Air Accident Investigation Unit
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Mobility and Transport
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Safety Investigation Report

Ref. AAIU-2022-05-17-01
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Status: Final

Scope: Limited

As per ICAO Annex 13 and EU regulation EU 996/2010, decisions regarding whether to conduct a civil aviation safety investigation, and the extent of an investigation, are based on many factors, including the level of safety benefit expected to be drawn from such an investigation.
For this occurrence, a limited-scope, fact-gathering investigation and analysis was conducted in order to produce a short summary report. The investigation mainly focussed on the actions and conditions directly relating to the occurrence and might not cover all aspects of the aircraft operation and/or possible underlying safety factors due to the expected safety benefit of it and/or the extent of evidence/resources available.

SYNOPSYS

Occurrence class	Accident
Occurrence category	Abnormal runway contact (ARC)
Date and time[1]	17 May 2022 12:58 UTC
Location	Aerodrome of Balen/Keiheuvel (EBKH)
Aircraft	Alexander Schleicher ASK-13
Aircraft category	Fixed wing - Sailplane - Non-powered
Location of departure	Aerodrome of Balen/Keiheuvel (EBKH)
Planned destination	Idem
Type of operation	Non-commercial - Local
Phase of flight	Takeoff
Injuries	2 minor
Aircraft damage	Substantial

What happened

During a winch start of a sailplane with two persons on board, the canopy opened in flight. The pilot released the towing cable and performed a 180-degrees turn to land back on the runway. The sailplane made a hard landing, slid off the runway and came to a stop colliding with trees bordering the airfield. Both occupants climbed out with minor injuries.

[1] All time data in this report are indicated in UTC, unless otherwise specified

1 THE OCCURRENCE

The purpose of the flight was an introductory flight for the passenger. The pilot sat on the forward seat and the passenger on the rear seat. An assistant (tip-runner), strapped the passenger on the seat and gave the pre-flight instructions.

The pilot performed the pre-flight checks in accordance with the check-list of the sailplane. The small aft ventilation window located left of the passenger's seat was closed by the assistant.
The pilot closed the canopy before the tow cable was attached to the sailplane. After the accident, when interviewed by the investigators, he stated he could not confirm he actually pushed the canopy closing ball grip forward, because this action is routinely performed.
The signal was given to start the take-off and the winchman sped up the winch. The sailplane started to climb, as foreseen.

The pilot noticed that initially, the speed was too low (75 km/h). It is not known whether the winchman accelerated the winching at some point.

When the sailplane reached the height of 80 m (according to the pilot – 100 m as evaluated by the winchman), the canopy was spotted in the open position by the ground crew. The winchman noticed an abnormal reflection. The pilot reacted immediately to the opening of the canopy by pulling on the release handle. The tow cable was released when the sailplane reached a height of 150 m.

The pilot brought the nose down of the sailplane and determined that a straight ahead landing was not possible. He decided to make a 180 degrees turn to land on the reciprocal runway.

The pilot stated;
"the canopy flung open, with force; it was brutal. This caught me by surprise. I was exposed to the relative wind on my body. My sunglasses flew away. I was nearly blind due to the wind and pressure on the eyes. I lost the flight references, the slip string was gone.
I lowered the nose to get a steeper angle to maintain speed. The sailplane drifted due to the crosswind.
Due to the situation, I could not control the sailplane as usual. As the height of the sailplane after releasing the tow cable was not high (90m), everything went very fast.
I decided not to jettison the canopy, as it might damage the rudder and cause a bigger problem"

Upon completion of the turnaround, the pilot felt the airspeed was too low and he brought the nose of the sailplane more down. The pilot does not remember whether he actually looked at the airspeed indicator.

The sailplane hit the ground hard with a steep nose down attitude on the middle of the runway. The left wing tip hit the ground. Witnesses did not see any flare. The sailplane bounced back and deviated to the left.

The sailplane exited the runway and came to a stop after colliding with a tree bordering the airfield.

The pilot climbed out and helped the passenger out of the aircraft. The ground crew and bystanders came quickly to the rescue.

2 CONTEXTUAL INFORMATION

2.1 Injuries to persons

When exiting the aircraft, the pilot complained about pain in the back, eventually without lasting effects. The passenger sustained minor injuries.

Table 1: List of injuries

Injuries	Crew	Passenger	Others	Total
Fatal				
Serious				
Minor	1	1		2
None				
Total	1	1		2

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2.2 Damage

2.2.1 Damage to aircraft

The sailplane sustained important structural damage to the nose, left wing tip and right wing.

2.2.2 Other damage

None

2.3 Pilot information

Table 2 : General pilot data

Nationality	Belgian	Age	71
License	Sailplane pilot licence since 1991		
Ratings	Sailplane		
Medical	VML		

Table 3 : Flying experience pilot

Total time:	800 FH on various type of sailplanes
Recent experience on ASK13:	Last 12 months; 26 flights Last 3 months: 4 flights
Other types flown	Alexander Schleicher Ka4, Ka6 CR, Ka 6 E Ka7, Ka8 Schempp- Hirth Janus C Rolladen-Schneider LS1, LS4 Centrair Pegase C101 LET L-13 Blanik

2.4 Aircraft information

The ASK-13 is a two-seater glider built by the German sailplane manufacturer Alexander Schleicher Gmbh & Co. The type is identified in the EASA Product list, dated 2022-04-26, with the CS-22 Certification Specification.
The wing features a 6 degree forward sweep and is fabric-covered. The fuselage is a welded steel tube structure, except for the nose, which is made of glass fiber.
Landing gear consists of a non-retractable sprung wheel.

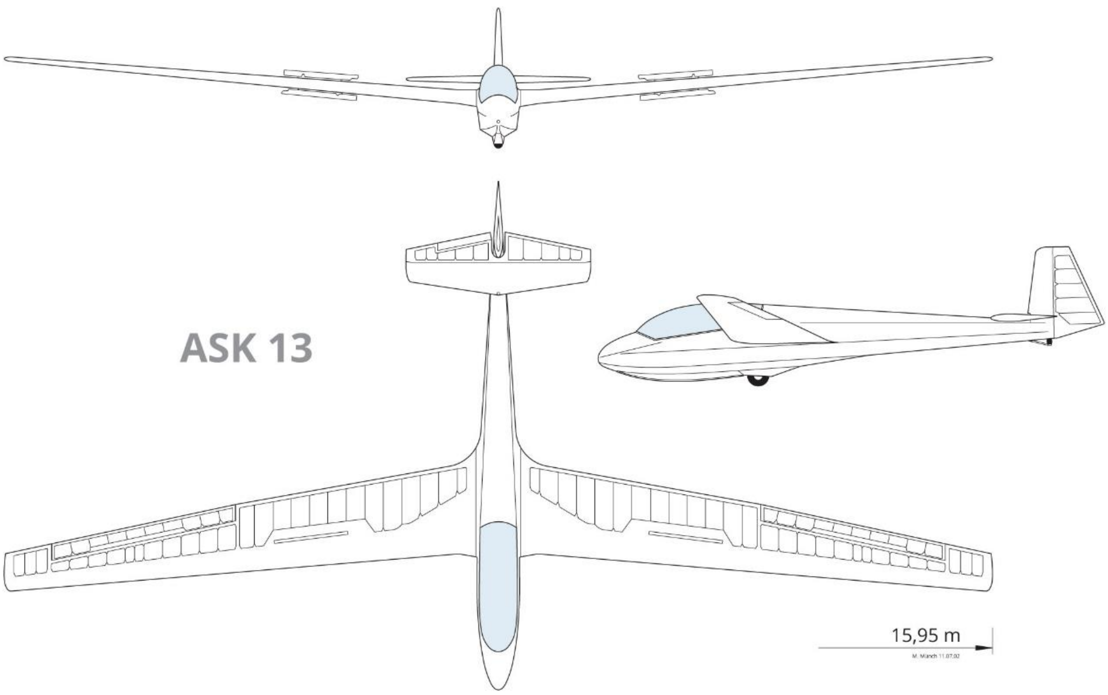


Figure 1: 3-view drawing (Source: Alexander Schleicher)

Year Built: 1987
Construction Number: 13665

Wing span: 16 m
Wing area: 17.5 m^2
Length: 8.18 m
Best glide ratio: 27

Stall speed: 57 km/h

Operating limitations:
Max. Speed: 201 km/h
Rough air: 140 km/h
Aero tow: 140 km/h
Winch tow: 100 km/h

2.4.1 Flight Manual:

Chapter 2 Operating Instructions:

Before every take off check canopy and airbrakes for complete locking.

Landing:

Approach speed 5o - 55 mph.
The glide angle can be adjusted in a wide range with the airbrakes. Touch down is best with partly extended airbrakes only. The wheel brake is actuated by the airbrake lever when fully pulled back.

2.4.2 Canopy opening

The canopy comprises a single transparent bubble set in a wooden structure.
It opens by pivoting on the right side around two hinges located on the outside, along the length of the fuselage, at the cabin

Figure 2: Open canopy (source: Alexander Schleicher)

The canopy is locked by inserting the two pins of a sliding metal bar on a plate attached to the canopy into two keepers attached to the fuselage. A ball grip (ball-shaped in two positions for operation from the front and rear seat) – is used to lock and unlock the canopy by moving the bar forwards or rearwards, to insert or release the pins into/from their keeper. The canopy is locked when the grip is in front stop position, each pin extended beyond its keeper.

The locking mechanism is spring loaded, making that the operator must exert a force to move the ball grip backwards. Releasing the ball grip will move the locking pin forwards. In resting position, the locking pins are protruding and (should) be engaged by ca 1cm into the keeper.

However, the operator is supposed to push the ball grip fully forwards to ensure the locking pin is fully engaged into the keeper; the pin protruding from the keeper.

The following pictures were taken from another ASK13 sailplane:


Figure 3: Canopy open and locking mechanism fully forwards


Figure 4: Ball grip forced rearwards, canopy closed.


Figure 5: Ball grip released, locking pin engaged in the keeper by spring force.

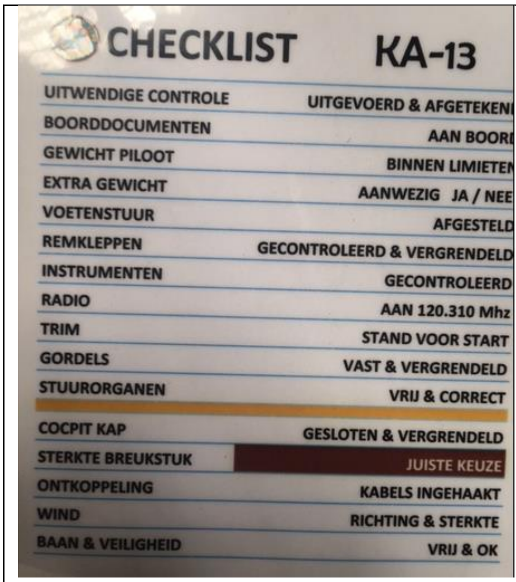

Figure 6: Ball grip fully forwards, locking pin protudes from the keeper


Figure 7: Ball grip forced rearwards, canopy closed (rear position)


Figure 8: Ball grip fully forwards, locking pin protudes from the keeper (rear position)

2.4.3 Checklist

The Sailing Club designed its own check list for the operation of the sailplane.



Check List	KA-13
External inspection _____	Performed and signed off
Aircraft documents _____	On board
Weight pilot___________	Within limits
Additional weight ______	Present yes / no
Rudder pedals ________	Adjusted
Air brakes ___________	Verified and locked
Instruments __________	Checked
Radio _______________	Set to 120.310 MHz
Trim ________________	Set to start
Seat harness _________	Set and locked
Flight controls _________	Free and correct
Canopy ______________	Closed and locked
Weak Link ___________	Correct choice
Disconnection ________	Cable hooked
Wind _______________	Direction and strength
Runway & safety ______	Free & OK

2.5 Meteorological conditions

Observation at EBLG, located 60 km to the North.

11:50 UTC
Wind: 160 degrees, 8 knots, variable between 130 and 250 degrees
Temperature: 24 degrees
QNH: 1020 hPa
CAVOK

2.6 Aerodrome information

EBKH is a private general aviation airfield located in Keiheuvel-Balen, a municipality of Belgium, Limburg Province, 60 km from the airports of Brussels and Liege. Aircraft on the airport include both motorized aircraft and gliders.
The airfield features a bi-directional runway 07/25 (Grass 690 m x18 m) with lateral strokes dedicated to sailplane activities.

ICAO code: EBKH

Coordinates: N 51°10.8' E 05°13.2' Mag Var: 1.3°W

Elevation: 131 ft / 40 m

2.7 Flight recorders

None installed, as not required.
However, the aircraft was equipped with a FLARM that allowed recording of the flight track.

2.8 Wreckage and impact information

After the accident, the closing system of the canopy was verified by a flight instructor and found operational.

All structural damage to the sailplane were caused by the hard landing.

The flight path was reconstructed with GPS data.

Figure 9: Flight Path (Source; Aeroclub)

Figure 10: Wreckage

Figure 11: Damage to LH Wing tip

2.9 Survival aspects

Both occupants wore their 4-points seat harness.

2.10 Tests and research (similar cases)

2.10.1 Occurrences of canopy opening in flight

The British Gliding Association reports a total of 213 occurrences of unwanted opening of canopy in flight, of which 59 for the period 2008-2017, giving an average of 6 occurrences per year for the United Kingdom (in 1999; 9500 members of the BGA, 500000 flights per year, 2300 sailplanes) ([2]).

In Belgium, the combined figures of the Liga voor Vlaamse Zweefvliegclubs, the Fédération des Clubs Francophones de Vol à Voile (FCFVV) and the Royal Belgian Air Cadets (RBAC) report an average of 3 events per year of unwanted opening of canopy in flight during the recent years, mostly leading to minor damage to the concerned gliders.

The FCFVV pointed out that the ASK13 is a type frequently used for training up to the first solo flights and therefore accumulates more flights than any other type, thus more likely to be the subject of this type of incident.

Canopy opening accidents.

The websites of the BEA, BfU and NTSB were consulted to find similar accidents.

2 accidents with the same sailplane type were found;

Table 4: Accidents with canopy opening in flight - ASK-13

SIA	Date	Type	Report reference	Detail	Outcome
BEA	28/10/2019	ASK-13	2019-0656 (1)	Winch take-off Solo Student pilot	Pilot seriously injured Aircraft destroyed
BfU	20/4/2010	ASK-13	10-3X037 (2)	Aerotow Dual Student and instructor.	Student seriously injured Aircraft light damaged

(1) The report states;

During the towed take-off (…) at a height of around 10 metres, the canopy of the glider (..) suddenly opened, probably due to it not being correctly locked before take-off.

(2) The report states (free translation from the German language):

[2] Memorandum by the British Gliding Association (AS29) 26 February 1999 and yearly safety review

The locking mechanism of the two hood latches has been examined for its function and the forces required for closing and opening.

Already when placing the hood on the fuselage frame it was found that the locking bolts engaged about one to two millimeters into the respective locking keepers. The canopy could not be opened, however, a proper locking was not achieved.

When closing the canopy and moving the locking mechanism, a force of approximatively 78N was required. The force required to open the locking mechanism was approximately 123N.

The complete closing and locking mechanism took place without tension between the canopy and fuselage contour. When properly locked, the incorrect opening or unintentional opening of the hood was not possible.

There were other accident investigations involving other types of sailplanes with similar canopy opening systems.

Table 5: Accidents with canopy opening in flight - other types

SIA	Date	Type	Report reference	Detail	Outcome
NTSB	29/08/2005	Grob G102	LAX05LA281 (1)	Aerotow Solo Student	Student seriously injured Aircraft substantial damage
NTSB	19/08/2014	SGS134	WPR14CA350 (2)	Aerotow Solo Pilot	Pilot minor injuries Aircraft substantial damage
BEA	01/06/2019	Grob G103	2019-0271 (3)	Aerotow. Dual Student and Instructor. Rear canopy (instructor) opens	Light injuries Aircraft substantial damage.
NTSB	26/07/2019	Schemp Hirth Ventus 2A	GAA19CA469 (4)	Aerotow. Single pilot,	No injury Aircraft substantial damage
NTSB	22/8/2019	Grob G103	GAA19CA506 (5)	Aerotow Solo Pilot Rear canopy opened	No injury Aircraft substantial damage

(1) Probable causes;
the student pilot's failure to ensure that the canopy was properly latched prior to departure. The inadequate supervision of the flight by the instructor and flight school was also causal

(2) Probable causes;
The pilot's failure to ensure the canopy was locked during the pre-takeoff inspection which led to the canopy opening in flight and the pilot's failure to maintain aircraft control during the subsequent landing

(3) Learning and conclusions:
The opening of the rear canopy led the student pilot to find himself in an unusual situation which distracted him from conducting the flight and maintaining the trajectory behind the towing aircraft. The student, unable to correct the dangerous position of the glider and without any instruction from the instructor, made the only decision for which he had been trained: the release of the cable. The low height at which the drop took place left little time for the instructor to choose a suitable site for a landing in the countryside

(4) Probable cause:
The pilot's failure to properly secure the glider's canopy before flight, which resulted in it opening in flight and the pilot's inability to maintain an appropriate final approach path and altitude, which resulted in impact with a shipping container

(5) Probable cause:
The failure of the glider tow rope, which lodged in the glider's rudder and resulted in a hard landing. Contributing to the accident was the pilot's failure to properly secure the glider's aft canopy.

2.11 Regulation

Note; the Alexander Schleicher ASK-13 holds the Segelflugzeug-Kennblatt (Type certificate Data Sheet) Nr267, certified against the Bauvorschriften für Segelflugzeuge (BVS), Heft 1, Ausgabe 1939, in Verbindung mit den Lufttüchtigkeitsforderungen für Segelflugzeuge (LFS).

The text hereunder describes the current applicable Certification Specifications CS-22 for Sailplanes, applicable to Canopy opening Controls.

Cockpit controls
(ED Decision 2003/13/RM)

(a) Each cockpit control must be located to provide convenient operation, and to prevent confusion and inadvertent operation. (See AMC 22.777(a))

(b) The controls must be located and arranged so that the pilot, when strapped in his seat, has full and unrestricted movement of each control without interference from either his clothing (including winter clothing) or from the cockpit structure. The pilot must be able to operate all the controls necessary for the safe operation of the aeroplane from the seat designated to be used for solo flying.

(c) In sailplanes with dual controls it must be possible to operate the following secondary controls from each of the two pilots' seats
    (1) release mechanism;
    (…)
    (5) opening and jettisoning device of the canopy;

CS 22.779 Motion and effect of cockpit controls
(ED Decision 2003/13/RM)
Cockpit controls must be designed so that they operate as follows:

Controls	Motion and effect
(….)	
Canopy jettisoning	not prescribed, preferably pull to jettison
(…)	

CS 22.780 Colour marking and arrangement of cockpit controls
Cockpit controls must be marked and located as follows:

Control	Colour	Location
(…)		
Canopy operating handle	white *	not prescribed.
Canopy jettison handle	red *	not prescribed but must be within easy reach
(…)		

*If canopy opening and jettison are combined in one handle, the colour must be red.

CS 22.807 Emergency exit
(ED Decision 2009/009/R)

(…)

(b) The opening, and where appropriate jettisoning, of each canopy or emergency exit must not be prevented by the presence of the appropriate aerodynamic forces and/or the weight of the canopy at speeds up to VDF or by jamming of the canopy with other parts of the sailplane. The canopy or emergency exit attachment fittings must be designed to permit easy jettisoning, where jettisoning is a necessary feature of the design.

(c) The opening system must be designed for simple and easy operation. It must function rapidly and be designed so that it can be operated by each occupant strapped in his seat and also from outside the cockpit.

(…)

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3 ANALYSIS

3.1 The flight

The opening of the canopy occurred during the initial phase of the towing. The canopy opened due to the effect of the airflow.

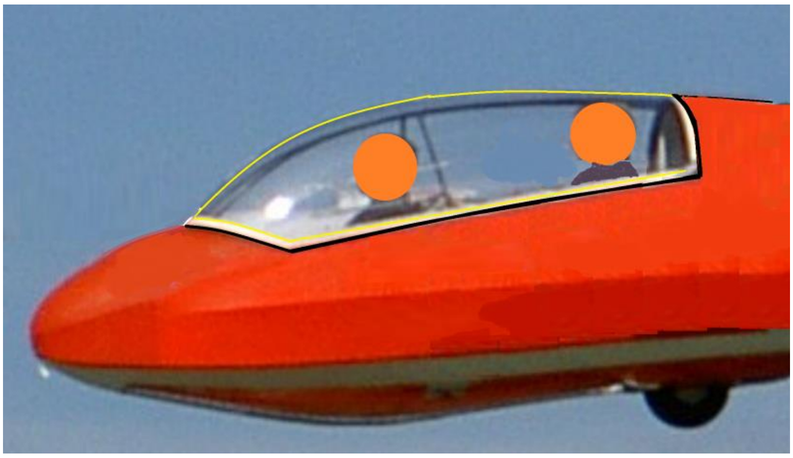

Figure 12: position of the pilots in the cockpit showing the exposure of the pilot to the wind in the absence of canopy (Source: wikipedia commons)

As described by the pilot (see Chap. 1.1. of this report), he was suddenly exposed to an airflow in excess of 100 km/h, his sunglasses were blown away, the naked eyes subject to the airflow, impairing his vision. The loss of wear vision correction spectacles would add a supplemental difficulty (depending on the level of correction).

As outlined in the various accident reports, the key factor for a positive outcome would be the pilot's ability to maintain control of the sailplane in spite of the loss of most references and a change in the sailplane behaviour, being subject to an asymmetric drag due to the canopy hanging on one side. An extensive flight experience, the ability to fly 'by feeling' is an asset. Most accidents resulting in serious injuries involve a pilot with low experience.

In this case, the pilot was quite experienced and stated that " he was not overly under stress during the incident ". His experience allowed him to make the following actions:

- Release the tow line;
- Determine that he was unable to land straight ahead and he had to make a 180 degrees turn.
- Perform the turn to return to the runway.
- Make pitch corrections to maintain a sufficient speed.

He did not attempt to close the canopy, which would have distracted him to the tasks to control the sailplane. The communication with the passenger was not possible due to the ambient noise and he did not take the initiative (nor was he expected to) to attempt the closing of the canopy.

The pilot succeeded in bringing back the sailplane for a landing on the runway. As for most of the similar accidents investigated, he could not avoid substantial damage to the sailplane.

The pilot further said; "in retrospect, I would have delayed the release of the tow cable somewhat, therefore, I would have more time to react and make a better landing".

3.2 Canopy opening

3.2.1 Risk Level

There are different systems of canopy opening in sailplanes;

- The canopy is removable (K6)
- Integral canopy, side-hinged on the left or right side (ASK-13);
- Canopy opening upwards, hinged at the rear (ASK-21 Rear canopy)
- Canopy opening upwards, hinged at the front end (ASK-21 Front Canopy)
- Canopy with fixed windbreakers (Slingsby T.21)

The probability of inadvertent opening of the canopy in flight and the severity of the consequences would be different for each configuration. Some configurations, such as a canopy hinged at the front end, or with a fixed windbreaker, would be probably more favourable.

As a side note, accidents involving inadvertent opening of canopies are also observed for motorized airplane, including types (Van's RV-6, RV-12 among others) having a forward hinged canopy ([3]).

At the least, the inadvertent opening of the canopy in a sailplane would induce a disturbance for the pilot. In a critical flight phase, such as the take-off, that disturbance may lead to accidents to the sailplane, or even to the tug airplane ([4]).

The global risk level can be deducted from the study of the British Glider Association; the current overall probability of inadvertent opening of the canopy is found to be reasonably probable (6 events per year with 500000 flights a year => 10^{-5} per flight).

On the other end, when applying Regulation (EU) 2020/2034, the risk involved would correspond to a "M1" ERCS Classification score.

[3] ATSB Nr AO-2014-164-SAN-012
[4] for example: NTSB WPR20LA141, May 9 2020

3.2.2 Canopy opening on the ASK-13: failure mode analysis.

Looking at the canopy of the ASK-13, such event could occur in the following circumstances;

Technical failure

- A failure of the canopy attachment points; Note; no technical defect was reported on the sailplane after the event.

Operational issues

- Failure to properly lock the canopy before the flight.
  - The Flight manual and the check list are requiring the pilot to close and lock the canopy. This involves two actions on the opening lever; during the closing of the canopy, the pilot has to pull the actuating lever backwards to allow the locking pin to be aligned with the keeper ring and then to push the lever forwards to make sure the locking pin is engaged in the keeper.
  - The locking system is inherently safe, as the spring loaded-mechanism acts like a drop bolt, normally pushing the locking pin into the keeper ring. The action of the pilot – pushing the lever forwards – is however necessary and intended to make sure the system is locked.
  - In case the pilot does not visually verify that the canopy is effectively locked – the locking pin being fully engaged in the keeper ring, the possible failure modes are;
    - Either the locking pin is already extended (lever pushed forward) when the canopy is being closed. This would imply that a gap would occur between the canopy frame and the fuselage, easily spotted by either the pilot or any assistant outside the sailplane.
    - The lever is not pushed forward and the spring force is insufficient to sufficiently engage the locking pin into the keeper ring, due to friction forces and ageing of the spring.

- Inadvertent opening of the actuating lever by the pilot or the passenger.
  - Unlike traditional barrel bolts, the canopy locking handle of the ASK-13 cannot be put in a secure position preventing its movement.
  - Bringing the actuation lever backwards would unlock the canopy. In flight, the airflow around the canopy would develop a vertical force that could be sufficient to open the canopy. The possible failure modes are:
    - During the important acceleration of a winch start, someone may, as a reflex action, hold on the opening mechanism and move it backwards. The pilot's hands are normally nowhere near the red-coloured ball grip. As for the action of a passenger, it could be possible, however unlikely, as being unnatural and against the instructions given.
    - A piece of clothing, such as a loose sleeve or jewelry may get caught on the ball grip and interact with the opening lever during normal operation. This failure mode was identified by the RBAC and caused at least two

known canopy-opening incidents on a Grob G-103, both without major consequences.

The most common and probable failure modes would be the failure to properly lock the canopy before flight and the inadvertent interaction of clothes on the ball grip.

3.3 Mitigating actions.

For all the glider clubs of Belgium, the opening of the canopy in flight is considered a known problem, characterized as 'classic'. In order to alleviate the risk, dedicated check-list, procedure and refresher training are put in place.

For some clubs, the focus is given to;

- A thorough briefing for the pilot and passenger about the opening and jettisoning system of the canopy.
- A check of the clothes (loose sleeves) before the flight,
- The pre-flight check-list must include the effective verification of the canopy securing.
- The confirmation to an person external to the sailplane that the action of securing the canopy is performed.
- The prohibition to suspend any object on the operating handles
- According to the type of canopy opening, the addition of visual aid, a coloured strip, that would allow a person, external to the sailplane to easily detect that a canopy is not closed properly.

These measures are generally known by all glider clubs and have shown their effectiveness to prevent the problem to occur, but these measures are not mandatory and not standardized, so there is no assurance they are overall applied.

3.4 Checklist

An aircraft are required to be operated in accordance with its Flight Manual. To support the pilot in executing the many tasks required, check-lists are commonly used.

Skybrary ([5]) defines;

The term "checklist" is often is used to refer to two different types of documents :

- *challenge-and-response checklists,*
- *read-and-do lists*

"Checklists" (whether challenge-and-response or read-and-do, whether paper or electronic) constitute tools that support flight crew airmanship and memory and ensure that all required actions are performed without omission and in an orderly manner.

[5] Checklists - Purpose and Use / SKYbrary Aviation Safety

The above generally applies for aircraft operated by a crew of pilots, for which an action is performed by one pilot and verified by the other, or check-lists used in emergency situations.

For single pilot aircraft, the use of a pre-flight checklist as a "read-and-do" allows the pilot to determine what action is required, but does not provide an easy solution to verify that the action was actually performed adequately, which must be the ultimate purpose of the check-list. This is why there were instances in which actions needed during pre-flight were omitted or unsuccessfully completed, although a checklist was used ([6]).

In an AOPA article ([7]), the 9500FH Master CFI Neil Singer outlines the importance of the 'checking' function of checklists.

> *More important than the added time and effort, however, is that running a checklist as a do-list is the less safe of the methods available. Especially in single-pilot operations, another method—the flow/checklist—is superior from a safety perspective. This method first has the pilot conduct a specific sequence of memorized actions without reference to a checklist. Then, once this "flow pattern" is completed, the pilot reads the corresponding checklist aloud, visually confirming the actions were taken as the checklist is read.*

Coming back to the accident event, for the closing of the canopy, the check list used by the pilot repeats the sentence of the Flight Manual, " Canopy…… closed and locked".

The British Gliding Association, ([8]), provides a generic guidance on the use of check lists in a way to ensure that the action required is effectively performed. It includes the list of items, followed by a dedicated action and concludes by a response. Both items and response (the actual content of the check-list) should be called aloud to enhance the perception the action was performed. For the canopy closing, it reads;

Item (aloud)	Action (action)	***Response (aloud)***
Canopy	Check canopy closed and locked by applying upward force on the frame (not the glass or DV Panel).	***Closed and locked***

For the pilot, knowing and applying the action required for the item is part of his knowledge of the aircraft and needs to provide the confidence the action was adequately performed.
In this particular case, it is interesting to note the suggested action provides a different verification than the visual inspection of the operating handle.

[6] Chap.1.11.2 – example; NTSB report WPR14CA350 –.

[7] Flow, then check – the 'check' in checklists should be just that - Neil Singer, May 1, 2019

[8] Gliding.world – Gliding the basics – Chap. 4.3 Checklists

4 CONCLUSIONS

4.1 Findings as to causes and contributing factors

- The canopy opened in flight, due to it being not secured before flight, or being inadvertently opened.
- The opening of the canopy caused the pilot to be exposed to the airflow, reducing his ability to control the flight of the sailplane, leading to a hard landing and loss of control of the sailplane on ground.
- The pilot could not confirm the canopy was secured before the flight.

5 SAFETY ACTIONS, MESSAGES AND RECOMMENDATIONS

*A **safety issue** is a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organization or a system, rather than a characteristic of a specific individual, or characteristic of an operational environment at a specific point in time.*

*A **safety action:** the steps taken or proposed to be taken by an organization or agency on its own initiative in response to a safety issue.*

*A **safety recommendation** is a proposal by the safety investigation authority in response to a safety issue and based on information derived from an investigation and/or study. It's aimed to improve the safety of an organisation and/or system and therefor always addressed to an organisation and/or agency, never to a specific individual. The sole purpose of a safety recommendation is the prevention of accidents or incidents and the reduction of the consequences of such occurrences. It, in no case has the purpose of creating a presumption of blame or liability for an accident or incident. Neither does it reflect the level of contribution to a specific accident or incident.*

*A **safety message:** An awareness which brings to attention the existence of a safety factor and the lessons learned. AAIU can distribute a safety message to a community (of pilots, instructors, examiners, ATC officers), an organization or an industry sector for it to consider a safety factor and take action where it believes it appropriate. There is no requirement for a formal response to a safety message.*

5.1 Safety issue: High risk of unwanted opening of the canopy in flight – by design

The probability of unwanted opening of the canopy is found to be reasonably probable (10^{-5} per flight) and it may lead to serious injuries or death as well as the loss of the sailplane – or even the tug airplane (in case of an aero-tow start),

Therefore;

Safety recommendation BE–2023-01:

It is recommended that EASA introduces a design requirement for sailplanes in order to alleviate the risk of unwanted opening of the canopy in flight.

Possible solution to contemplate might include;

- A "barrel lock" design, in which the operating handle is brought into a secure position preventing its inadvertent operation. The jettison handle should operate in the same fashion.
- Visual aid for the pilot and external persons.

5.2 Safety issue: High risk of unwanted opening of the canopy in flight – operational

Sailplane canopies may open in flight due to a variety of causes, such as; the pilot not ensuring the opening lever is in the locked position or by loose clothing interfering with the opening lever. The checklist should be used as a final, pre-take-off check and no as a read-and-do list. The checking should be done both visually and manually.

Therefore, to the Belgian gliding associations:

Safety recommendation BE-2023-02:

It is recommended that the Fédération des clubs Francophones de vol à voile – FCFVV reviews the checklists in use by each gliding club and the related procedures to ensure their application is sufficient robust to alleviate the risk of an unwanted opening of canopy in flight, including adequate passenger briefings. It should also be ensured that the check that the canopy is locked, is done both visually and manually (by applying upward force on the frame).

Safety recommendation BE-2023-03:

It is recommended that the Liga van Vlaamse Zweefvliegclubs (LVZC) reviews the checklists in use by each gliding club and the related procedures to ensure their application is sufficient robust to alleviate the risk of an unwanted opening of canopy in flight, including adequate passenger briefings. It should be ensured that the check that the canopy is locked, is done both visually and manually (by applying upward force on the frame).

ABOUT THIS REPORT

General	
What?	Safety investigation reports are a technical document that reflects the views of the investigation team on the circumstances that led to the accident or serious incident and is conducted in accordance with Annex 13 to the Convention on International Civil Aviation and Regulation (EU) No 996/2010.
Objective	**The sole objective of safety investigations is the determination of the causes, and to define safety recommendations in order to prevent future accidents and incidents. It is not the purpose of this investigation to apportion blame or liability.** In particular, Article 17-3 of Regulation (EU) 996/2010 stipulates that the safety recommendations made in this report do not constitute any suspicion of guilt or responsibility.
Investigation authority	The Air Accident Investigation Unit of Belgium (AAIU for the rest of this publication). It is the Belgian permanent national civil aviation safety investigation authority as defined in Article 4 of Regulation (EU) No 996/2010 and established in accordance with the Royal Decree of 26 December 2022. This unit is part of the Federal Public Service Mobility and Transport and is functionally independent from the Belgian Civil Aviation Authority and other interested parties.
This investigation	
Investigation initiation	AAIU was notified of the occurrence by the standard reporting scheme on 18 May 2022 . Considering the nature and limited damage it was decided to not travel to the scene of this incident.
Scope	Limited For this occurrence, a limited-scope, fact-gathering investigation and analysis was conducted in order to produce a short summary report. The investigation mainly focussed on the actions and conditions directly relating to the occurrence and might not cover all aspects of the aircraft operation and/or possible underlying safety factors due to the expected safety benefit of it and/or the extent of evidence/resources available.
Other parties involved	The Gliding Associations of Belgium.
	AAIU Belgium would like to thank the mentioned parties above and all other entities and individuals that have contributed to this safety investigation.