ACCIDENT

Aircraft Type and Registration:	Schleicher ASW 27-18E (ASG 29E) glider, G-VLCC	
No & Type of Engines:	1 Solo Type 2350 two-stroke engine	
Year of Manufacture:	2007 (Serial no: 29511)	
Date & Time (UTC):	21 July 2016 at 1043 hrs	
Location:	Moundsmere, near Basingstoke, Hampshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - 1 (Fatal)	Passengers - N/A
Nature of Damage:	Glider destroyed	
Commander's Licence:	British Gliding Association Gliding Certificate	
Commander's Age:	60 years	
Commander's Flying Experience:	1,800 hours gliding (of which 3 were on type) Last 90 days - 16 hours Last 28 days - 0 hours	
Information Source:	AAIB Field Investigation	

Synopsis

Following a launch by aerotow, there was a period of soaring flight before the pilot apparently started the glider's sustainer engine for practice, as pre-planned. Shortly afterwards the glider was seen descending steeply toward the ground, which it struck at a speed in excess of 100 kt. There was no evidence of any technical failure.

The pilot was an experienced glider pilot and seemed fit and well before the flight. However, it is possible that the pilot was incapacitated during the latter stages of flight and the pathologist could not rule out the possibility that she might have lost consciousness, as a result of a cardiac problem owing to a family history and reports of heart palpitations about two weeks prior to the flight.

History of the flight

At 0830 hrs on the day of the accident the pilot attended a briefing to gliding club members concerning the day's flying conditions and a suggested gliding task. Club members wishing to participate in the task were to cross a start line, close to Lasham Airfield, fly a route of approximately 300 km and return to Lasham. The pilot's intention was to launch by aerotow and to soar in the vicinity of Lasham, until she was ready to start the task. Once at a safe altitude, she planned to practise starting the glider's sustainer engine, to run it for a short time and then to stow it before the cross-country task.

The glider, an ASG 29E, had been stored in its trailer since its owner flew it four days previously. Three people assisted the pilot to attach the glider's main wing sections to the fuselage and then she completed rigging the machine herself, including the loading of water ballast from four 25 litre containers into the tanks in each wing.

By 1000 hrs the pilot was sitting in the glider, queuing for an aerotow in the launch 'grid', when an acquaintance spoke to her. She was having difficulty integrating her Naviter Oudie tablet device[1] with the glider's flight computer but the acquaintance later said that the pilot appeared to be her usual "energetic and bubbly" self. Her husband, whose own glider was positioned further back in the queue, stated afterwards that his wife told him before takeoff that she was unconcerned by the issue with the Oudie.

When it was the pilot's turn for an aerotow she was assisted by two gliding club members. She was wearing a parachute and one of the members helped her with her harness. This member owns and flies an ASG 29E and, acting as ''wingtip runner", he lifted the right wing of the glider in readiness for the launch. He felt the water ballast moving as he levelled the wings and assessed there was between 80 and 100 litres of water in the wing tanks. While assisting the pilot he judged by her speech and demeanour that she was "relaxed and well."

At the pilot's request, the other club member attached the tow rope and issued radio instructions for the tug to take up the slack on the tow cable and then to commence takeoff. The wingtip runner ran forward with the glider and kept the wings level for as long as he could. He did not observe which flap setting the pilot had selected, but he did observe that the pilot appeared to have full aileron control and the wings remained level after he let go. From his experience of this glider type, he would have expected a lack of aileron control at low speed and one wing to drop if the flaps were not at '*setting 2*' at the start of the takeoff.

This was the tug pilot's sixth glider tow of the morning and he experienced no difficulties with the tug aircraft. Weather conditions were favourable; visibility was good, there was a light north-westerly wind and, at nearby RAF Odiham, the only recorded cloud below 10,000 ft agl was a scattered layer at 3,600 ft agl. The Met Office later stated the wind direction was from 250º to 260º at 1,000 ft agl veering to 280º to 290º by 4,000 ft agl, and that up to this altitude the wind speeds were less than 10 kt. The start of the aerotow was logged at 1020 hrs and the tug pilot reported the ground run and takeoff were normal.

At approximately 500 ft agl the tug pilot saw in his rear-view mirror that the glider was moving from side to side and up and down, in a manner he assessed as unusual, given the height. The tug pilot continued climbing, at an estimated airspeed of 70 to 75 kt, and made one gentle turn toward the northwest. He was surprised to see the glider continuing to move around, predominantly from side to side, but the glider pilot did not initiate any radio communication to ask for an adjustment of the tow speed or to indicate she was experiencing a problem.

Footnote

[1] See *Recorded information* for further detail.

At approximately 1,500 ft agl, the tug pilot sensed an area of good thermal activity and was surprised the glider pilot did not release the tow. Then, passing 1,800 ft agl, the tug pilot could not see the glider in his mirror and thought it may have released, although he had not felt an appropriate reaction from the tug. He therefore continued to climb and, shortly afterwards, saw the glider in his mirror, moving quickly up from below his line of sight to a relatively high position. The glider pilot then released the tow at approximately 2,000 ft agl, a normal aerotow release height in the UK, and turned left, while the tug pilot turned right and descended, without seeing the glider again.

A number of other gliders were already airborne and were thermalling to the northwest of Lasham. A pilot in one of these gliders was listening on a common radio frequency used by many of the pilots after launch. At approximately 1035 hrs he heard the pilot of G-VLCC replying to a radio call from her husband, who was flying in his own glider. Her brief response sounded characteristic of her and the other pilot later assessed she was not experiencing any difficulty when she spoke.

A few minutes later, the pilot's husband called her again and she indicated to him she was "climbing up nicely". His impression was that everything was fine in his wife's glider and a further pilot who overheard this exchange, and who knew the pilot of the ASG 29E well, also thought she sounded normal. Nobody reported hearing her speak on the radio again.

Two witnesses on the ground appear to have seen the glider as the accident occurred. One man was in a garden two miles west of Lasham when he saw a glider approximately one mile from his position, above the accident site. Its nose was pointing steeply down and it seemed to be "spiralling downwards". He thought it rotated three or four times before his view was obscured, by which time the glider was sufficiently close to the ground for him to fear it had crashed. He set off with a relative to check nearby fields and to see if they could assist the pilot.

A second witness, approximately 1.25 nm north of the first witness, was standing at the edge of a woodland clearing. At approximately 1045 hrs he heard the noise of an engine and looked up to see a glider, apparently intact, which he assessed was flying low and approximately in a southerly direction. There was a "whooshing" sound as the glider passed by and the witness also heard a noise that suggested an engine was stuttering. The witness' view of the glider was quickly obscured by trees and a few seconds later he heard a "bang", which led him to believe it had hit the ground.

A loud noise, which sounded like an engine running up and dying away two or three times was heard by four people at a farm. One of them, who was driving a farm vehicle, described hearing the high-pitched "screaming" of an engine above the noise of his own machine, and then a loud crashing sound. Three of these witnesses went to investigate and they found wreckage of the glider in a field, approximately 300 metres from the farm. One person called the emergency services while the other two approached the glider but could not help the pilot, who had suffered fatal injuries.

Recorded information

Several pieces of avionics were recovered from the accident site, including a Naviter Oudie navigation tablet device and an LXNAV LX8080 flight computer with integrated FLARM[2], which would have recorded a log of the flight into memory. These were, however, damaged to the extent that no data could be recovered from their memory.

Some of the UHF broadcasts from the FLARM were detected and recorded by a ground-based receiver near the airfield. The recording was then automatically uploaded to a server operated by the Open Glider Network (OGN)[3]. Upon request, the AAIB was provided with a copy of the recording which contained the time (to the nearest second), position (latitude and longitude), GPS height, vertical speed (climb rate) and turn rate for each of the detected FLARM broadcasts from G-VLCC.

Figure 1 shows the track of the glider beginning on the ground at Lasham at 0953 hrs (airborne at 1020 hrs) to about 550 ft above the accident site at 1043:20 hrs, 4.5 km west of the airfield. The flight time from tug release was about 21 minutes. The recorded height, vertical speed and turn rate for these points is presented as a time history at Figure 2 and includes a calculation of ground track angle based on the angle between its present position point and the previous point.

The figures show that, following the tug release at just under 2,400 ft amsl (about 1,900 ft aal), G-VLCC turned to the left, to the north of the release point, where it commenced a climb to 3,270 ft, gaining about 810 ft [A]. The glider then tracked west then east, descending to 2,910 ft. It then climbed again to 3,370 ft [B] before descending to 3,200 ft. The final climb was to 3,920 ft amsl [C].

G-VLCC then descended at between 400 and 500 ft/min, initially tracking west, in a gentle (about 1°/s) turn to the left. After about 90 seconds (now tracking south and descending through 3,250 ft) the turn tightened, taking the glider onto an easterly track, then tightened further to about 4°/s onto a north-north-westerly track where it levelled off at 3,050 ft for about 25 seconds. From the top of the final climb to this point the glider's path over the ground was 3 nm, which it covered in 167 seconds giving an average groundspeed of 65 kt. The FLARM ground-receiver then lost contact for 35 seconds; however, the straight-line distance travelled during this period was 0.55 nm which indicates an average groundspeed slightly greater than 57 kt.

Footnote

2 FLARM is a collision avoidance system for General Aviation, light aircraft, and UAVs that alerts the pilot to both traffic and potential collisions with aircraft that also have FLARM installed. FLARM obtains its position and altitude readings from an internal GPS and a barometric sensor and broadcasts, every second, a prediction of its position about two seconds ahead. Broadcasts are with radio signals in the UHF band.

3 The Open Glider Network (OGN) is a project run by enthusiasts with the aim of creating and maintaining a unified tracking platform for gliders and other GA aircraft with FLARM.

Figure 1

Flight track of G-VLCC with area of climbing marked at A, B & C and the last 35 seconds of recordings in light blue (Figure 3). The distribution of points varies as not all of the FLARM broadcasts were detected by the ground-receiver

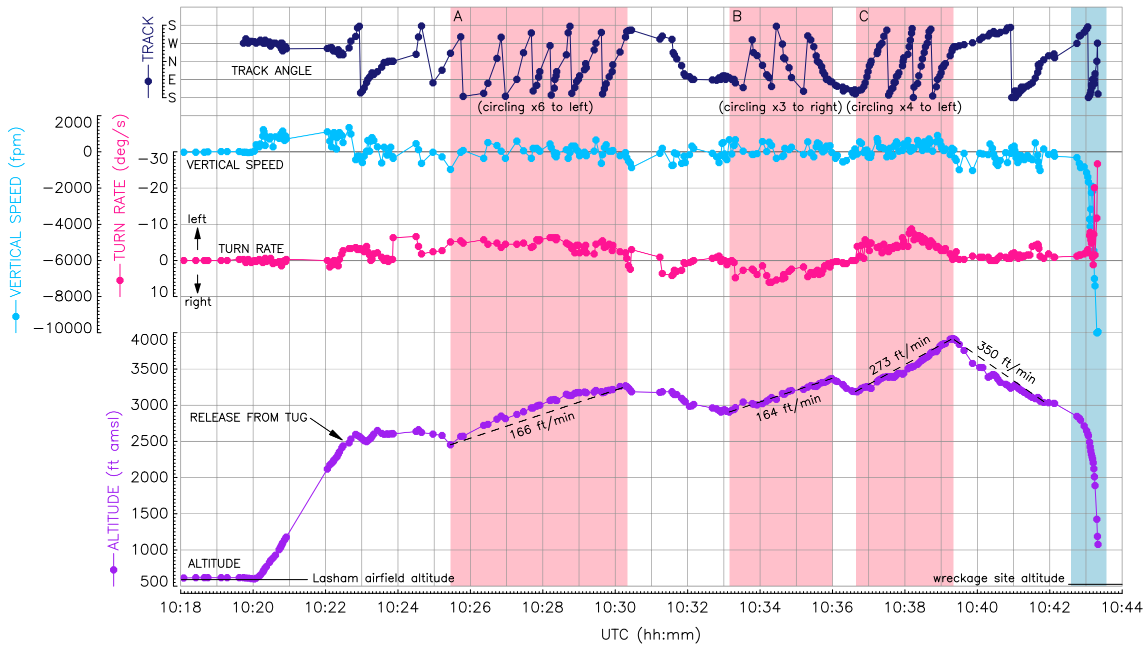

Figure 2

FLARM flight data with the last 35 seconds of recordings highlighted in light blue (Figure 3) – the highlighted areas in pink indicate when G-VLCC was climbing

Figure 3 shows the FLARM flight data once contact was regained, with G-VLCC at 2,850 ft on a south-westerly track, gently descending and turning, through to the end of the recording 35 seconds later. Groundspeed (calculated from distance travelled and time taken between points) is also presented, together with a parameter labelled '3D' groundspeed that incorporates the component of vertical speed.

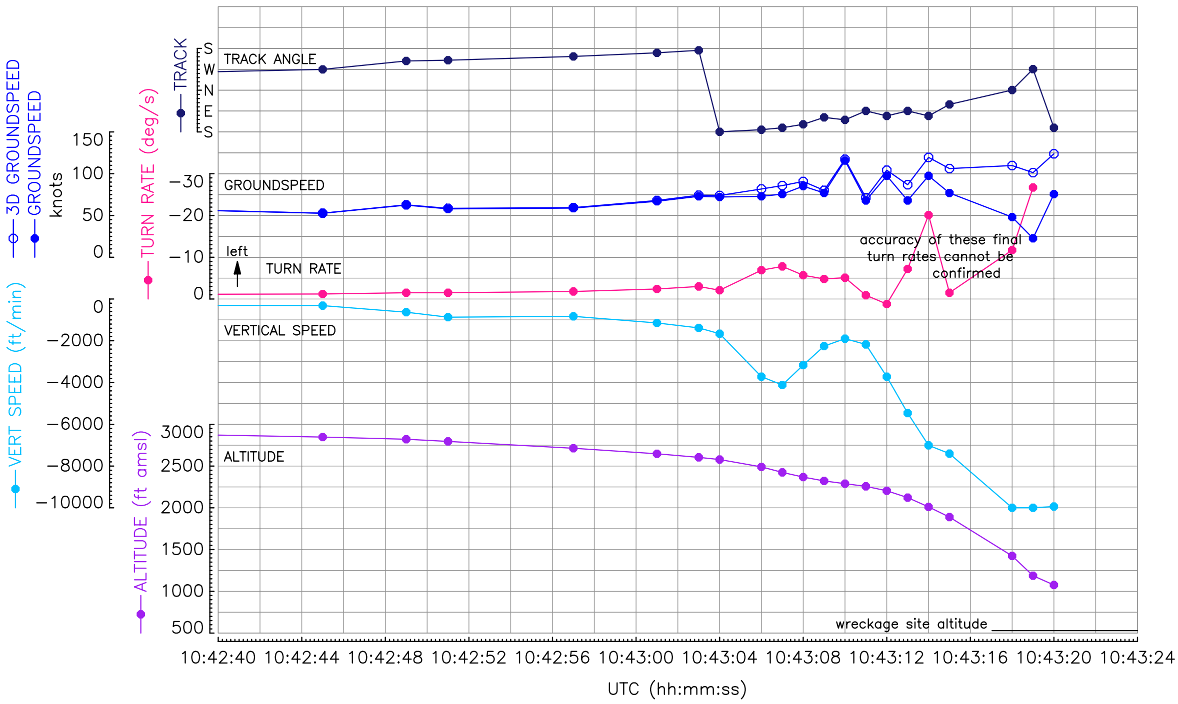

Figure 3

FLARM flight data – last 35 seconds of recordings

G-VLCC continued to turn and descend, reaching a descent rate of 1,660 fpm after 19 seconds and this rapidly increased to 4,000 fpm over the next 3 seconds. There was a similar marked increase in the turn rate during this period. Over the next 3 seconds the descent rate reduced to 2,000 fpm; however, within another 4 seconds it had increased to over 7,000 fpm, with the glider now about 1,500 ft above the ground. The calculated groundspeed throughout the last 35 seconds was always greater than 50 kt and for the last 18 seconds it was greater than 70 kt.

Ground-receiver contact was then lost for a couple of seconds before regaining contact for three last points to be recorded. The last point positioned the glider about 550 ft agl, near the accident site and the groundspeed and vertical speed combined indicate the glider hit the ground with a speed in excess of 100 kt.

11 April 2015 flight in G-VLCC by the pilot

A copy of the downloaded log files from the LX8080 for the two previous flights by the pilot was provided by the owner of the glider, so that the Engine Noise Level (ENL) data could be examined, to establish whether the sustainer engine had been used on either of these flights. With the exception of the pilot's first flight in G-VLCC on 11 April 2015, there was no evidence that the engine may have been used. The flight data for the 11 April 2015 flight (Figure 4) shows that significant noise was detected twice when the glider was airborne – the first lasting 100 seconds and the second 60 seconds. However, when analysing the phase of flight (position and altitude), climb rate and speeds immediately prior to and during these periods of high ENL values, only the first was consistent with use of the engine. It is therefore probable that the engine was used in the first period (100 seconds) and it is only a possibility for the second.

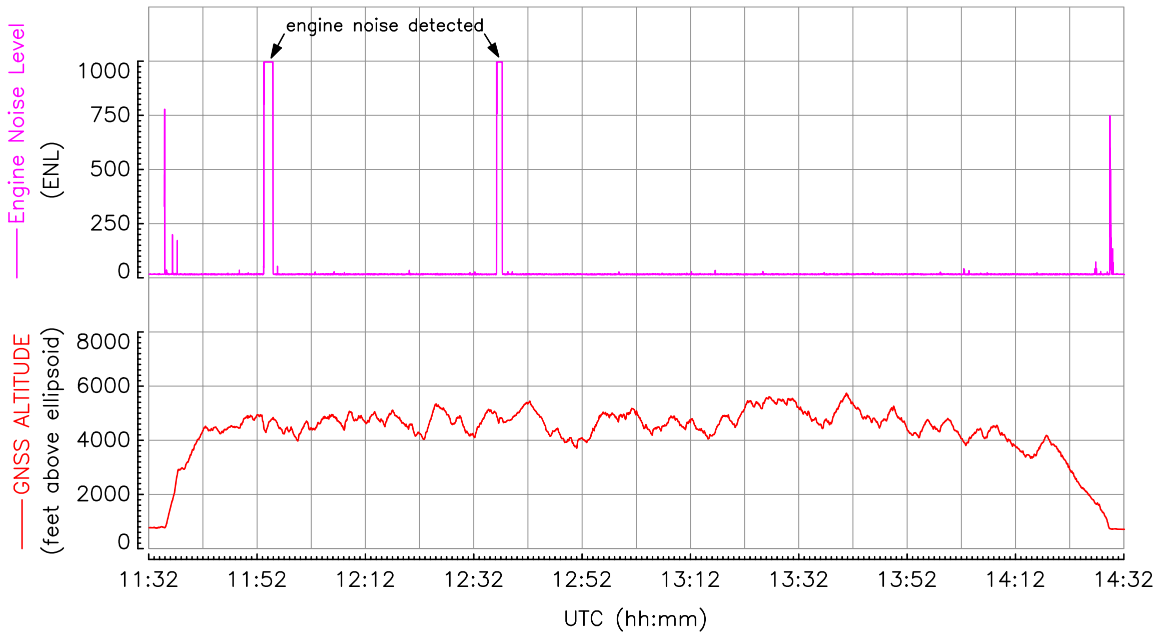

Figure 4

Data from flight on 11 April 2015 showing when noise from the engine may have been detected

Glider description

ASG 29E is the product name for the ASW 27-18E, which is a single-seat self-sustaining powered glider, designed and manufactured by Alexander Schleicher GmbH & Co. The glider is a derivative of the ASW 27 with a T-tail, retractable sprung landing gear and a water ballast system (Figure 5). Interchangeable outer wing sections allow participation in 15 m and 18 m competition classes.

Image courtesy of Alexander Schleicher GmbH & Co

Figure 5

General view of an ASG 29E with the engine deployed

Maintenance and glider history

G-VLCC was manufactured in 2007 and had a valid Airworthiness Review Certificate (ARC). When the ARC was issued in March 2016 the glider had accrued 637 flight hours and 192 flight cycles. It was fitted with an optional water ballast tank in the fin but the tank had been damaged and could not be used. At the time of the accident the glider was configured with an 18 m wingspan.

System descriptions

Flying controls

The elevator, flaps, aileron and airbrake controls connect automatically when the glider is rigged. With the exception of the rudder, the controls are actuated using a combination of push rods and levers. The rudder is operated by steel control cables.

Pitch and roll are controlled using a conventional control column and there is a basic mechanical trim facility for pitch. The rudder is controlled using rudder pedals that can be adjusted to suit the pilot.

Flaps

Two trailing edge flaps, which also function as ailerons, cover the entire span of each wing. The flaps are controlled using a lever in the cockpit and the seven positions and recommended phase of flight are defined within the flight manual (Table 1).

Flap setting	L	6	5	4	3	2	1
Flap deflection	47º / 12º	24º / 22º	20º / 19º	12º / 11º	5º	0º	-2.5º
Description	Landing	Thermalling	Thermalling	Neutral	Gliding	Gliding	Gliding

Table 1

Flap settings as presented in the flight manual
(flap deflection is tabulated as inboard flap angle / outboard flap angle)

Airbrakes

Each wing has a triple-blade airbrake that extends from the upper surface and is controlled using a lever in the cockpit. The flight manual states that the airbrakes increase the sink rate and stall speed and have a small effect on trim.

Water ballast

The nose sections of the inner wings contain integral water ballast tanks and each wing can hold approximately 85 litres. A 5 litre ballast tank in the vertical fin can be installed as an option to counteract the nose-heavy moment of the wing ballast.

Carrying water ballast is a disadvantage when climbing in rising air (thermalling) but the increased weight allows the glider to fly at a higher airspeed for a given glide angle. Carriage of ballast is, therefore, advantageous during cross-country competitions in good soaring weather and 100 litres of ballast was typical for this glider in the prevailing conditions.

Sustainer engine

The glider is equipped with a Solo 2350 two-stroke, two-cylinder sustainer engine driving a two-blade, fixed-pitch, composite propeller. The engine is capable of delivering up to 24 horsepower and is normally stowed inside the fuselage behind the cockpit. The engine is extended by an electrically-driven screwjack and starting is reliant on the airflow to rotate the propeller. Engine status is displayed on a cockpit instrument that also performs engine control and monitoring functions.

The engine is controlled using a lever that protrudes from a detented slot on the cockpit left side console (Figure 6). There are five positions and the lever is connected to an engine control unit by means of a mechanical linkage. The control unit is mounted behind a removable panel in the left side of the engine compartment and consists of a sliding assembly that operates electrical microswitches to ‘sequence’ the engine.

A fuel tank located just behind the pilot contains 10.5 litres of fuel, which is sufficient for approximately one hour of powered flight. The fuel shutoff valve is operated by a lever in the cockpit (Figure 6) and, if inadvertently left closed, is automatically opened by the action of moving the engine control lever to the ignition position.

Figure 6

Fuel shutoff and engine control levers

Engine operation

There are five detented lever positions for the engine control (Figure 7).

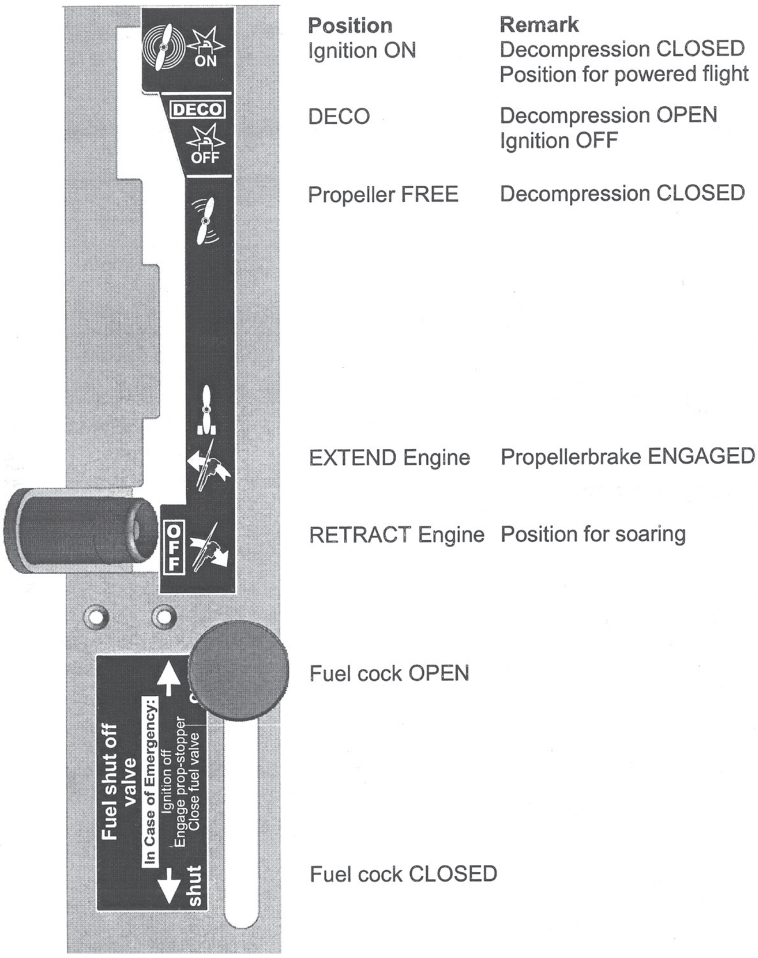

Figure 7

Engine control lever positions

The engine is extended into the airflow by moving the control lever forward to the EXTEND position. The flight manual recommends this is accomplished at an airspeed of less than 76 kt and an experienced ASG 29E pilot stated he would aim to do this at approximately 50 kt, with the flaps at setting 5. A green light illuminates on the cockpit instrument when the engine is extended fully. If the engine does not extend fully, a red light flashes, accompanied by an audio alert and an error message on the cockpit instrument display.

Advancing the control lever to the DECO position withdraws a propeller stop and opens the decompression valves, allowing the propeller to windmill. The flight manual states the glider should be accelerated to 65 kt before pushing the control lever fully forward to IGNITION ON, closing the decompression valves and starting the engine. The experienced ASG 29E pilot stated he would aim to accelerate to 75-80 kt, selecting the flap to setting 3. When the engine has started, engine speed will increase above 4,400 rpm and the airspeed should be reduced to 51 kt, at which the glider will climb steadily unless in sinking air.

The glider does not have a throttle control and engine speed is dependent on the airspeed. Engine speed is monitored and the status is displayed on the cockpit instrument. A green light signifies 4,400 to 5,200 rpm and a yellow light signifies 5,200 to 5,400 rpm. Depending upon airspeed, it is possible to exceed the maximum engine speed of 5,400 rpm and if this occurs, a red light illuminates and the ignition is switched off automatically until the over-speed is no longer present. Pilots familiar with the ASG 29E commented that the engine sound under such conditions is distinctive as the ignition cuts in and out; a flight test report in Sailplane & Gliding magazine dated August 2007 described it as '*splutter'*. The experienced pilot (quoted previously) described it as a "surging effect" and noted that it would not happen if the airspeed was less than approximately 60 kt. He pointed out that, because it is a fixed-pitch propeller, the rpm is very dependent on airspeed.

The flight manual states that the time taken to extend and start the engine is approximately 40 seconds. Height loss is '***usually** about: 100 – 200 m (330 – 660 ft)*'.

The engine is stopped by moving the control lever aft to the DECO position and reducing airspeed. When the propeller has slowed, the engine lever is moved to the propeller free position, which closes the decompression valves. The propeller stop is engaged by moving the control lever to the EXTEND position and the engine is retracted by moving the lever fully aft to the RETRACT position.

Accident site

The accident site was in a corn field approximately 2 nm west of Lasham airfield. The accident followed a period of dry and warm weather that had created a very hard surface to the field. The glider was severely disrupted in the ground impact and the fuselage forward of the wings was fragmented through the site, which was approximately 30 metres wide. The tongue-and-fork joint between the wings was secure but the wing structure had broken up exposing the internal flying control rods, which were heavily distorted. Both airbrakes were found extended and the engine had detached from the fuselage. The tail boom had broken into multiple pieces but the fin, rudder and right horizontal stabiliser remained as an assembly.

The extremities and major components of the glider were identified at the site, indicating that it was structurally intact prior to the impact. The majority of the external white surfaces had a mottled brown dusty coating that was consistent with the wreckage being enveloped in a cloud of dust and water when the water ballast tanks ruptured on impact.

Clear indentations in the soil, approximately 5 cm in depth had been made by the left winglet and left wing outboard leading edge. The general disposition of the wreckage was consistent with the glider having crashed at high speed in a steep nose-down attitude with the nose approximately 30° from vertical.

The wreckage was recovered to the AAIB facility at Farnborough for detailed examination.

Detailed examination of the wreckage

Flying controls

Damage on the left wing appeared to have been caused by interference with the airbrakes as they extended and fouled the adjacent distorted structure. It was, therefore, concluded that the airbrakes extended as the glider broke apart.

The positions of the remaining flying control surfaces at the time of the accident could not be determined. There was no evidence of a pre-accident flying control system failure but it was not possible from the wreckage alone to eliminate the possibility of a control restriction or jam.

Engine

Damage sustained by the engine and its associated components was consistent with it being in the extended position when the impact occurred. The propeller blades had detached from the hub and chordwise scoring and leading edge damage indicated that the propeller was rotating at impact.

The fuel shutoff valve selector lever was found in the OPEN position but the operating linkage had detached from the valve. The shutoff valve itself was fully open.

The engine control lever had come out of its detented slot and it was not possible to determine the position of the lever at the time of the impact, either from the engine or the control unit. The engine control unit remained in place and comparison with a reference unit showed its position was consistent with the control lever being in the PROPELLER FREE position. The possibility that the control unit had been disturbed during the impact could not be discounted and the installation is such that the sliding mechanism would probably be displaced aft when the forward fuselage broke apart.

The extent of the damage precluded testing of the engine but strip examination revealed no evidence of any pre-accident damage or undue deterioration. The owner of the glider reported that the engine had been started without difficulty on the two flights prior to the accident.

Landing gear

The condition of the landing gear indicated that it was retracted at impact.

Canopy

The canopy release mechanisms were identified and the locking pins were fully engaged. There was no evidence that the pilot was in the process of jettisoning the canopy.

Weight and balance

G-VLCC had an empty mass of 344.6 kg and a maximum permitted takeoff mass of 600 kg in the 18 m configuration. The estimated takeoff weight for the accident flight was 534 kg, giving an estimated wing loading of 50.9 kg/m^2. The centre of gravity was calculated to be 275 mm aft of the datum, almost midway between the forward and aft limits as prescribed in the flight manual.

Handling

The ASG 29E, and the ASG 29 with no engine, have become very popular over the last 10 years and many examples are operated in the UK. The manufacturer indicates there are approximately 190 ASG 29E gliders in use worldwide and approximately 110 ASG 29 gliders.

Sailplane & Gliding magazine published flight test reports on the ASG 29 (June 2006) and the ASG 29E (August 2007) which state '*Control was direct and stable: with comfortably low, unambiguous forces…*' and '*…easy to fly, making it ideal for club use*'. The 2007 report says starting the engine is '*really easy*' and the glider is described as having high performance while being '*reliable and safe'*.

Aerotow

The flight manual suggests that pilots should begin their takeoff using flap setting 2, to achieve best lateral control. The flap setting should then be increased steadily to setting 5 during the ground run, with setting 4 or 5 used when airborne. The manual also notes that setting 4 can be maintained throughout the whole aerotow and indicates that 70 kt would have been the ideal airspeed for G-VLCC in this phase of the flight.

During Sailplane & Gliding magazine's 2006 assessment, setting 4 was used for the ground run and the tow and the test pilot reported:

> *'At a towing speed of 110 km/h (59 kt) the tug was clearly visible above the instrument panel. For even better visibility on slower tows, the flaps could be set to 5, which lowers the nose. I also checked the behaviour on tow with the flaps set to 6 or even L, and found no significant tendency to 'go out of control' and over climb the tug even at high towing speeds.'*

A reference card found in the glider suggested that setting 2 or 4 could be used for the ground run and setting 4 or 5 on the aerotow.

Airspeed

The ASG 29E's normal operating airspeed range (marked in green on the airspeed indicator) is from 56 to 113 kt and the best-rate-of-climb speed, when powered by the sustainer engine and at maximum weight without water ballast, is 51 kt.

A table in the flight manual offers stall speeds for different flap settings and weights. For a glider weighing 530 kg, the table indicates a minimum stall speed of approximately 42 kt at flap setting 5 (which might increase to 45 kt at an angle of bank of 30º), with or without the engine extended.

Use of the sustainer engine

The sustainer engine is fitted to allow continued flight when there is insufficient lift to allow the glider to soar and the flight manual suggests that the minimum safe height before extending and starting the engine is 1,300 ft. It advises pilots to familiarise themselves with starting procedures '*within safe reach of an airfield*' and recommends running the engine for a short time before commencing a cross-country flight, to ensure that it is operating correctly and that the fuel lines are filled. The minimum speed for extending and starting the engine is 45 kt and the maximum speed with the engine extended is 76 kt.

A few weeks before the accident, the glider's owner suggested to the pilot and her husband[4] that all three of them should routinely practise engine starts at a safe altitude. The accident occurred during the pilot's first flight following this discussion and she had informed her husband that she would run the engine for a short time that morning when she was in a safe position. He saw her looking at the engine procedures checklist in the flight manual prior to the flight.

Manoeuvres

The flight manual states the ASG 29E is not approved for aerobatic manoeuvres and intentional spins or spiral dives are not permitted. During certification tests with the engine extended the glider recovered from a spin after two turns without any pilot input. It was also shown that recovery was possible from a spin that turned into a spiral dive with the engine windmilling, without exceeding its design manoeuvring speed or the maximum positive manoeuvring load factor of +5.3g. The flight manual lists the actions to be taken to recover from a spiral dive:- '*release stick*', '*reduce bank angle with aileron and rudder against the direction of turn*', '*gently pull out of the dive*'. The manufacturer stated that these actions will lead to an immediate recovery.

Footnote

[4] The pilot's husband was also a glider pilot, current on the LS8 and the accident glider.

Gliding procedures

Licensing and gliding club procedures

The pilot of G-VLCC was in possession of a valid British Gliding Association (BGA) certificate. The UK Air Navigation Order (ANO) does not require a glider pilot to possess a flight crew licence and pilots may operate a glider in the UK if they possess BGA certification.

The BGA does not regulate a glider pilot's recency and gliding clubs issue local guidance on levels of recency deemed appropriate for their site. At Lasham, pilots with more than 100 hours total flying experience and who fly '*30-40 hours per year or more'* are advised to have a '*check flight*' with an instructor only if more than three months have elapsed since their last flight.

Pilot information

Medical requirements

A pilot is deemed medically fit to fly a glider solo if they possess a current motor vehicle driving licence and are flying as a BGA gliding certificate holder, rather than with a flight crew licence. The pilot of G-VLCC was in possession of a current driving licence and there were no indications from her medical record that she was unfit to hold this licence. Previously, in order to compete in international gliding competitions, the pilot held an EASA Class 2 medical certificate but its validity expired on 30 April 2014.

Medical history

Nine days before the accident, the pilot had indicated to a friend that she had difficulty sleeping a few nights earlier because of "palpitations and thought she was having a heart attack". There was no evidence the pilot talked to anyone else, including her husband, about her sensation of palpitations nor did she consult a medical professional.

Two days before the accident, while on another business trip, the pilot stayed overnight with close friends from the gliding community. They recalled that she seemed her normal "effervescent" self. However, while discussing her forthcoming retirement, she said that she would probably not do any more gliding when she retired because she was "too tired". The friends were surprised by this remark but the pilot did not elaborate further.

Witnesses who interacted with the pilot on the morning of the accident thought she seemed fit and in good spirits. One of these witnesses described her as an "energetic, bubbly lady" and noted that morning "she was her usual self and appeared very well". Her husband stated that the previous evening she had been quite relaxed, that they had spent the night in their caravan at the airfield and that she seemed typically "lively" on the morning of the flight.

Family history

Both the pilot's natural mother and her maternal grandmother suffered cardiac illness when aged over 60. The pilot's mother reported having a heart attack when she was aged 65, with further complications, and her brother, the pilot's uncle, suffered serious cardiac illness which began with a heart attack at the age of 43.

Post-mortem examination

The histopathologist who carried out a post-mortem examination stated that his findings were consistent with the glider suffering a high-velocity impact in a nose-down attitude. He observed no evidence of pre-existing natural disease that could have contributed to death but he was constrained by the extent of the injuries following the accident and it was not possible to analyse the pathology of the pilot's cardiac system. After learning about the related family history and the pilot's report of an abnormal heart rhythm, the pathologist observed that this could explain a sudden loss of consciousness but could offer no corroborative physical evidence for this.

Experience

The pilot started hang gliding in 1979 and became an accomplished hang glider pilot before obtaining her BGA certificate in 1997. She had flown in excess of 1,800 hours in gliders, had represented her country in international competitions and had gained an array of gliding certificates, diplomas and records[5]. Other, experienced, glider pilots praised her piloting skills and stated she was "sensible", "cautious" and demonstrated "exemplary airmanship". Her husband also stressed that she was a focussed and well-disciplined pilot, who was not easily distracted.

Over the last few years the pilot mostly flew in a Rolladen-Schneider LS8, a single-seat glider without a sustainer engine. No log book entries were made after August 2013 but there were loose notes relating to some flights during 2014. From the start of that year, all the pilot's flying was from Lasham and the Gliding Club's launch record, along with glider log data, provided information of flights made after the last log book entry. Nearly all of these flights were in an LS8 but one, on 22 February 2014, involved a refresher flight with an instructor in a two-seat glider and this was completed satisfactorily.

On 11 April 2015 the pilot flew the accident glider for the first time, on a flight that lasted 2 hours 55 minutes. Her only other flight in it was on 3 April 2016 and this lasted 29 minutes but, in the 12 months prior to the accident, she also flew 12 times in an LS8, the last flight being made on 15 May 2016. Her estimated total flight time over this last year was 36 hours.

Footnote

[5] British gliding records are listed by category and glider class at https://members.gliding.co.uk/competitions/british-gliding-records/

Manufacturer's comments

Aerotow

The glider manufacturer commented that if flap setting 4 had been used and the glider towed at 70-75 kt, the pilot should not have had difficulty maintaining the tow position. Even if another flap setting had been used, the pilot might have had to concentrate more on holding position and this should not have posed any particular problem. The manufacturer considered that, barring a control difficulty, the only plausible explanation for the glider's movement was that the pilot lost concentration while focussing on some other task, such as changing a setting on a flight computer.

Given the pilot was seen before takeoff to experience some difficulty integrating her tablet device with the on-board equipment, she may have had further difficulties as the aerotow progressed. There may, equally, have been another unknown source of distraction in the cockpit.

Descent with engine deployed

The manufacturer stated that a deployed engine 'acts as a large airbrake' and limits the airspeed in descent. It was the manufacturer's opinion that the engine noises heard by the witnesses on the ground probably reflected an engine speed accelerating above 5,400 rpm, due to high airspeed, and the ignition cutting out until the engine speed reduced below 5,400 rpm. At high airspeed the engine would have accelerated again and the process would have repeated.

Analysis

Engineering

Ground marks and the disposition of the wreckage showed that the glider struck the ground in a steep nose-down attitude with the nose approximately 30° from vertical. The glider was structurally intact before the impact occurred.

The engine was in the deployed condition and damage to the propeller showed it was rotating. Witness reports of a "screaming" engine which was running up and dying away two or three times are most likely explained by the automatic over-speed protection temporarily switching off the ignition. This would suggest that the engine was running prior to the accident.

With the exception of the airbrakes, which were stowed, it was not possible to establish the position of the flying control surfaces. Detailed examination showed no evidence of a pre-accident flying control system failure but it was not possible to eliminate the possibility of a control restriction or jam.

There was no evidence that the pilot was in the process of jettisoning the canopy.

Flight preparation

On the day of the flight the pilot appeared to have made her preparations in her usual, thorough manner and the only apparent difficulty she had was in programming the tablet device she used in the cockpit. The glider was loaded to less than its maximum takeoff mass, the centre of gravity was close to the middle of the allowed range and it was evident the pilot planned to deploy and run the sustainer engine for a short time at a safe altitude. This was in accordance with the manufacturer's recommendations.

The pilot had only flown the Schleicher ASG 29E twice before but she was an experienced pilot who should not have had difficulty flying this glider with its benign handling characteristics. Her last flight with an instructor took place two years and five months previously but, with her level of experience, neither the BGA nor her gliding club requires such a pilot to have regular check flights.

Aerotow

The wingtip runner and the tug pilot both said the takeoff appeared normal. However, despite the tug being flown at a suitable speed, the glider apparently moved around from side to side and up and down after passing 500 ft. Given the pilot's high level of experience, she should not have had any problem maintaining a steady position on this tow and she did not indicate on the radio that she had encountered a problem. As no technical defect was later found, it is possible that the pilot was distracted by something which caused her to lose concentration when flying the glider.

Soaring

The recorded data indicates that for 16 minutes after launch the pilot soared the glider within a few miles of Lasham in readiness for starting the cross-country task. During this time she was heard speaking on the radio and gave no indication that she was encountering any difficulty; if there had a been a problem she could have returned safely to Lasham at any point.

Final descent

The highest altitude 3,920 ft amsl (approximately 3,400 ft above ground level and coincident with the lowest reported cloud) was recorded at 1039:15 hrs, while still close to Lasham. The glider appears to have then descended at an average rate of descent of 350 ft/min for approximately 2.5 minutes before flying almost level at 3,050 ft amsl for some 25 seconds. It is possible the engine was deployed and started during this descent but there is no indication of the glider climbing as would be expected following a successful engine start.

There are a number of stages to the engine starting procedure and the glider's owner said he found it stressful doing this when at low level. It is uncertain whether the pilot had started this engine previously but, given her level of experience and the evidence from the Sailplane & Gliding magazine, it should not have been particularly challenging to achieve this pre-planned task when 3,000 ft above the ground and within easy gliding distance of the airfield.

Based on a wind speed of no more than 10 kt and the available groundspeed data, there is no evidence the glider was flown at or below the stall speed before the FLARM signal was temporarily lost.

In the 35 seconds for which the FLARM signal was lost, the glider was generally flying into wind and the average groundspeed of 57 kt, suggests an airspeed of between 57 and 67 kt, greater than the stall speed. If the engine had not been started earlier in the descent, then it might have been started at this stage, with the glider still more than 2,500 ft above the ground. It is also possible that having deployed the engine, the pilot experienced difficulty starting it because the data does not reflect a gentle climb consistent with powered flight.

During the last 35 seconds of recorded flight the glider descended approximately 2,500 ft and turned left from a heading that was initially south-westerly, maintaining an average groundspeed greater than 50 kt. The groundspeed and the rate of turn increased quickly in the last 8 seconds or so, suggesting the glider entered a spiral dive shortly before it struck the ground at a speed in excess of 100kt. This is close to the maximum speed the manufacturer expects to be achieved, in a dive, with the engine deployed.

An eyewitness, positioned approximately one mile from the accident site, believed the glider made three or four spiral turns in the last few seconds of flight but this could not be substantiated from the available data. The data does indicate that in the last few seconds of flight the glider entered a spiral dive prior to impact.

From the noises heard by several witnesses it is considered likely that the engine was running while the glider was diving for the last few seconds of flight, with the apparent running up and down most likely caused by the automatic over-speed protection temporarily switching off the ignition.

Possible incapacitation

In this accident, investigation showed no evidence of a technical malfunction, the pilot was very experienced and was operating in a benign environment. It appears possible that she lost control of the glider due to incapacitation while starting, or after starting, the sustainer engine. If she had experienced a technical problem, such as a jammed control column, it is likely she would have made a distress call on the radio or attempted to open the canopy in order to parachute free from the glider.

There is evidence the pilot believed she experienced an abnormal heart rhythm about 13 days before the accident and the familial history of such illness adds to this possibility. There is no evidence to indicate the pilot suffered cardiac illness earlier in this flight but it is likely that she was incapacitated in some way during the latter stages of flight and the pathologist could not rule out the possibility that she might have lost consciousness as a result of a cardiac problem.