ACCIDENT

Aircraft Type and Registration:	1) Scheibe SF27 glider, HGM 2) Schleicher ASW 19 glider, GDP
No & Type of Engines:	1) None 2) None
Year of Manufacture:	1) 1965 2) 1979
Date & Time (UTC):	2 October 2006 at 1515 hrs
Location:	Sutton Bank, North Yorkshire
Type of Flight:	1) Private 2) Private
Persons on Board:	1) Crew - 1 Passengers - None 2) Crew - 1 Passengers - None
Injuries:	1) Crew - 1 (Minor) Passengers - N/A 2) Crew - 1 (Fatal) Passengers - N/A
Nature of Damage:	1) Aircraft destroyed 2) Aircraft destroyed
Commander's Licence:	1) British Gliding Association (BGA) Gliding Certificate 2) British Gliding Association (BGA) Gliding Certificate
Commander's Age:	1) 50 years 2) 48 years
Commander's Flying Experience:	1) 733 hours Last 90 days - 20 hours Last 28 days - 5 hours 2) 280 hours Last 90 days - 10 hours Last 28 days - 1 hour
Information Source:	AAIB Field Investigation with assistance from the British Gliding Association (BGA)

Synopsis

Two gliders, a Scheibe SF27 and a Schleicher ASW 19B, were flying close to Sutton Bank, North Yorkshire, when they were in collision close to a bank of cloud. Both gliders lost portions of wing in the impact and were rendered incapable of flight. The pilot of the SF27 was able to escape from his aircraft and parachute to the ground: the pilot of the ASW 19 was not able to release his cockpit canopy and was killed. The engineering investigation indicated that both aircraft were serviceable until the moment of collision.

Two Safety Recommendations were made shortly after the event and a further two are made in this report.

History of the flight

The two pilots, and others, were members of a group from the Welland Gliding Club, which regularly organised expeditions to fly at the Yorkshire Gliding Club at Sutton Bank; the club hosts many such expeditions each year from clubs around Britain. The group arrived on the Saturday before the accident, intending to spend the week gliding and socialising.

The gliding club site is situated on top of a ridge, which forms around a bowl on its western side (see Figure 1). The site has two takeoff and landing 'runs', north/south and east/west. The east/west run was in use on the day of the accident, with the launch point established just south of the club building. The elevation of the site is 920 ft amsl and its geographical situation provides the opportunity for ridge soaring, whilst the presence of the Pennine hills to the west means that wave lift is also often present. Orographic cloud often forms over the site, sometimes rapidly, when a moist westerly air stream exists in the area.

On the day of the accident, the weather at Sutton Bank was changeable. Three training flights took place in the morning but a rain shower then stopped flying for a time. Once the rain shower had passed, operations recommenced, with aerotow launches. The ASW 19 (GDP) was launched at 1447 UTC and the SF27 (HGM) directly afterwards at 1458 UTC.

No evidence was available of the flight of the ASW 19 from the end of the aerotow launch until the final moments before the collision.

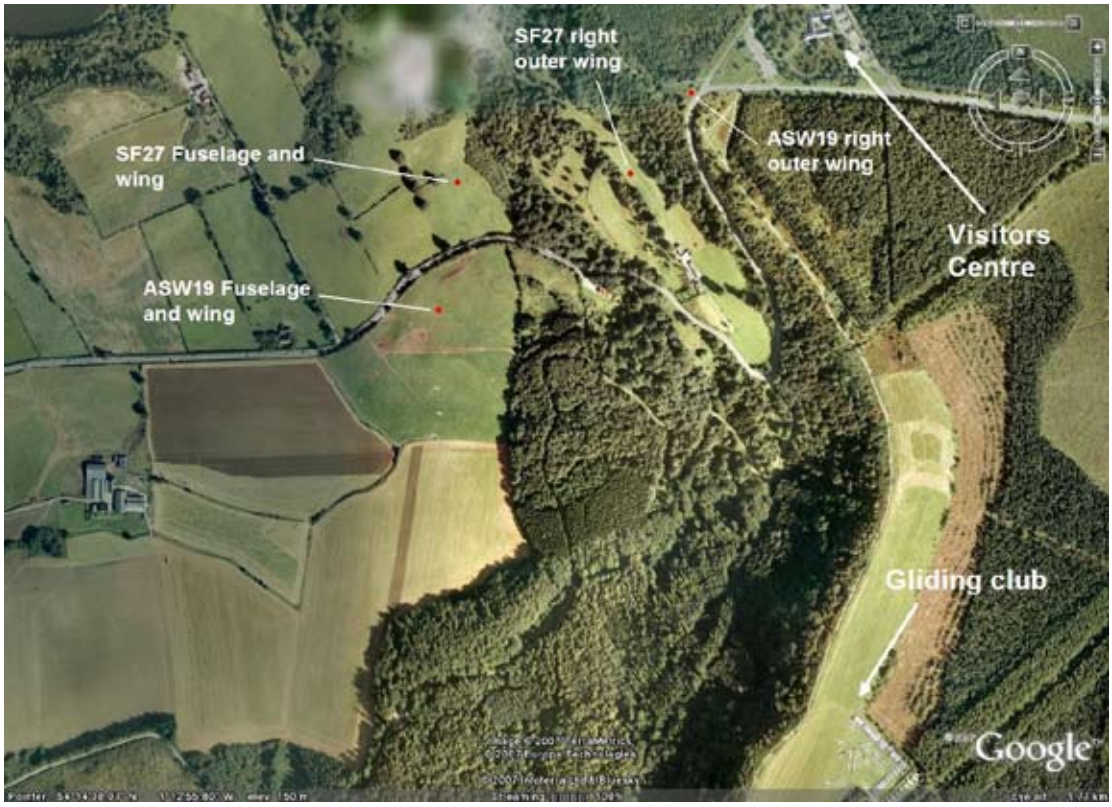

Figure 1

Accident site

The surviving (SF27) pilot recalled releasing from the aerotow at 2,000 ft above the site[1] and soaring near, and predominantly to the south of, the site, during which time he was concerned about a bank of cloud to the west-south-west of the airfield, drifting towards it. Shortly before the collision he was tracking roughly north along the ridge to the west of the site, at about 1,500 ft. Immediately prior to the collision, he recalled being in a gentle left turn, skirting around a cloud mass, the edge of which was somewhat broken and "scuddy". His intention was to manoeuvre towards the Thirsk area, where the weather was clearer. He recalled that his speed was about 45 kt and he was experiencing a little lift. He was monitoring communications on the Sutton Bank gliding frequency, 129.975 MHz, on his radio. He heard no communications which related to the ASW 19 after his launch.

The SF27 pilot suddenly saw the orange wing tip and nose of another glider at between his one and two o'clock position[2], and he realised that a collision was inevitable. Instinctively he entered a descending left turn, with the objective of preventing a cockpit-to-cockpit collision (which he thought highly probable and likely to be fatal). He recalled that the other aircraft "may have been descending out of scuddy cloud", and that it may have been flying fast and straight towards him. He ducked his head as the other aircraft's wingtip was about to impact his canopy, and immediately heard a loud bang.

The two aircraft collided almost head on, each aircraft's canopy being severely damaged by the other's wing. The wing structure of the SF27 separated from the fuselage; one wing of the ASW 19 separated approximately half way along its span.

Footnote

1 Glider pilots operating at Sutton Bank commonly refer to their vertical position as height above the site. The site is 920 ft amsl.

2 Relative position of another aircraft is frequently expressed by 'clock code': an aircraft straight ahead is at 12 o'clock, one to the right at three o'clock, directly behind at six o'clock, and to the left at nine o'clock. Other points are referred to in order.

The SF27 pilot then felt a cold rush of air, and his aircraft rolled to the right to an inverted position. He did recall operating the canopy jettison lever, but the canopy did not part from the glider. A substantial part of the canopy had been destroyed in the impact and the pilot later remembered kicking himself free of the cockpit and being momentarily delayed in locating his parachute release, before operating it. He heard the parachute canopy deploy and then looked up to check that it had deployed correctly. He made an uneventful parachute descent, landing in a wooded area. His parachute canopy caught in the trees and he found himself suspended by his canopy and harness, his toes just touching the ground. He released his harness and made his way to a clearing in the trees where he used his mobile telephone to call the club, before walking out of the wood towards a nearby road and being met by the emergency services. He sustained a broken bone in one hand, and cuts and bruises.

The ASW 19 and its pilot fell to the ground. The pilot was found close to the wreckage of his glider, his harness was found unfastened and the canopy release mechanism had been operated. He was wearing a parachute but it had not been operated. The impact with the ground was not survivable.

Staff and visitors at the club called the emergency services as soon as they heard the collision. A flying instructor, airborne in a motor glider, made a 'MAYDAY RELAY' call addressed to the Distress and Diversion cell at the London Area Control Centre, which was relayed to the cell by a commercial aircraft airborne near London. The instructor selected 7700 on his transponder[3] to assist ATC in identifying the location of the accident.

Footnote

3 The 'MAYDAY' code, which alerts air traffic controllers using secondary radar to an aircraft in distress.

Witness recollections

There was only one eyewitness to the collision. The partner of another glider pilot was standing in the car park beside the gliding club, and observed three gliders airborne: the ASW 19, the SF27, and her partner's glider. In due course, she saw two gliders "heading towards each other in thin misty cloud" and then colliding. She saw wreckage falling, and one parachute opening and descending.

Another pilot, the partner of the eyewitness, was airborne at the time. Prior to the collision, he recalled flying along the ridge, and attempting to make radio contact with the ASW 19 pilot, first on the Sutton Bank frequency 129.975 MHz and then on 130.4 MHz, the 'cloud flying' frequency. He intended to inform him of a "squall with a band of cloud" approaching the site. He recalled that he was flying at approximately 1,000 ft above the site, below "an upper, broken layer of cloud, base approximately 1,350 to 1,400 ft above the site". He also recalled that "rain was falling on the southern end of the bowl with isolated patches of scud covering the majority of the bowl area". He recalled flying along the ridge, towards the north, just past the middle of the bowl, and seeing another glider "higher, at approximately 1,400 ft above the site…", shortly after which he heard a thud. He immediately checked his flying controls, which responded normally, and then he turned to the left and saw debris falling from the sky.

A gliding instructor was at the launch point when he heard a 'crunch', which he realised was a mid-air collision. He saw "two gliders, seemingly locked together – the wreckage separated leaving one glider spinning around and the other with debris also falling from the sky". He then saw a parachute open.

Recorded data

Both gliders had a GPS receiver coupled to a glider logger. The GPS receivers and the loggers had the ability to record the track of the aircraft to memory. In all cases, a battery was required to maintain the memory. The GPS from the SF27 was never recovered; the glider logger was recovered but had failed to record the track of the accident flight due to a low battery.

The GPS from the ASW 19 was recovered but was not operational. Investigation revealed that the power circuitry had been disrupted during the accident, such that the battery powering the memory quickly depleted, losing any track information that may have been recorded. However, the glider logger had sufficient battery power to maintain its memory but was too damaged for a normal download of the unit. The memory was extracted with the assistance of the Bureau d'Enquetes et d'Analyses (BEA - equivalent to the AAIB in France) and decoded with the assistance of the logger manufacturer and one of the original design team members. It was established that the last logged flight was on the previous day.

Radar data from the Claxby and Great Dun Fell radar heads were analysed. The only steady tracks recorded were secondary radar tracks relating to aircraft that had ATC transponders switched on. Neither glider was equipped with a transponder and primary radar was not able to track targets in the area at the altitudes involved.

At 1516 hrs a secondary radar detected a transponder transmitting the emergency 7700 squawk in the area of the accident. Previously, secondary radar had not detected this aircraft, suggesting that the aircraft's transponder was switched on at 1516 hrs specifically to transmit the emergency code. Subsequently, radar tracked the transponder staying close to the accident site.

In summary, neither the radar data nor the data from the onboard equipment yielded evidence useful in this investigation.

Meteorology

The Met Office provided an aftercast which showed low pressure centered over the North Sea feeding a moderate west-north-westerly airflow over Yorkshire on the day of the accident. The weather was partly cloudy with some showers in the area. Surface visibility was assessed as 30 to 40 km but locally 10 to 15 km in showers. The cloud was one or two octas of cumulus, base 2,500 ft, becoming three to seven octas of cumulus base 2,000 to 2,500 ft in showers. There were three to seven octas of strato-cumulus with a base between 5,000 and 8,000 ft. The report also stated that:

> *'it is possible that stratus cloud was forming on west-facing ridges base between 1,500 and 2,000 ft.'*

The wind at the surface was assessed to have been from 250° at 15 kt, with isolated gusts up to 25 kt. The wind at 1,000 ft was from 270° at 20 kt, and at 2,000 ft from 280° at 20 to 25 kt.

Communications

Both gliders were fitted with VHF aeronautical radios. In the Yorkshire Gliding Club Standard Operating Procedures (SOPs), the following instruction was given regarding radio communications:

> *'The club frequency is 129.975 MHz'*
>
> *'The frequency shall be used for all communications with the gliding club and within 10 nm of site.'*

The radio fitted in the ASW 19 was found with frequency 130.4 MHz selected. Neither 129.975 nor 130.4 MHz is recorded, and no witnesses recalled hearing transmissions from the aircraft on the day of the accident.

The BGA's *'Laws and Rules'* list the frequencies to be used for glider operations in the *Recommended Practices'* section as follows:

> *'130.4 MHz Cloud flying and relaying cross-country messages only.*
>
> *129.975 MHz As a control frequency within a 10 NM radius and up to a height of 3,000ft. above certain approved airfields. (CGFF – Common Glider Field Frequency).'*

There is no advice about frequency use when cloud flying in the vicinity of *'approved airfields'* such as Sutton Bank.

The SF27 pilot

The SF27 pilot had begun gliding in 1989, and had flown regularly since then. He gained a basic instructor qualification in 1996 and an assistant category instructor qualification in 1997. He was a BGA airframe inspector. He first flew at Sutton Bank in 1996, and then in 1997, and each year afterwards.

The SF27 pilot was in the habit of practising emergency procedures regularly, including self-briefing on how to abandon his aircraft, and practising the required actions. He told AAIB investigators that he considered this was a significant factor in his successful abandonment of his aircraft.

He was an assistant category instructor at the Welland Gliding Club. As an instructor, and taking his age into account, he was required to renew his medical declaration every five years. His last medical declaration was on

1 May 1996. To ensure continuity of qualification this declaration should have been renewed by the end of April 2001 and then again by the end of April 2006. The club's instructor records for 2003, 2004, and 2005 showed this renewal date, but the club management had not identified that his medical declaration had lapsed.

After the accident, the SF27 pilot underwent an eye examination with a CAA optometrist, who found that his uncorrected eyesight was well within the standards required for the medical declaration. He did not wear corrective lenses.

The ASW 19 pilot

The ASW 19 pilot learnt to glide in 1998-99, and flew regularly thereafter, purchasing the ASW 19 in 2002. He made regular annual trips to Sutton Bank with other members of his gliding club. He held a BGA Silver Certificate and a valid medical declaration to Group 1 standard.

A post-mortem examination carried out on the pilot revealed no pre-existing medical conditions and the toxicological report was negative.

Oversight of gliding activity in the UK

Gliding in the UK is not formally regulated, but the British Gliding Association (BGA) offers a system of voluntary oversight including the publication of Laws and Rules for glider pilots, instructors, and examiners, and a system of accreditation of flying ability with certificates for heights gained, distances flown, and durations of flight. Almost all gliding clubs in the UK are members of the BGA and have agreed to be bound by its procedures.

BGA Laws and Rules and other information

Only two BGA Rules apply specifically to flight in or near cloud:

> *'6.12 No glider shall enter cloud within a radius of 5 nautical miles of a gliding site, except from at least 200 feet from below the lowest part of the cloud.*
>
> *6.13 No glider shall enter cloud unless all its occupants are wearing parachutes and have been instructed in their use.'*

The Rules of the Air Regulations permit gliders in the UK to operate under VFR or IFR in Class F or G airspace. No training syllabus has been published and there is no requirement for training relating to cloud flying under IFR. There is no minimum experience level, and no minimum aircraft equipment requirement for glider flight under IFR.

AAIB investigators met with members of the BGA executive who provided a copy of a publication entitled *'Bronze and Beyond'*[4], which is frequently read by glider pilots seeking guidance on, and amplification of, the Laws and Rules. In the section *'Flying in cloud – procedures'*, the book states:

> *'You should use your radio to announce on 130.4 MHz that you are entering cloud. You should give your callsign, height and position, and say that you are entering cloud…*
>
> *When you leave the cloud, announce your callsign and the fact that you are now clear of cloud.'*

Footnote

[4] 'Bronze and Beyond' by John McCullagh, ISBN 0-9548742-0-X.

Previous mid-air collisions involving gliders in the UK

The BGA provided information (an internal report) on previous mid-air collisions between gliders in the UK. The report identified a total of 37 mid-air collisions, and a breakdown of the types of collision is given in the tables below.

33 of the 37 collisions were in the glider circuit or the vicinity of the gliding site ('vicinity' was not formally defined) see Table 2. Weather had been deemed to be a factor in only one other event (AAIB report EW/C2004/04/03). In that event, two gliders collided in conditions of decreased visibility below cloud near Lasham airfield. The investigation determined that late sighting by the pilots of each others' aircraft meant that there was insufficient time for effective avoiding action to be taken.

Collision avoidance in glider operations

Glider flying is usually conducted without the intervention of air traffic control; indeed imposition of effective control upon aircraft which rely upon atmospheric lift for sustained flight would be practically difficult. On occasions, gliders do enter or cross controlled airspace, but this accident occurred in Class G airspace.

Glider pilots, therefore, are responsible for using the 'see and avoid' principle to prevent collisions with other aircraft and must maintain an effective lookout.

Mid-air collisions involving gliders 1987 - 2006			
Aircraft involved	*Collisions*	*Fatal collisions*	*Fatalities*
Glider/Glider	27	10	17
Glider/Tug aircraft	7	2	3
Glider/Light aircraft	2	1	1
Glider/Parachutist	1	1	2
Totals	37	14	23

Table 1

Mid-air collisions involving gliders (and tugs) by flight regime	
Flight regime	*Collisions*
In or joining thermal	13
Airfield circuit	13
Ridge soaring near airfield	3
Thermal soaring near airfield	3
Following close behind	2
Total	34
Note: this table excludes the three collisions between gliders and light aircraft/parachutist	

Table 2

Flight in or near cloud

AAIB investigators discussed the practice of flying in or near cloud with the BGA executive. The BGA put forward the perspective that very little such flying occurred in relation to the total amount of glider flying, and that much of this flying was done by glider pilots who were professional pilots and therefore likely to be competent at instrument flight and well aware of the hazards inherent in flight in restricted visibility.

Further information - collision avoidance systems

The nature of gliding, particularly at hill soaring sites, is such that there may be numerous gliders flying in relatively close proximity and pilots must keep a good visual look out to avoid potential collisions. In order to assist in collision avoidance several electronic systems have been developed to provide early warning of potential collision to glider pilots. One such system makes use of a low-powered radio transceiver, linked to a GPS system, which transmits and receives location, speed and direction information. A processor within the unit identifies any potential conflicts and then alerts the pilot to the direction and relative level of danger. This system is not, however, compatible with the collision avoidance systems used by general and commercial aviation. The system has been adopted in some areas within Europe, such as the Alps, but as yet has not seen widespread use in the UK. Several trials are currently being undertaken by the British Gliding Association to determine the system's effectiveness and training requirements. Neither glider involved in this accident had the equipment fitted.

Engineering examinations

Wreckage distribution and examination

The remains of the gliders occupied four separate sites. The fuselage and majority of the wing structure of the SF27 had landed in a field at the bottom of Sutton Bank, approximately 150 meters north of the A170 road. A section of the SF27's right wing, together with the remains of the aircraft's canopy, were found part way up the slope of the Bank, 200 metres east of the rest of the glider. The ASW 19 was at the bottom of the Bank in a field immediately to the south of the A170. Numerous fragments of both gliders' wings and canopies, the SF27's wing/fuselage fairing and a 2.9 metre long section of the ASW 19's right wing were found on the A170 and the visitors centre car park at the top of the Bank. The distribution of the wreckage is illustrated in Figure 1.

The fuselage of the SF27 was substantially complete and continuity of the aircraft's controls within the fuselage was confirmed on site. The wing structure had suffered from significant break up.

The ASW 19 appeared to have impacted the ground at a very steep angle and was found inverted, the pilot probably being thrown from the cockpit during the ground impact. The right wing of the glider had been severely damaged in the region of the right air brake and was missing approximately 3.5 metres of its outboard section including the right aileron. The continuity of the controls was confirmed to the tail, left wing and up to the break in the right wing.

Fragments of the cockpit canopy frame and glazing, together with the remains of a PDA (palmtop computer) and GPS were recovered from the area immediately around the glider; one item of specific interest recovered from the field was the 'D' ring from the pilot's parachute,

which had become detached from the parachute deployment lanyard. The pilot's parachute had not deployed and the swaged 'ball' used to retain the 'D' ring had been pulled off the end of the deployment lanyard. A fingertip search of the area around the glider failed to locate the 'ball'. When the glider had been 'righted' the seat harness was found unfastened and apparently undamaged. The forward section of the cockpit canopy, which included the canopy jettison latch, was found in the cockpit - the latch was in the 'jettison' position but the canopy had remained attached to the glider by several electrical cables which had been secured by a cable tie.

The remains of both gliders were recovered to the AAIB for further detailed examination.

Detailed examination

The log books for the gliders confirmed that they both possessed valid British Gliding Association (BGA) Certificates of Airworthiness and had been maintained in accordance with the BGA Glider Maintenance Schedule. The records for the ASW 19 confirmed that it had a 'fixed' instrument panel; a modification had been issued by the manufacturer which allows the instrument panel to hinge upwards with the canopy to allow easier access to the cockpit.

Schiebe SF27

Examination of the control circuits within the fuselage showed no evidence of pre-impact damage or disconnection and, despite the fragmentation of the wing, all of the wing control circuits were identified and no evidence was found of pre-impact damage or disconnection.

The rear structure of the cockpit, including the pilot's headrest, had been significantly damaged and the wing mounting structure immediately behind the cockpit had been severely disrupted on the right side. The damage to the cockpit canopy matched the damage to the fuselage, which confirmed that the canopy was in position when the damage occurred and was consistent with an impact from an object passing over the SF27 from nose to tail. Fragments of the wing/fuselage fairing were found to have orange paint transferred, probably from the airbrakes of the ASW 19.

The wing structure consisted of three major sections. The right wing was intact for 2.6 metres outboard of the right wing root but then a section of the wing structure, approximately 1.8 metres long, had been fragmented. This damage was consistent with the airborne collision.

Schleicher ASW 19

Examination of the ASW 19 showed that the right wing had failed 2.9 metres from the wing tip, in the region of the right wing airbrake, and the section of wing released by the failure included the right aileron. A fragment of wing skin, identified as being from the underside of the wing in the region of the failure, was found to have black paint smeared onto its surface which was only found on the tubular frames of the SF27's fuselage structure. The angle of the smearing indicated that a portion of the SF27 had hit the leading edge of the wing between 2.9 and 4 metres from the wing root whilst moving under the wing at an angle of 25°, from left to right, relative to the ASW 19.

The flight instrumentation fitted to the glider had been significantly damaged. However it was possible to determine, after disassembly that the gyroscope within the artificial horizon had been rotating with some speed at the time of impact with the ground.

Examination of the cockpit confirmed that the seat harness was undamaged and did not exhibit any 'hardening' of

the belt webs at the harness mounting points which is normally seen when such material is subjected to impact loads. The harness locking mechanism functioned correctly and showed no evidence of being subject to excessive force.

ASW 19 cockpit canopy

The ASW 19 cockpit canopy is secured to a hinged arm at its forward edge by a 'toggle' latch, which allows it to be lifted forwards and upwards for entry and exit. The canopy is locked closed by two 'latch pins', in the rear canopy frame, which protrude into holes in the fuselage structure. In an emergency the canopy can be jettisoned by pulling a knob which releases the forward 'toggle' latch and allows the canopy to swing upwards and rearwards in the airflow; given sufficient airspeed the canopy will jettison with the rear locking pins still engaged. However; at low speed or in unstable flight, it may be necessary for the pilot to release the two rear pins to allow separation of the canopy.

The mounting plate (for the cockpit canopy) on the forward hinge arm was examined and found free from damage or witness marks from the forward canopy latch. The cockpit canopy frame had broken into several pieces but both rear latch pins were secure in their respective frame sections and the position and damage to the pins confirmed that they were extended in the 'locked' position when the glider struck the ground.

Two mounting brackets, one to hold a PDA and the other to hold a GPS unit, were found attached to the canopy frame. The cables, 'cable-tied' to the forward section of the canopy frame, were confirmed as being used to provide power to units fitted in these mounts. One of the cables was a multi-core coiled cable which was securely attached to the metal frame used to mount instrumentation and electrical connectors in the cockpit. The mounting plate on the canopy hinge arm was examined in detail, particularly in the area where the canopy jettison latch would engage, and found to be free from any damage or distortion.

Examination of a similar ASW 19 showed that, in the seated position, the pilot's knees are raised above the hips and the lower legs project under the instrument panel to a point just below the knees, with little space available for movement of the lower legs. During informal trials on the ground, it was found to take five to six seconds for a person to extricate himself from the cockpit.

The parachute worn by the pilot of the ASW 19 was a Thomas Sports Equipment TSE28 parachute. The data card in the parachute confirmed that it had been inspected and repacked by the manufacturer in October 2005. The manufacturer confirmed that the 'D' ring retaining ball is 'pull' tested with a 300 lb load before installing the rip cord in a parachute, that the minimum height required to obtain a full deployment of the parachute is 500 ft and that the recommended method used to operate this type of parachute is to grasp the 'D' ring in both hands and pull it downwards and across the body.

The parachute's deployment lanyard, consisting of a multi-strand cable, had 'unwound' and its end was bent, indicating the application of a significant side load. The 'D' ring was compared to that of a sample TSE28 and found to be deformed, see Figure 2. Tests carried out on a sample parachute showed that this damage was consistent with a high side load applied in the ground impact and, when pulled using the recommended method, the sample parachute and the parachute from the ASW 19 deployed with a steady force of about 6 kg .

Figure 2

'D' ring distortion

Analysis of impact and escape issues

The paint transfer seen on the SF27 overwing fairing, and the fragment of the lower surface of the right wing from the ASW 19, confirmed that initial impact was between the right wing of the ASW 19, approximately 3 metres outboard of the wing root, and the cockpit canopy and right wing root of the SF27, see Figure 3. The forces involved in such a collision would have been sufficient to disrupt the wing-to-fuselage mountings of the SF27 and cause the separation of the outboard section of the ASW 19 wing. The loss of such a large portion of the wing, including the aileron, would have made the ASW 19 uncontrollable and caused it to roll right as it descended. The fact that fragments of both glider's canopies were found at the top of Sutton Bank, and that a 3 metre section of the right outboard wing of the SF27 was found 200 metres away from the main wreckage, confirmed that there were additional impacts between the two gliders but there was insufficient evidence to determine the sequence of these additional impacts. At some point after the initial impact the outboard right wing of the SF27 failed, approximately 4.5 metres from the wing root, which would have made this glider incapable of flight.

The pilot of the SF27 stated that the collision occurred at approximately 1,500 ft above Sutton Bank. Calculations by the AAIB indicated that the time taken for both gliders to descend to the ground would have been approximately 14 seconds and they would have descended below the minimum height (500 ft) for a full parachute deployment within about 10 seconds. The evidence at the site indicated clearly that the pilot of the ASW 19 had managed to unfasten his seat harness but had not managed to leave the cockpit of the glider before it hit the ground; the damage to the parachute 'D' ring was further indication of this.

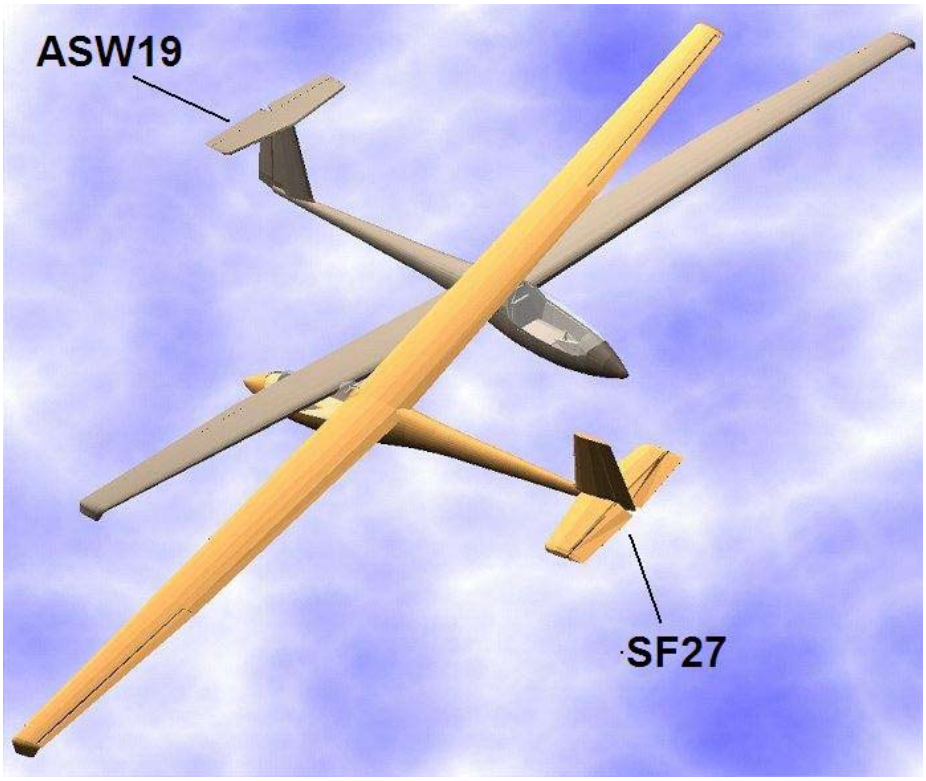

Figure 3
Collision reconstruction

Three factors appear to have acted against the ability of the pilot of the ASW 19 to escape successfully in the limited time available. First, and most significantly, was the presence of the cables attached to the front of the canopy frame. Despite the severity of the impact with the ground, and the break up of the canopy frame, the forward section of the frame had remained attached to the gliders fuselage by the PDA and GPS cables; it is therefore considered that, even had the jettison sequence been completed, the cables would have prevented a successful separation of the cockpit canopy. This factor was identified early in the investigation and was the subject of two AAIB Safety Recommendations, published in AAIB Special Bulletin S8/2006.

Second, the canopy jettison sequence in the ASW 19 had not been completed. Although the lack of distortion or witness marks to the forward canopy hinge plate, where the canopy jettison latch locates, indicated that the leading edge of the canopy had been released, the distortion to the rear canopy locking pins confirmed that they had remained in the locked position. Given the uncontrolled nature of the glider's descent, and the significant loss of airspeed during the collision, it is likely that there would have been insufficient airflow over the canopy for it to separate without disengaging the two rear locking pins.

The third factor was the configuration of the ASW 19 cockpit. The layout of the SF27 cockpit is relatively 'open' with little or no restriction to leg movement, whereas the 'fixed' instrument panel in the ASW 19 would have presented a restriction to the pilot attempting to bail out. The uncontrolled gyrations of the ASW 19 after the collision would have aggravated this situation.

In summary, no technical defects were identified which would have contributed to the mid-air collision and the damage sustained by both gliders was sufficient to render them both incapable of flight immediately after the collision. The relatively low altitude of the mid-air collision gave both pilots very little time to abandon their gliders successfully. The restrictive nature of the ASW 19 cockpit and the uncontrolled nature of the glider's descent would have significantly increased the time required to 'bail out' of the glider. The pilot of the ASW 19 had begun attempts to abandon his glider but did not complete them before it hit the ground.

Safety actions and recommendations on escape

AAIB discussion with experienced glider pilots and members of the BGA, on the subject of cockpit cables, suggested that similar modifications may have been made to other gliders. Therefore, the following Safety Recommendations were made in AAIB Special Bulletin 8/06, in December 2006:

Safety Recommendation 2006-127

The BGA should advise glider pilots to incorporate into their pre-flight checks a check to ensure that no modifications have been made which would prevent the canopy being jettisoned in emergency.

Safety Recommendation 2006-128

The British Gliding Association should remind its inspectors of the provisions of BGA Glider Maintenance Schedule Task 8, specifically with regard to ensuring that any canopy may be fully jettisoned without restriction.

The BGA has accepted these recommendations. In addition, on a number of occasions the BGA has reminded pilots of the need to ensure that nothing interferes with the correct operation of canopy jettison systems. This has included technical documentation and an article in the BGA 's own '*Sailplane and Gliding*' magazine.

Analysis of the collision

The engineering investigation indicated that both aircraft were serviceable until the moment of collision.

Both pilots were experienced and reasonably current, and both had previous experience of flying from the Sutton Bank site. Although the SF27 pilot's medical declaration was out of date, the examination carried out by the CAA provided reassurance that his eyesight met the relevant standards.

The history of mid-air collisions involving gliders in the UK from 1986 to 2006 does not demonstrate that flight in or near cloud is a frequent factor in mid-air collisions; only one similar accident was recorded.

The absence of any record of the flight of the ASW 19 deprived the investigation of important information. However, the eyewitness account of the two aircraft colliding close to cloud, and the SF27 pilot's recollection of seeing the other aircraft coming towards him, perhaps descending out of cloud, suggest that the pilot of the ASW 19 may have been descending from within cloud or flying on the edge of cloud. The engineering investigation also found that his artificial horizon was operating at the time of the accident. His radio, tuned to the cloud flying frequency, suggested that he had either been flying in cloud, or had considered doing so. Therefore, it seems probable that the collision occurred as the ASW 19 descended out of cloud, or through 'scuddy' cloud near the main cloud base.

Glider operations rely upon the 'see and avoid' principle, and operations in or near cloud make this method of collision avoidance difficult or impossible.

This collision was essentially a consequence of misfortune. However, by choosing to fly close to or in cloud, each pilot had accepted an elevated risk of encountering another aircraft with little or no time to see and avoid it. The investigation considered the general practice of flying gliders in cloud and identified that little guidance exists, and no formal training is available to glider pilots who wish to learn to fly in cloud. It is considered that further action on the part of the BGA would assist pilots in making good decisions relevant to the risks inherent in flight in or near cloud, and therefore, the following Safety Recommendation is made:

Safety Recommendation 2007-096

It is recommended that the British Gliding Association should remind glider pilots of its operational regulation 6.12 and provide reference material for its clubs, instructors, and pilots, that identifies the risks associated with flying gliders close to cloud or in marginal visual flying conditions.

There was a safety mechanism which could have given the pilots of the two aircraft the opportunity to be aware of each others' proximity, and perhaps have assisted in avoiding collision, namely the use of their VHF radios[5]. Although the BGA had promulgated procedures under which glider pilots could make radio calls announcing their intentions to fly in cloud, and provided a specific frequency for this purpose (130.4 MHz), similar guidance (and the standard operating procedure at Sutton Bank) suggested that pilots flying in the vicinity of the airfield should use and monitor another frequency (129.975 MHz). Thus, while pilots engaged in cloud flying would be aware of each others' presence and intentions, those not cloud flying, but flying close to the base or edge of cloud, would not be aware of the aircraft in, and possibly about to exit, the cloud. Where the cloud was widespread, and perhaps its boundaries indistinct, this would provide an opportunity for two pilots, with the best intentions of complying with the relevant guidance, to encounter each other's aircraft at close quarters without warning.

This was discussed with the BGA, and the following Safety Recommendation is made:

Safety Recommendation 2007-097

It is recommended that the British Gliding Association should provide its clubs, instructors, and pilots, with guidance to achieve the most effective use of the BGA cloud flying frequency for collision avoidance purposes. This guidance should take account of local requirements to monitor other frequencies.

Additional safety actions

In the time since the accident, the Welland Gliding Club has undertaken to introduce robust procedures to ensure that instructors have current medical declarations.

Footnote

[5] There is no regulation requiring gliders to carry radio equipment, whether cloud flying or not, but radios are very commonly fitted to gliders used for cloud flying.