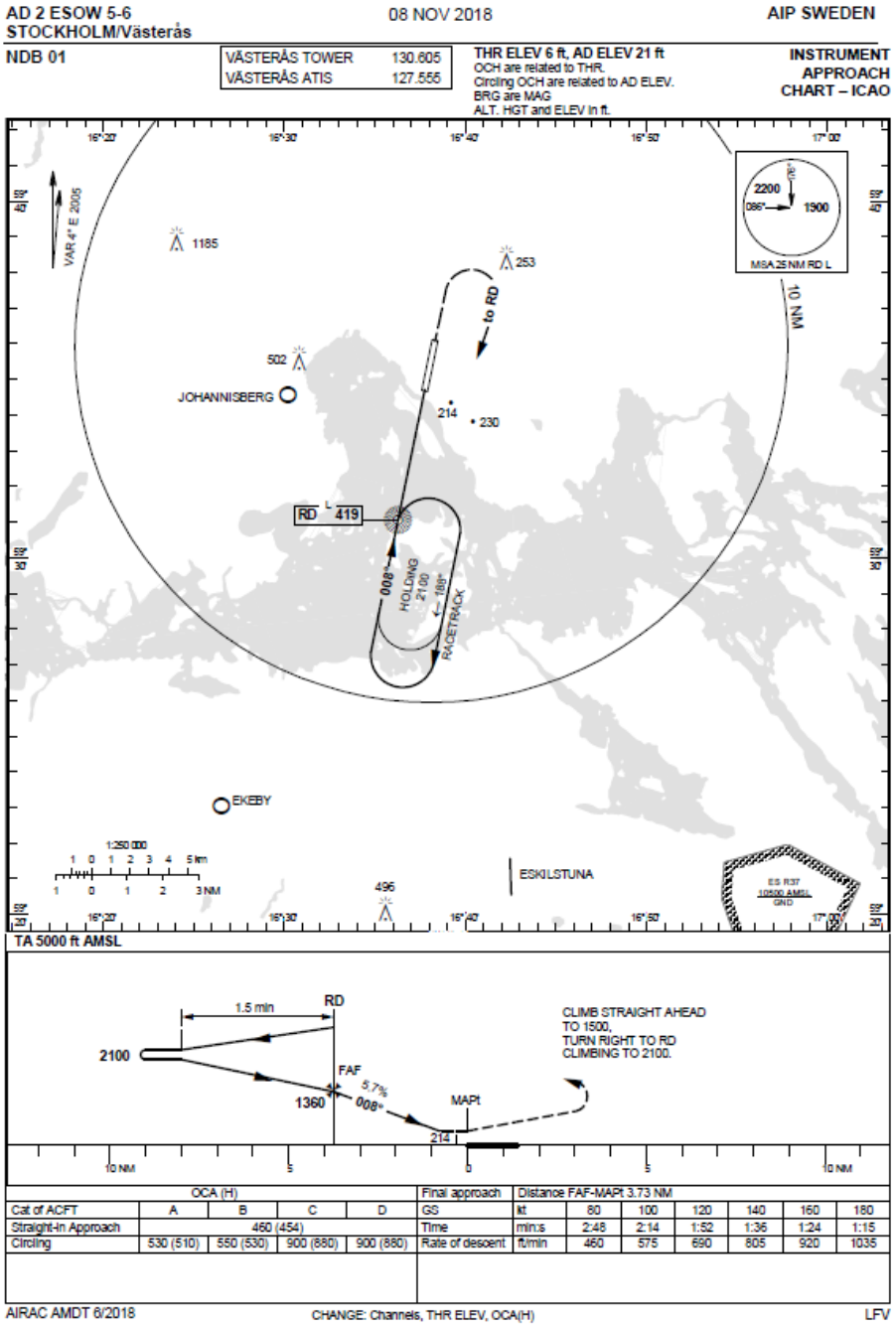

Figure 1. Chart for instrument approach NDB 01. The lower part shows the vertical cross-section of the go-around, which involves a climb to 1,500 feet and then further to 2,100 feet. Source: AIP Sweden.

The second aeroplane, a Piper PA-28 with the call sign SE-GVE, was being operated by the Voluntary Flying Corps. The flight was being performed in accordance with a VFR[9] flight plan and was a training flight that encompassed a navigation flight to the west of the airport. The instructor sat in the right seat and the pupil sat in the left seat.

Both aeroplanes took off from Stockholm/Västerås Airport and had equipment for two-way radio communications.

[9] VFR – Visual Flight Rules.

A third aeroplane, with the call sign SE-KHP, was in the airport's traffic circuit.

According to AIP[10] Sweden, the traffic regulations at Stockholm/-Västerås Airport (ESOW) for air traffic that is adhering to visual flight rules (VFR) when the tower is closed include the following:

- The traffic circuit to the main runway shall be flown to the east of the runway.
- Arriving VFR traffic should pass the airport at 1,500 feet before joining the traffic circuit.
- VFR entry and exit points should be used.

The AIP contains no restrictions on IFR approaches when the tower is closed.

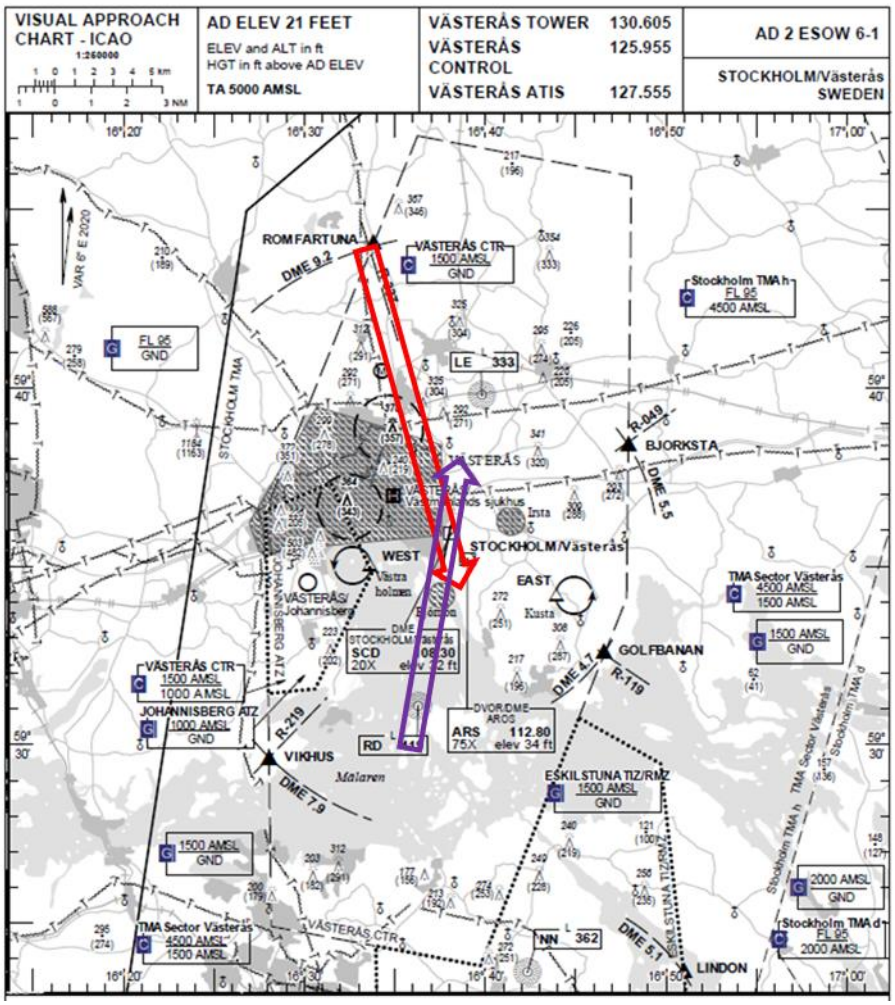

Figure 2. Expected flight paths for VFR approach from Romfartuna (red arrow) and go-around from an NDB approach (purple arrow). The arrows have been added by SHK. Source: AIP Sweden.

[10] AIP – Aeronautical Information Publication.

1.1.2 Sequence of events

The Cessna performed an instrument approach to Stockholm/Västerås Airport in accordance with the procedure for NDB runway 01, which initially involved a procedure turn at an altitude of 2,100 feet above a non-directional beacon called RD, south of the airport. The Cessna used the radio to report its passage over the beacon in a southerly direction at 2,100 feet.

One and a half minutes later, the PA-28, which was adhering to the procedure for VFR approach to the airport, reported that it was passing the entry point Romfartuna at an altitude of one thousand feet and was proceeding to land. Romfartuna is an entry point that lies to the north-west of the airport (see Figure 2).

The Cessna later reported *"We are RD inbound for a low approach, then straight ahead back to RD with a right turn"*.

Immediately afterwards, the aeroplane SE-KHP announced: *"SE-KHP joining downwind runway 01 in about two minutes"*, and then: *"HP joining left downwind, traffic circuit runway 01, left downwind"*.

The Cessna then announced *"Long final for go-around runway 01, we intend to make a right turn. Where is the aeroplane on downwind?",* at which point SE-KHP responded, *"left downwind, HP, abeam overhead position now, in left downwind"*. The Cessna confirmed that the message had been understood and announced, *"Västerås radio, Scavac1W going around, 700 feet climbing, intend to make a right turn"*.

Half a minute later, the PA-28 reported: *"And Västerås radio, SE-GVE overhead, 1,500 feet for a right turn to 01"*.

The crew of the Cessna have stated that the climb was performed with full throttle and at a speed of 80 knots. In conjunction with the pilot beginning a right turn at 1,500 feet in accordance with the procedure, the right pilot detected the PA-28 diagonally to the left at the same altitude and at a distance of 100 to 150 metres. The right pilot then immediately took over manoeuvring of the aeroplane and performed an avoidance manoeuvre by banking to the right to a bank angle of 60 degrees and pulling the yoke back as hard as he could. The left pilot has stated that he was focused on his instruments and felt the right pilot take over the yoke. When he looked out, he saw the underside of the PA-28, which was in a right turn at a bank angle of 90 degrees. After the aircraft had passed one another, the Cessna went into a normal climb to the north and then returned for landing on runway 01.

The crew of the PA-28 have stated that the airport's runway was passed in level flight at an altitude of 1,500 feet, in accordance with the procedure for VFR approach to the airport, and that the Cessna was detected at the same altitude and at a distance of 50–70 metres. The left pilot then initiated an avoidance manoeuvre to the right, after which the right pilot took control of the aeroplane and applied a full bank to the right. The PA-28 then completed a normal landing circuit and landed on runway 01.

Sensor data show that the aeroplanes passed close to one another at about the same altitude and with a minimum horizontal separation of 150 metres (0.08 Nm). In addition, sensor data show that the PA-28 made a sharp avoidance manoeuvre to the right just before the paths crossed (see Figure 4).

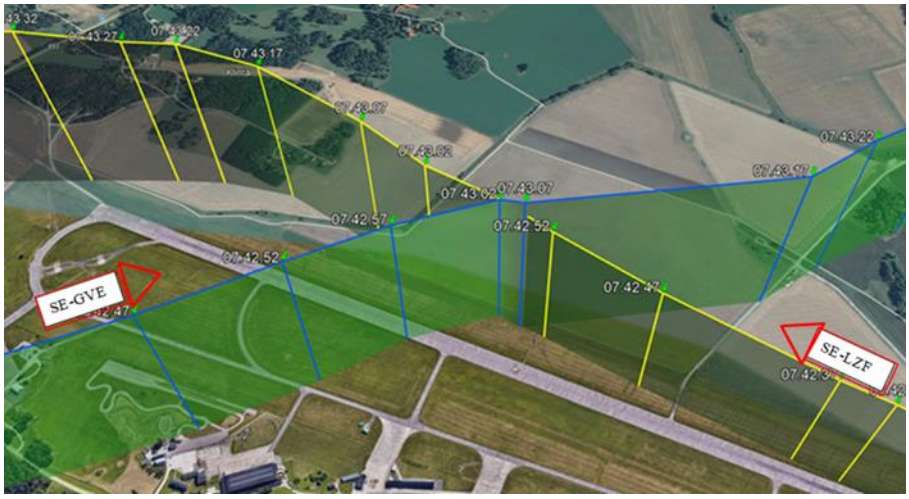

Figure 3. Fused radar track (ARTAS) that shows the Cessna in yellow and the PA-28 in blue. Source: Google, Lantmäteriet registration number Reg. no. R61749_190001.

Figure 4. Trajectory based on raw WAM[11] radar data shows the PA-28's avoidance manoeuvre with a right turn at 07:42:59. Source: Google, Lantmäteriet registration number Reg. no. R61749_190001.

The incident occurred in daylight at position 5935N 01538E, 460 metres above mean sea level.

[11] WAM – Wide Area Multilateration.

1.2 Injuries to persons

None.

1.3 Damage to the aircraft

None.

1.4 Other damage

None.

1.5 Crew information

1.5.1 Qualifications and duty time of the pilots

Cessna 172 (SE-LZF)

The instructor

The instructor was 48 years old and had a valid CPL with flight operational and medical eligibility. At the time, The instructor was acting as a student under instruction and was PF[12].

Flying hours				
Latest	24 hours	7 days	90 days	Total
All types	1	10	85	4,094
On type	1	6	45	3,490

Number of landings, on type – last 90 days: 48.
Type rating concluded on 4 April 2017.
Latest PC[13] conducted on 18 October 2018.

Student

Student was 30 years old and had a valid CPL with flight operational and medical eligibility. At the time, the student was acting as instructor and was PM[14].

Flying hours				
Latest	24 hours	7 days	90 days	Total
All types	1	9	74	618
On type	1	9	73	587

Number of landings, on type – last 90 days: 111.
Type rating concluded on 6 April 2017.
Latest PC conducted on 18 January 2018.

[12] PF – Pilot Flying.
[13] PC – Proficiency Check.
[14] PM – Pilot Monitoring.

PA-28 (SE-GVE)

The instructor

The instructor was 65 years old and had a valid PPL with flight operational and medical eligibility. At the time, The instructor was PM.

Flying hours				
Latest	24 hours	7 days	90 days	Total
All types	5	8	90	5,558
On type	5	8	48	>1,000

Number of landings, on type – last 90 days: 64.
Type rating concluded on 23 March 1988.
Latest PC conducted on 29 May 2019.

Student

Student was 37 years old and had a valid PPL with flight operational and medical eligibility. At the time, the student was PF.

Flying hours				
Latest	24 hours	7 days	90 days	Total
All types	3	6	59	209
On type	3	6	6	21

Number of landings, on type – last 90 days: 41.
Type rating concluded on 7 October 2018.
Latest PC conducted on 2 September 2019.

1.6 Aircraft information

1.6.1 Cessna 172

The Cessna 172 is a high-wing, single-engine aeroplane with four seats (see Figure 5).

Figure 5. Cessna 172R. Photo: OSM Aviation Academy.

Aeroplane	
TC-holder	Textron Aviation Inc.
Model	172R
Serial number	17281331
Year of manufacture	2006
Gross mass (kg)	Max. take-off mass 1,110, current 1,015
Centre of gravity	Within limits.

Engine	
TC-holder	Lycoming Engines
Type	IO-360-L2A
Number of engines	1

Hold item list	Not relevant to the occurrence

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

1.6.2 Piper PA-28

The Piper PA-28 is a low-wing, single-engine aeroplane with four seats (see Figure 6).

Figure 6. Piper PA-28. Photo: Voluntary Flying Corps.

Aeroplane	
TC-holder	Piper Aircraft Inc.
Model	PA-28-161 (Warrior II)
Serial number	28-7816164
Year of manufacture	1978
Gross mass (kg)	Max. take-off mass 1,055, current 1,022
Centre of gravity	Within limits.

Engine	
TC-holder	Lycoming Engines
Type	O-320-D3G
Number of engines	1

Hold item list	None

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

1.6.3 Field of view from cockpit

In both the Cessna 172 and the PA-28, the view outward from the pilot's seat and the front passenger seat allow those sitting there a field of view ahead and to the sides, with the exception of that which is blocked by the window beams that surround the windscreen and side windows (see Figures 7 and 8).

Figure 7. View from the cockpit of a Cessna 172. Photo: OSM Aviation Academy.

Figure 8. View from the cockpit of a PA-28. Photo: Voluntary Flying Corps.

1.7 Meteorological information

According to SMHI's analysis: wind approx. north 5–10 knots, visibility >10 km, cloud 1–3/8 with ceiling at 1,500–2,000 feet, temperature/dewpoint +9/+7°C, QNH 1012 hPa.

The incident occurred in daylight. The sun was at 27 degrees over the horizon in a direction of 125 degrees.

1.8 Aids to navigation

The Cessna, which was performing an instrument approach, was using a non-directional beacon called RD that is located 3.7 nautical miles south of the threshold of runway 01.

1.9 Radio communications

Both aeroplanes were communicating on the airport's radio frequency. SHK has studied the recordings of this frequency and relevant parts are reproduced in section 1.1.2.

1.10 Aerodrome information

The airport is an approved instrument aerodrome[15] according to AIP Sweden.

The AIP states that the airport's terminal area (TMA) and control zone (CTR) are only established during the tower's hours of operation.

It also states that all navigation aids operate 24 hours a day. These include the non-directional beacon RD to the south of the airport.

The airport has a paved runway in a north/south direction that is designated 01/19 and a grass runway that runs parallel to the main runway and is located to the west of it.

The paved runway is 2,581 metres long and 45 metres wide.

1.11 Flight recorders

There were no flight recorders and these were not required either.

The G1000 navigation system on the Cessna records normal navigation data. However, at the time of the incident, the memory card was full, which meant that data concerning the flight in question were not recorded.

1.12 Site of occurrence

The occurrence took place in the airspace above Stockholm/Västerås Airport.

1.13 Medical and pathological information

There is nothing to indicate that the mental or physical condition of the pilots were impaired before or during the flight.

1.14 Fire

No fire broke out.

1.15 Survival aspects

1.15.1 Rescue operation

None.

[15] Instrument aerodrome – aerodrome with an instrument flight procedure that is approved for operational use in at least one direction.

1.16 Tests and research

Three sensors belonging to LFV have recorded the sequence of events:

- Bällsta MSSR Mode S
- WAM Stockholm
- Uppsala MSSR

On the basis of the WAM radar data from both aeroplanes, SHK has, with the help of a consultancy, Logical Arts, been able to create 3D animations that visualise the incident (see Figures 9–12). The animations provide a view from above and from the side and from inside each cockpit. The aeroplanes' own movements such as bank angles and pitch angles are approximate and were generated by the software on the basis of the available sensor data.

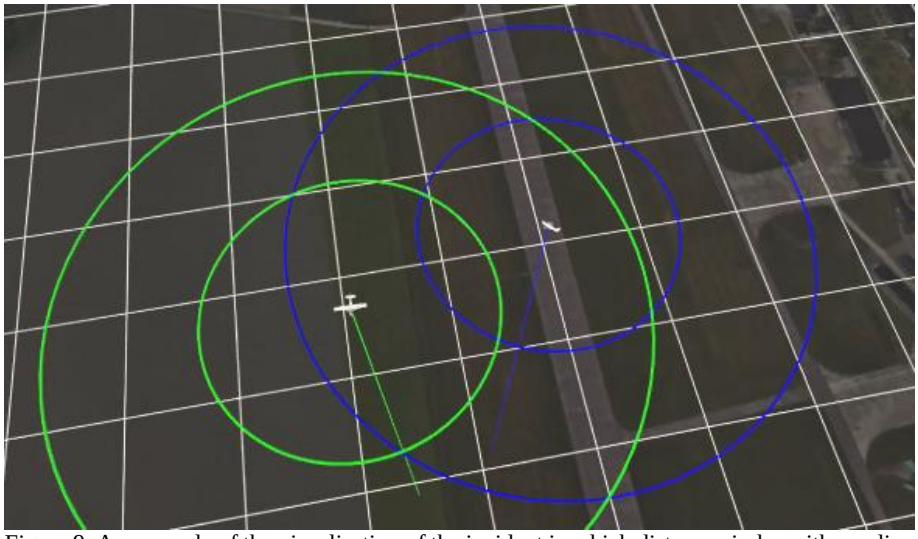

Figure 9. An example of the visualisation of the incident in which distance circles with a radius of 50 and 100 metres indicate the distance between the aeroplanes.

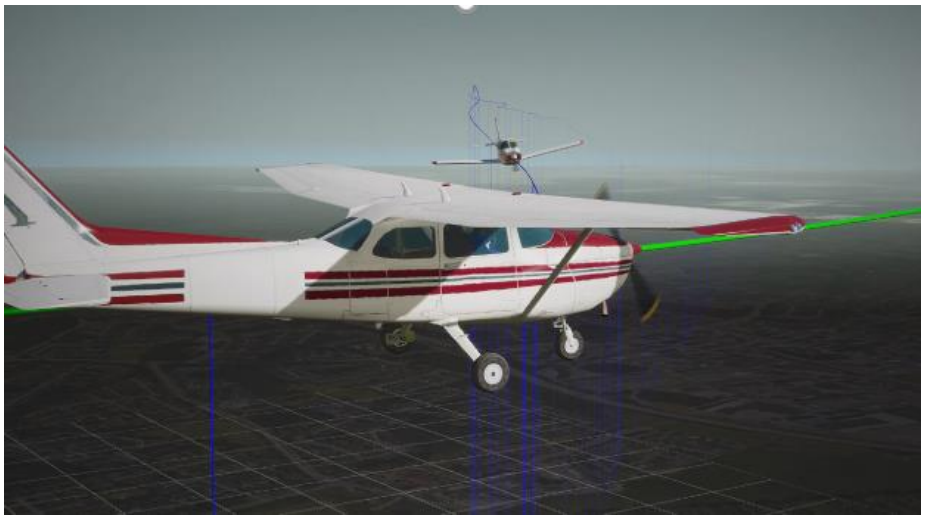

Figure 10. An example of visualisation of the relative position between the aeroplanes just before they passed one another. The models are intentionally enlarged and not to scale.

Figure 11. Visualisation of the view to the left from the cockpit of the PA-28 just after passing the other aeroplane.

Figure 12. Visualisation of the view from the cockpit of the Cessna just before passing the other aeroplane. The side beam may block the view of oncoming traffic. The silhouette of the PA-28 is seen over the horizon. The red circle marks the PA-28.

1.17 Organisational and management information

1.17.1 OSM Aviation Academy's organisation and safety management system

OSM Aviation Academy is an approved training organisation (ATO[16]) that is authorised by the Swedish Transport Agency.

In Sweden, OSM is based at Stockholm/Västerås Airport and conducts training on the aeroplane types Cessna 172 and Diamond DA42.

[16] ATO – Approved Training Organisation.

OSM has a safety management system (SMS)[17] with manuals, key personnel and processes for managing its operations in accordance with the applicable authorisation.

OSM has begun a detailed risk identification and management process, but the risks of the type of occurrence in question (mid-air collision IFR/VFR) have not been documented.

According to OSM's interpretation of the regulations, there have been no obstacles to performing IFR approaches in accordance with the published procedures when the airport has been open but the tower closed.

1.17.2 The Voluntary Flying Corps' organisation and safety management system

The Voluntary Flying Corps' (FFK's) task is to recruit and train personnel that are able in both war and peace to be a resource for society in the event of extraordinary situations and severe conditions. The instructor and the student were both members of FFK.

According to its statutes, FFK's operations are to be conducted with a high level of flight safety, punctuality and efficiency, and the quality of its operations shall be ensured through FFK's own safety management system (SMS).

FFK is undergoing a transition from its previous aerial work authorisation in accordance with TSL 2018-3159, to a more AOC[18]-like structure.

1.17.3 Nya Västerås Flygplats AB's organisation and safety management system

Stockholm/Västerås Airport is owned by the City of Västerås and is used for both scheduled flights and general aviation, which includes air ambulance operations, training flights, aerial photography, private aviation and air-taxi services.

The airport uses a quality and operations management system (QOMS[19]) that has an integrated safety management system (SMS).

However, the risk of the type of occurrence in question has not been documented in the system.

[17] SMS –Safety Management System.
[18] AOC – Air Operator Certificate.
[19] QOMS – Quality & Operations Management System.

According to the Swedish Transport Agency's decision TSL 2018-665, dated 7 February 2018, Stockholm/Västerås Airport is authorised to be an instrument aerodrome. This authorisation has been granted in accordance with Regulation (EU) 139/2014 and Regulation (EC) No 216/2008.

1.18 Additional information

1.18.1 Previous occurrences

SHK has studied a list of occurrences that took place in the years 2001–2019 taken from the ECCAIRS[20] database, which is part of a European reporting system for accidents and incidents within civil aviation. The list indicates that on several occasions in recent years there were reports of occurrences in conjunction with the tower at Stockholm/Västerås Airport being closed. On these occasions, there has been both IFR and VFR traffic using the airspace above the airport at the same time.

Two occurrences have taken place shortly before the one that is the subject of this investigation. On 7 June 2019, the air traffic controller felt that the traffic situation was intensive in conjunction with the opening of the tower. There were several IFR and VFR aeroplanes close to the airport. The situation became difficult for the controller before he was able to open and establish controlled airspace above the airport.

On another occasion, 31 July 2019, parachutists were jumping over the airport at the same time as there was both VFR and IFR traffic. This took place when the tower was closed.

It has also emerged during the investigation that a number of additional occurrences have taken place at Stockholm/Västerås Airport when the tower was closed but that these occurrences have not been reported to the ECCAIRS database.

1.18.2 Regulations concerning airports and the need for air traffic services (ATS)

Under Chapter 2.4.1 of Annex 11 to the Convention on International Civil Aviation (Chicago Convention), the need for the provision of air traffic services (ATS) shall be determined by consideration of the types of air traffic that are involved, the density of air traffic, the meteorological conditions and other factors that may be relevant. Air traffic services is a collective term for various types of services for the purpose of ensuring the safety of air traffic. This includes air traffic control (ATC) and flight information service (FIS). Air traffic control is in turn a collective term for area control service (ACC), approach control service (APP) and aerodrome control service (TWR).

[20] ECCAIRS – European Coordination Centre for Accident and Incident Reporting Systems.

Commission Regulation (EU) 139/2014 laying down requirements and administrative procedures related to aerodromes pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council states that the aerodrome operator shall ensure directly, or coordinate through arrangements as required with the accountable entities providing the following services that the provision of air navigation services is appropriate to the level of traffic and the operating conditions at the aerodrome, and that the design and maintenance of the flight procedures is implemented in accordance with the applicable requirements (ADR.OR.C.005).

The Swedish Transport Agency's regulations (TSFS 2018:98) and general advice concerning the use and design of airspace and procedures states that the minimum requirement for an instrument aerodrome is a traffic information zone (TIZ) and a traffic information area (TIA). Together, these constitute a demarcated uncontrolled airspace within which only limited air traffic control support is provided, known as an aerodrome flight information service (AFIS[21]).

1.18.3 Air operations regulations when flying in uncontrolled airspace (class G)

Part-NCO of Commission Regulation (EU) No 965/2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council contains general air operations rules for non-commercial air operations with other-than complex motor-powered aircraft.

NCO.OP.100 states that the pilot-in-command shall only use aerodromes and operating sites that are adequate for the type of aircraft and operation concerned. In accordance with NCO.OP.110, for instrument flight rules (IFR) flights, the pilot-in-command shall select and use aerodrome operating minima for each departure, destination and alternate aerodrome.

In addition, NCO.OP.115 states that the pilot-in-command shall use the departure and approach procedures established by the state in which the aerodrome is located, if such procedures have been published for the runway or final approach and take-off area to be used. The pilot-in-command may deviate from a published departure route, arrival route or approach procedure, provided obstacle clearance criteria can be observed, full account is taken of the operating conditions and any ATC clearance is adhered to or when being radar-vectored by an ATC unit.

The document *Notice of Proposed Amendment 2020-02* contains the European Union Aviation Safety Agency's (EASA's) proposed amendments to Part-NCO and the acceptable means of compliance (AMC) issued in view of these. This proposes, among other things, that an

[21] AFIS – Aerodrome Flight Information Service.

addendum be introduced into NCO.OP.115 in order to clarify and explain that IFR operations are permitted in the absence of instrument flight procedures but that the pilot is responsible for ensuring that the trajectory chosen is safe.

The Annex to the Commission Implementing Regulation No 923/2012 laying down the common rules of the air and operational provisions regarding services and procedures in air navigation contains rules of the air for aviation within the EU (SERA[22]).

Appendix 4 to the Annex, which is a summary of the rules in SERA.6001 and SERA.5025(b), states that IFR and VFR flights are permitted in uncontrolled airspace and receive flight information service if this is requested. For IFR flights there is a requirement for radio contact, which does not apply to VFR flights. ATC clearance is not required.

The Swedish Transport Agency's regulations (TSFS 2014:71) and general advice concerning rules of the air contains provisions that supplement SERA. Chapter 2, Section 6 of TSFS 2014:71 states that when an ATS unit at an aerodrome is temporarily closed, an aircraft shall monitor the ATS unit's published radio frequency and blindly transmit information that may serve as guidance for other aircraft in order to avoid collisions, for example concerning position, altitude and intentions. This is also stated in section ENR 1.1-1 of the general rules in AIP Sweden.

In terms of right-of-way, SERA.3210 specifies that when two aircraft are converging at approximately the same level, the aircraft that has the other on its right shall give way.

1.18.4 Questions for the EASA and the Swedish Transport Agency

SHK has asked EASA and the Swedish Transport Agency how they believe the applicable regulations are to be interpreted in terms of IFR landings on open but uncontrolled aerodromes that are only surrounded by uncontrolled airspace (class G airspace).

EASA has stated that there are no obstacles in the European regulations to performing such landings when it comes to non-commercial operations with other-than complex motor-powered aircraft and has referred to both certain provisions in Part-NCO of Commission Regulation (EU) No 965/2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council and to SERA.

[22] SERA – Standardised European Rules of the Air.

EASA has also claimed that under SERA, IFR flights are also permitted in class G airspace under instrument meteorological conditions (IMC)[23]. SERA also does not contain any restrictions on performing instrument approaches or landings at an uncontrolled aerodrome.

The existing restrictions on air operations in these respects are specified in Part-NCO and include that the pilot-in-command may only use aerodromes that are adequate for the type of aircraft and operation concerned (NCO.OP.100) and that the pilot-in-command shall select and use aerodrome operating minima for each procedure (NCO.OP.110).

According to EASA, this question is an air operations question and not an aerodrome question.

The Swedish Transport Agency has stated that, according to the applicable regulations and the practises that apply, performing instrument flight procedures or landing as an IFR flight is not permitted at an uncontrolled aerodrome that does not have an open ATC or AFIS.

An open ATC or AFIS means that the infrastructure, ground traffic and air traffic is monitored in order to support safe clearance of the traffic.

The Transport Agency interprets the regulations to imply that instrument flight procedures are not permitted in airspace that is not demarcated, because the approval of the aerodrome as an instrument aerodrome and of its instrument flight procedures is conditional on both the airspace being demarcated and air traffic control (ATC) or aerodrome flight information service (AFIS) being provided. In addition, the flight safety assessment that forms the basis of the approval is also based on these conditions.

In this context, the Transport Agency has pointed to the provision in Section 14 of TSFS 2018:98, which specifies that the minimum requirement for airspace at an instrument aerodrome is a traffic information zone and a traffic information area. If no such zone or area has been established, it is no longer possible to use the aerodrome as an instrument aerodrome.

When asked how it handles any deviations from EASA regulations in the national regulations, the Transport Agency has stated the following.

Prior to beginning a regulation project, the Transport Agency conducts an assessment of whether there is an opportunity and a need to issue national regulations within the area in question. EU law takes precedence to national rules and Sweden may not regulate at the national level something that is already regulated under EU law (known as double regulation). Consequently, the Transport Agency issues national regulations only if a certain provision in an EU regulation requires or allows such national regulations, or if there is no EU provision that

[23] IMC – Instrument Meteorological Conditions.

regulates the matter in question. Under all circumstances, this only takes place if the national provisions do not conflict with applicable EU law. Usually, this requires an analysis of every individual EU provision in order to enable an assessment to be made of whether national provisions may or should be issued. These assessments are also reviewed as long as a regulation project is ongoing.

1.18.5 Instrument approaches to open aerodromes without air traffic control in other countries

SHK has asked the investigatory authorities in Ireland and Germany whether it is permitted in their countries to fly in accordance with IFR procedures to an instrument aerodrome when the air traffic control is closed.

In Ireland, open instrument aerodromes are always surrounded by class C airspace and are thus controlled. The question is therefore not applicable there.

In Germany, flying in accordance with IFR procedures to uncontrolled aerodromes is permitted. However, maintaining radio contact is mandatory (known as RMZs[24]).

1.18.6 Actions taken

OSM Aviation Academy

OSM Aviation Academy has decided to, among other things, minimise IFR flights outside of the tower's opening hours and to move IFR approaches to Eskilstuna Airport. Following the incident, the operator has performed additional risk analysis regarding flying in the Stockholm/Västerås Airport when ATC is closed and mid-air collision. These risks have then been added to the operator's hazard-log.

FFK

When FFK next uses Stockholm/Västerås Airport for a course, it will, among other things, be conducting a briefing that describes the special problems that exist when flying around the airport. In addition, an orientation course on flight paths for IFR traffic will be held for all students and instructors.

The airport

Following the incident in question, the airport has decided that only traffic operating in accordance with visual flight rules (VFR) may operate when the tower is closed. This decision also means that only parties that, under agreements with the airport, are based there, are permitted to use the airport when the tower is closed.

[24] RMZ – Radio Mandatory Zone.

AIP Sweden

Under AD2 of AIP Sweden, the NDB procedure for runway 01 at Stockholm/Västerås Airport has been amended as of 30 January 2020. This amendment means that after a go-around, the aircraft shall climb to 2,500 feet instead of 1,500 feet, as was the case under the previous procedure.

1.19 Special methods of investigation

None.

2. ANALYSIS

2.1 The incident

The incident occurred during visual meteorological conditions over the main runway at Stockholm/Västerås Airport at a time when the tower (TWR) was closed and the airspace over the airport was therefore unconrolled (class G). Under such conditions, the commander of each aeroplane is responsible for maintaining separation between their own aircraft and others.

At the time of the incident, one of the aeroplanes was flying in accordance with visual flight rules (VFR) and adhering to the published landing procedure for this, while the other aeroplane was flying in accordance with instrument flying rules (IFR) and adhering to the published landing procedure for an NDB approach. Both aeroplanes were in radio contact with one another and announced their positions and intentions. In spite of this, the aeroplanes ended up on converging courses at approximately the same altitude and an immediate avoidance manoeuvre was deemed necessary.

The right-hand pilot in the Cessna detected the PA-28 at the same altitude at a distance of only 100 to 150 metres and performed an avoidance manoeuvre. The PA-28 detected the Cessna at a distance of only 50–70 metres and the left-hand pilot also performed an avoidance manoeuvre. Sensor data shows that the aeroplanes passed close to one another at about the same altitude and with a minimum horizontal separation of 150 metres (see section 1.1.2).

The IFR procedure NDB01 includes a go-around phase that involves a climb to 1,500 feet and then a right turn while climbing to 2,100 feet. This means that the aeroplane may be approximately over the runway at 1,500 feet. At the same time, the VFR approach procedure from Romfartuna specifies a passage over the runway that should take place at precisely 1,500 feet on the way to entering the aerodrome traffic circuit. Consequently, if these procedures are performed at the same time by two different aeroplanes, there is a point at which these converge at the same altitude.

Even though the aeroplanes were communicating with one another and announced their positions and intentions, no actual coordination took place between them. This may have led to the crews' mental pictures of the aeroplanes' interrelation being incomplete.

Added to this is the fact that the aeroplanes were adhering to different landing procedures and in order to gain a complete understanding of the other aeroplane's intended flight path if you have insight into the landing procedures of both your own aeroplane and the other aeroplane. A pilot who is flying VFR and who does not have any instrument rating (IR) cannot be expected to have this knowledge. Accordingly, this may

lead to a limited understanding of the IFR flight's intentions even if these are being communicated by radio.

As reported in section 1.6.3, it is possible from the front seats of both a Cessna 172 and a PA-28 to see straight ahead and to the sides, with the exception of what may be blocked by the window beams that surround the windscreen and side windows. Because the PA-28 was approaching diagonally converging towardsthe Cessna from the left side, the window beam in the Cessna may, to a certain extent, have blocked the view and contributed to the late detection of the oncoming PA-28.

In addition, IFR flight requires the pilot to concentrate on the flight and navigation instruments, which may affect the potential to effectively survey the airspace. In this case, the other pilot's role as instructor on board meant that they were to supervise the student's handling of the aeroplane. All in all, SHK's assessment is that these factors had a detrimental impact on the Cessna crew's chances of detecting the PA-28 at an earlier stage.

With regard to the PA-28, which was obliged to give way to the Cessna that was approaching from the right at the same altitude, the late detection may have been influenced by the fact that the Cessna was below the horizon and against a background of terrain with low contrast against the silhouette of the aeroplane. In addition, the Cessna was in a direction which was close to that of the sun at the time. However, according to statements from the crew of the PA-28, the sun was not perceived to be a factor that had an impact.

2.2 IFR approaches to an uncontrolled aerodrome in uncontrolled airspace (class G airspace)

This investigation has demonstrated problems that may arise when VFR and IFR approaches are taking place at the same time to an uncontrolled airport in uncontrolled airspace (class G airspace) and where the two different procedures' cross one another at the same altitude.

SHK shares EASA's opinion that, from the perspective of EU law, there are no obstacles to flying and landing in accordance with IFR procedures at an instrument aerodrome where the air traffic control is closed and that is at the time surrounded by uncontrolled airspace (class G airspace), provided the provisions in Part-NCO and SERA are adhered to.

According to the Swedish Transport Agency, IFR approaches to an uncontrolled instrument aerodrome are, however, not permitted because the Transport Agency has stipulated in supplementary provisions to the applicable EU law (Section 14 of TSFS 2018:98) that an instrument aerodrome and its associated approved and published instrument flight procedures require, as a minimum, a traffic information zone and a traffic information area to be established. It is the view of the Transport Agency that if no such zone and area are established, the aerodrome ceases to be an instrument aerodrome.

Whether such restrictions or supplementations in respect of the EU rules in Part-NCO and SERA introduced by the Transport Agency through Section 14 of TSFS 2018:98 are consistent with EU law is, at first hand, not a question for SHK. The Transport Agency has described the general considerations that it makes when such national regulations are decided on, but has not gone into any more detail on which considerations were made in this case.

It is SHK's opinion that it appears problematic that an instrument aerodrome which is certified and approved in accordance with the EU regulations would cease to be that at certain times of the day because the air traffic control is closed.

The wording of Section 14 of TSFS 2018:98 also suggests more that an instrument aerodrome may not be kept open if the requirements in the provision are not fulfilled, rather than that an instrument aerodrome suddenly ceases to be that under such circumstances.

Furthermore, for a certified instrument aerodrome to, in such cases, amorphously and instantaneously change to being regarded as something else and thus be able to operate under other conditions appears alarming from an aviation safety perspective.

Irrespective of how that relates to this, however, it can be concluded that the Transport Agency's interpretation of Section 14 of TSFS 2018:98 and the consequences of this interpretation are not expressed in any way in AIP Sweden, which is the information that pilots are expected to have knowledge of and is published and produced under the supervision of the Transport Agency. Instead, AIP Sweden explicitly states that the approach aids at Stockholm/Västerås Airport are available 24 hours a day, i.e. even outside of the tower's hours of operation. Furthermore, it does not state that the approach procedures published in AIP Sweden for the airport do not apply at certain times.

Consequently, this may explain why the IFR procedure was being used despite the fact that, in the view of the Transport Agency, this was not permitted. It can also be pointed out at this juncture that the airport also did not appear to be under the impression that IFR procedures were prohibited outside of the tower's hours of operation because, following the occurrence, they have, through agreements with operators based at the airport, restricted use of the airport outside of air traffic control's hours of operation to only VFR traffic. This would of course not be necessary if this was a direct consequence of existing regulations.

In this context, there is also reason to specifically address the fact that it emerged that on a number of occasions in recent years, occurrences perceived as being risky have been reported in conjunction with the airport's air traffic service being closed. On these occasions, there has been both IFR and VFR traffic using the airspace above the airport at the same time and also performing landings.

As far as SHK has been able to establish, no specific risk analyses concerning the risk of a collision between aircraft under these conditions has been conducted within the scope of the airport's or operator's safety management system.

All in all, the circumstances set out above give the impression that there is a need to clarify how the content of Section 14 of TSFS 2018:98 relates to the provisions in EU law on IFR approach to an uncontrolled instrument aerodrome in uncontrolled airspace (class G airspace) and to communicate this in a clear way to both aerodromes and pilots. The Swedish Transport Agency is therefore recommended to take action in order to bring this about.

3. CONCLUSIONS

3.1 Findings

a) The pilots had flight operational and medical eligibility to perform the flights.
b) The aeroplanes had no known technical faults that prevented the flights.
c) The airport was certified as an instrument aerodrome.
d) One of the aeroplanes was flying IFR with repetitive NDB instrument approaches in accordance with the airport's published IFR approach procedure.
e) The other aeroplane was flying VFR and was to land in accordance with the airport's published VFR approach procedure.
f) The procedures that the aeroplanes were adhering to resulted in the flight paths crossing at the same altitude over the runway.
g) The pilots detected each other's aeroplanes at a late stage and performed avoidance manoeuvres.
h) The minimum horizontal separation between the aeroplanes was c. 150 metres.
i) The incident occurred in daylight with visual meteorological conditions and good visibility.
j) At the time of the incident, the airport was open but the tower was closed.
k) According to Swedish rules, the minimum requirement on airspace at an instrument aerodrome is that there is a traffic information zone and a traffic information area.
l) According to the Swedish Transport Agency's interpretation of applicable regulations, IFR flights are not to take place to an instrument aerodrome if the tower is closed.
m) No prohibition or restrictions on IFR approaches outside of the tower's hours of operation were documented in AIP Sweden.

3.2 Causes/Contributing Factors

The incident was caused by the aeroplanes adhering to two different approach procedures with flight paths that crossed one another at the same altitude.

Several factors may have contributed to the incident. The window beam of the Cessna may, to a certain extent, have blocked the Cessna pilot's view and thereby have contributed to late detection of the approaching PA-28. The Cessna pilot, who was flying in accordance with IFR rules, may be presumed to have been concentrating primarily on the flight and navigation instruments and not sufficiently on outward visual observations. Furthermore, the Cessna was below the horizon from the perspective of the PA-28, which may have made it more difficult for the pilot of the PA-28 to detect the Cessna earlier.

Another contributing factor may have been that the crew of the PA-28 did not fully understand the intentions of the Cessna because they did not have valid instrument ratings and therefore did not have knowledge of the format of the IFR procedures at the airport.

4. SAFETY RECOMMENDATIONS

The Swedish Transport Agency is recommended to:

- In consultation with EASA, clarify the prerequisites for IFR flights to uncontrolled instrument aerodromes and take action to ensure this is communicated to all parties concerned (see section 2.2). (*RL 2020:05 R1)*

The Swedish Accident Investigation Authority respectfully requests to receive, **by 15 August 2020** 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 Gideon Singer