Accident

Aircraft Type and Registration:	Schleicher ASW 24, G-CHBB	
No & Type of Engines:	None	
Year of Manufacture:	1991 (Serial no: 24132)	
Date & Time (UTC):	16 August 2023 at 1125 hrs	
Location:	Dunstable Airfield, Bedfordshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - 1 (Fatal)	Passengers - N/A
Nature of Damage:	Unknown	
Commander's Licence:	Sailplane Pilot's Licence and BGA Certificate	
Commander's Age:	47 years	
Commander's Flying Experience:	131 hours (26 of which were on type) Last 90 days - 11 hours Last 28 days - 0 hours	
Information Source:	AAIB Field Investigation	

Synopsis

The accident occurred during an aerotow launch from Dunstable Airfield. Eyewitnesses reported that, at an early stage in the launch, the glider's vertical positioning behind the tug was unstable. While the pilot appeared to regain some control over the instability, shortly after the towing aircraft lifted off, witnesses noticed the tow rope had become detached from the glider, which was below 50 ft agl at the time. Despite the lack of traction from the towing aircraft, the glider continued to climb to between 50 and 100 ft agl before it entered a steep left turn with low and reducing airspeed. Shortly after entering the turn the glider yawed left and autorotated into an incipient spin before striking the ground nose first. Witnesses on the airfield arrived at the glider within 80 seconds of the accident but nothing could be done to save the pilot who had suffered fatal injuries during the accident sequence.

The investigation did not identify any mechanical issues with the tow release or other defects which could have led to an uncommanded release of the tow cable or adversely affected the controllability of the glider.

The investigation could not conclusively determine why or how the tow rope came to be released from the glider at an early stage in the takeoff. With the glider no longer connected to the towing aircraft, the accident pilot found himself in a challenging position, possibly suffering from the negative performance shaping effects of startle and/or surprise. With little height or speed available to him he needed to quickly decide on an appropriate course of action. That he decided to turnback toward the airfield indicates he did not consider landing ahead was a viable option. Tragically, at the height and speed he found himself, turning back proved unachievable.

This accident serves to highlight how challenging it is to make effective decisions when something goes wrong unexpectedly at a critical stage of flight. While pilots may verbalise their intentions as part of an eventualities brief, being able to enact the plan when startled, surprised and under extreme pressure, is not necessarily assured.

History of the flight

The accident pilot arrived at Dunstable Airfield on the morning of 16 August 2023 and proceeded to rig G-CHBB after removing it from its trailer. Other than asking for the assistance of another club member to help him attach the wings, the pilot completed the rigging process by himself. The glider was then towed to the launch queue at the start of the westerly aerotow run (Figure 1).

With the help of a wing runner, the pilot conducted a check of the glider's tow cable release mechanism before beginning the launch sequence. Once the tow rope had been finally secured and the slack taken up, the accident pilot used his onboard radio to call "all out" to the tug aircraft's pilot, signalling that he was fully ready for the launch. The tug pilot then applied full power and began the takeoff roll.

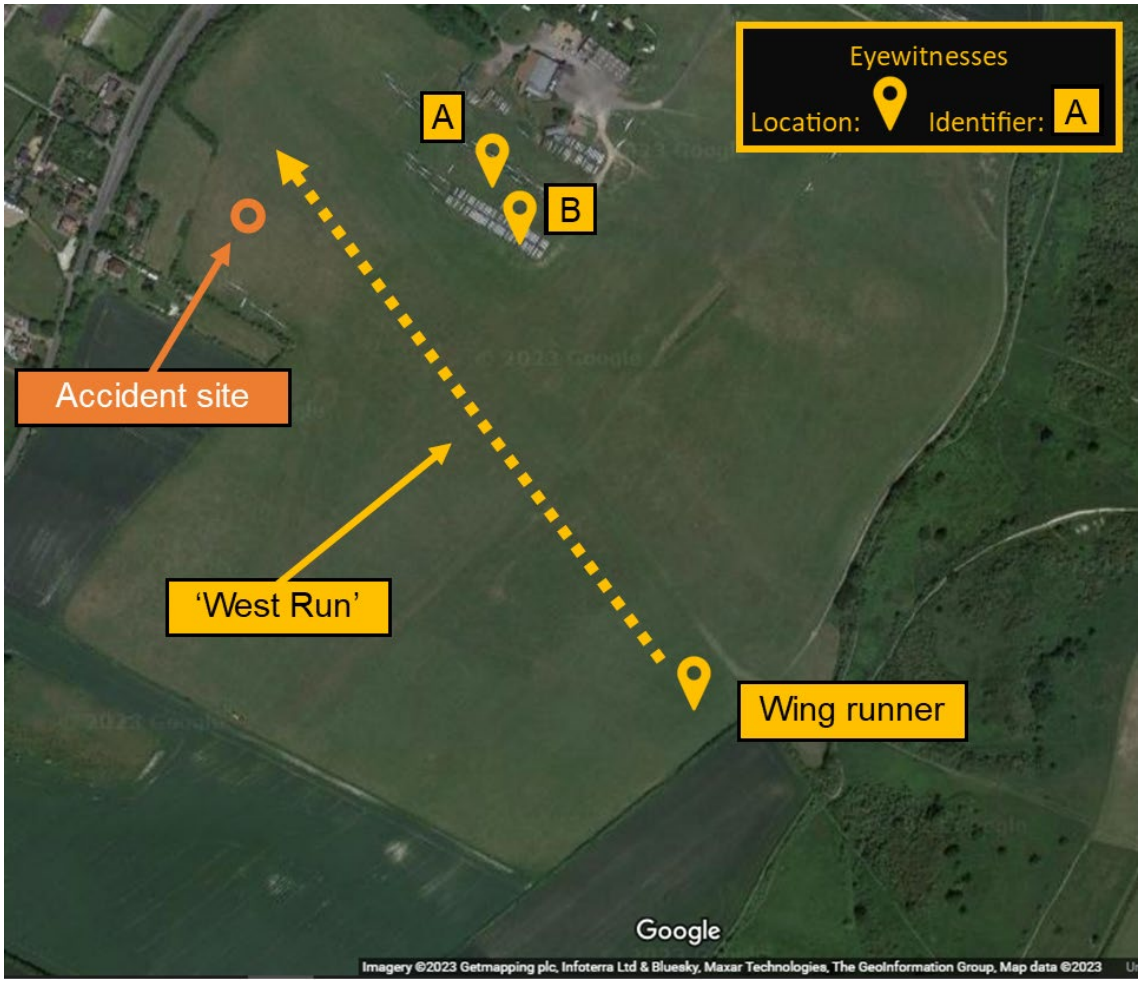


Figure 1

Overview of Dunstable Airfield, including accident site and eyewitness locations

The wing runner ran with the glider until its speed was too fast for him to keep up, so he released the wingtip. At that stage everything seemed normal with the glider, its airbrakes were retracted, and the pilot appeared to have no difficulty holding its wings level. The wing runner headed back to the starting position but on hearing shouts from nearby onlookers turned around to see what was happening. At that point he saw G-CHBB initially below the level of the tug aircraft before it then climbed higher. From the way the glider was flying, he assessed that it became very slow as the climb progressed and that the takeoff was going "badly wrong." G-CHBB then entered a steep left turn, during which the left wing dropped and the glider appeared to enter a spin to the left before striking the ground nose first shortly thereafter.

The tug pilot reported that the initial stages of the aerotow were as expected. Shortly after commencing the ground roll he looked in his mirrors and saw that all looked normal with the glider, its wings were level and its airbrakes were retracted. After checking on the glider, he focused his attention on flying his own aircraft, G-LGCC, safely off the ground. Shortly after lifting off, and while still over the airfield, he detected an unexpected increase in performance from the tug as it started to climb and accelerate faster than expected. While he had not felt any sensation of the tow rope releasing, he could not see the glider in his mirrors and became concerned that it was no longer attached to the tug. He radioed the glider pilot asking him to confirm that he had released the tow but did not receive a reply. Shortly afterwards, an observer on the ground radioed the tug pilot informing him that the glider had crashed. The tug pilot then flew an abbreviated left hand circuit to land on the Northeast Run and parked his aircraft at the aerotow launch grid. On vacating the aircraft, he inspected the tow rope which he saw remained hooked onto to the rear of the tug. The tow rope was intact, with its weak link and connecting rings still attached at the glider's end.

The nature of the glider's flightpath after it lifted off caused Eyewitness A, who was stood on the airfield near the row of glider trailers (Figure 1), to become concerned about the general vertical stability of the tow. He reported that, at an early stage in the aerotow, while the tug was still on the ground the glider was flying "unusually high." The glider pilot initially corrected by descending to an estimated 0.5-1.0 m above the ground but this correction was followed by a second vertical oscillation. After the tug got airborne the glider appeared to settle into a more stable position, climbing with the tug. When it was passing through a height of approximately 6 m the glider appeared to pitch forward slightly. This pitch forward was preceded by a noise that the witness thought could have been the sound of the glider's towing hook back releasing[1] due to the oscillations. This witness reported then being "surprised to see the glider pitch up to re-establish the original climb angle, at [which] point the tug was clearly accelerating away" from the glider. He watched the glider climb to approximately 25 m where it levelled to a "normal gliding attitude" before entering a steep left turn. He estimated that the glider completed approximately 90-120° of turn before its nose dropped into an "almost vertical" attitude from which it did not recover. The witness ran to the accident site to find the pilot "still strapped in but unconscious."

Footnote

[1] As a safety precaution for winch launching the hook was designed to release the tow cable if the attachment ring was pulled rearwards, for example, if the glider were to be still connected as it flew past the winch position.

Eyewitness B, who was standing to the southeast of Eyewitness A, also noticed the glider when it was at low level approximately over the middle of the airfield. His attention was drawn because the distance between tug and glider was increasing, indicating they were no longer connected by the tow rope. His expectation at that point was the glider pilot would lower the nose and land ahead, but he described the aircraft as initially turning right before starting to climb and then entering a steep left turn. To Eyewitness B, the left turn appeared to be a deliberate action.

On seeing the events unfold two club members who were at the aerotow launch point immediately drove to the accident site. They arrived within 80 seconds of G-CHBB striking the ground, with Eyewitness A having reached the glider just before them. The pilot had observably suffered significant injuries and was unconscious. One of the responders was medically trained and initially managed to detect a weak pulse at the pilot's neck, although this faded shortly thereafter. An emergency services ambulance arrived at the glider within eight minutes of the accident, but nothing could be done to save the pilot.

Recorded information

An International Gliding Commission (IGC) logger and two navigation devices were recovered from the accident site, each of which could record positional flight data. The IGC logger and both navigation units were damaged because of the ground collision such that the stored data was unrecoverable from their internal memory. The navigation devices each had a supplementary microSD card for the logging of data; however, no record of the accident flight was found on either of those.

The glider and tug both had FLARM units fitted that logged and broadcast positional data (ie GNSS). The broadcast data was picked up by Open Glider Network (OGN) ground station receivers in the local area and recorded by the central OGN system.

Data for the takeoff rolls of both G-CHBB and G-LGCC on the accident flight are presented at Figure 2. This figure presents the information relative to the runway so that from above and side, the distance between the two aircraft can be visualised. It also compares the groundspeed of both aircraft.

Figure 3 plots the calculated distance between the aircraft, based on interpolations of their position each second. This figure highlights that the distance begins to diverge from about time 11:24:49, which corresponds to 1 s before G-CHBB reached 400 m distance on Figure 2. G-CHBB then veers slightly left, then right, before beginning the final steep turn to the left. The maximum recorded height was 60 ft agl.

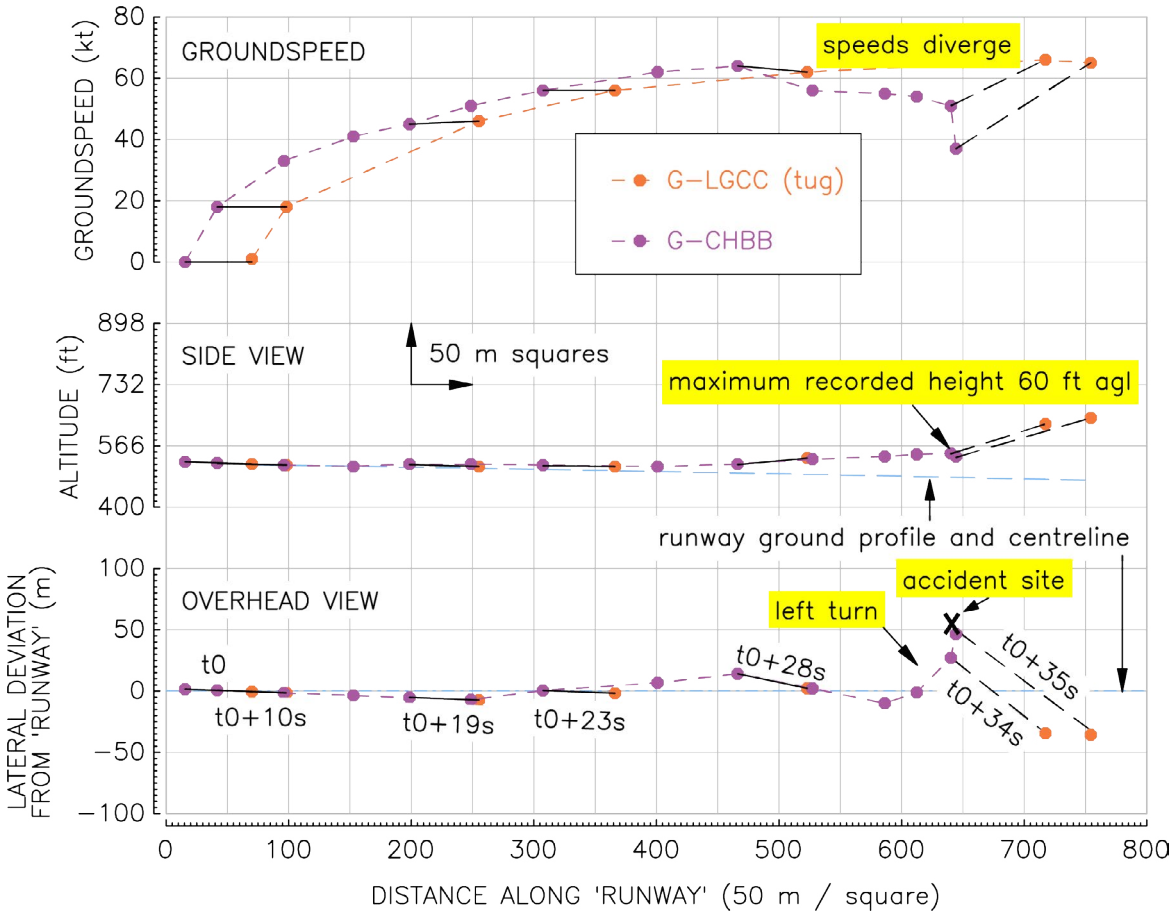


Figure 2

GPS-derived data comparing speed and relative positions of G-CHBB and G-LGCC (note that points for both aircraft that share the same time and linked with a line that is solid if the distance between them is approximately the length of the tow cable)

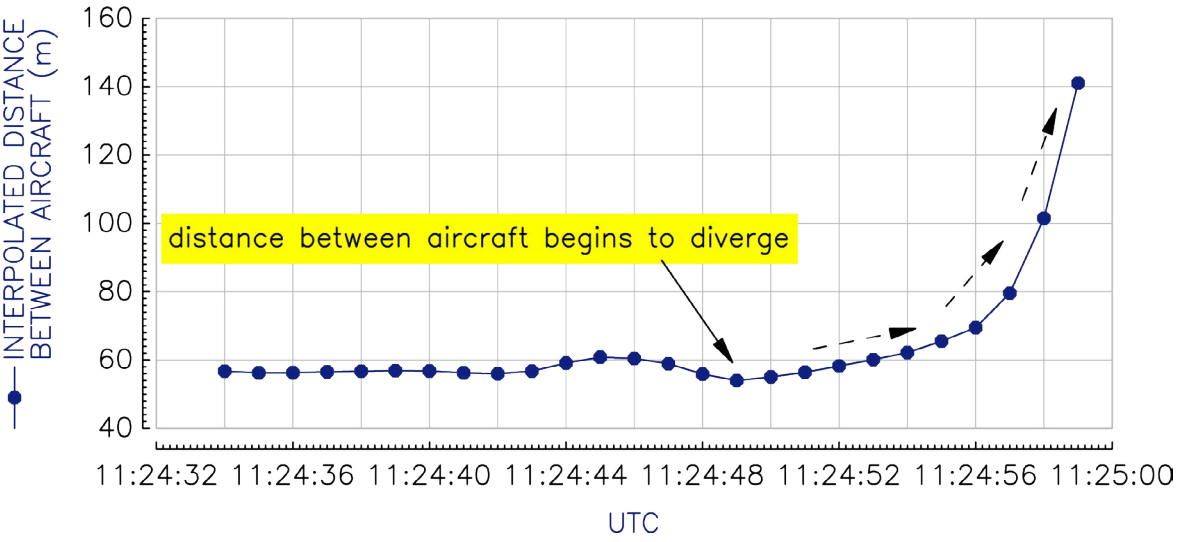


Figure 3

Interpolated distance between aircraft

Accident site

The accident site was located on the airfield, close to the western boundary which is bordered by the B489 road. The glider had come to rest upright, pointing in a northerly direction and the wreckage distribution was confined to a small area.

Onsite examination

Ground marks corresponding to the profile of the glider's nose and the leading edge of the right wing, indicated that the glider had struck the ground in a steep nose-down attitude. It then bounced, coming to rest several metres aft of the initial impact point.

The nose of the glider and cockpit area had suffered substantial disruption and the canopy had shattered. The right wing had completely fractured at the approximate mid-point, remaining attached to the inner part of the wing only by the aileron control rod. The outboard leading edge showed evidence of contact with the ground, as did the right wingtip which was partially dislodged.

The left wing appeared largely undamaged, except for some cracking close to the wing-root.

The tailboom had separated from the glider during the impact and remained attached to the fuselage only by the horizontal elevator control rod, which was bent. The tailboom and tail assembly came to rest parallel to the right wing trailing edge, with the tip of the horizontal tailplane resting on the upper wing surface.

The airbrakes on both wings were found extended. The left airbrake appeared undamaged. The forward web of the right airbrake was buckled, and the top surface exhibited a concave profile. A light linear scuff mark on the right side of the vertical fin, was consistent with it having struck the top of the extended right airbrake, during the impact sequence.

Control continuity was confirmed within the elevator, rudder, aileron and airbrake control circuits.

Aircraft information

The ASW 24 is a single-seat high-performance 'standard class' sailplane. It was designed and manufactured by Alexander Schleicher GmbH and first flew in 1987. It is of predominantly composite construction and is equipped with a retractable mainwheel and single cable-operated centre-of-gravity (CG) tow release (also known as a "belly hook" or "CG hook"). The flight control systems for the aileron, airbrake, wheel brake and elevator are of the pushrod type, while the rudder is operated by cables.

The ASW 24 has a provision for the carriage of water ballast but there was no evidence that water was being carried on G-CHBB.

G-CHBB was constructed in 1991 and was initially privately operated in the UK. Since 2002 it had been owned and operated by the resident gliding club at Dunstable Airfield. Between January and May of 2016, at 2,473 flying hours (FH) and 1,138 launches, G-CHBB

underwent a 3,000 hour life extension inspection at a maintenance facility in Poland. The glider gelcoat was also refinished at this time and it was repainted.

Since 2019, G-CHBB was maintained under the gliding club's Self-Declared Maintenance Programme, which was based largely on the BGA's Minimum Inspection Programme. It underwent an annual inspection and Airworthiness Review Certificate renewal on 5 December 2022, at 2,759 FH and 1,340 launches. The most recent maintenance inspection took place on 1 August 2023, following a field landing. Prior to the accident flight G-CHBB had accumulated 2,776 FH and 1,351 launches.

Detailed aircraft examination

Canopy release

The canopy release levers were found in a partially open position, however damage to the canopy rim and the shoot bolts of the release mechanism, indicated that the canopy was closed at impact. Disruption to the cockpit due to impact forces would have caused the release levers to move.

Flight controls

The control rod attached to the airbrake handle was bent 90° upwards, having suffered substantial disruption during the impact. While the right airbrake was damaged by contact with the vertical fin, close examination of the left airbrake, did not reveal any indication that the airbrakes had been deployed prior to the impact.

Due to the disruption of the cockpit, it was not possible to confirm the trim setting.

Tow release system

It was not possible to test the function or measure the release force of the tow release system in its installation condition, due to the extent of the disruption to the cockpit and forward fuselage. The tow release handle was undamaged and the cable was intact, free from bends or kinks, and appeared to move freely through the cable guides/sheaths. Upon removal from the glider, the housing and hook of the tow release coupling were free from dirt or corrosion and the hook appeared to operate normally. The tow release was taken to the manufacturer's facility for detailed examination and testing.

A short section of winch cable, likely from a previous winch cable break, was retrieved from the airfield in the approximate area of G-CHBB's takeoff roll. It was damaged and badly deformed with individual cable strands splayed. Its condition was consistent with having been run over by the airfield tractor mower. There were no witness marks on G-CHBB's lower fuselage or on the tow release itself, to indicate that this debris could have interacted with the tow cable release in any way. Its presence on the airfield was therefore considered incidental.

Tow release

Maintenance requirements

The tow release on G-CHBB was a Tost Type G88 release, serial number (SN) 056068 which was manufactured in 1991 and fitted to G-CHBB at the time of production. Tow releases are certified, safety-critical parts and are treated as lifed items. Other than routine cleaning and lubrication, no modification, adjustment, or overhaul is permitted and overhaul can only be conducted at Tost facilities.

The overhaul requirements for the Tost tow releases have evolved somewhat over time. Earlier models of tow release were required to be overhauled every three years. When the G88 model was introduced, the initial issue of the operating manual published in 1989, specified a maximum operation period of four years or 2,000 launches, whichever occurred soonest.

In 2001, Tost issued a Technical Note (TN) No.1-2001 amending the maximum overhaul interval for all models of tow release to 10,000 actuations, which it considered equivalent to 2,000 launches, and the four-year interval became a recommendation. The G88 operating manual was updated accordingly. Airworthiness Directive 1989-018/3 effective date 2 April 2002[2], was issued to mandate the requirements of TN No.1-2001.

Prior to the EASA taking over responsibility for the airworthiness of aircraft in 2008, UK gliders were unregistered and unregulated, and their airworthiness was supported at a national level by the BGA. Historically, under the BGA system, Tost tow releases were maintained 'on condition,' subject to a daily function check, annual inspection and replacement when found to be worn. This 'on condition' self-regulated approach was withdrawn effective 30 April 2005, since when Tost tow releases fitted to UK gliders became subject to the life limitations described in AD 1989-018/3. The BGA's interpretation of the Tost life limitations indicated that club gliders could assume 4 to 5 actuations per flight, which equates to 2,000 – 2,500 launches and private gliders could assume 3 to 4 actuations per flight, which equates to 2,500 – 3,000 launches.

G-CHBB relevant maintenance records

G-CHBB's maintenance documentation did not include any records to indicate that the tow release had been overhauled since its manufacture.

Life-limited items on G-CHBB were tracked on a 'lifed items status report' included in the maintenance documentation for each annual inspection. For each item, the recorded information included the current hours and launches of the component, the overhaul interval, when an overhaul had last been conducted and when it was next due (in launches). Following the introduction of a new format logbook in 2019[3], this information was also

Footnote

[2] Airworthiness Directive 1989-018 issue 3 effective date 2 April 2002 (issued by German Luftfahrt-Bundesamt), superseded AD 1989-018 dated 23 February 1989 and AD 1989-018/2 dated 18 October 2001. The original version of the AD was not applicable to the G88 model of tow release.

[3] G-CHBB's first logbook covered the period September 1991 to November 2019. A second logbook covered the period November 2019 to 2023.

recorded on the 'lifed items' page of the logbook. The gliding club used 2,500 launches as the overhaul interval for the tow release on G-CHBB; but as the glider had not reached this threshold, these reports typically showed that the overhaul was next due at 2,500 launches.

Photographs taken during the life extension inspection in 2016 (at 2,473 FH and 1,138 launches) showed that the tow release had been removed from the glider, cleaned and repainted after which it looked as if new (Figure 4). While the associated worksheets and life extension inspection checklist indicated that the hook had been inspected, no other maintenance on the tow release was documented.

Figure 4

G-CHBB tow release before (left) and after (right) cleaning and repainting in 2016

The subsequent 'lifed items status report' in January 2017 continued to show that the next overhaul was due at 2,500 launches. However, the equivalent report for the next annual inspection in November 2017 (at 2,528 FH and 1,183 launches) indicated that the tow release overhaul had last been completed at 1,138 launches (which corresponded with the 2016 life extension inspection) and was next due when the glider reached 3,638 launches. This information was then carried through on subsequent 'lifed item status reports' and was transferred into the new logbook in 2019.

Both the January 2017 and November 2017 reports were compiled by the same inspector. He indicated that he could not imagine having changed the information without some corroborating evidence but given the time elapsed, could not recall what that may have been. He offered a possible explanation that upon seeing the photographs taken during the life extension and/or the apparent 'as new' condition of the hook during a subsequent annual inspection, he may have made the assumption that it had been overhauled.

Examination and testing of the tow release

The tow release from G-CHBB was taken to the manufacturer's facility for examination, testing and disassembly. Its records showed that S/N 056068 had not been returned for overhaul since its original manufacture. External visual examination confirmed the tow release to be in its original design condition, with the exception that the housing and ring cage had been repainted, using paint different to that used by the manufacturer. All mechanical parts moved freely, although there was no evidence of recent cleaning or lubrication.

The force required to release a tow cable with 750 daN load was measured twice, at 128 N and 126 N. For new or overhauled tow release couplings, the manufacturer adjusts this value to be within the range of 110 ±15 N. Although marginally out of range, the manufacturer stated that lubrication would bring the release force within range, and therefore considered the measured value to be acceptable. The automatic release angle was measured as 81°, which was in the allowable range of 83 ± 7°.

Disassembly revealed that all internal parts were present and unaltered from the original design. Residue of old grease was evident on internal components. Neither the inside of the housing, nor the bolt shanks had been repainted, indicating that repainting had taken place without disassembly.

In summary, there was no indication that the tow release coupling had been modified, disassembled or damaged in the past. Its condition was consistent with a tow release of its age that had not been subject to overhaul. The manufacturer considered that the painting and apparent lack of recent lubrication appeared to have no negative effects on the function of the tow release. Based on the test results, the manufacturer considered that the release was in an acceptable technical condition.

The manufacturer considered that G-CHBB's tow release would have lost its airworthiness in 1995, four years after its manufacture, because prior to 2001, it required G88 tow releases to be overhauled every four years or 2,000 launches, whichever occurred first. Being a German company, its position was based on the German regulations applicable at the time. However, at that time, tow releases on UK gliders operated under the BGA system were maintained 'on condition' and were not required to comply with the manufacturer's four-year overhaul interval.

Airfield information

The airfield occupies an undulating site on lower ground to the west of Dunstable Downs. The resident gliding club oversees flying from the airfield including winch, aerotow and self-launch operations. There are several launching tracks (runs) available depending on the wind conditions on the day (Figure 5). On 16 August 2023, the wind was relatively light and blowing from a northerly direction, so the Northeast Run was operational for winch launching. There were a significant number of pilots participating in a club cross-country event and requiring aerotow launches, therefore a grid-style launch queue was established on the West Run to deconflict from the winch launching activities. As a further measure, the winch cables were retracted and no winch launching took place during the period when the aerotow run was active.

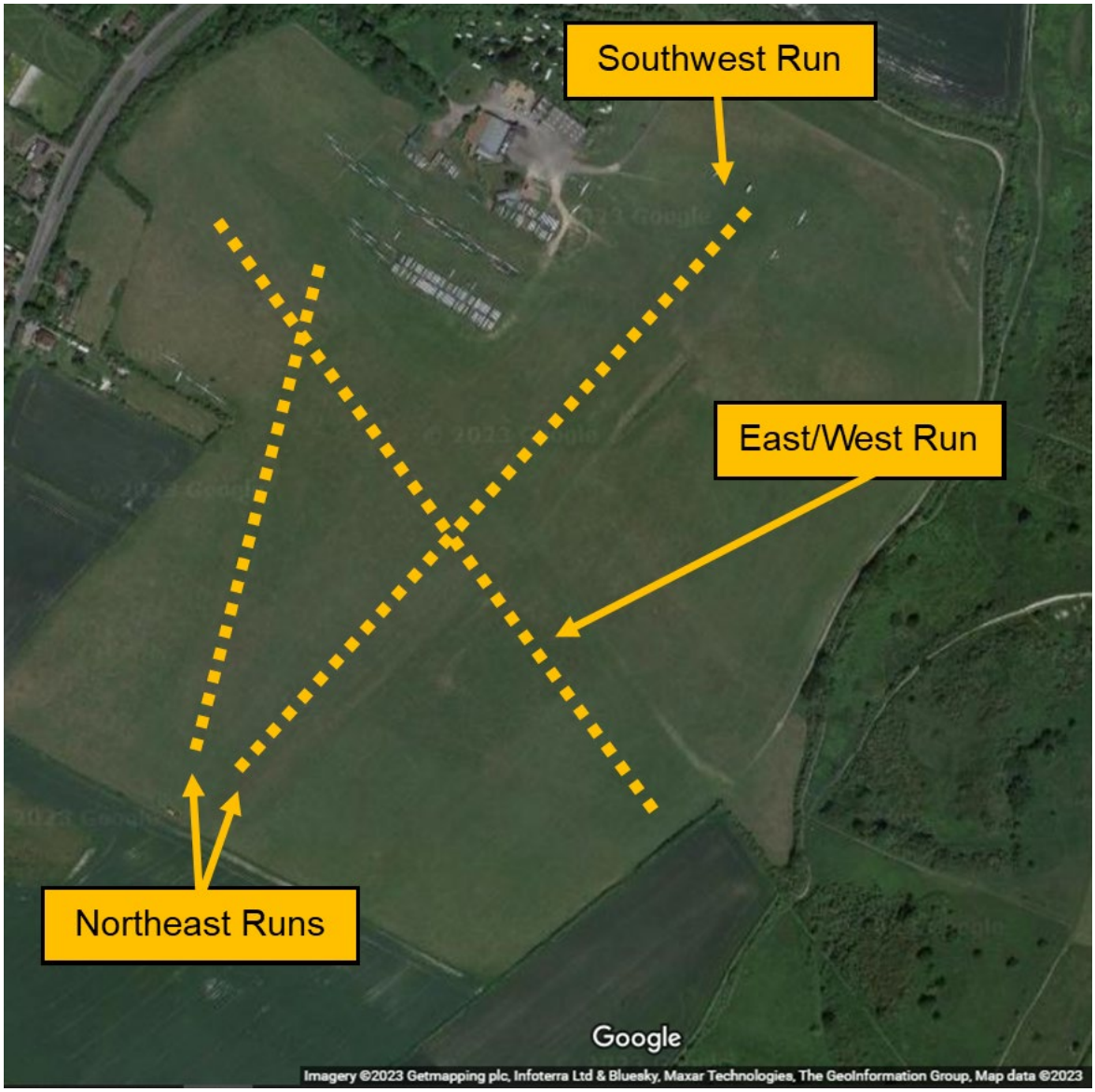


Figure 5

Launch runs at Dunstable Airfield

The West Run's average gradient is 2.4% downhill from the launch point to the airfield's north-western boundary. Beyond the boundary the ground falls away more steeply toward the B489 road, residential buildings, and trees before rising gently over open farmland beyond (Figure 6). In part to avoid overflying the hazards west of the road, but also for noise abatement considerations, tug pilots aerotowing on the West Run would aim to turn right onto a more north/northeasterly track once safely airborne.

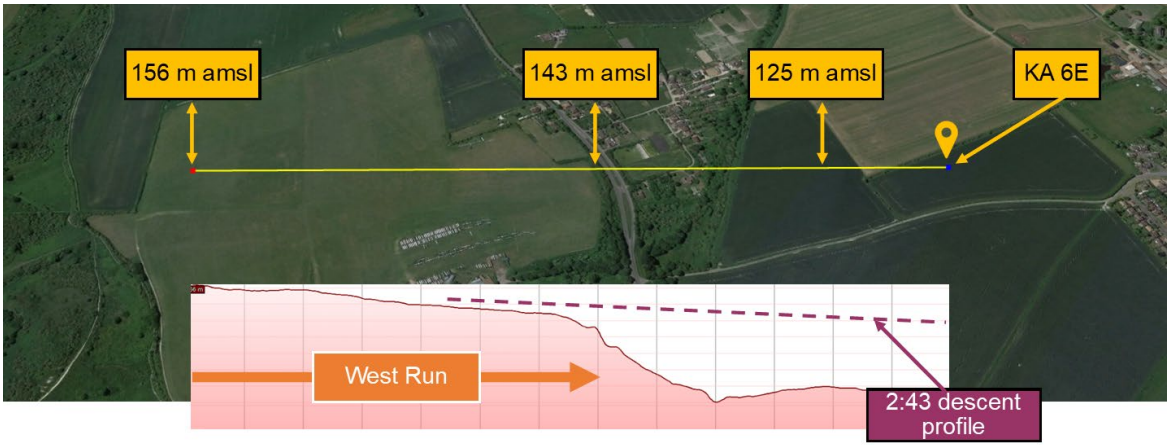


Figure 6

Cross sectional elevation of the West Run[4,5]
(imagery ©Google Earth 2023)

On the West Run there are only two realistic options for landing in the event of an aerotow launch failure below a height at which a turnback toward the airfield would be achievable. The first is to land within the remaining airfield ahead, the second is to glide over the B489 to land in one of the fields beyond the intervening hazards. Pilots at the club are trained that, before the tow commences, they should have in mind a cut off/decision point during the launch where the first option of landing and stopping within the airfield boundary is no longer possible, thereafter landing out would become the target. These decision points would vary for each launch depending on factors such as the known gliding performance of the aircraft being flown and the prevailing weather conditions. Given the area of inhospitable ground between the B489 and the open fields, there could be occasions where a launch failure occurred with insufficient clear airfield ahead for a normal braked landing yet the distant fields were unreachable due to the glider's performance. In such a situation, landing on the airfield and deliberately executing a ground loop[6] would likely be the preferred option. The images at Figures 7 and 8 below are from two separate points approximately 40 ft above the West Run and give an indication of the likely view ahead for the accident pilot from those locations. Figure 7 was thought to be the earliest point at which the tow rope could have released and Figure 8 was the approximate position of the glider when it commenced the final left turn.

Footnote

4 Position KA 6E is explained in section '*Organisational information/Aerotow launch failure events at Dunstable Airfield.*'
5 The significance of the 2:43 descent profile is detailed in section '*Aircraft handling/Gliding performance.*'
6 See section '*Aircraft handling/ASW 24 handling notes*.'

Figure 7

View from the estimated earliest position when the tow rope became disconnected

Figure 8

View from the approximate position of G-CHBB immediately before the left turn

Weight and balance

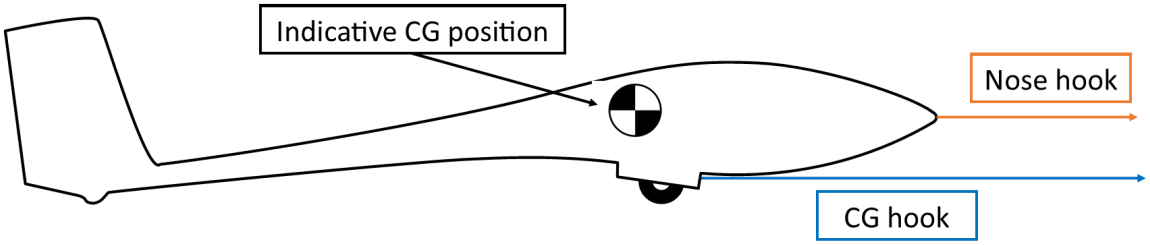
Based on the glider's last weighing record, dated October 2022, the basic weight of the aircraft was 255 kg and the range of allowable pilot weights to remain within CG limits was 67-110 kg. While wearing his parachute, the pilot's boarding weight would have been approximately 90-95 kg.

Aircraft handling

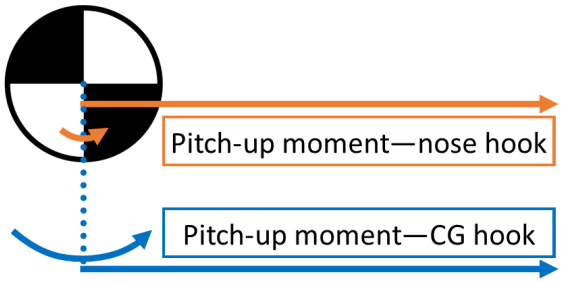
Aerotowing using CG vs nose hook

For either winch or aerotow launching, gliders need to be fitted with an appropriate hook to which the launching cable or tow rope can be attached. Gliders are primarily equipped with a CG hook which has a back release capability and is compatible with either winch or aerotow launch methods. While the CG hook can be used for aerotowing, having the tow cable attached lower than the glider's vertical CG position generates an undesirable, but unavoidable, nose-up pitching moment. Where fitted, a nose hook is preferred for aerotowing because, while the pull force from the nose hook might not always be vertically aligned with the CG, the magnitude of any resultant pitching moment would be significantly less than when using the CG hook (Figure 9). G-CHBB did not have a nose hook, therefore the CG hook was necessarily used for both winch and aerotow launching.

The club explained that the mitigations to compensate for the CG hook pitch-up moment, "setting the correct trim position and applying modest forward inputs on the control stick," are drawn to the attention of pilots when they are first converting to the ASW 24 type.



(a) Nose vs CG hook configuration



(b) Exemplar comparison of nose vs CG hook, pitch-up moment about CG

Figure 9

Indicative comparison of nose-up pitching moments for CG and nose hooks
(Illustration not to scale nor representative of the actual CG position for the ASW 24 type)

ASW 24 handling notes

The ASW 24 Flight Manual (FM) describes the type as a '*high-performance*' aircraft, '*suitable for record breaking and competition flying*' which possesses '*pleasant flying characteristics*.' It further states that, in the event of a stall '*in straight or circling flight, relaxing of back pressure on the stick will always lead to recovery.*' An independent flight test evaluation report, published in 1994[7], described the stalling characteristics of the ASW 24 as being '*relatively gentle for a high-performance sailplane*,' but that '*it would drop a wing if provoked and will start to spin if the stick is held aft.*'

The FM guidance for aerotowing is that a tow rope between 40 m and 60 m in length should be used and the pitch trim should be set '*nose heavy.*' Pilots are also advised that fully deploying the airbrakes at the start of the takeoff run can be '*useful*' to prevent the glider from overrunning the tow rope until the slack is taken up. If used in this manner, the airbrakes should be '*promptly closed and locked*' once the ailerons have become effective during the ground run. The tow rope was 50 m long and the air brakes were seen to be retracted before takeoff. Disruption of the cockpit area meant that the takeoff trim setting could not be determined.

The recommended aerotow takeoff technique is that, once airborne the glider pilot should initially climb to and maintain between 1 m and 2 m above the ground '*in order to avoid pitch oscillations caused by ground effect and slipstream turbulence from the tug*.' The FM states a '*maximum acceptable crosswind component*' of 13½ kt for aerotowing.

The '*Emergency Procedures*' section of the FM directs that, '*if the aircraft threatens to roll out beyond the intended landing area*,' the pilot should initiate a controlled ground loop '*not less than 40 m'* from the boundary hazard. The aim of ground looping would be to scrub off speed and bring the glider to rest before it overruns the landing area.

Stalling speed

Interpolation of the FM performance information using an assumed all up weight of 350 kg gives a basic stalling speed for an ASW 24 in level flight of approximately 36-37 kt. In a balanced turn at 60° angle of bank[8] the stalling speed would increase to approximately 57 kt and would further increase with steepening bank angle.

Gliding performance

The performance chart at Section 5.3 of the glider's FM (Figure 10) indicated that, in a clean configuration and wings level flight, airspeeds in the range 47-59 kt would generate a maximum achievable glide ratio of 1:43, equating to an approximate descent gradient of 2.32%. Either side of that speed range gliding performance would be reduced.

Footnote

[7] Flight test evaluation of the Schleicher ASW 24W by Richard H Johnson. Published in Soaring Magazine, May 1994.

[8] The maximum bank angle provided for on the relevant FM '*Stalling Speed Diagrams*.'

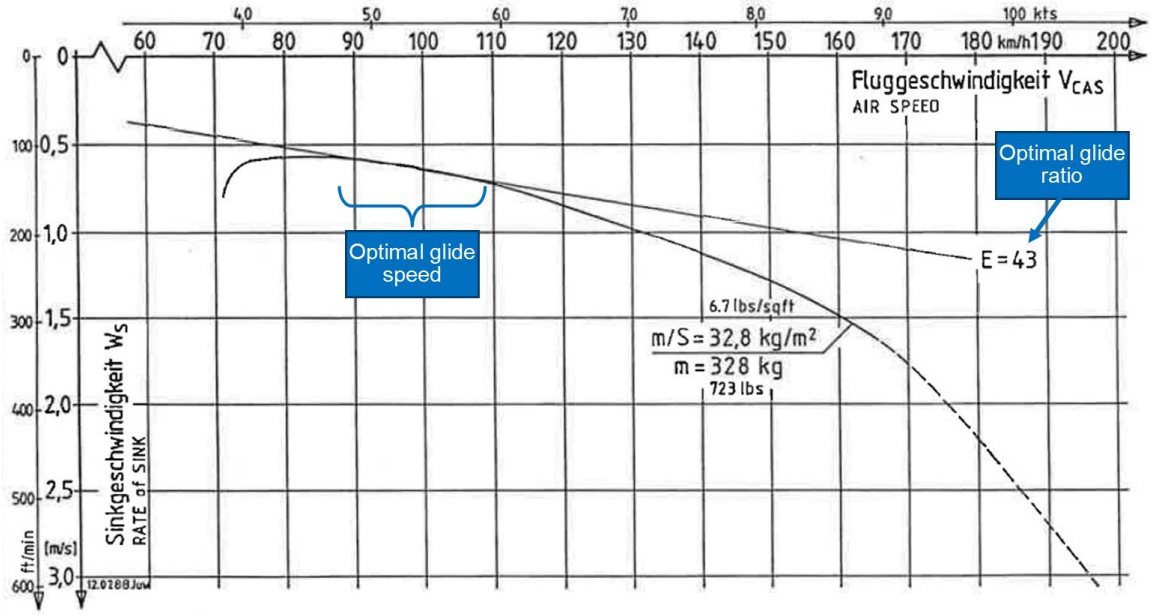


Figure 10

ASW 24 FM performance chart (courtesy of manufacturer)

The FM did not contain performance data for other than the clean configuration. An experienced ASW 24 pilot reported that, in their opinion, gliding performance would be reduced to approximately 1:30 with the landing gear extended. As an additional margin for uncertainty, the investigation used a notional 2:43 (1:21.5) glide angle when estimating the gliding range options available to the pilot after the tow rope became disconnected[9].

Meteorology

At the time of the accident, good weather prevailed at the airfield. It was a sunny day with broken cloud above 1,000 ft and excellent visibility. There was a gentle northerly breeze which would have resulted in a crosswind from the right of approximately 5-10 kt for aerotows using the West Run.

Personnel

The accident pilot had been a member of the club at Dunstable since taking up the sport in 2018 and most of his flying had been undertaken there. He held a Sailplane Pilot's Licence issued by the CAA in August 2021 as well as a UK Gliding Certificate issued by the BGA[10]. He first flew solo in July 2018 and completed the requirements for the Silver Badge[11] endorsement in September 2021. In 2022 he qualified as a BGA Basic Instructor[12] and successfully completed a bi-annual competency check flight with one of the club's instructors in February 2023.

Footnote

[9] See *Analysis/Decision making* section.

[10] Under delegation from Royal Aero Club who are recognised by the Fédération Aéronautique Internationale as the air sports authority in the United Kingdom.

[11] Qualification requirements detailed at Sporting badges and diplomas requirements - Pilot & Club Info (gliding.co.uk) [accessed 28 November 2023].

[12] Details of BGA instructor rating scheme can be found at About BGA Instructor and Coach ratings - Pilot & Club Info (gliding.co.uk) [accessed 28 November 2023].

The club advised that, because G-CHBB was a club-owned glider, prior to flying it, the pilot had been required to "demonstrate his abilities to a senior instructor." The type conversion process comprised "an evaluation of the pilot's suitability to fly the type, the associated training on rigging/derigging, and check flights in another high-performance glider, with his first flights on type being supervised."

Having first flown G-CHBB in March 2019, the accident flight was the pilot's twenty-fifth launch in the glider, and he last flew it on 16 June 2023. All his flights in G-CHBB were launched by aerotow. From the data available to the investigation, since March 2019, over 72% of all the flights undertaken by the pilot in any glider were aerotow-launched.

Autopsy findings

A post-mortem examination did not discover evidence of the pilot suffering from any acute or chronic medical condition that might have contributed to or caused the accident. The pathologist's finding was that the pilot died from '*multiple traumatic injuries.*'

Organisational information

Oversight of UK gliding

The BGA, as the sport governing body of gliding in the UK, publish their own operational regulations through their '*Laws and Rules*' webpage[13]. This webpage also contains links to BGA protocol documents detailing requirements and guidance for its member pilots. One of these documents, Managing the Flying Risk[14] (MFR), has the described aims of providing '*pilots and clubs with guidance on how to better understand, minimise and manage the hazards associated with gliding operations, including with powered gliders and tug aircraft.'* The guidance contained within the document comprises 24 sections designed to cover the complete spectrum of gliding operations, for example, Section 5 contains a 'currency barometer' and Section 10 provides guidance on safe aerotowing.

The Section 5 barometer acts as a quick reference guide for pilots to assess their level of currency. It uses inputs of launches completed and hours flown in the previous 12 months to generate a pilot currency status of Red, Yellow or Green. The accident pilot had flown a total of 53 launches and 18¾ hours flight time since 17 August 2022, correlating to a Green ('*your status is good but take care*') currency status, as described by the barometer. In addition to generating a currency status, the barometer also recommended that pilots who had completed less than three takeoffs and landings in the previous 90 days should undergo a dual check flight before flying as pilot in command. The accident pilot had flown three takeoffs and landings within the preceding 90 days. The club's operations manual also explicitly recommended the BGA currency barometer to it members and explained where a copy could be found displayed on a noticeboard in the club buildings.

Footnote

[13] Available at Laws and Rules - Pilot & Club Info (gliding.co.uk) [accessed 10 April 2024].
[14] Available at https://members.gliding.co.uk/bga-safety-management/managing-flying-risk-index [accessed 11 October 2023].

The guidance in Section 10 of the MFR document focused on aerotowing and listed '*gliders fitted with* [CG] *hook only*' as an additional risk factor which might contribute to a tug upset[15] situation due to the undesirable pitch up moment generated by geometry of the tow hook being below the glider's CG.

Guidance for launch failures

In common with powered aviation, losing launch traction during takeoff is an acknowledged risk factor for gliding. Exemplar failure modes might be a launching winch losing power or the tow rope breaking at a critical point on an aerotow. Techniques for safely handling such emergencies, generically referred to as cable breaks, are introduced at an early stage in a pilot's training. Cable breaks are routinely practised during subsequent check flight details for qualified pilots. When conducting dual training and check flights, launch failures are typically simulated by the instructor initiating an unannounced early cable release during a launch. Due to the elevated risk of landing away from the airfield, invariably such simulated emergencies will be initiated when the glider is able to safely land within the runway remaining ahead or is high enough to fly an abbreviated circuit to land back on the airfield.

Simulated cable breaks are not routinely initiated below turnback heights on aerotows, instead low level failures are practised in motor gliders. For these simulations, the motor glider's throttle is closed to simulate the cable break and reopened once the trainee has completed their immediate actions of establishing a safe gliding speed and identifying a suitable landing area.

In the June/July 2023 edition of their Sailplane & Gliding magazine, the BGA published an article titled 'Aerotow Options'[16] which discussed the topic of preparation for aerotow launch failures. The article included discussion on launch failure eventualities and reference to the use of simulators and motor gliders to safely simulate low-level aerotow launch failure events.

The club reported that their instructors teach students about launch failures, and how to handle them, in a manner consistent with the BGA Instructors' Manual and reinforce to pilots the potential hazards of turning back without sufficient height. The club was commissioning a flight simulator to further supplement the teaching of low-level aerotow failures in addition to "continuing emphasis being applied as part of a pilot's eventualities assessment."

Attempting to turnback toward the airfield following a loss of traction in the early stages of a takeoff attracts significant risk. In such a situation, the aircraft is critically low on both height and airspeed meaning there are limited viable options open. In a turn an aircraft's stalling speed and the amount of induced drag generated both increase. Unless height is available for the pilot to maintain speed by descending, the glider will decelerate. In situations such as this, the tighter and more prolonged a turn the more rapid the speed decay and the more likely it is the aircraft will enter a stall and/or spin with insufficient height available for recovery.

Footnote

[15] When an out of position glider causes the tow rope to exert a sufficiently destabilising force on the tug aircraft that its pilot loses control of their aircraft.

[16] Available at Aerotow options - Pilot & Club Info (gliding.co.uk) [accessed 11 April 2024].

Loss of roll control leading to a glider's wingtip touching the ground during the takeoff roll has led to fatal cartwheel accidents in the past. Glider pilots are instructed to immediately release the tow by pulling on the cable release if an uncontrollable wing drop occurs on the ground. To facilitate a timely reaction, pilots are encouraged to keep one hand on the cable release toggle, at least until they are safely airborne[17].

BGA instructor guidance

Among various resources for instructors across the many clubs comprising its membership, the BGA publishes an instructor manual on its website. Section 4-17 of the manual[18] covers aerotow launching. Specifically, some of the hazards associated with aerotow launch failures are outlined as follows:

> *'During the early stages of an aerotow, safe landing options are limited. Unlike wire launches, there can be a period when it isn't possible to land safely within the airfield boundaries. In the event, there is little time to think about the options or to search for places to go, so it's important to identify suitable off-field emergency landing areas during the tow… Until the glider is at a safe height to turn back, the only options are to land straight ahead or a few degrees to either side. At some sites there may be a short period in which the only available option is a more or less controlled crash. The primary aim then is to avoid personal injury. Fly the glider onto the ground in a clear space and ground loop at the slowest achievable speed… If the controlled crash option seems unpalatable, compare it with the risks of doing a low turn, catching a wingtip and cartwheeling, or spinning.'*

A key risk factor for aerotowing is the glider getting significantly out of position, vertically and/or in azimuth, which poses a serious threat to the towing aircraft. Glider pilots are taught that in such situations, the only safe option is to release the tow and abort the launch. Regarding tug upsets, section 4-17 of the manual states:

> *'These are serious and have caused the deaths of a number of tug pilots. If the glider is allowed to climb rapidly behind the tug, it can very quickly become impossible to prevent it accelerating upwards in a slingshot action (rather like a winch launch) and tipping the tug over into a vertical dive... Once that has happened only height can save the tug pilot from disaster. Downward displacement of the glider to a position below the slipstream is quite acceptable, but upward displacements are much more critical. The glider pilot must release immediately if the glider is going high and the tendency cannot be controlled, or the pilot loses sight of the tug. Factors which can combine to create a tug upset accident [include] … glider with a belly or CG hook…'*

Footnote

[17] BGA Instructor Manual, sections 17-3 (*Ground Operations*) and 17-7 (*Take-off*).

[18] Available at https://members.gliding.co.uk/library/instructors/bga-instructor-manual-section-4-17 [accessed 11 October 2023].

In addition to guidance contained in its instructor manual, the BGA publishes comprehensive aerotow safety information via its website. Their '*Safe Aerotowing*' webpage[19] includes detailed information and links to resources relating to the '*inherent hazards*' of aerotowing. One of the linked resources is the BGA's '*Safer Aerotowing leaflet*'[20] which focuses on the risk from, and prevention of, tug upsets.

Gliding club operations manual

The resident gliding glub at the airfield published its own operations manual designed to ensure that '*all club operations* [were] *carried out safely and efficiently, and that all members* [were] *fully aware of both the club's operational requirements and their own responsibilities*.' The local rules and procedures contained within it were complementary and subordinate to regulations contained in publications issued by relevant higher authorities (eg the CAA and the BGA). Pilots flying from the airfield were required to read and abide by document's contents.

One specific requirement of the manual was that '*before requesting a launch, each pilot must carry out a pre-flight safety check*.' This check was to include a pre-flight walk round inspection of the aircraft by the pilot in command and the completion of an internal pre-flight checklist following '*the standard BGA procedure, represented by the mnemonic CBSIFTBEC*.' The letter 'E' of the mnemonic was explained to represent '*Eventualities: consider the range of available options in the event of a launch failure…*'

The consensus amongst glider pilots asked by the investigation was that, when considering eventualities, they would brief (self-brief if solo) the height and geographical cut off points they planned to use in the event of a launch failure and that from a low height landing ahead would likely be the safest and preferred option. Subject to local conditions on the day, approximately 300 ft would be the minimum height at which they considered turning back toward the airfield, would present as a viable option when operating from the West Run.

Tests and research

Aerotow failure statistics

Including the accident flight, the BGA's safety archive contained records of 40 reported aerotow failures below 300 ft in the 10 years to August 2023. The accident flight was the only one of those launch failure events to prove fatal. Three people suffered serious injuries in two of the other occurrences, both of which involved two-seat gliders, each with two people on board. On 22 of the reported events the pilot elected to land straight ahead, and from a total of 26 occupants from the aircraft involved, only three suffered minor injuries, the rest were unhurt.

Footnote

[19] Available at https://members.gliding.co.uk/bga-safety-management/safe-aerotowing [accessed 11 October 2023].

[20] Available at https://members.gliding.co.uk/library/safety-briefings/safe-aerotowing-booklet [accessed 2 May 2024].

On all occasions where occupants suffered serious injury, the pilot had initiated a turn rather than choosing to land straight ahead. The BGA statistics did not contain details of the degree of turn attempted in each case. The information was caveated that it '[did] *not imply the pilot definitely attempted to turn back to the airfield*' and that such turns '[could] *have been to avoid an obstruction, or by reason of loss of control, or some other reason.*'

Aerotow launch failure events at Dunstable Airfield

To supplement the BGA's statistics, the gliding club provided more detailed information about low level aerotow launch failure events[21] which had occurred at Dunstable Airfield since early July 2022.

On 8 July 2022, the pilot of a Schleicher KA 6E glider inadvertently operated the tow release shortly after the tug got airborne on the West Run. The glider pilot judged that he would be unable to land and stop within the remaining clear area in front of him and that, being at a very low level, turning back was not an option. He continued ahead and landed in a crop field approximately 300 m past the inhospitable area that lay between the B489 road and the start of the open fields to the northwest. The glider touched down close to the point marked as '*KA 6E*' on Figure 6. The only damage sustained in the landing was to the tailplane which caught on the wheat crop growing in the field. In reviewing the incident, the club observed that '*aerotowing from Dunstable, like most gliding clubs, carries a strong risk of damaging a glider in the event of a low level launch failure… When we consider a low termination of aerotow under 'Eventualities' before launching we can only aim to avoid an accident which would injure the pilots*.'

On 17 December 2022, a Schleicher ASK 21 got out of position high behind the tug at an early stage in the takeoff and the instructor released the tow rope at an estimated height of 75-100 ft. Judging there was enough height available to him, the instructor turned right to land back on the airfield. Witnesses observed that the start of the turn '*looked okay*' but that the glider quickly ran out of speed before descending out of sight behind intervening higher ground in the middle of the airfield in a steep turn with a low nose attitude. Moments later the sound of an impact could be heard. The glider's right wingtip had struck the ground in the turn causing the aircraft to cartwheel, during which the fuselage broke in half and the tailplane was ripped from the fin. While the glider was severely damaged, the two occupants escaped serious injury.

On 7 October 2023, approximately eight weeks after the G-CHBB accident, a Schleicher ASK 21 glider was being aerotowed on the Southwest Run when it became apparent, from the tug aircraft's slow initial acceleration and protracted ground run, that it was not performing as expected. While the tug managed to get airborne, it then sank back onto the runway so the instructor in the glider took control and released the tow to abort the launch. The instructor then flew a shallow 'S-turn' to position for landing in a field just beyond the airfield boundary. The glider did not suffer any damage and neither occupant was injured.

Footnote

[21] In addition to the accident flight.

Other information

Startle and surprise

Startle is a '*brief, fast and highly physiological reaction to a sudden, intense or threatening stimulus*'[22]. A startle response occurs immediately in response to a startling stimulus and can impair pilot responses for a short period of time, usually between 0.3 and 1.5 s[23].

Surprise is '*an emotional and cognitive response to unexpected events that are (momentarily) difficult to explain, forcing a person to change his or her understanding of the problem*'. Surprise often follows a startle response if the cause of the stimulus that triggered the startle is not understood. Experimental studies looking at the effects of surprise on pilots have shown for example, delayed initiation of responses[24] and incorrect or incomplete application of procedures[25].

Analysis

Technical aspects

The investigation did not identify any defects which could have adversely affected the controllability of the glider. While it was not possible to rule out a technical issue during takeoff which may have caused the pilot to be distracted or his attention to be diverted, no such issues were identified by the wreckage examination. Although the airbrakes were found extended, the evidence suggests that this occurred when the glider struck the ground. This is consistent with the wing runner and tug pilot's observations that the airbrakes were not deployed during the takeoff run.

Examination and testing of the tow release coupling did not identify any mechanical issues which could have led to an uncommanded release of the tow cable. The measured release force was only marginally outside the normal range, despite an apparent absence of recent lubrication and the manufacturer considered the release to be in an acceptable technical condition.

The investigation noted that G-CHBB's more recent technical records did not accurately reflect the overhaul status of the tow release. The tow release had never been overhauled and had not reached the 2,500 launch overhaul criteria. However, an erroneous entry in the maintenance documentation implied that it had been overhauled at 1,138 launches. The reason for this was not determined, but it is possible that repainting of the release during maintenance in 2016, which gave it the appearance of a new or overhauled release,

Footnote

[22] Landman, A., Groen, E.L., van Passen, M.M. Bronkhorst, A. & Mulder, M. (2017) 'Dealing with unexpected events on the flight deck: A conceptual model of startle and surprise' in Human Factors, Vol 59 pp 1161-1172.

[23] Martin, W., Murray, P. & Bates, P. (2012) 'The effects of startle of pilots during critical events: a case study analysis' Proceedings of 30th EAAP Conference: Aviation Psychology & Applied Human Factors – working towards zero accidents.

[24] Martin, W.L., ' Murray, P.S., Bates, P.R., & Lee, P.S. (2016) 'A flight simulator study of the impairment effects of startle on pilots during unexpected critical events.' Aviation Psychology and Applied Human Factors, Vol 6, pp24-32.

[25] Casner, S.M., Geven, R.W. & Williams, K.T. (2013) 'the effectiveness of airline pilot training for abnormal events.' Human Factors, Vol 55, pp-477-485.

could have created a false assumption that an overhaul had taken place. While this is not ideal from the perspective of airworthiness management of a lifed component, this documentation discrepancy had no bearing on the subsequent maintenance or condition of the tow release. Although it could have done so in the future if the glider had continued to operate beyond 2,500 launches.

Despite having been in service for 32 years, due to G-CHBB's low utilisation it had accumulated only 1,351 launches and, in other circumstances may have continued to operate for many more years before eventually meeting the 2,500 launch overhaul criteria for the tow release. While the tow release manufacturer recommended overhaul every four years, since 2001 there has been no mandatory calendar backstop to the overhaul interval. While not relevant to this accident, the absence of a mandatory calendar backstop may have relevance to other low utilisation gliders currently in operation.

Tow instability

G-CHBB was not fitted with a nose hook and towing using the CG hook was a known potentially destabilising factor for glider pilots aiming to maintain a consistent relative vertical position on aerotow. Nonetheless, the pilot had successfully flown 24 previous aerotows in G-CHBB using the CG hook. While the investigation considered other potential operational factors, such as distraction, it did not find evidence to support a finding that any of them directly contributed to the observed initial vertical instability on the accident flight. Considering the aerotow safety guidance published by the BGA, the pilot's status as a Basic Instructor, and that aerotowing was his preferred launch method, it was thought likely the pilot was aware of the risk posed by tug upsets and the BGA instructor manual's direction to release a tow if '*the glider is going high and the tendency cannot be controlled*.'

Cable release scenarios

While no evidence was found as to the mechanism by which the tow rope released from the glider, it was considered most likely to have resulted from the observed vertical instability of the tow. Credible scenarios for the disconnection were thought to be the hook mechanism back releasing or the pilot operating the tow release, either deliberately or by accident.

- For the mechanism to have back released, a force opposite to the direction of the tow would need to have acted on the CG hook. With a taut tow rope this would be impossible unless the glider was at an extreme angle. If the glider had started to catch the tug, possibly due to speed gained when recovering from the initial balloon after liftoff, the tow rope would have become slack and bowed. A slack rope would make back release more likely, especially if the tug was still on the ground and/or the glider was low enough for the rope to drag on the grass and impart a rearward force on the CG hook. That the tug pilot did not feel his aircraft react to the glider releasing suggests the tow rope was not taut when it became unhooked.

- Unintentional operation of the tow release mechanism could have occurred if the pilot was holding onto the release handle during the launch and inadvertently pulled it, as happened on 8 July 2022 in the incident involving a KA 6E glider. Inadvertent operation could have been made more likely if the primary focus of the pilot's attention was controlling the pitch oscillations experienced after liftoff. A factor strengthening the possibility of inadvertent release (which could include a back release) is that, from the earliest estimated point of disconnection, there appeared to be enough airfield ahead in which to land and stop before the boundary hedge. The pilot being unaware the rope had already released might also explain why the glider appeared to follow the tug's climb after the disconnection. The temporary pitch forward seen by Eyewitness A as the glider passed through a height of approximately 6 m might possibly have been an artefact of the release removing the nose-up pitch moment from the CG hook, which was then compensated for instinctively by the pilot. For an unintentional release it is more likely the pilot would have suffered from startle and/or surprise on realising that he was no longer connected to the tow rope. A response delayed by startle or surprise would have put the glider even closer to the point at which landing on the airfield ahead became untenable.

- It is possible the pilot released the tow intentionally due to concern about the risk of causing a tug upset if he was significantly out of position. The investigation did not find evidence to support or disprove any other factor, medical, operational or technical, that might have prompted the pilot to abort the launch. Factors considered to mitigate against an intentional release were:

    - It appeared to Eyewitness A that the accident pilot had managed to control the initial vertical instability and was in a normal position when the tug lifted off, thus the risk of an imminent tug upset seemed to have been avoided.

    - As soon as the pilot knew they were no longer connected to the tow, lowering the nose to maintain an efficient gliding speed would have been the most appropriate course of action. Climbing and losing speed would be counterintuitive.

    - If he made a conscious decision to release the tow cable it would be less likely for the pilot to experience subsequent startle and surprise and more likely that he would respond to the emergency without additional delay.

While the investigation considered these three scenarios, it was not possible to determine, which, if any of them, explained how the tow rope came to be released.

Decision making

Regardless of how it happened, once the tow rope had detached, the pilot was committed to an immediate emergency landing and needed to quickly decide the most appropriate course of action.

Based on interviews with other glider pilots, from the height and position at which the disconnection occurred, landing ahead would appear to have been the most appropriate course of action. The investigation learned of three recent aerotow launch failures from similar heights at the airfield, one of these happened approximately eight weeks after the G-CHBB accident. Of those three events, the two where the pilot continued ahead and landed out were successful, the one where the pilot attempted a turnback resulted in a cartwheeling accident, although both occupants escaped serious injury.

Analysis of recorded data and imagery taken by the investigation indicated that, from the earliest estimated point at which the tow rope released, there was probably enough of the airfield ahead for some form of emergency landing short of the airfield boundary. Any delay to recognition of, or response to, the disconnection would increase the risk of landing too close to the trees and bushes bordering the airfield to avoid a collision, thus making that option increasingly untenable.

Comparing a notional 2:43 glide angle with the terrain elevation profile of the West Run (Figure 3), from the earliest point of disconnection it could theoretically have been possible for the pilot to glide past the B489 and land in the open fields beyond. While theoretically possible, this may not have been apparent to the accident pilot at the time and it was not known if he was aware of the successful field landing carried out by the KA 6E pilot in July 2022. From below 100 ft agl the pilot would have been largely unsighted on the low ground and intervening hazards between the airfield boundary and the fields to the northwest (Figure 5), making it more challenging to judge the distance to a safe landing area.

Previous accidents, in powered and non-powered aviation, have shown that turning back to the airfield following a loss of launch traction at low level is a high-risk manoeuvre. The BGA statistics, supported by details from those incidents which occurred at Dunstable, reinforce the message that landing ahead from a low level launch failure is likely to offer the greatest probability of a successful outcome. Based on the pilot's flying background and interviews with instructors who had flown with him, the investigation concluded that, ordinarily, when conducting his pre-flight checklist, the accident pilot would have self-briefed to land ahead following an abort below 300 ft and to only contemplate returning to the airfield when above that height.

While the pilot may have self-briefed to land ahead, startle and surprise could have contributed to him not executing his pre-determined plan, especially if at the point of decision neither of the landing areas ahead looked assured. It was not possible to determine why the accident pilot made the decision to initiate the steep left turn that precipitated the final loss of control.

The flight evaluation published in the May 1994 edition of Soaring Magazine reported that the ASW 24 type had relatively gentle stalling characteristics but would '*drop a wing if provoked and* [would] *start to spin if the stick is held back*.' The glider's angle of bank, seen on CCTV as it turned left, appeared to exceed 60° and to generate the observed rate of turn the stick would need to have been pulled rearwards. At 60° angle of bank the glider's stalling speed would have increased to approximately 57 kt. The glider's airspeed was not recorded but its groundspeed on entering the turn was 57 kt and this reduced during the turn even though the tailwind component was increasing. The tightness of the turn and reducing airspeed meant the glider entered an unsustainable flight regime and departed from controlled flight at a height and attitude from which recovery was impossible.

In response to the accident, the resident gliding club has begun a process of trying to identity where they could make recommendations and improvements regarding low level aerotow failures. They noted that, while such failures are practised, because of the risks associated with field landings, they would never be initiated at a height which precluded a successful turnback and landing on the airfield. They considered that this practice might seduce pilots into thinking that a turnback would always be possible. To counter this risk, the club aerotowing training syllabus includes training in a motor glider so that low level failures can be simulated in a safe and realistic manner. Following the accident, the club's flight simulator became operational and their intention was to use it to supplement the teaching of low level launch failure handling. The club were also intending to review the way they taught eventualities, '*to better reflect what we would actually do in the event we found ourselves somewhere we weren't expecting*.' They observed that while pilots would include landing out in their eventualities brief, taking the decision to land off-site *'is something a lot of people might well struggle with*.'

Conclusion

Whatever the cause of the tow rope becoming released from the glider, the accident pilot found himself in a challenging position, possibly suffering from the negative performance shaping effects of startle and/or surprise. With little height or speed available to him he needed to quickly decide on an appropriate course of action. That he decided to turnback toward the airfield indicates he did not consider landing ahead was a viable option. Regardless of that perception, at the height and speed he found himself, turning back proved unachievable.

The hazards associated with launch failures are acknowledged at all levels within the gliding community and mitigation in the form of procedures, awareness programmes, and pilot training and assessment are well-established. Nonetheless, pilots experiencing a low level aerotow failure are potentially faced with an unenviable dilemma. In the words of the BGA instructor manual, they could find themselves needing to deliberately initiate a '*controlled crash*' with the primary aim of minimising personal injury. Turning away from a certain accident might seem lower risk, but in a situation such as the accident pilot found himself, by potentially avoiding a controlled crash pilots can quickly find themselves facing an uncontrolled one where the outcome relies entirely on providence. Tragically, the accident pilot was not as fortunate as the occupants of the ASK 21 that cartwheeled at the airfield in December 2022. From the BGA statistics, it is compelling that, while some of the gliders suffered substantial damage, where pilots elected to land ahead following a low level

aerotow failure, none of the occupants suffered more than minor injuries. Although only a small sample size, being able to analyse in more detail the four events which occurred at Dunstable reinforces the argument; landing ahead proved successful, while turning back resulted in the loss of both aircraft and the death of the accident pilot.

This accident serves to highlight how challenging it is to make effective decisions in the heat of the moment when something goes wrong unexpectedly at a critical stage of flight. While pilots may verbalise their intentions as part of an eventualities brief, being able to enact the plan when startled, surprised and under extreme pressure, is not necessarily assured. Practising such failures at low level on live aerotows would carry significant risk and likely result in an unacceptable percentage of training events ending in accidents. Using motor gliders to safely train for low level aerotow failures is an established practice within the gliding community, flight simulators, provided they are sufficiently representative, would appear to offer an additional opportunity to help de-risk the process. Another technique to make decision making more consistent and to reduce the likelihood of startle and surprise is for pilots to regularly rehearse the actions they would take in response to failures at various stages of flight. For maximum benefit, rehearsals should include mental visualisation as well as physical movement simulating the actual control inputs and selections that would be required. In this way, an emergency scenario becomes more familiar to the pilot, therefore making it potentially less startling or surprising if it occurs for real. With most of the decision making and preparation being done beforehand, when faced with rehearsed emergencies pilot response can be more consistent and reliable.

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