ACCIDENT

Aircraft Type and Registration:	Schleicher ASW 20 L, G-LYSA	
No & Type of Engines:	None	
Year of Manufacture:	1978 (Serial no: 20054)	
Date & Time (UTC):	18 June 2014 at 1618 hrs	
Location:	North Hill Airfield, Sheldon, Devon	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - 1 (Fatal)	Passengers - N/A
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	BGA Gliding Certificate	
Commander's Age:	73 years	
Commander's Flying Experience:	Approximately 12,000 hours (of which 11 were on type) Last 90 days - 24 hours Last 28 days - 12 hours	
Information Source:	AAIB Field Investigation	

Synopsis

The glider was making an approach to the landing site and was witnessed flying at a near constant low height along much of the field. The glider then entered a steep right turn at the upwind end of the field, during which the nose dropped. The glider struck the ground in a steep nose-down attitude, probably as a result of stalling during the turn. The pilot was fatally injured.

It was considered that the pilot probably made an error of substitution by operating the landing gear lever rather than the airbrake. As a result of this accident, the BGA re-issued a Safety Alert letter to owners of this type of glider to inform them of the risks of using the wrong control whilst attempting to operate the airbrake lever.

History of the flight

The pilot was on his fourth flight of the day having previously flown two instructional flights and a short solo flight. In addition, he had participated in a retrieve of the accident glider from a nearby field where it had landed earlier. This involved de-rigging the glider and then re-rigging it after it had been transported back to the airfield. During the winch launch on his third flight, another pilot noticed that the glider airbrake was unlocked and made a radio call to him. The pilot appeared to stow the airbrake and the launch continued normally.

The accident flight commenced at 1514 hrs and lasted 64 minutes. Near the end of the flight, the pilot was heard to call downwind for a hangar landing[1]. After turning onto final approach, the pilot overtook another glider that was at a height of approximately 50 ft on the normal final approach. The pilot of this glider described the speed of the accident aircraft as appearing abnormally high. Subsequently, several witnesses observed the aircraft flying down the centre of the field at an estimated height of between 30 and 100 ft agl in an easterly direction. They all commented that the aircraft was too high to make a normal landing within the field length remaining. Some witnesses reported seeing the flap position cycling through various positions and two witnesses reported seeing the dihedral of the wing changing in a corresponding way[2]. When it was abeam the crash site, the aircraft entered a steep turn to the right at an angle of bank reported to be between 60° and 80°. Most witnesses described the speed of the glider at this point as being abnormally slow and two witnesses described the glider pulling up slightly, immediately before entering the turn. After the aircraft had turned right through approximately 160°, the nose dropped suddenly and the aircraft impacted the ground in a steep nose-down attitude. The observed configuration of the glider throughout this manoeuvre was: flap extended, landing gear up (the landing gear doors were observed to be slightly open by one witness) and airbrake in.

Generally, witnesses who met with the pilot during the day, reported that he appeared fit and well and in good spirits. However, when the pilot was sitting in the glider cockpit just prior to his final launch, one witness reported that he appeared slightly confused and hesitant with the pre-launch airbrake check.

Examination of the aircraft

Examination of the wreckage at the accident site indicated that the aircraft had struck the ground in a steep nose-down attitude. This resulted in bending failure of the small diameter aft fuselage, because of the offset axial compressive loading created by the position of the centre of mass of the tail unit above the fuselage centre line. Impact forces had also fragmented the cockpit section of the aircraft. One of the two wing tip extensions had disengaged, apparently as a result of damage to the attachment rib due to inertia loading. It was noted that a composite grip, subsequently identified as that from the control stick, had separated and come to rest approximately 10 metres ahead of the aircraft.

The wreckage was recovered to the AAIB, where a detailed examination confirmed substantial disruption of the flying control system, the flap operating system and the airbrake controls. There was, however, no evidence of any pre-impact failure. A metallic strip, normally attached to the inner left wall of the cockpit and forming detents for the landing gear lever in the respective up and down positions, was separated as a result of the structural disruption. This damage removed any restraint on the operating lever and mechanism, allowing the inertia force of the impact to displace the single mainwheel forward from an initially retracted

Footnote

[1] A hangar landing is where a glider lands on a different part of the airfield so that it finishes the landing run conveniently close to the hangar for subsequent storage.

[2] With no flap extended, this type of glider exhibits a characteristic dihedral bend to the mainplane in flight. This bend visibly reduces when flap is extended and the centre of lift moves inwards.

position or ensure it remained at the forward extended position. The pre-impact position of the landing gear could not be confirmed by wreckage examination.

Examination of the control stick and the separated grip revealed that the latter was shaped to be held comfortably by the hand and incorporated a 'swollen' profile at its upper end, to limit the possibility of the hand slipping upwards and becoming disengaged. The stick was made up of a tubular metal.

Under laboratory examination, it was determined that the grip, of composite material, had been manufactured from two halves that had been bonded together. Subsequently, a resin coating had been applied to the inner surfaces and allowed to cure. The evidence indicated that this had then been ground down mechanically until it formed an interference fit around the metallic stick. The grip had thereafter been secured by being driven axially onto the end of the tubular metal stick, although the extent of engagement between the handle and the stick was only limited. No adhesive or mechanical fastener had been used to join the grip to the metal tube. As a consequence, the strength and stiffness of the joint was probably sufficient to leave no evidence of inadequacy during normal use but the joint was lacking in attachment strength. The grip had, apparently, separated under the bending and tensile forces created by the pilot's hand gripping the stick firmly during the impact. It is also possible that the grip may have become separated from the stick following an instinctive hard pull back on the control by the pilot, immediately before impact. Once the grip had separated, the top of the tubular stick was exposed.

The grip carried a press-to-transmit button for the radio and a switch to alter the mode of operation of the variometer, an instrument that was not available at the time the aircraft was manufactured. It appears that the grip fitted at the time of the accident was not the one with which the aircraft was equipped on initial manufacture. It is probable that the grip was fitted as part of the implementation of the upgrade of the variometer to enable the mode select switch of the instrument to be incorporated.

The manufacturer of the control grip publishes fitting instructions and these, translated, state[3]:

> *'The mounting in the glider can be done by each (technical experienced) pilot. After removing the old pilot stick and cutting off the wiring the new stick is mounted on the control rod for example with acidfree silicone or thickened resin. Finally the wiring has to be re-build.*
>
> *Before gluing the pilot stick in your glider you should check, if the mounting should be symmetrical of with an angle around the axis of the control rod to reach a better haptic adaptation.*
>
> *The stick has NO aviation approval (as the most pilot sticks in gilders), the mounting has to be checked by an aviation inspector. I will not overtake any responsibility or liability for the usage of this pilot stick in aircrafts or other applications.'*

Footnote

[3] The English instructions are a translation, made by the manufacturer, from the original language.

Although the maintenance records of the aircraft appeared to be complete, they covered a period of 35 years, during which time the aircraft had been in the possession of five different owners. Two of these had been based in the Irish Republic, where the aircraft had been registered for seven years.

Meteorology

An automatic weather station is located at Dunkeswell Aerodrome, 1 nm to the east. At 1600 hrs, the recorded weather was: surface wind from 030° at 10 kt, visibility 23 km, few clouds at 2,900 ft, broken clouds at 4,300 ft and temperature of 20.5°C. At 1700 hrs, the recorded weather was: wind from 050° at 11 kt, visibility 20 km, scattered clouds at 2,700 ft, a further layer of scattered clouds at 4,100 ft and temperature 20.4°C.

An anemometer, located on top of the hangar at the gliding site, recorded a surface wind speed of 10 kt gusting to 15 kt at 1615 hrs, and 9 kt gusting to 13 kt at 1620 hrs; both readings from a direction of 022°. The temperature recorded at the site was 25°C but this was from an uncalibrated source.

The pilot

The pilot had extensive experience as a commercial helicopter pilot before taking up gliding in 1998. The majority of his gliding experience was on ASK13 and ASK21 gliders, and he only recorded having flown the ASW20 glider on 10 occasions, amassing just over 11 hours on type.

The pilot was an assistant instructor at the gliding club. He usually acted as the duty instructor at the gliding site on Wednesdays, as he was doing on the day of the accident. He held a Silver rating and a Light Aircraft Pilot's Licence (LAPL) medical certificate.

Comparison of glider types

In the last year, the pilot had flown ASK13, ASK21, SZD51 Junior, DG505 and ASW20 gliders. Apart from the ASW20, these gliders have a single lever control on the left side of the cockpit and this controls airbrake operation. The ASW20 has three levers on the left side of the cockpit controlling landing gear, airbrake and flap operation. The flap lever is uppermost and has a pin that engages with holes in a plate on the canopy rail to retain the lever at discrete flap settings. The airbrake lever is coloured dark blue, operates in the conventional sense and the lever hangs down from the horizontal operating rod on which it is mounted (see Figure 1). However, the pilot can rotate the lever handle around the operating rod so that it can be conveniently positioned; often this will be with the lever in a horizontal orientation resting on the top of the pilot's left leg. The landing gear lever protrudes vertically out of a slot in the sidewall. The lever is retained at each end of the travel by a gate that locks the landing gear in the chosen position; rearwards movement of the lever retracts the landing gear. The handles on the three control levers are similar in size, shape and feel.

The landing gear lever handle is black and the airbrake lever handle is dark blue; although they are different colours, the visual contrast between the two lever handles is small. After

the landing gear is extended, with the airbrake still retracted, the two co-responding control levers are very close to each other in the cockpit. In addition, the landing gear lever and, in its natural position, the airbrake lever, would both be orientated vertically.

In Figure 1, the flap lever is shown in the high-speed position (-11°), the airbrake lever is shown in a partially extended position and the landing gear lever is in the down position.

Figure 1

Left internal side wall of an ASW20 glider
(This is not an image of G-LYSA.)

Other events involving misuse of controls

The British Gliding Association (BGA) provided statistical data on incidents and accidents where pilots have incorrectly used the landing gear control instead of the airbrake. Of the 30 such events between 1974 and 2014, 28 involved ASW15, ASW19, ASW20 and Pegase gliders[4] and 19 resulted in the aircraft landing long or overshooting the landing area altogether.

In addition, 14 incidents involved 10 other types of glider in which the flap lever was, mistakenly, operated instead of the airbrake.

In December 2010, the BGA issued a Safety Alert to all registered owners of these gliders informing them of the potential for this control confusion.

The ASW20 glider was last produced in 1990. It was superseded in 1995 by the ASW27, which, with subsequent gliders produced by the manufacturer, had the landing gear lever positioned on the right side of the cockpit. This design change effectively eliminated the possibility of confusing the airbrake lever with the landing gear lever.

Footnote

[4] These four glider types have a similar configuration of airbrake and landing gear controls.

Pathology

The pilot sustained multiple injuries in the accident and the pathologist stated that these may have proved fatal in the longer term. However, an injury to the head, caused by the control stick tube, was judged to be immediately fatal.

No medical or toxicological factors were found which could have had a bearing on the cause of the accident.

Airfield information

North Hill is a grass gliding site located one mile west of Dunkeswell Airfield. The operating area is approximately 1,000 m in length and 350 m at the widest point. Two operating strips are normally used, these are orientated 260°/080° and 235°/055° respectively. The field slopes slightly downhill from the intersection of the two strips and the hangar area at the eastern end of the field. On the day of the accident, the gliding club was winch launching gliders from the 055° strip and they were landing to the north of this strip. At the end of the day, pilots landed their aircraft on or near the eastern part of the 080° strip so that they were conveniently close to the hangar for subsequent stowage. An air/ground radio is available and this is used for glider pilots to make information calls. On the day of the accident, a large number of large wrapped straw bales were spread over the field to the north of the crash site. Figure 2 shows a view of the final approach on the day of the accident, and the field to the north containing the straw bales.

Figure 2

A view of the airfield from the direction of the final approach
(The accident site is at the far end of the field, beyond the isolated tree.)

Recorded data

G-LYSA was equipped with a number of cockpit instruments that had GPS capability and could record flight track logs. These were a Naviter Oudie moving map display, a LX Flarm Red Box and a Cambridge Aero Instruments 302 variometer with 303 display. The accident flight was only recorded by the moving map and variometer logger.

Figure 3 shows the final part of the track, in profile, with spot heights and groundspeeds (averaged between successive points). Figure 4 shows the ground track as a time history. These Figures indicate that the glider was downwind abeam the airfield at 700 ft aal, with a groundspeed of 60 kt, and descended to 400 ft aal above the airfield perimeter when established on final approach. Over the next 12 secs, there were minor variations in the glider's height, before it descended at about 1,250 ft/min to 125 ft aal, above a point just east of the airfield's two launch strips. Over the last 20 secs (to the last recorded point), the glider descended to 70 ft aal and then climbed back to 100 ft aal as it commenced a turn to the right. The groundspeed for this last point had reduced to 45 kt. Using the surface wind measured at the site two minutes before the accident, the airspeed at this point was estimated to have been between 52 and 55 kt. The data indicates that the drag of the glider increased during the approach; this is evident from the reversal in the increasing speed trend, while the descent continued.

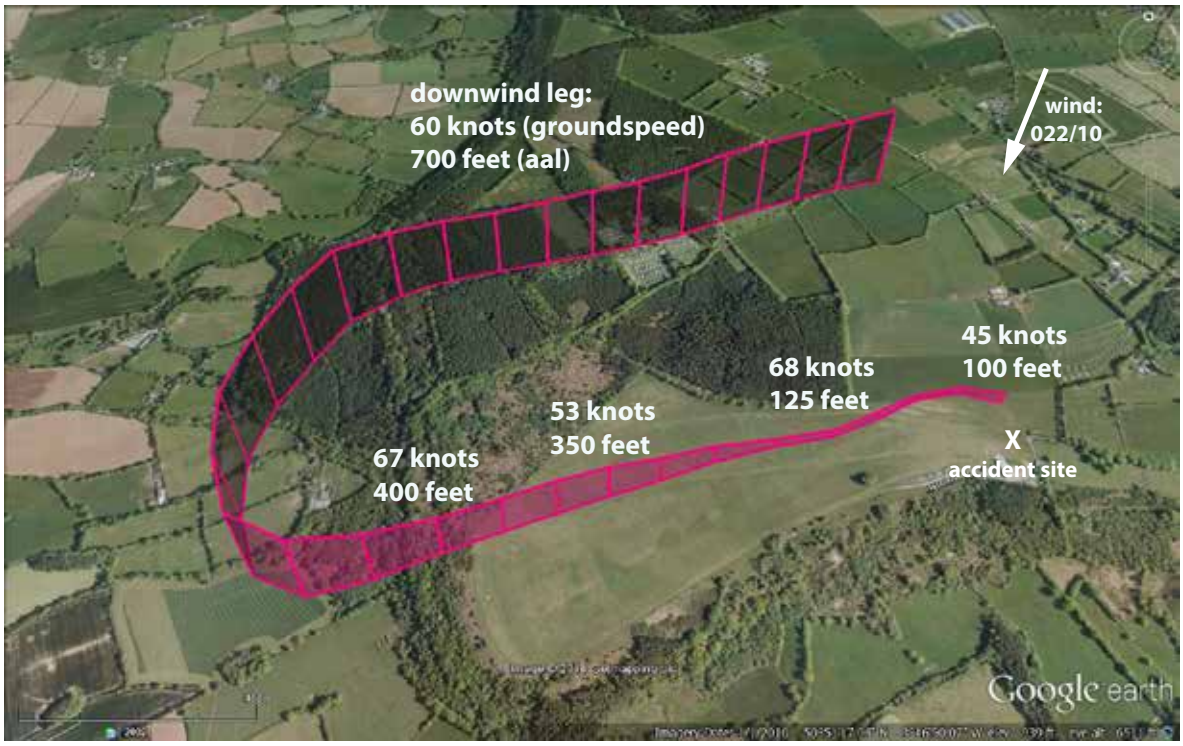

Figure 3

G-LYSA approach to North Hill

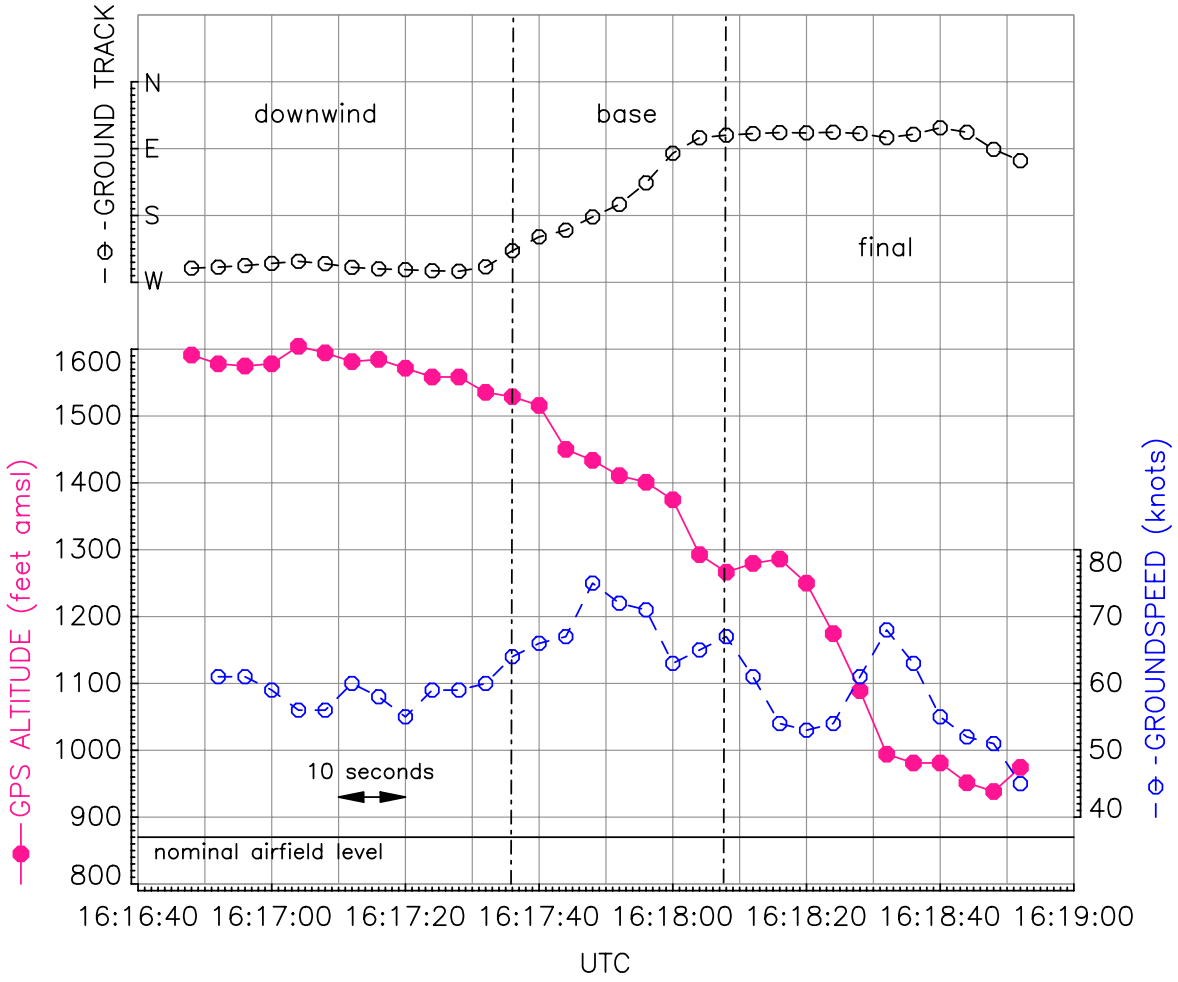

Figure 4
Recorded data for G-LYSA's approach to North Hill

Other factors

The following factors were considered during the investigation.

Fatigue

The pilot departed home at approximately 0800 hrs (local time) that morning, which was one hour earlier than he normally left when he was going to the gliding site. The journey to the airfield was estimated at about 1 hour. Thereafter, he had carried out two short flights in the morning prior to participating in a glider retrieve from a field near the gliding site. A glider retrieve involves dismantling the glider and man-handling the components into the glider trailer. On return to the airfield, the components are removed from the trailer and the glider is reassembled. This process involves a reasonable amount of physical labour. Subsequently, the pilot flew two further sorties, the last of which lasted 64 minutes and terminated in the accident.

Heat

The weather on the day of the accident was warm and sunny; at the time of the final flight, the temperature was above 20°C. The pilot normally wore a hat when flying and would routinely carry some water. However, although there is evidence that he was wearing a hat, no water bottle was found at the accident site.

Unfamiliarity with the aircraft

The pilot was highly experienced and had been flying gliders regularly for 16 years. However, his experience in this model of glider was limited. Although there is no evidence that he was ill-prepared for his flight in the glider, it was relatively unfamiliar to him and this would have imposed an additional workload on him during the flight. This workload would have increased further during the approach and landing phase where it is naturally more demanding. That the airbrake had been unlocked on a previous launch, further indicated that the pilot may have been unfamiliar with the control layout.

It has been recognised that, beyond an optimum level of workload, any further increase leads to a degradation in performance.

> *'As the demands of the task, or the workload, are increased, the standard of our performance increases to an optimum level of workload and performance is achieved. Any increase in workload after this point leads to degradation in performance. At extremely high levels of workload (overload), important information may be missed due to the narrowing or focussing of attention onto only one aspect of the task'[5].*

Analysis

The pilot would normally fly downwind to land with the landing gear deployed. On approach, the glider would often be configured with intermediate flap extended and the airbrake being used by the pilot to control the angle of approach. Although the landing gear and airbrake levers are different colours, the visual contrast between the two lever handles is small. Additionally, after the landing gear is extended, with the airbrake still retracted, the two levers, which are of similar size, shape and feel, are very close to each other and can assume similar orientations. Under these circumstances, there is potential for a pilot to mis-identify the correct control and operate the incorrect one.

Should the pilot inadvertently operate the landing gear lever instead of the airbrake lever, he would then retract the landing gear and not deploy the airbrake. In this accident, the landing gear was observed to be retracted and there was no evidence that the airbrake was being used. Without the airbrake, the glider would maintain a shallow descent angle and this, coupled with the slight downhill slope of the landing zone, would explain the apparent lack of height loss and why the glider continued at its observed height until it was near to the end of the field. (The recorded data indicated that there was an increase

Footnote

[5] Human Factors for Aircrew. Green, Muir, James, Gradwell and Green.

in drag during the approach and witness evidence suggested that it was most likely that the variations in drag were caused by the observed flap operation, not airbrake.) At this point, the airspeed was estimated to be between 52 and 55 kt. The aircraft then entered a steep turn to the right, with over 60° angle of bank. A slight pull up on entry to the turn, observed by some witnesses, would have had the effect of reducing this airspeed. At 60° angle of bank, in a steady turn, the effective stalling speed of the glider, with maximum flap selected, is approximately 51 kt. Any increase in angle of bank beyond 60° would have further increased the stalling speed, as would a flap selection less than the maximum. It is probable that, in turning downwind, the combination of reducing airspeed and increasing bank angle led to the aircraft stalling at a low altitude, from which recovery would not have been possible in the height available.

It is probable that the pilot made an error of substitution by operating the landing gear lever rather than the airbrake. He then appears to have operated the flap lever, instead of the airbrake, to control the rate of descent on the final approach to his intended touchdown zone. This error, on this and other gliders of similar control configuration, has been well documented by the BGA. The investigation examined possible factors that could have contributed to this error; heat and physical fatigue, unfamiliarity with the aircraft and control similarity. The possibility that the pilot was suffering from the effects of heat, dehydration and physical fatigue which adversely affected his mental performance could not be discounted. The pilot had been outdoors for much of the day, the weather had been warm, he had been involved in a glider retrieve in the middle of the day and was at the end of his fourth flight, which had lasted 64 minutes. Any fatigue experienced by the pilot would have reduced his performance and his capacity to analyse the situation when it deviated from expected norms. His lack of familiarity with the glider could have increased his mental workload, further adversely affecting his mental performance. Lastly, the similarity in position, orientation, feel and low colour contrast of the airbrake and landing gear controls increased the likelihood of the pilot operating the wrong one by mistake. It was not possible to determine which of these factors led to the error but it is probably that all of them played some part in the accident.

There was no evidence of any pre-impact failure on the glider. However, the apparent separation of the grip from the control stick during the impact exposed the pilot to the tubular end of the stick, with fatal consequences. Other injuries he sustained may have proved fatal in the longer term. The fitting instructions, provided by the manufacturer of the control grip, state that some form of adhesive should be used to secure the grip to the control stick. No evidence was found that any adhesive had been used in the fitting of this grip.

Conclusions

The investigation assessed that an undetermined combination of fatigue, unfamiliarity with the glider and similarity of the landing gear and airbrake controls probably led to the pilot operating the landing gear control, by mistake, instead of the airbrake control. This resulted in the aircraft being configured with the landing gear retracted and the airbrake not deployed for the final approach. With the flaps appearing to be cycled through various

positions, it did not seem to descend on the normal final approach path but maintained height until it was near the upwind end of the field. A subsequent steep turn, which put the glider in a downwind position, resulted in it stalling at a height from which it was not possible to effect a recovery.

Safety actions

As a result of this accident, the BGA re-issued a Safety Alert letter to owners of ASW 15, ASW19, ASW20 and Pegase gliders to inform them of the risks of using the wrong control whilst attempting to operate the airbrake lever.

In August 2014, the BGA issued a Safety Alert recommending that control column grips should be fitted in accordance with the instructions supplied with the product, and that pilots should check the stick grip for security as part of the routine daily inspection.