Statens haverikommission
Swedish Accident Investigation Authority

Interim Statement SRL 2019:01e

Accident near Umeå Airport, Västerbotten County, on the 14 July 2019 involving the aeroplane SE-MES of the model GA8-TC 320, operated by Umeå Skydiving Club.

File no. L-96/19

26 September 2019

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

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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.

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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 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 results of the investigation will be published in a final report. Such a report shall be published, if possible, within twelve months after the accident. However, SHK has decided to publish an interim statement at an earlier date. The statement contains – in addition to a report of the sequence of events – information on the progress of the investigation and relevant parts of the factual material gathered in the case. Publication of the interim statement takes place during a phase where the investigation has not yet been completed, for which reason the content of the material now presented may come to be supplemented, amended or omitted in the final report.

The interim statement has not undergone the consultation process that precedes the publication of a final report. Hence, SHK cannot guarantee that everything presented in this interim statement will be part of – or be identical to – the content of the subsequently published final report on the event.

The investigation

The Swedish Accident Investigation Authority was informed on the 14 July 2019 that an accident involving an aeroplane with the registration SE-MES had occurred near Umeå Airport, Västerbotten County, that same day at 14:07 hrs.

The accident is being investigated by SHK as represented by Mr Mikael Karanikas, Chairperson, Mr Ola Olsson, Investigator in Charge, Mr Sakari Havbrandt, Technical-operational Investigator, Johan Nikolaou, Peter Swaffer and Gideon Singer, Operations Investigators, and Tomas Ojala, Investigator specialising in Fire and Rescue Services.

SHK is being assisted by Mr Ulf Ringertz, expert in aeronautical engineering, and Ms Liselotte Yregård, expert in aviation medicine.

Accredited representatives from Australia and the USA are also participating in the investigation.

The Swedish Transport Agency and the EASA are participating in advisory capacities and have been continuously kept informed of the investigation.

Interim Statement SRL 2019:01e

Aircraft:	
Registration, type	SE-MES, GA8
Model	GA8-TC 320
Class, airworthiness	Normal, Certificate of Airworthiness and valid Airworthiness Review Certificate (ARC)[1]
Serial number	GA8-TC320-12-178
Operator	Umeå Skydiving Club
Time of the occurrence	14 September 2019, at 14:07 hrs in daylight. Note: all times are given in Swedish daylight saving time (UTC[2] + 2 hrs)
Location	Near Umeå Airport, Västerbotten County, (position 6346N, 02019E, 1 metres above sea level)
Type of flight	Private/jump run
Weather	According to SMHI's analysis: At flight level 130: wind 340˚/20 knots, temperature -10 °C, cloud with base at FL80 and top at FL110 to FL140. At the crash site: South to south-easterly wind 5 knots, visibility >10 km, clouds 5–7/8 with the base higher than 5,000 feet, temperature +15°C, dewpoint +8°C, QNH[3] 1014 hPa.
Persons on board:	9
Crew	1
Passengers	8
Injuries to persons	9 fatalities
Damage to the aircraft	Destroyed

[1] ARC – Airworthiness Review Certificate.
[2] UTC – Coordinated Universal Time.
[3] QNH – atmospheric pressure at mean sea level.

1. FACTUAL INFORMATION

1.1 History of the flight

1.1.1 Preconditions

The purpose of the flight was to drop eight skydivers from flight level 130 (approximately 4,000 metres). Earlier in the day, the pilot had completed two jump runs with the same aircraft. During the first run, he was accompanied by the skydiving club's chief pilot in the right pilot's seat for a routine inspection.

1.1.2 The flight and the accident

The pilot was approaching the airport and made a request to climb due to clouds, which was granted by the air traffic control, however no altitude was specified. He was then cleared by the air traffic control to drop the skydivers, which he acknowledged. There was no further radio communication with the aircraft.

Radar data combined with wind data indicate that its ground speed was slowing down as the aircraft climbed to FL136 (approximately 4,200 metres). The aircraft then suddenly veered to the left, to an opposite direction of travel, and started to descend rapidly. The aircraft thereafter travelled just under a kilometre while descending approximately 1,500 metres, which indicates a dive of more than 45 degrees. From 2,500 metres, the aircraft descended more or less vertically at a descent rate of around 60 m/s.

Several recordings of the final phase of the course of events, filmed from the ground, show that the fuselage, without the fin and stabiliser, was rotating in the horizontal plane with the left wing pointing upwards and the right wing missing.

A witness to the accident noted upon arriving to the scene of the crash that the rear cabin door was open, but found no sign of life among those on board.

1.2 Injuries to persons

	Crew	Passengers	On board, total	Others
Fatal	1	8	9	-
Serious	-	-	0	-
Minor	-	-	0	Not applicable
None	-	-	0	Not applicable
Total	1	8	9	-

1.3 Damage to the aircraft

Destroyed.

1.4 Other damage

Damage to the ground and limited fuel and oil spills.

1.5 The crew

1.5.1 Pilot's qualifications

Pilot in command

Pilot in command, 28 years old and had a CPL(A)[4] with flight operational and medical eligibility.

Flying hours				
Last	24 hours	7 days	90 days	Total
All types	2	2	12	214
Type in question	2	2	12	12

Number of landings actual type last 90 days: 24
Familiarization on type 20 April 2019.
Last PC[5] carried out on 14 December 2018 in an aircraft of the type Piper PA-28.

1.6 Aircraft

The aircraft was of the model GA8-TC 320, normally called Airvan (see figure 1).

Figure 1. Aircraft SE-MES. Photo: Umeå Skydiving Club.

[4] CPL(A) – Commercial Pilot Licence.
[5] PC – Proficiency Check.

The aircraft has a turbocharged, 300 horsepower piston engine of the model Lycoming TIO-540.

The high-wing aircraft is mainly made from aluminium and fitted with wing struts.

The aircraft had been modified for skydiving, which meant that there were no seats other than the two pilot seats.

The aircraft was equipped for IFR flight, i.e. to be operated in accordance with instrument flight rules.

1.6.1 The aeroplane

Type certificate holder	GA8 Airvan Pty Ltd.
Model	GA8-TC 320
Engine	Lycoming TIO-540-AH1A
Year of manufacture	2012
Gross mass, kg	Max. authorised gross mass 1,814[6], actual gross mass 1,904
Centre of gravity	Outside of mass and balance envelope. See also Chapter 1.16.2.

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

1.6.2 Operational limitations

The aircraft's maximum permitted speed is 185 knots.

The aircraft's maximum manoeuvring speed[7] is 121 knots.

Maximum g-load (g-force) is +3.8 and -1.52. According to the design requirements, the failure load must be at least 1.5 times the maximum load, i.e. +5.7 G and -2.3 G respectively.

At maximum gross mass and retracted wing flaps, the aircraft has a stall speed of 64 knots according to the flight manual.

1.6.3 Description of parts or systems significant to the occurrence

Doors

The aircraft model has three doors: one door for each pilot seat and one for the rear cabin. The two pilot doors open forward and have no emergency release. The rear door opens outwards and then slides forward along the left side of the fuselage.

[6] There is a modification to increase maximum authorised take-off mass to 1,905 kg for the aircraft model. According to the manufacturer, this modification had been made but not documented for the aircraft in question.

[7] Maximum manoeuvring speed – maximum speed for full or abrupt flight control movements.

Skydivers interviewed by SHK have stated that the rear door is heavy to open, even at low speed.

1.6.4 Flight manuals

The flight manual has a supplement referring to skydiving. This supplement specifies, among other things, that a maximum of five skydivers are permitted behind an imagined line that runs across the aircraft at the forward edge of the rear door.

1.7 Meteorological information

According to SMHI's analysis:

At FL130: wind 340 degrees/20 knots, temperature -10 °C, cloud with base at FL80 and top at FL110 to FL140.

At the point of impact: South to south-easterly wind 5 knots, visibility >10 km, clouds 5–7/8[8] with the base higher than 5,000 feet, temperature +15°C, dewpoint +8°C, QNH 1014 hPa.

The airport observation at 13:50 hrs indicated clouds 5–7/8 with a base at 8,400 feet.

The airport observation at 14:20 hrs indicated clouds 5–7/8 with a base at 7,800 feet and overcast cloud coverage with a base at 9,800 feet.

The accident occurred in daylight.

1.8 Aids to navigation

The aircraft was equipped with several different GPS-based navigation systems: Garmin GTN 650 and Garmin GTN 750 along with an Aspen PFD[9].

It has not been possible to retrieve any data from the navigation systems.

1.9 Radio Communications

During the flight, the pilot was in contact with the air traffic control in Umeå. Radio communications were normal up until the sequence of events leading up to the accident began. After this point, there was no radio transmission from the pilot. No distress call has been registered in the radio communications.

1.10 Aerodrome information

Not applicable.

[8] 5–7/8 means that there is cloud coverage across between five to seven eights of the sky.
[9] PFD – Primary Flight Display.

1.11 Flight recorders

1.11.1 Recorded radar positions from LFV – Air Navigation Services of Sweden

SHK has received recorded secondary surveillance radar positions from LFV. Data on the final phase of the flight have been entered into figure 2 below.

The aircraft's transponder sends two types of information to the secondary radar system: an identification signal and the aircraft's altitude.

The lateral position is calculated by the radar equipment with the help of the transponder identification signal, whereas the altitude is provided directly by the aircraft transponder.

From 12:07:27 (UTC) until 12:07:40, the altitude remained unchanged according to the recording. In the event that the transponder does not send any altitude information, up to three of the subsequent points will be recorded at the last received altitude.

Other registered data, for example from ProTrack (see 1.11.4), indicates that the aircraft had a descent speed of 70–102 m/s during this period, and that the altitude at 12:07:40 was 1,800 metres, or 5,900 feet.

In addition to information on position and altitude, the secondary radar data gives an estimation of ground speed. This speed information is intended for air traffic controllers, and is therefore presented less meticulously. However, it is possible to discern certain tendencies. SHK will carry out further studies of radar data in order to try to obtain more precise speed information.

However, the existing data shows that the ground speed was slowing down as the aircraft climbed to FL136 (approximately 4,200 metres).

At 12:05:00, the pilot requested permission for a drop at a higher altitude due to the clouds, and at 12:05:53 he received clearance to drop the skydivers.

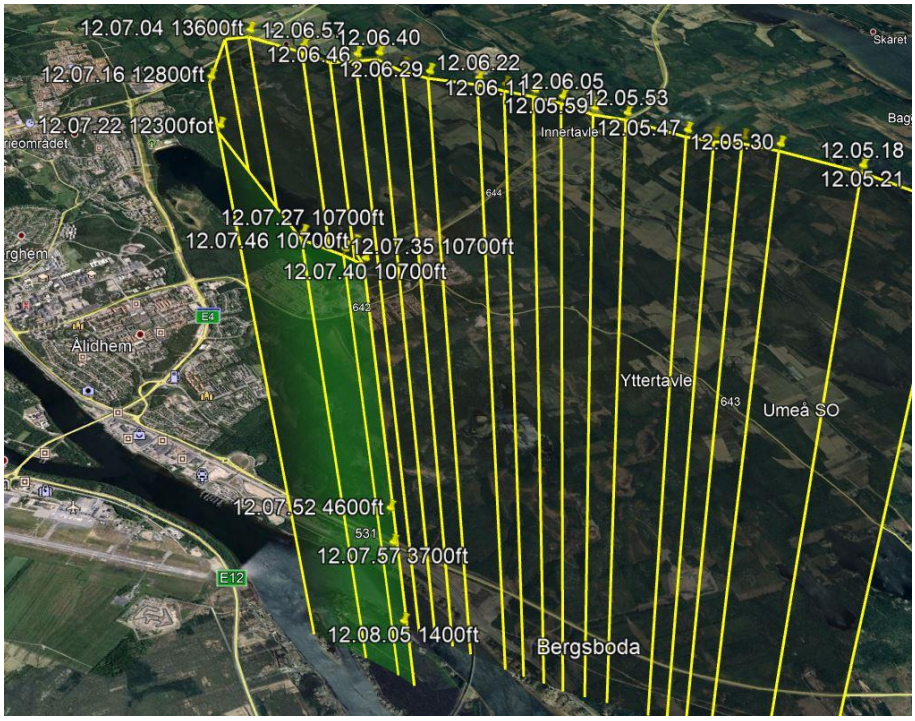

Figure 2. Radar data from LFV superimposed on a map from Google Earth: © Lantmäteriet Ref. R61749_190001.

1.11.2 Recorded radar positions from the Swedish Armed Forces

SHK has also obtained primary radar data from the Swedish Armed Forces. This data will be analysed further in order to estimate the aircraft's flight speed and flight path during the sequence of events.

1.11.3 Sound recording from surveillance camera

A surveillance camera, located seven kilometres from the point of impact, has registered the sound of the aircraft engine. A preliminary analysis of the sound recording has shown that the propeller speed varied between 2,000 and 3,000 RPM over two quick cycles after the aircraft had started to loose altitude. The recording will be analysed further.

1.11.4 Recording from ProTrack

SHK has obtained data from two of the skydivers' electronic devices (ProTrack), which is intended to give the skydiver audio signals referring to altitude and descent speed. The devices have recorded altitude and descent speed. The readings have been essentially identical, and one is presented in figure 3 below.

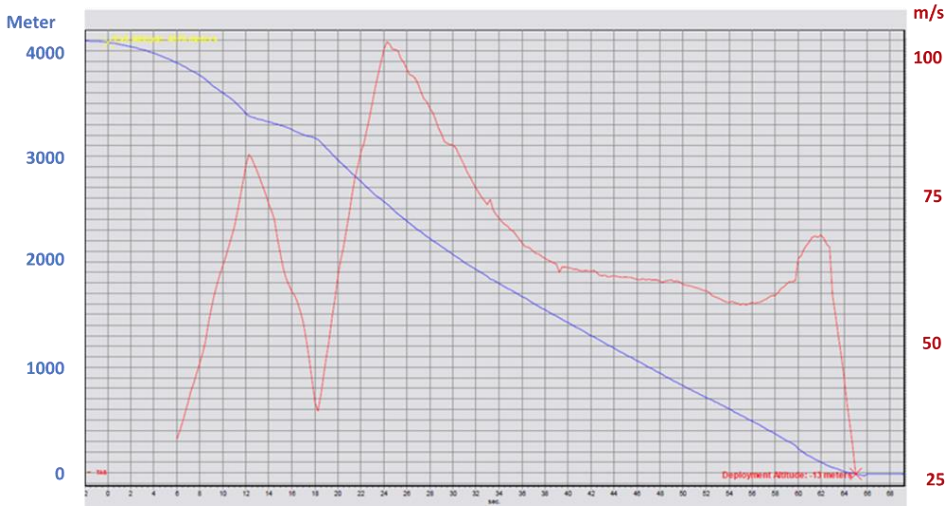

Figure 3. The blue line shows the altitude in metres and the red line indicates descent rate in metres per second.

1.11.5 Recording from automatic activation devices

The equipment of each of the skydivers included an automatic activetion device (AAD), the purpose of which is to automatically deploy the reserve parachute at a certain altitude if the descent speed is too high. All of these devices had been triggered.

Seven of the AADs were of the type “Cypres”, which has a memory unit.

SHK has downloaded data from six of these. One unit had been mechanically damaged and was therefore unreadable.

All six of the devices have recorded data from 2,200 metres down to the ground. All of them indicate the same descent rate linearly all the way, which was approximately 60 m/s (see figure 4).

All six deployed the reserve parachute as they should, depending on the selected altitude setting, at 250–350 metres above ground.

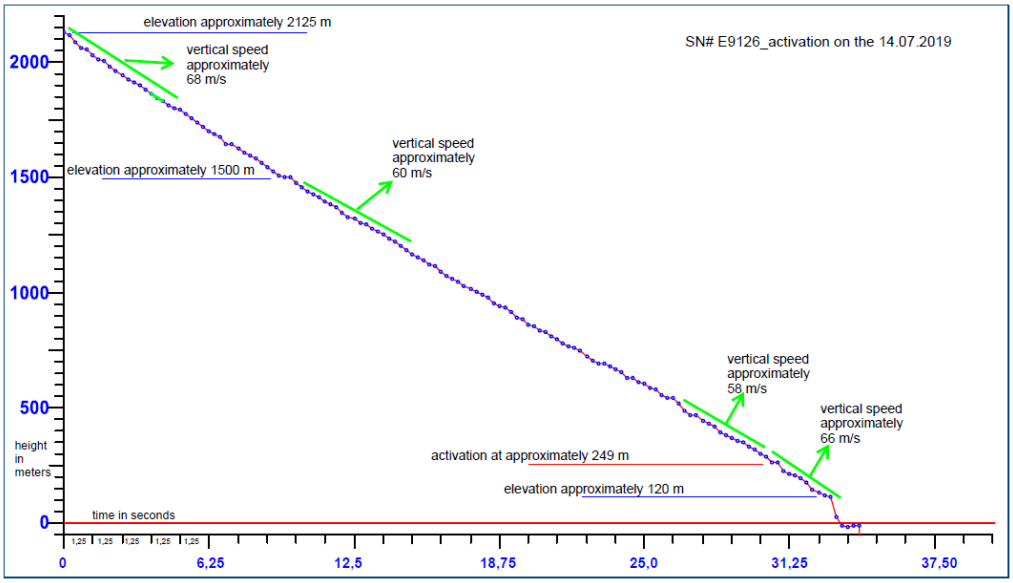

Figure 4. Reading from one of the AADs.

1.11.6 Recording from engine-monitoring instrument

The aircraft was equipped with an engine-monitoring instrument of the model J.P. Instruments EDM 800.

This instrument has a memory unit that records engine parameters. SHK has sent the instrument to the French safety investigation authority (BEA) for reading of the data. Unfortunately, the instrument was too damaged for a normal reading. BEA is working with J.P. Instruments in the USA, making further attempts to read the data.

1.11.7 Other possible recordings

SHK has obtained a number of cellular telephones found on board the aircraft and is still investigating the possibilities of using the data contained in these.

1.12 Accident site and aircraft wreckage

1.12.1 Accident site

The fuselage hit the ground in a forest area on the island of Storsandskär in the Umeå River.

The point of impact is located around 2,300 metres southeast of the site at Umeå Airport where the skydivers had planned to land.

Several parts had broken off the aircraft prior to impact, and these were found in various locations on the island and in the river.

1.12.2 Aircraft wreckage

The main wreckage consisted of the fuselage, the left wing including its wing strut, the right wing strut along with the engine and propeller.

The right wing, the left and right stabilisers and the fin had separated from the fuselage before impact.

The right wing was broken into two parts.

The outer part of the right wing and the right part of the stabiliser were found in the river, west of Storsandskär. The inner part of the right wing was found 125 metres west of the fuselage. The fin was found 225 metres to the west, and the left part of the stabiliser was found 250 metres southwest of the fuselage.

The locations of the different parts of the wreckage are marked in figure 5. It has not been possible to determine whether the parts marked in the figure as wreckage part 1 and 2 comprised the right stabiliser or the right outer wing, respectively. The reason for this is that they were salvaged before SHK arrived on site.

Figure 5. Site of the accident and location of the parts of the wreckage. Photo: Google Earth: © Lantmäteriet Ref. R61749_190001.

Certain smaller parts of the wreckage are still missing, such as the balance horn of the right elevator.

There are clear indications that the rear door was fully open at the time of impact (see figures 6 and 7).

Figure 6. The image shows the door handle position when open on an undamaged aircraft of the same model as the one in the accident.

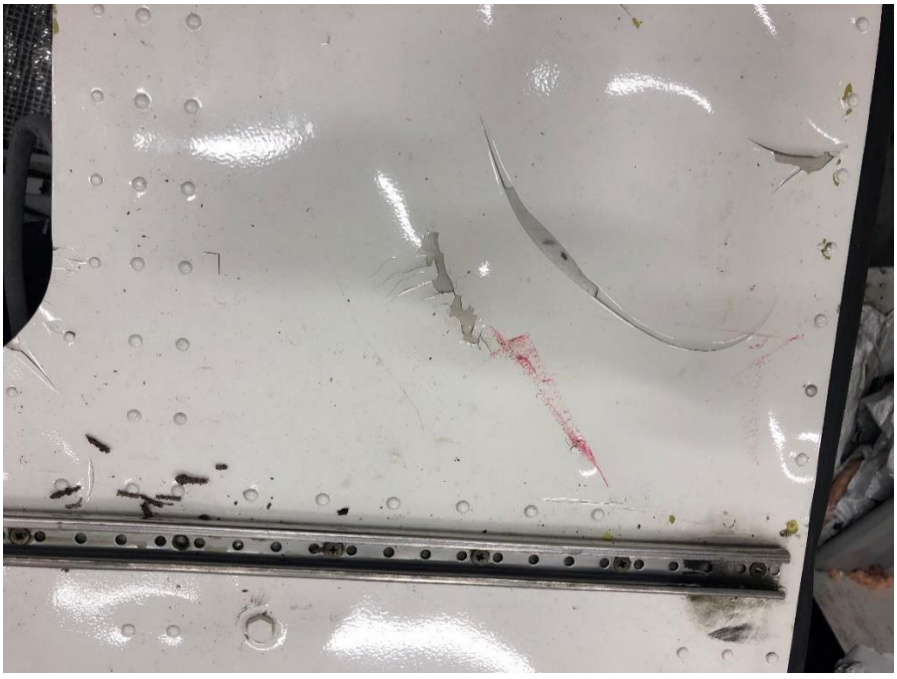

Figure 7. Impact mark from the door handle on the fuselage of SE-MES.

All parachute equipment were found complete inside the fuselage wreckage.

The aircraft has been salvaged from the site of the accident and taken in by SHK for closer inspection.

1.13 Medical and pathological information

Nothing has been found thus far to indicate that the mental and physical condition of the pilot was impaired before or during the flight.

1.14 Fire

There were no signs of fire or explosion.

1.15 Survival aspects

The impact was not survivable. All on board were wearing parachutes. The reason why none of them managed to escape the aircraft will be investigated further.

1.15.1 The rescue operation

The emergency locator transmitter (ELT[10]) of type Kannad 406 AF Compact was activated during the occurrence. However, no signal was received by JRCC[11].

The results of the investigation of the rescue operation will be published in the final report.

1.16 Special investigations

1.16.1 Initial technical investigation

SHK has carried out an initial technical investigation of the aircraft wreckage.

There were deformations on the underside of the outer right wing indicating that the wing had been subjected to abnormal negative load (see figure 8).

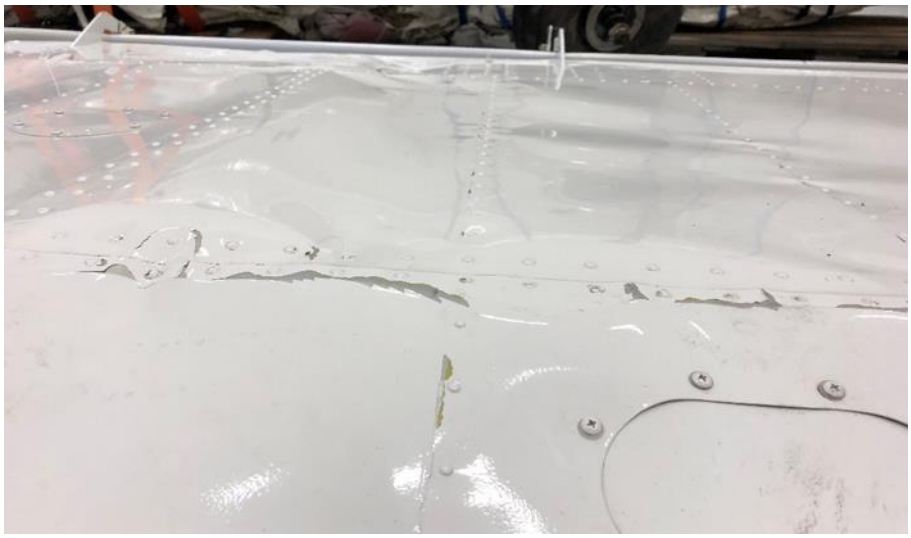

Figure 8. Underside of right wing.

[10] ELT – Emergency Locator Transmitter.
[11] JRCC – Joint Rescue Coordination Centre.

Damage to the outer right wing also indicated that the fracture occurred in a positive load (see figures 9 and 10).

Figure 9. Upper side of right wing.

The right wing strut had broken at its upper attachment to the underside of the wing. The damages to the inner part of the right wing indicated that it had been bent upwards and broken off from the fuselage.

Figure 10. Underside of right wing.

The broken-off attachment of the right wing strut has undergone fractographic examination (see figure 11). There were no fatigue cracks in the fracture surfaces, nor any traces of corrosion or other material defects. The investigation showed that the fractures arose during overload with tensile stress and bending.

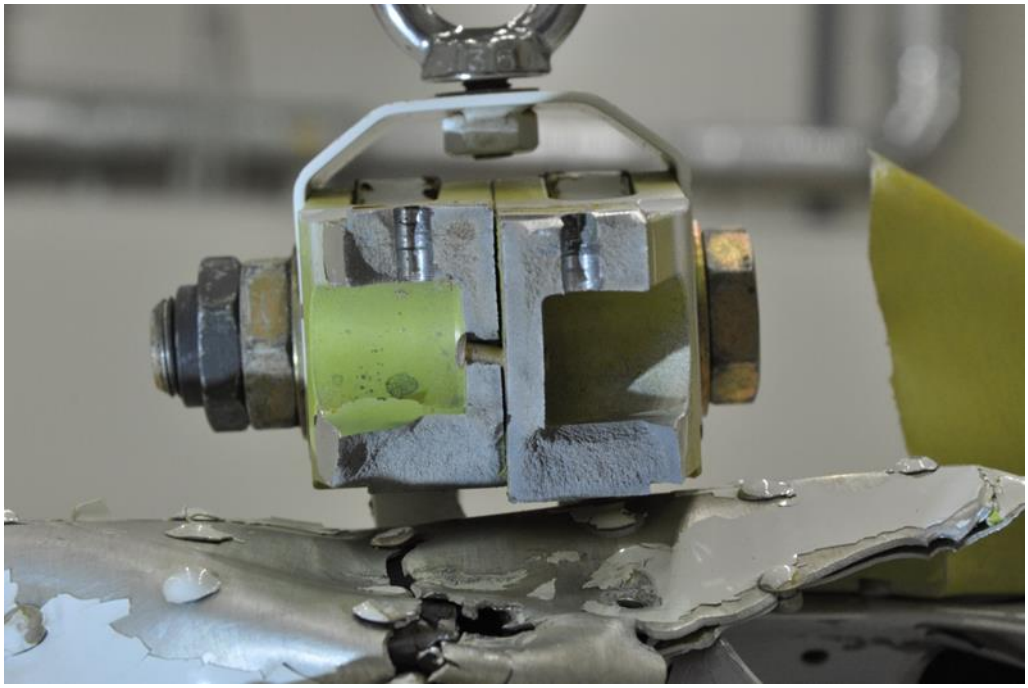

Figure 11. The broken-off attachment of the right wing strut.

The damage to the broken-off stabilisers and the fin indicate high aerodynamic loads.

Fracture surfaces on the parts that separated from the aircraft before the impact have been examined. No signs of fatigue or other defects have been found.

1.16.2 Weighing of an aircraft of the same model

SHK has weighed another aircraft of the same model to determine the centre of mass with skydivers at the different stages of the flight.

By weighing and calculating changes in mass moment of inertia, the skydivers' longitudinal centre of mass in the aircraft could be calculated for take-off as well as for the skydivers' normal position when opening the door in preparation for the drop.

The weight and position of those on board at the time of the accident have been estimated with the help of information from the skydiving club.

Using the above information, SHK has preliminarily calculated the mass of the aircraft at the time of the accident to be 1,904 kg. The centre of mass has been calculated at 1,642 mm behind the reference plane at take-off and 1,674 mm at the normal position for door opening.

The permitted range at maximum gross mass is 1,422–1,626 mm. This means that mass and balance were outside the mass and balance envelope.

At the same time, it must be emphasised that the mass and balance of the aircraft in question cannot be exactly determined afterwards.

An aircraft is not rendered impossible to fly as soon as it goes outside the permitted weight and balance envelope. SHK will calculate how the longitudinal stability is impacted by the aforementioned mass and balance conditions.

SHK will carry out further inspections and calculations in these respects, and will also calculate how the longitudinal stability is impacted by the calculated mass and balance conditions.

1.17 The operator's organisation and management

1.17.1 The Swedish Parachute Association

Pursuant to Chapter 12, Sections 1 and 8 of the Aviation Act (2010:500) and Chapter 12, Sections 1 and 4 of the Aviation Ordinance (2010:770), the Swedish Transport Agency has delegated the tasks of issuing qualifications and student permits and of implementing inspection and supervision of sport parachuting in Sweden to the Swedish Parachute Association (SFF). The Swedish Transport Agency has also instructed SFF to ensure that these activities otherwise meet the applicable flight safety requirements. The delegation and the agreement between the Swedish Transport Agency and SFF state that the organisation's activities are to be controlled through a handbook system that describes, among other things, the procedures and instructions for the activities.

SFF has established such a handbook system. Chapter 402:03 contains provisions on aircraft and pilots. In accordance with section 3.3.1 of that chapter, the pilot of an aircraft used for parachuting must be approved for the assignment and trained by an aviation company Head of Flight Operations or by the person responsible for flight operations within a parachuting club, and the flying hours requirements must be met.

1.17.2 Umeå Skydiving Club

Umeå Skydiving Club is a non-profit association conducting parachuteing activities as a member of the Swedish Parachute Association.

The club's normal procedure for drops from the aircraft model

According to the procedure normally followed by Umeå Skydiving Club, the throttle is reduced after reaching the appropriate altitude in order to maintain a speed of 80 knots. The cooling of the engine is to be checked and the pilot is to follow the plotted GPS course to the airfield. One minute prior to the planned drop, permission is requested from the tower, and once it has been given, the ceiling light is turned on. Ten seconds before the drop, the pilot reduces the engine to 2,000 RPM and closes the cowl flaps.

1.18 Additional information

1.18.1 Parachuting regulations

Parachute dropping is considered as Specialised Operations and is primarily regulated in Annex VIII (Part-SPO)[12] of Commission Regulation (EU) No 965/2012 laying down technical requirements and administrative procedures related to air operations. However, SPO.GEN.005 states that parachute dropping with aircraft other than complex-motor-powered aircraft may under certain circumstances, such as non-commercial activities, be conducted in accordance with Annex VII (Part-NCO)[13].

Operations conducted under Part-NCO require no special permits or approvals from Swedish government agencies.

The Swedish Civil Aviation Authority's regulations (LFS 2007:46) on parachuting contains provisions on flying duties on board aircraft used for parachute dropping, flight equipment and flight crews, as well as special safety provisions. These provisions partly overlap with those of Part-NCO.

1.18.2 Action taken

SHK has continuously kept the relevant government agencies informed about the investigation.

1.19 Special methods of investigation

None.

Continued investigation

SHK will continue the work on additional fact gathering and analysis.

The final report is expected to be published in the first half of 2020.

On behalf of the Swedish Accident Investigation Authority

Mikael Karanikas Ola Olsson

[12] SPO – Specialised Operations.
[13] NCO – Non-commercial air operations with other than complex-motor-powered aircraft.