ACCIDENT

Aircraft Type and Registration:	LS1F Glider, BGA4665
No & Type of Engines:	None
Year of Manufacture:	1976
Date & Time (UTC):	9 August 2005 at 1725 hrs
Location:	Near Husbands Bosworth Airfield, Leicestershire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A Others - 1 (Fatal)
Nature of Damage:	Extensive damage to the left wing, left aileron separated from the wing and damaged right winglet
Commander's Licence:	BGA Glider Pilot's Certificate (Gold and Three Diamonds)
Commander's Age:	24 years
Commander's Flying Experience:	692 hours (of which 317 were on type) Last 90 days - 111 hours Last 28 days - 46 hours
Information Source:	AAIB Field Investigation

Synopsis

The accident occurred during a race as part of the Junior World Gliding Championships. During the final approach to cross the finishing line a glider, flying at a height of approximately 15 ft banked at an angle of about 20 degrees to the left, passed a group of spectators who were standing on vehicles outside the airfield perimeter. The left wing of the glider struck one of the spectators, a professional photographer, causing him fatal injuries. The glider made a largely uncontrolled landing in a nearby field. It was seriously damaged but the pilot was unhurt.

The investigation concluded that gliders involved in the race had been flying unnecessarily low during the approach to the finish. The accident and other evidence suggested a problem with the safe conduct of race finishes and deficiencies in the training for and oversight of such events. Since this accident, the British Gliding Association has been proactive in trying to address some of these issues but its rules do not apply to gliding Championships conducted in the UK under the International Gliding Commission Rules. The AAIB made five safety recommendations.

Factual information

History of the flight (pilot's perspective)

The pilot was participating in the Junior World Gliding Championships, held at Husbands Bosworth Airfield in Leicestershire. He was competing as part of the British team and on the morning of Tuesday 9 August, the third day of the competition, he attended a briefing for the day's task. This was to be an assigned area task to be flown for a planned minimum duration of three hours.

The pilot was aero-tow launched at about 1200 hrs and the start was opened at 1230 hrs. He crossed the start line at about 1300 hrs, flying between 3,500 and 4,000 ft, on a southerly track towards the first task area based on Towcester. The pilot flew into the area to a point near Kidlington before changing track to the west for the second area, based on Enstone. Here he flew into the area to a point near Chedworth, a disused airfield, before changing track for the final area based on Control Point East. This was a control point situated 10 km due east of Husbands Bosworth, designed to bring the competitors back to the airfield in line with the active runway. His final point was about 15 km from Husbands Bosworth Airfield at which time his flight computer was indicating that he already had sufficient altitude for the final glide back to the finish. The pilot recalls he was at between 2,000 and 2,500 ft which he believes was about 300 ft over his calculated minimum required for the final glide.

The pilot began his descent for the finish line flying at 80 to 85 KIAS, in close proximity to another member of the British team who was about 100 to 200 m ahead. Conditions were good and the glider was not subject to any sinking air, allowing the pilot to increase his speed to 110 KIAS some 2 to 3 km from the finish. He continued his descent so that by 1 km from the airfield the glider was about 50 to 60 ft agl.

The pilot continued his approach, crossing a field close to the airfield boundary in which was a set of wires. The presence of these wires was highlighted to pilots during each race briefing because a pilot returning to the airfield late in the day could be affected by a low sun ahead making these wires difficult to see. The accident pilot described his technique for crossing such obstacles. This involved flying low enough so that the obstacle could be clearly seen above the instrument cowling in the cockpit. At low airspeeds with a relatively high pitch angle, this would require the glider to be flown at or slightly below the height of the obstacle. He would then pull up in order to clear the obstacle. The pilot estimated the wires were suspended about 30 ft above ground level and that he would have flown below this height in order to see them against the skyline. He recalls pulling up to clear them by about 10 ft and then dropping down again on the other side to a height of about 15 to 20 ft to fly over the adjoining field. The field contained a standing crop of wheat and was bounded by a hedge. The pilot stated he could see a red box shaped vehicle ahead of him at the end of the field with about three or four people standing on it taking photographs. He did not recall seeing any other people or vehicles. The pilot also stated that he was flying towards the sun which, by then, was low in the sky.

The pilot stated he was concentrating on the finish line and his intended landing for which he needed to identify a suitable area of the airfield. Several gliders had already landed and were clearing the landing area. He also needed to avoid his team mate and another glider, Both of which were finishing just ahead of him. The pilot remained aware of the people on the vehicle by the hedge at the edge of the field but considered he was high enough to clear them. He estimates by this point his speed had reduced to about 70 KIAS. He stated that the glider's 'clean' stall speed is about

40 KIAS and that the minimum approach speed to land safely was about 55 KIAS.

The pilot recalls easing back on the control stick slightly as he approached the hedge; but he did not recall banking. He stated that he looked out over to his right to see when he was clear of the photographers as they had disappeared from sight below the nose of the aircraft. Then suddenly there was a massive bang and the glider slewed to the left and climbed to about 100 ft. It then pitched down, yawed left and accelerated whilst he tried to regain control to raise the nose, control the yaw and bring the wings level. He then lowered the landing wheel in expectation of crashing in order to cushion the impact. The glider continued to roll right and the pilot applied full left aileron, but to little effect. He then instinctively opened the airbrakes and almost immediately the glider hit the ground, one wing low, slewing it round before coming to rest. The pilot was uninjured in the impact and was able to open the canopy, although it was slightly jammed. He climbed out and was soon met by various witnesses coming to his aid.

History of the flight (ground perspective)

As on previous days during the competition, a small group of spectators had gathered late in the afternoon under the final approach to the airfield to watch the gliders as they approached the finish line. On this particular afternoon, five vehicles had driven about 100 m off the main road, bounding the southern boundary of the airfield, along an unmade farm track which ran beside a hedgerow. This hedgerow was about 900 m east of the landing area and the position of the vehicles was under the flight path of the gliders as they came in to land (see Figures 1 and 2). Some of the occupants then climbed on to their vehicles to get a view over the hedge of the gliders coming towards them. Amongst these spectators was a small group from one of the gliding teams standing on top of their red van. Next to them was parked a large silver-coloured estate car, on the roof of which stood a professional photographer who was wearing an orange T-shirt. The photographer specialised in taking photographs of gliders and had been covering the previous days of the competition. In conversation with the group on the van, he had told them that on the previous day, he had seen gliders brushing the edge of the trees and he had been forced to jump from the roof of his car in order to avoid a low-flying glider.

The spectators by the hedge watched and took photographs as the gliders started to return to the airfield. Various witnesses commented on the low height of the gliders as they flew across the field in front of the hedge behind which the vehicles were parked. The witnesses on the van stated that they were aware of the glider involved in the accident pulling up over some wires two fields in front of them before dropping down to a very low height as it flew across the field directly beyond the hedge behind which they were parked. They commented that other gliders had also flown very low over this field; however, this particular glider had remained low beyond the point at which the other gliders had pulled up to clear the hedge. One of these witnesses stated that he shouted a warning to his friends and then saw the glider start to bank when it was about 20 m in front of them. He stated the fuselage passed just to the right of the van at a low height with the glider still banking with the left wing low at an estimated bank angle of 20º. The witness shouted a warning to the photographer and then saw the glider's left wing strike him about two thirds of the way along the wing towards its tip. The photographer fell from the roof of his car landing on the bonnet of the car parked alongside. Some of the spectators in the vicinity then began to administer first aid whilst others drove back to the airfield to summon help.

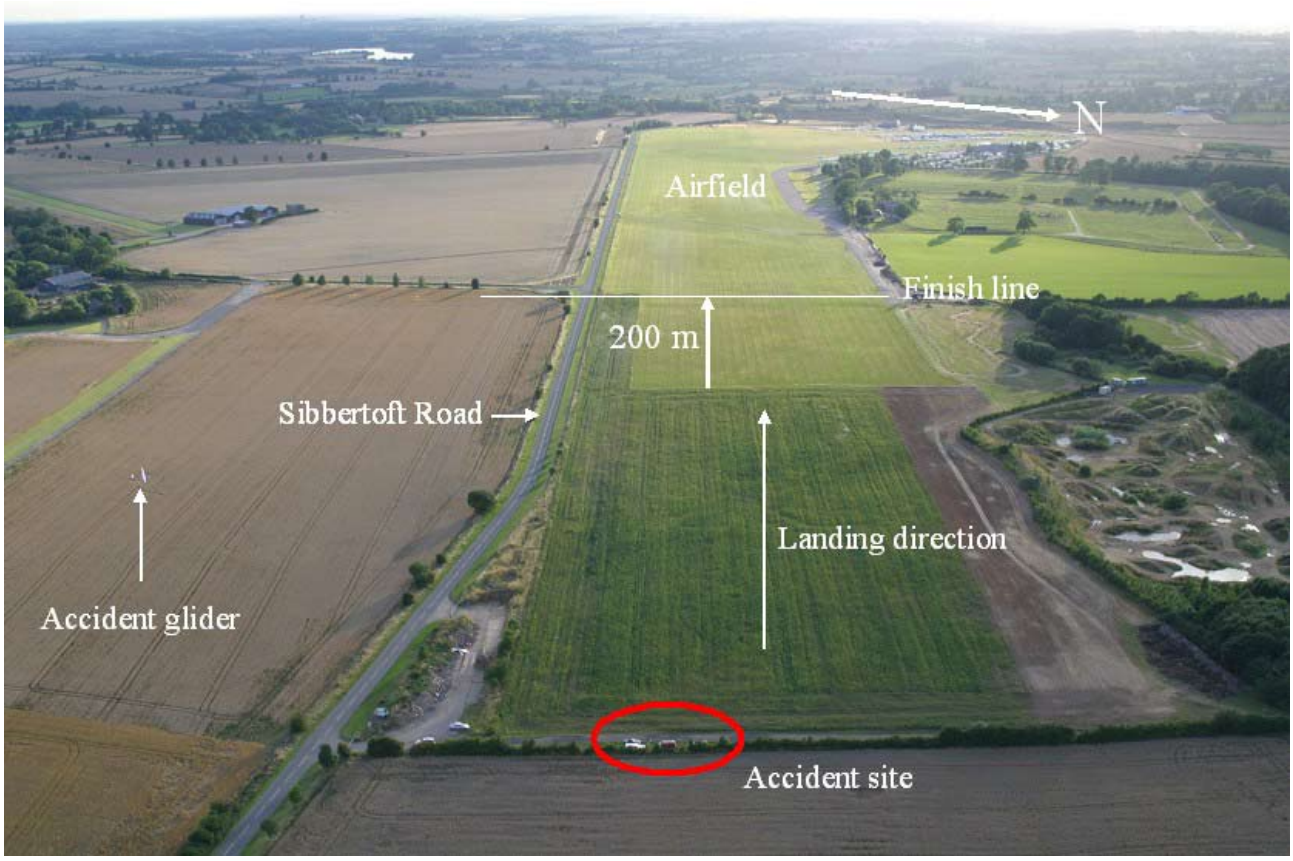

Figure 1

Accident site relative to Husbands Bosworth Airfield

Figure 2

View looking east of vehicles parked in the lane

Post impact actions

Although the race organisers were not immediately aware of the injured photographer, having seen the glider crash, they summoned the emergency services. The pilot was somewhat shaken but otherwise uninjured and on arrival, the emergency services attended to the photographer. One of the spectators estimated that an ambulance had arrived within 10 minutes, followed shortly afterwards by the fire services. The police helicopter, based only about a mile away, also responded, landing next to the accident site to offer any assistance it could. Finally, the local air ambulance, based at East Midlands Airport, was tasked to attend the scene.

When made aware of the injured photographer, the race organisers realised that his location, and that of those attending to him, was below the flight path of the finishing gliders and they made repeated radio broadcasts for competitors to finish no lower than 200 ft over the finishing line. These broadcasts were made on the radio frequency used by the competitors at the finish to inform the race organisers that they were five minutes and one minute from landing, as required by the competition rules.

The air ambulance was aware that a gliding competition was in progress at Husbands Bosworth Airfield because the competition had been notified in NOTAM H2724/05. However, the NOTAM made no mention of any new ATC frequencies being used. After takeoff, the air ambulance pilot checked with East Midlands ATC to confirm if there was an additional ATC frequency in use during the competition but ATC were unaware of any such frequency and suggested that the pilot use the gliding common frequency of 129.97 MHz. This was also the frequency published in the pilot's aeronautical guide for Husbands Bosworth Airfield. The air ambulance pilot stated that on arrival at Husbands Bosworth, he made several calls to the airfield on this frequency but without response. He was aware of numerous gliders making an approach to the airfield, describing some as being as low as 15 to 20 ft whilst still outside the airfield boundary. He instructed his crew members to keep a good lookout and switched on all the helicopter's external lights to make it as conspicuous as possible. The pilot was then marshalled to land close to the scene of the accident by one of the crew members from the police helicopter in attendance. The police helicopter departed shortly after the air ambulance's arrival.

The photographer continued to receive medical treatment at the scene for at least 20 minutes after the arrival of the air ambulance. During that time gliders continued to fly low overhead and on one occasion, so low that those at the scene were forced to dive to the ground for fear of being hit. After this protracted period of treatment, the photographer was eventually transferred to the air ambulance. As the air ambulance was preparing to depart, the police helicopter returned and was able to pass the appropriate competition frequency of 134.55 MHz to the air ambulance pilot. After making a call on this frequency, notifying its imminent departure, the air ambulance departed for the Queens Medical Centre in Nottingham where the photographer later died.

Airfield description

Husbands Bosworth is a large grass airfield on the border of Leicestershire and Northamptonshire and is home to one of the UK's largest gliding clubs. Activity at the airfield is confined to gliding and the operation of light aircraft involved in glider aero-tow launching. The takeoff and landing area is orientated east-west with Sibbertoft Road running parallel to the southern boundary of the airfield. Not far beyond the road to the south are two additional grass landing strips. These are

both privately owned and are solely for the use of light aircraft operated by the respective strip owners. Further south, and in close proximity to these two airstrips, is the permanent base for a police helicopter which is jointly operated by the three adjacent police forces of Leicestershire, Northamptonshire and Warwickshire.

The approach to the airfield from the east is generally over farm land. However, there are farm buildings situated about 1,200 m from the landing area, on the northern edge of the approach path. The wires highlighted to competitors in the pre-race briefing were telegraph wires running through a field west of, and adjacent to, the access road to this farm. The telegraph poles were approximately 30 ft high and the wires dipped between them to a height of about 27 ft.

Accident site description

The accident occurred outside the eastern boundary of Husbands Bosworth Airfield. The photographer's vehicle had been parked on a grass area to the right of a farm track that ran north from Sibbertoft Road. The position of the vehicle was roughly 350 m from the airfield's eastern boundary and 900 m east of the start of the landing area. In addition to the photographer's vehicle, there were four other vehicles parked in the vicinity. A red van and a black car were both parked to the north of the photographer's car and a black car and a silver car were parked alongside each other to the west. At the time of the accident the photographer was standing on his vehicle, giving a combined height of approximately 11 ft. There were also four spectators on the red van with a maximum height (with the spectators standing) of about 12 ft. A hedge ran north-south just to the east of the vehicles. The height of the hedge varied along its length but in the area of the cars it extended to a maximum height of about 15 ft.

Examination of the bushes and the vehicles did not reveal any contact damage from the glider. However, the black car had extensive damage to its bonnet, consistent with the photographer striking it after being hit by the gilder.

Glider examination

The glider came to rest in a standing crop of wheat, about 400 m to the south-east of Husband's Bosworth Airfield and to the left of Sibbertoft Road. Figure 3 is a picture of the glider just before it struck the ground. Inspection of the glider revealed extensive damage to the left wing, with pronounced damage about 3 ft inboard from the wing tip. The left aileron had completely detached and was found lying against the fuselage. The only other noticeable damage was to the right winglet, consistent with contact with the wheat. Detailed examination of the glider did not reveal any pre-accident defects with its structure or flying controls.

Figure 3
Glider just before ground impact

Glider's attitude and height at impact

From examination of the accident site and the glider, it was apparent that the photographer had been struck by the leading edge of the left wing. The damage to the glider's left wing indicated that the strike occurred about 3 ft inboard of the left wing tip. Using this evidence, together with video recordings (described in detail below), it was found that the manoeuvring glider was banked at least 20º to the left when it struck the photographer. The height of the glider fuselage at this point was estimated to be about 15 ft agl (see Figure 4a). Had the glider been in a wings-level attitude at a height of 15 ft agl, it would have cleared all of the obstacles and the spectators (see Figure 4b).

Flight recorders

Competition rules required all the competing gliders to be fitted with an International Gliding Commission (IGC) approved GNSS[1] flight recorder[2] programmed to record the glider's altitude (both GPS and barometric) and its geographic position at intervals of 10 seconds or less. However, most competitors voluntarily carried a second 'back-up' recorder. Competitors' recorders were analysed at the end of each race in order to determine the distance covered by each glider, the time taken to do so and to confirm that no time or altitude infringements had occurred.

Analysis of the information recorded for the race during which the accident occurred indicates that the club class gliders were all below 500 ft agl some 2 nm (3,704 m) before finishing the race, and in one case 3 nm (5,562 m). It further indicates that the majority of gliders were below 250 ft agl at least 1.5 nm (2,778 m) prior to crossing the finishing line.

Using the recorded data, a plot was created of the accident glider's track and that of the two preceding gliders as they approached the airfield (Figure 5).

Photographic and video evidence

A considerable amount of recorded video and photographic evidence was available of the period leading up to, and including, the accident. The video imagery was analysed by the National Imagery Exploitation

Figure 4a

Impact banked

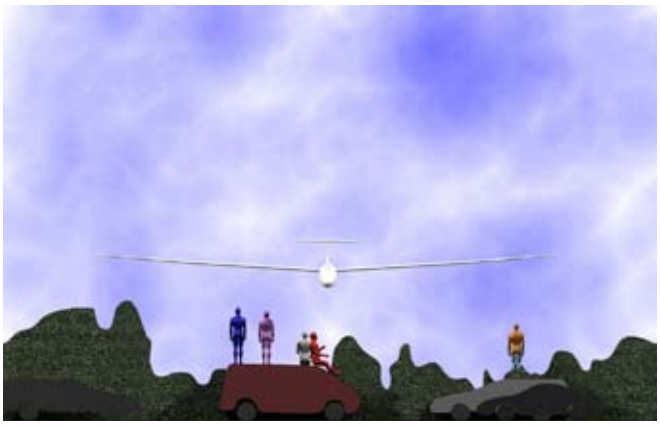

Figure 4b

Glider wings-level at 15 ft agl

Footnote

[1] Global Navigation Satellite System.

[2] Most IGC-approved GNSS FRs integrate the GPS and other functions such as a barograph in one sealed case.

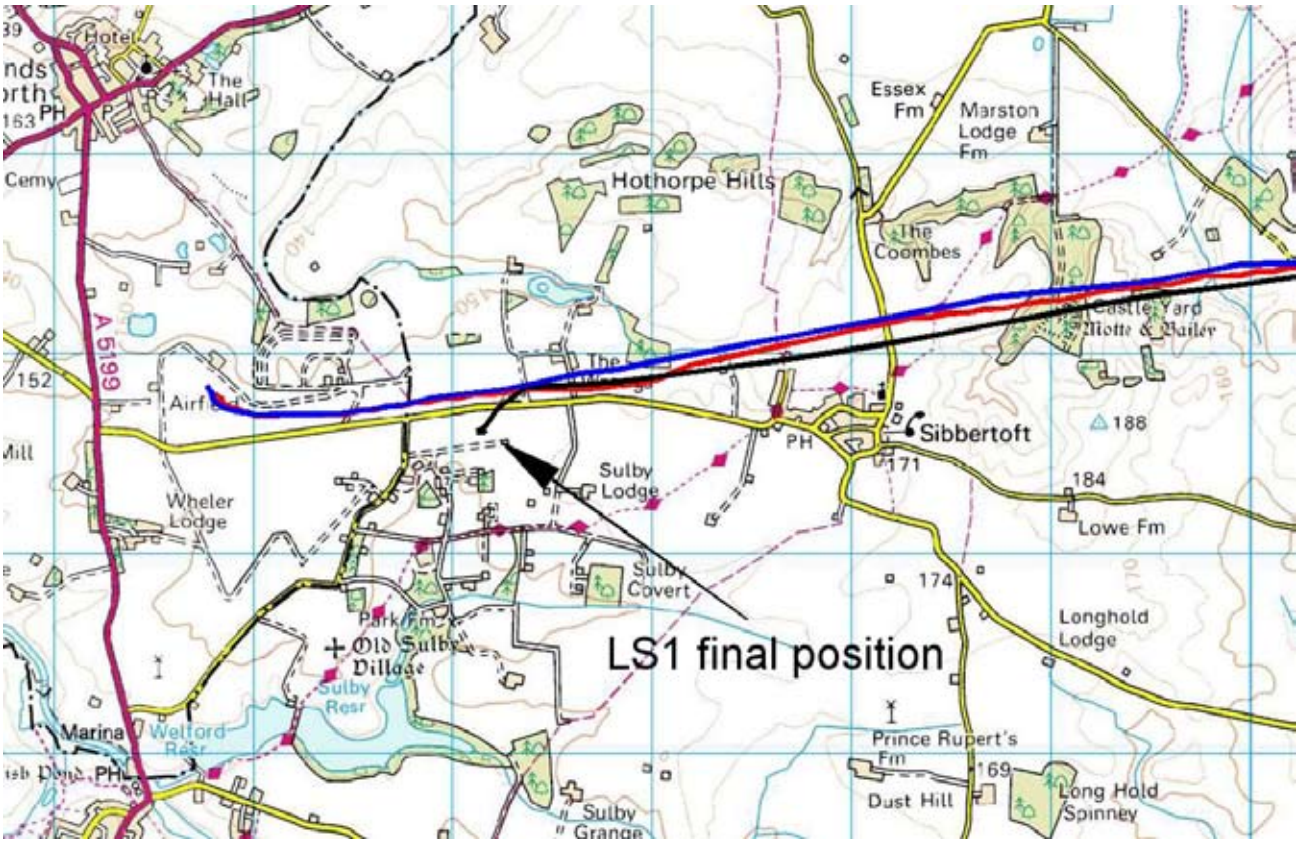

Figure 5

Ground tracks of gliders approaching the airfield

Centre. This evidence showed gliders descending on the approach to the airfield to a very low height before pulling up to clear the wires running to the farm which were at or below 30 ft agl. Gliders could then be seen descending again to below 30 ft agl to cross the field in front of the photographer. The gliders then pulled up to clear the hedge in front of the photographer before proceeding to cross the finishing line on the airfield.

Video imagery showed the accident glider approaching the airfield from the east. Nine seconds before striking the photographer, it gained height to clear the 30 ft high telegraph wires by 2.5 ± 0.5 m (between about 6 and 9 ft). After clearing the wires it descended to a minimum height of 1.4 ± 0.2 m (about 4 ft) above the crop until 1.7 seconds before striking the photographer when it began rolling to its left and climbing.

Photographs recovered from the deceased photographer's camera show the two gliders finishing just ahead of the glider involved in the collision. The first glider passed just to the north of the photographer whilst the second passed just to the south. Both gliders were extremely low as they passed over the field immediately to the east of the photographer with some photographs appearing to show that the photographer was looking down on the gliders from his vantage point on the car roof (see Figure 6 in which the pilot and glider have been disidentified). Photographs recovered from the photographer's camera also showed other pilots clearly waving at him as they flew past at low height.

The last two photographs on the photographer's camera are of the glider that struck him. These, together with other video imagery, showed that he had the camera up to

Figure 6

Photograph of an approaching glider

his eye whilst the glider crossed the field in front of him. Video evidence showed the photographer was standing upright, ducking at the last moment before being struck by the glider's left wing.

Pathology

The pathologist's report indicates that the injuries sustained by the photographer were consistent with him bending down at the time of the impact.

Pilot's background

The pilot started flying paragliders in 1999 and gliders in 2000. He first flew in gliding competitions in 2002. Since then he had flown in competitions at numerous UK airfields, including several previous competitions at Husbands Bosworth. He had also flown gliders in Italy, South Africa, Australia, New Zealand and Spain, and had competed in South Africa and Spain.

In January 2004 the pilot moved to South Africa, taking his glider with him. In July 2004 he returned briefly to the UK to take part in the British Junior National Championships, at which he secured a place on the national team for the 2005 World Junior Championships. He continued to compete whilst in South Africa and came third in the country's National Championships early in 2005. He returned to the UK in March 2005, basing his glider at Husbands Bosworth, although he flew at numerous other locations for training. This included official training for the British team in Spain, culminating in a week's training at Husbands Bosworth immediately prior to the commencement of the World Junior Championships on 6 August 2005.

The pilot stated that he had never received any formal training in conducting the final glide for competitions; he had developed his technique through experience. He

did, however, comment that occasionally he had been able to fly with a coach in a two-seat glider during team training events and had discussed that aspect of his race technique at these times.

BGA Junior Team training

The BGA's perspective on the training given to the Junior Team members differed from the accident pilot's recollection. Initially, the Association stated that training in the management of final glide finishes is not provided within an official BGA or Fédération Aéronautique Internationale's (FAI) syllabus. However, later, the BGA stated that the syllabus used by the British Team coaches present at the Junior Team training camp in Spain during April 2005 included final glides in its list of topics. The BGA further stated that this element of the coaching placed emphasis on achieving an efficient and safe approach to the finish line and that the accident pilot was advised on how to manage the final glide to a competition finish.

Pilot's medical

The pilot held a valid JAA Class 2 medical certificate. The certificate required that he wear corrective lenses and limited him to day VFR flights only because his red/green colour perception was deficient. At the time of the accident the pilot stated he was wearing corrective contact lenses and non-prescription sunglasses tinted medium-brown.

Photographer's background

The photographer had been a freelance professional in the aviation field for some years and was also a qualified glider pilot. He specialised in taking photographs of gliders and many of his pictures appeared in gliding magazines and associated publications. His photographs were used extensively in the programme for this competition, including that on the front cover. In the course of his work he covered many of the main gliding competitions, both in the UK and abroad. As a result, he was known to many people in the gliding world. He would normally wear an orange coloured top when photographing at such events.

Competition description

The competition, the World Junior Gliding Championships, was held between 6 and 20 August 2005. It was organised as a joint venture by the British Gliding Association and the local Soaring Centre. The competition rules were the international rules set down by the FAI's delegated gliding authority, the International Gliding Commission (IGC). Competitors were required to observe the 'Rules for World and Continental Championships' as modified or amplified by 'Local Procedures', also approved by the IGC. These Local Procedures were the method by which the competition organisers' requirements and restrictions could be notified to competitors. A list of the IGC's approved competition penalties are included at Appendix 1.

There were about 60 pilots competing from 18 different countries and they were required to be under the age of 25 years at the time of the competition. Details of the event and the pilots competing were included in the competition programme. The programme featured, on its cover, a photograph of a glider flying low over a field prior to landing. The photograph had been taken at a previous competition at Husbands Bosworth Airfield (see Figure 7), by the photographer who was fatally injured in this accident. The official language for the competition, as with all IGC races, was English. Gliders were divided between two different classes: standard class and club class. Standard class was for gliders with a maximum wing span of 15 m and no wing flaps, but with no other limitations. Club class was for older gliders which had previously been in the standard class, but which had now

been superseded. The club class aircraft flew under a handicapping system based on the type of glider.

Competition took the form of both racing tasks and area tasks. A racing task consisted of gliders flying round a set course, generally of 100 to 300 km in total length. The results were determined by ranking the pilots in order of the time taken to complete the course, the winner being the pilot who finished in the quickest time.

An area task also involved flying around a set course. In this case, however, turning points were replaced by designated areas. Pilots determined how far they would fly into each of these areas before heading for

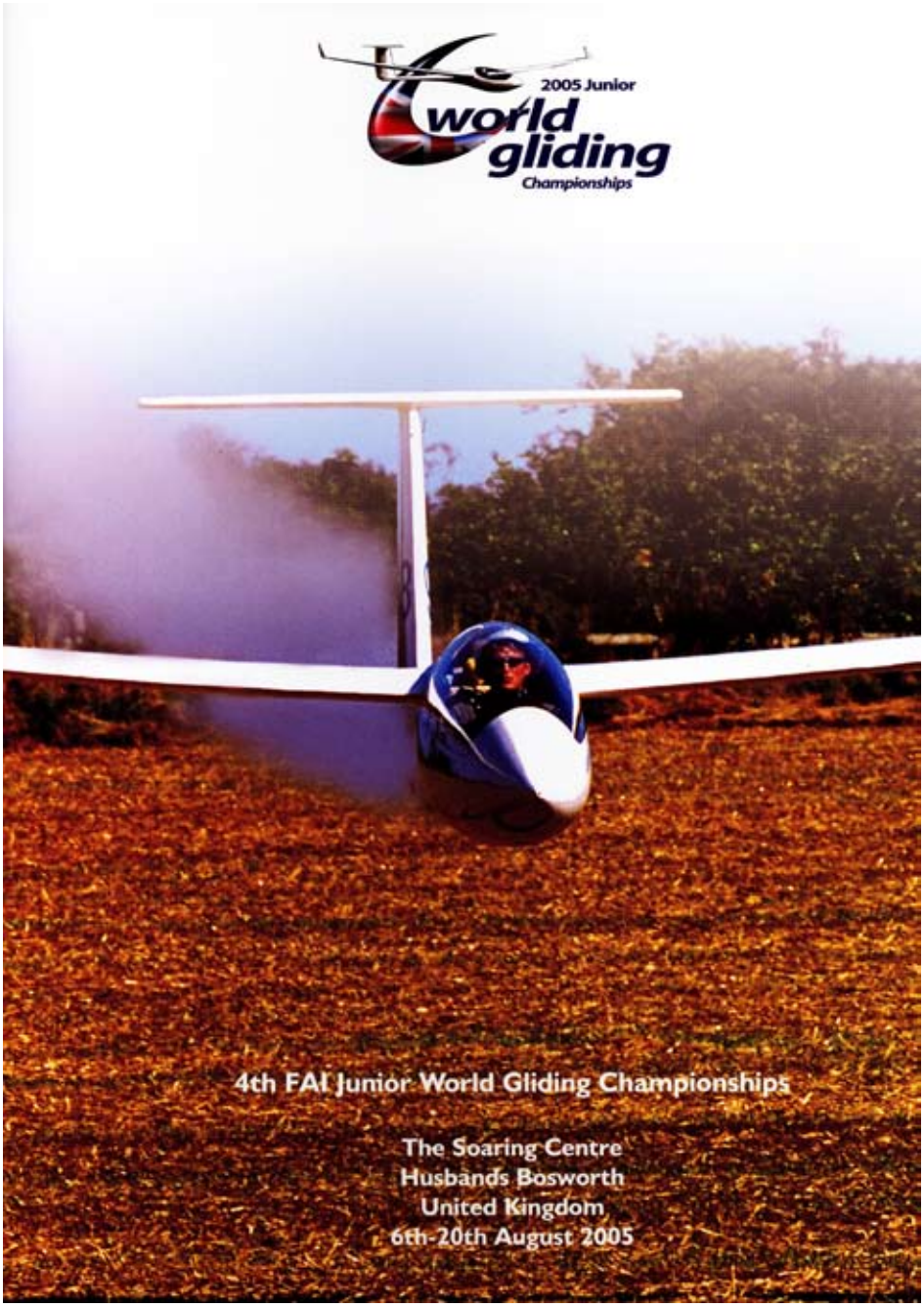

Figure 7

2005 competition cover photograph

the next one, aiming to remain airborne over the course for a specified time, generally three hours. The total distance achieved after crossing the start line was then compared against the time taken, in order to calculate the average speed.

The finish was the same for both types of race. For this competition, the finishing line was 1,000 m long extending perpendicular to the landing direction, running south from the northern edge of the airfield. Its position was marked by the presence of a scaffolding tower on which stood the competition officials. The line was positioned about a quarter of the way into the airfield, in the direction of landing. Its location was such that, once crossed, gliders would either have sufficient energy remaining to complete a circuit before landing or, if not, have sufficient distance ahead to be able to land. The competition rules stated that the minimum height for crossing the finish line was 100 ft agl, except when landing straight ahead.

Each day the race organisers chose the type of competition and the route to be flown depending mainly on the prevailing weather conditions.

Race technique

Having completed the required course, pilots attempt to set course direct for the finishing line as soon as they reach a point where they consider they have gained sufficient height to be able to do so under the prevailing conditions. This portion of the flight, known as the final glide, is critical in achieving a good result. If the glider is too high when starting the final glide, it will cross the line with surplus energy remaining and the pilot will have wasted time in achieving the unnecessary height. If, however, the glider is too low when starting the final glide, there is a danger that the glider will have insufficient energy to cross the finishing line resulting in it landing short. Consequently, the final glide forms an important part of the race.

Glider pilots have different methods of calculating the point at which to commence their final glide. The accident pilot used a final glide computation employing the McCready theory[3]. He used a small computer which compared the glider's current position with that of the finish, taking into account any remaining part of the course still required to be completed. The computation then monitored the climb rate achieved in the final thermal and took into account the wind and thermal conditions to determine the best glide speed and the altitude required to achieve the fastest return to the finish. The pilot would then continue to climb higher, generally by about 200 to 300 ft, adding a margin to insure against any sinking air that might exist on the final leg.

Once the pilot sets out on his final glide, should there be no adverse thermal conditions, then any margin added in the final climb equates to additional potential energy that can be usefully converted into speed. Thus, once he is assured of crossing the finishing line, the pilot seeks to increase his speed such that he crosses the finishing line with minimum safe energy remaining.

In order to maximise the use of any excess energy during the latter stages of the final glide, pilots in a race may descend to a low level some distance from the finish line. Sinking air is not encountered at this level and if low enough, the glider may also benefit from being in ground effect. Ground effect is encountered below a height equal to about half the glider's wingspan.

Footnote

[3] In the 1950s McCready devised a means of calculating the optimum speeds to fly between thermals based on the performance of the glider, the sink rate between thermals and the rate of climb in the next thermal.

Flying in ground effect minimises induced drag but has no effect on profile drag. Therefore, flying in ground effect is most beneficial when the glider is flying at low airspeeds. If the altitude at the start of the final glide is insufficient for the conditions subsequently encountered, then flying low may be the only way to conserve enough energy for the glider to reach the finish line.

Control of spectators at gliding competitions

On the day of the accident, no attempt was made to control or influence the presence of spectators beneath the final approach path. Moreover, evidence was found of low flying in close proximity to people during the final approach phase of other international competitions. For instance, photographs published on the Internet of the 2005 FAI European Championships held overseas show spectators close to gliders in the late stages of the final glide to the finishing line. Two examples are shown in Figures 8 and 9 below; the gliders and their pilots in these examples have been deliberately disidentified.

It is not possible to determine from the photographs the distance of these spectators from the finish line but the gliders were reportedly crossing the airfield boundary shortly before finishing. There are several spectators within a few metres of the low-flying gliders and neither glider appears to have extended its landing gear. The alignment of the shadows indicates that the pilots were looking 'into sun' which could have made it more difficult for them to see the spectators. Some spectators appear to have resorted to crouching down to increase their separation from the gliders.

NOTAMS

In order to allow penetration of specified areas of controlled airspace during the competition, the organisers applied for a temporary exemption from Rule 21 of the Rules of the Air Regulations 1996. This application was made to the Terminal Airspace Section of the CAA. The competition was also notified to the CAA's Airspace Utilisation Section (AUS). Although no specific request was made for a NOTAM to be published advising of the competition, there was an expectation that one would be published because this had occurred under similar circumstances in the past.

Figure 8

Glider and spectators

Figure 9

Glider and spectators

Information provided to the AUS was forwarded by them to the Aeronautical Information Section (AIS), the unit responsible for publishing NOTAMs and which is managed by National Air Traffic Services (NATS). The AIS duly published a NOTAM advising details about the scope and duration of the competition. However, no frequency information had been provided to the AUS by the competition organisers. This may have been because the competition organisers did not apply to the spectrum management section of the CAA's Directorate of Airspace Policy in time for the competition frequencies to be allocated and then notified to the AUS. Consequently, the NOTAM did not contain information about the communication frequencies allocated for use during the competition.

CAA Aeronautical Information Circular (AIC) number 86/2004 advises that organisers of unusual aerial activities should notify the AUS by means of the standard notification Form SRG 1304 (Special Events and Unusual Aerial Activity Application Form). The AIC states that this information is used to ensure that:

> *'the Activity is notified to other airspace users through the NOTAM system'.*

Form SRG 1304 does not request information on the radio frequencies to be used.

Traditionally, the BGA had not used Form SRG 1304 to notify the AUS of competitions it intended to hold. AUS staff stated they were happy with the unofficial means of notification used and that any information they required which was not provided under this system was obtained by the AUS contacting the BGA. The original information provided by the BGA about this and other competitions in 2005 made no reference to frequencies to be used at the events. Similarly, the AUS Airspace Co-ordination Notice produced by the AUS for the World Junior Gliding Championships made no reference to radio frequencies used during the competition.

After the accident, the race organisers tried to get the competition frequency for the airfield published by NOTAM. To do this they contacted the AIS who informed them that because Husbands Bosworth was not a licensed airfield, they would be unable to publish a NOTAM of that nature relating to the airfield.

Radio carriage

In order to compete, each glider was required to carry a radio transceiver capable of operating on the competition frequencies. RTF messages were used by the race organisers to announce the start line opening time to competitors and for competitors to inform the race organisers that they were approaching the finish line. Calls on the main competition frequency of 134.55 MHz were required five minutes and one minute before crossing the finish line. This frequency was also used as the safety frequency.

Rules of the Air Regulations

New low-flying regulations came into force on 1 April 2005, four months before the accident. This amended legislation (Rule 5) is reproduced in its entirety at Appendix 2. All aircraft, including the participants in any gliding competition held in the UK, should comply with the Air Navigation Order and Rules of the Air Regulations.

BGA Rated Competition Rules

The BGA's Competition Rules did not apply to this IGC sanctioned competition. However, the majority of gliding competitions in the UK are conducted under BGA Competition Rules and the Association modified its rules after this accident. The changes to the penalties sections

of the rules are evident in the differences between the Association's 2005 Competition Rules (see Appendix 3) and its 2006 Competition Rules (see Appendix 4).

Analysis

Causal factors

The glider that struck the photographer was manoeuvring at about 15 ft agl as it popped up to avoid the hedge. Had it not been rolling, it would have passed over the people standing on their vehicles to watch the gliders, but only by a few feet at most. There were several people standing on vehicles beneath the final approach path so a small error of height judgement by the pilot as he flew the pop-up manoeuvre could have resulted in more than one person receiving fatal injuries, even if he had maintained wings level. The pilot was aware of the spectators on the van but he (and perhaps others) did not regard them as a hazard that they should clear by a substantial margin.

Whilst the accident pilot was aware of the spectators on the van, he stated that he did not see the photographer prior to the impact. The photographer purposely wore an orange top at gliding events to make himself more conspicuous but he may have been partially obscured behind the hedge and it is likely that the accident pilot's attention was drawn to the group standing on the red van as the largest object in the vicinity. Consideration was given to the colour of the photographer's orange shirt and the pilot's imperfect red/green colour perception but it was concluded that this was unlikely to have contributed to the accident. Indeed, the low position of the sun was more likely to have restricted the pilot's vision, a fact he had commented upon when interviewed. However, because the pilot seemed to have no problem in seeing the group on the van, it seems unlikely that his colour perception was really a contributory factor.

The photographer had a distorted view of the glider's relative position as he was viewing it through the lens of his camera and this, combined with the rapid onset of the rolling manoeuvre, meant he had insufficient time to drop clear of the wing or jump off his vehicle (as he had done the day before) and he received fatal injuries.

The spectators under the final approach placed themselves in an area where they knew the gliders would be low, and furthermore, they chose to sit or stand on their vehicles to get a better view. These spectators were all involved in the competition and should have appreciated the risks involved. The photographer had positioned himself in comparable positions before so he must have been aware of the risks involved but perhaps he chose to accept those risks in order to obtain some unusual and exciting photographs of gliders.

Before the race, the photographer may have actively made pilots aware of his location. This possibility cannot be substantiated but he was not the only person who chose to be in that area on the day of the accident and others were also taking photographs. Moreover, it seems improbable that all the pilots who were flying very low were doing so in the hope of creating a good photographic opportunity.

The nature and extent of the low flying, and the speeds of the gliders finishing the race, suggest that the flying witnessed during this race was not due to the gliders being low on energy. It is likely that the majority of the pilots believed it was an acceptable racing tactic.

Low flying risks

The glider that struck the photographer may have been flying lower than others finishing the same race, but being a competitive event, if one pilot used this tactic and it was thought by others to offer an advantage, then all of them

were likely to adopt a similar technique. Consequently, many of the gliders were finishing the race at heights which placed them in ground effect (ie less than half a wingspan). They were flying at such heights for as much as 1,000 m before they reached the airfield boundary.

Flight at very low height did not present a particular risk to people within the confines of the airfield because the race organisers had control of activities on the airfield and spectators were positioned to the side of the flight line rather than under it. However, some pilots' racing tactics did present a significant risk to people under the flight path, whether they were spectators or not, and for several hundred metres outside the airfield boundary.

The vehicles parked in the lane where the accident occurred were largely hidden by the trees of the hedgerow from the view of the low-flying glider pilots crossing the field leading up to the lane (as shown in Figure 2). However, the spectators standing on the vehicles should have been visible to the glider pilots although they would not necessarily have been particularly conspicuous. On the other hand, as some video recordings showed, the spectators standing on their vehicles could be seen clearly by people on the airfield standing close to the finishing line. The white clothing of one spectator made that person very conspicuous. The lane was a place where, at the time of the accident, the race organisers attempted no control or influence over the presence of people. It would seem that those in authority were either unaware of these people or were content to tolerate their presence. Nevertheless, during subsequent race days at Husbands Bosworth, the competition officials wisely positioned a member of staff at the entrance to the lane to discourage people from standing there.

The pilot's described technique for clearing obstacles such as low wires, tree lines and hedges was flawed because if a pilot is not to leave the pull-up too late, he or she has to concentrate their gaze on the obstacle, which is above the horizon. This narrow focus of concentration is exacerbated if the glider is racing in close proximity to other gliders, for the pilot may also have to monitor other pilots' manoeuvres to minimise the risk of an aerial collision. Consequently, the pilot is less likely to see people or obstacles at a similar height to the glider and might have to make sudden rolling manoeuvres to avoid other gliders or re-position towards a clear area for landing. As in this case, unexpected manoeuvres may compromise a spectator's ability to avoid a glider they are watching.

This accident and the photographs at Figures 8 and 9 demonstrate that there is a tendency for spectators to position themselves deliberately outside the confines of the airfield, where the competition organisers may have no effective authority to exclude them. These people may accept or underestimate the personal risks they take. However, there is also a risk to other people who might not be spectators or not involved in gliding and who happen to pass beneath the final approach path, even though they may be hundreds of metres from the finishing line. To ensure a safe margin of clearance between gliders and people during a competition finish, there appear to be only two options: exclude people from the area beneath the final glide or ensure that gliders to do not fly so low that they risk colliding with a person.

Low-flying regulations

The Local Procedures specified '*the minimum for crossing the finishing line, except when landing straight ahead, is 100 feet AGL'*. These Local Procedures did not mention any requirement to observe the UK statutory low-flying regulations, nor did they specify any minimum height before crossing the finishing line or any clearance height by which spectators were to be avoided.

Most competitors landed straight ahead. By landing immediately after crossing the finishing line, the pilots were in effect carrying out two tasks in quick succession but treating them as concurrent manoeuvres. In doing so, some may have thought that because ultimately they were landing, they were absolved from the obligation to observe Rule 5 whilst they were racing towards the finishing line. However, gliders do not normally approach a glider site at high speed and very low height requiring pop-up manoeuvres to avoid obstacles outside the airfield boundary. Usually, they land from an approach involving a gradual descent at moderate airspeed, crossing the airfield boundary at a height that does not normally present a risk to spectators or passers-by. Therefore, it is clear that the finishing technique used in this race by many of the competitors did not constitute '*landing in accordance with normal aviation practice*' (see Rule 5 para (3)(a)(ii)) which automatically exempts pilots from having to observe the '500 feet rule' stipulated in para (2)(b)).

A further exemption from the '500 feet rule' exists for aircraft taking part in flying displays, including air races, (see Rule 5 para (3)(f)) when '*within a horizontal distance of 1,000 metres of the gathering of persons assembled to witness the event*'. In discussing the implications of this regulation with the CAA, their representative believed that this exemption was intended to apply only where a specific permission for the event has been received from the CAA. Such permission would be specific and would include the area and lowest height over which the low-flying exemption would extend. In the representative's opinion, the Authority would be unlikely to approve heights below 100 ft outside an airfield boundary.

Section 8.9 of the IGC rules in force at the same time stated the penalties in force for dangerous or hazardous flying and gave a list of specific examples and penalties. Included in these were '*Finish: crossing below height or altitude limit'* and '*Finish: hazardous manoeuvre*.' The penalties applicable varied from a warning for the first offence through losing 25 points to disqualification from the competition.

By examining these rules it might be considered that sufficient regulations existed at the time which would actively have prohibited the nature of the low flying witnessed. The fact that they didn't suggests that neither the competitors nor the race officials believed it constituted dangerous flying. Indeed, one competition official stated:

> *"Most had been flying the same pattern, arriving at the last hazard, the power lines in the distance, then diving down. This converts the safety margin of height they had at the lines to speed in order to finish quickly, and is a common and sound competitive tactic."*

The fact that, after the accident, race officials thought it appropriate to brief pilots that they should not fly unnecessarily low when approaching the finish is therefore of note. Equally of note is the fact that when racing re-started, there appeared to be no repetition of the very low flying and 'pop-up' manoeuvres previously witnessed, yet the competition seemed unaffected.

IGC response to the accident

The accident was discussed at an IGC Bureau meeting held in Paris in October 2005 but before the full details of the accident were available to the Committee. At that time the Bureau believed that the most positive step to reduce the chances of a similar accident was to revisit the way in which the IGC gives advice to contest organisers regarding control of the public and advice to

pilots when finishing a race. The IGC stated that they were in the process of changing the way in which they ensure the quality of their events. Part of that process was to include advice on the handling of spectators and how to organise the final glide route to minimise the risk to both pilots and spectators.

BGA response to the accident

After this accident, the BGA clarified and expanded their race competition rules relating to dangerous flying, specifically at the finish. These changes were included in their competition rules for 2006. Regarding dangerous flying during the finishing of a race, the changes applicable to competing pilots were:

> *Finish and approach to finish – hazardous manoeuvre, including:*
>
> *1) any sudden change of attitude other than for the purposes of avoidance of other aircraft, airfield objects or people.*
>
> *2) Proximity to ground and obstacles of less than 30 ft. except when landing (characterised specifically by cracked airbrakes and wheel down or low energy <70 knots IAS).*

Changes applicable to the organisers and race officials were:

> *'The event Director must now appoint an additional specific safety officer, who may if required also be the Deputy Director, to ensure that flying conduct relating to finishing is continually monitored by one or both.'*

Compliance with Rule 5 of the Rules of the Air

The BGA oversees most gliding activities in the UK, including the conduct of the majority of gliding competitions. The CAA does not regulate gliding but glider pilots are still required to comply with the Rules of the Air. Specifically, the wording of Rule 5 does not absolve glider pilots from observing the low-flying restrictions except when hill soaring.

Rule 5 permits an element of low flying closer than 500 ft to people and obstacles so long as an aircraft is landing or taking off in accordance with normal aviation practice. However, manoeuvring a glider at heights less than half a wing span can place a wing tip so close to the ground that, if the glider is not within a cleared or protected area, it presents a significant risk of collision with unseen persons or obstacles. Consequently, flying at heights below half a wing span outside an airfield boundary places other people at real risk, particularly in circumstances where a person blends into the background or is not looking in the direction of the glider. The risk described may be infrequent but, as this accident demonstrated, the consequences are likely to be fatal for the bystander or walker who does not hear or see the glider.

The changes to the BGA's competition rules that arose from this accident are evident in the differences between the Associations's 2005 competition rules (Appendix 3) and its 2006 competition rules (Appendix 4). These changes should be welcomed. However, although the outcome might well be beneficial, a minimum height of 30 ft does not necessarily ensure the safety of spectators underneath the final approach path, particularly since 'persons' are not mentioned in the revised competition rules. Consequently, to control the hazards to spectators and competitors, the BGA competition rules may need further refinement, particularly since they appear to be in conflict with the provisions of Rule 5. Therefore, it was recommended that:

Safety Recommendation 2006-119

The British Gliding Association should seek approval from the Civil Aviation Authority for the wording of the Association's competition rules in respect of the minimum height for finishing a race.

Furthermore, if the BGA considers that a competition finish cannot comply with Rule 5, a dispensation in accordance with Rule 5 (3)(f) (flying displays or air races) might be required from the CAA. Since the wording of Rule 5(3)(f) does not specify that prior permission from the CAA is required before holding *'a flying display, air race or contest'*, the Authority's policy would benefit from clarification and publication. Therefore it was recommended that:

Safety Recommendation 2006-120

The Civil Aviation Authority should clarify and publicise whether permission from the Authority is required before exemption from the 500 feet low-flying rule in accordance with Rule 5 (3)(f) is applicable.

Training and qualifications

No specific training is required to take part in gliding competitions but the IGC specifies minimum qualifications and experience for international championships. Competitors are expected to familiarise themselves with the FAI Sporting Codes as well as the Rules and Procedures issued for the event. They are also required to sign a declaration that they have read these documents but no other mechanism is in place to ensure they have either done so or, more importantly, understood them. This is particularly relevant to events where English is not every competitor's native language.

The pilot stated that he had received little training or coaching in how to perform the final glide manoeuvre. It was a technique he had learned through experience gained during previous races, both in the UK and overseas. Such experience was shaped by witnessing the technique used by others and by the way the regulations were commonly interpreted by competition organisers.

The accident pilot believed that sinking air was unlikely to be encountered at low height. He also believed that although manoeuvring was inefficient, the penalty was small compared to the potential benefit of avoiding sinking air. By flying in ground effect where there was no prospect of encountering sinking air, he believed he was likely to obtain a net benefit from this tactic. However, his theory took no account of the prospect of low-level wind shears that might exist in the lee of line-elevated features and obstacles.

The role of team coaches

According to the BGA:

> *'manoeuvring unnecessarily at height or close to the ground is neither demonstrating good airmanship or efficient.'*

Moreover, the BGA stated that had the 'pop-up' technique for clearing obstacles been observed during the British Team training events, the Team coaches would have criticised it for being 'unacceptably dangerous'. However, only the larger and better organised teams had coaches present at the competition and not every British Team coach was able to be present on every competition day. Also, the British Team coaches would have been unable to monitor their team pilots' individual final glides on a daily basis because, typically, they had other duties to perform in the coaching role. However, on the competition days following the accident, the British Team coach advised the Team pilots to finish 'high' and there was no repetition of the pop-up manoeuvres prevalent on the day of the accident.

Not every team had the benefit of a coach on the day of the accident but it is likely that some of the team coaches and competition officials were aware of the low-flying techniques used by many pilots during the finish. It seems that the final glide element of the race was neither being effectively trained nor properly monitored. This problem was more 'international' than 'national' and so it was recommended that:

Safety Recommendation 2006-121

The International Gliding Commission should, through national gliding associations, require, competition team coaches to include techniques for the safe conduct of race finishes within their coaching sessions.

Emergency response

The race organisers were able to respond quickly to the accident and the emergency services also provided a rapid response. However, the operator of the air ambulance reported that the lack of a notified frequency for the airfield during the competition had serious implications for the safety of their response to the incident. Another major problem was low flying by gliders over the emergency services in attendance.

The BGA notified the AUS of the event. However, they had not included, nor were they asked for, details of the frequencies used by the competition. The BGA did not traditionally use Form SRG 1304 to notify the AUS of their competitions and the AUS were content with this arrangement because they felt that they had all the information they required. It is unlikely that had the BGA used the Form SRG 1304, they would have supplied the frequencies and there was no prompt on the form for them to do so.

Had the competition organisers ensured that the normal airfield frequency for Husbands Bosworth remained monitored and answered, omitting to notify the competition frequencies to other agencies would have been of little significance. However, the consequences of aircraft being unable to contact the airfield had been overlooked. The police helicopter based nearby had been notified of the frequencies in use but only because of its proximity to the competition base.

Having become aware of the problem, there appeared to be no mechanism by which the race organisers were able to have the frequency change notified. The AUS have since informed the AAIB that they would have been able to amend the NOTAM relating to the competition to include the change of frequency had they been contacted. A method therefore existed to have the information published, albeit in a somewhat circuitous manner, which the race organisers could not have been expected to have known.

An immediate solution to the problem would have been to ensure the normal airfield frequency remained monitored for the duration of the competition. A future solution, perhaps, relies on the AUS and the AIS reviewing their procedures in light of this event. Although the BGA had not specifically requested a NOTAM be published advising of the competition, there was an expectation that one would be published, simply because this had occurred under similar circumstances in the past. Formal action to notify other airspace users about intensive gliding operations is both a courtesy and a safety measure which should always be carried out. Therefore, it was recommended that:

Safety Recommendation 2006-122

The British Gliding Association should comply with Civil Aviation Authority Aeronautical information Circular 86/2004 and include, in their notifications to the Authority, the frequencies to be used for the competition.

Safety Recommendation 2006-123

The Civil Aviation Authority should instruct National Air Traffic Services Ltd, the organisation that manages the UK's Aeronautical Information Section, to endeavour to include any non-standard radio frequencies in NOTAMs about gliding competitions.

Low flying after the accident

The emergency services were particularly concerned by continued low flying over their position as they attended the critically injured photographer. One overflight had been so low that they were forced to throw themselves flat on the ground for their own safety. The race organisers had made repeated transmissions on the finishing frequency that the competitors should not finish below 200 ft. The response by some pilots to these instructions suggests that perhaps they did not receive the message, did not understand it, could not comply with it due to a lack of aircraft energy or ignored it. The competitors were all required to transmit on the finishing frequency, both at five minutes and one minute prior to landing, so there should have been ample opportunity for them to have received the message. The language used during international gliding championships is English and so all competitors should be able to understand such an instruction.

Because the video evidence suggests that the gliders were not flying low due to a lack of energy, this raises the question as to whether the instruction was simply ignored, if not by all, then by at least some of the competitors. Certainly some were flying so close to the helicopter that the emergency services personnel felt threatened. This suggests that when flying so low, some pilots were unable to see well-lit obstacles directly ahead in time to avoid them.

This situation persuaded the race organisers to publish additional instructions to competitors before racing resumed. These instructions advised them of the announcements that would be made and the correct response to them, should there be an incident, either on the final approach or on the airfield. Logically, such instructions should form part of a normal competition brief and be included in Local Procedures.

Conclusion

A contributory cause of the accident was spectators deliberately positioning themselves too close to the finishing zone. However, the root cause was the practice of flying too low outside the confines of the airfield and resorting to pop-up manoeuvres to clear obstacles. This racing tactic, which was employed by many competitors, was unnecessary and it deprived them of a good view of obstacles ahead.

Pragmatic changes to the BGA competition rules should reduce the risk to spectators and competitors for competitions held under BGA rules. Some of these rules could usefully be incorporated into Local procedures for future competitions held in the UK under FAI Rules. Organisers of all gliding competitions should be encouraged to consider the public in their risk assessments. However, the BGA rule changes concerning low flying appear to be inconsistent with the Rules of the Air Regulations and these inconsistencies should be resolved. Omitting competition frequencies from the published NOTAM created additional and unneccesary risks for the emergency services attending the accident.

Safety Recommendations

During the course of the investigation, the AAIB made the following safety recommendations:

The British Gliding Association should seek approval from the Civil Aviation Authority for the wording of the Association's competition rules in respect of the minimum height for finishing a race. (Safety Recommendation 2006-119)

The Civil Aviation Authority should clarify and publicise whether permission from the Authority is required before exemption from the 500 feet low-flying rule in accordance with Rule 5 (3)(f) is applicable. (Safety Recommendation 2006-120)

The International Gliding Commission should, through national gliding associations, require, competition team coaches to include techniques for the safe conduct of race finishes within their coaching sessions. (Safety Recommendation 2006-121)

The British Gliding Association should comply with Civil Aviation Authority Aeronautical Information Circular (AIC) 86/2004 and include, in their notifications to the Authority, the frequencies to be used for the competition. (Safety Recommendation 2006-122)

The Civil Aviation Authority should instruct National Air Traffic Services Ltd, the organisation that manages the UK's Aeronautical Information Section, to endeavour to include any non-standard radio frequencies in NOTAMs about gliding competitions. (Safety Recommendation 2006-123).

Appendix 1

Extract from IGC Competition Rules

8.9 LIST OF APPROVED PENALTIES

Type of Offence	First Offence	Subsequent Offence	Max Penalty
Overweight/Underweight of W kilograms	W x 2 pts	n x W x 2 pts	n x W x 2 pts
Wrong, late or missing information			
Documentation not complete	No launch	No launch	No launch
Configuration check not complete	No launch	No launch	No launch
Notification of start time > 30 min after start	Warning	10 pts	25 pts
Declared start time differing from the real time	Warning	10 pts	25 pts
Changing FR without advising the Organisers	10 pts	20 pts	25 pts
Incorrect FR adjustment (Time interval between fixes > 10 sec)	Warning	10 pts	25 pts
Late delivery of documentation (FR, outlanding certificate) > 30 minutes	Warning	10 pts	25 pts
Late delivery of backup documentation > 60 min.	Warning	10 pts	25 pts
Incomplete outlanding report	Warning	10 pts	25 pts
Incorrect Start			
Between 0 and 0.50 Km from the start line	50 pts	50pts	50pts
More than 0.50 km from the start line	No valid start	No valid start	No valid start
Valid Start at Incorrect Start Point	100 pts	100 pts	100 pts
Incorrect Rounding of Turn Points or Areas			
More than 0.50 km from the boundary of the Turn Point or Area	50 pts	50 pts	50 pts
More than 1.00 km from the boundary of the Turn Point or Area	No Control	No Control	No Control
Dangerous or hazardous flying			
Cloud flying	100 pts	Day Disqual.	Disqualification
Circling in wrong direction in the local zone	Warning	(n-1) x 25 pts	Disqualification
Circling in the start zone	Warning	(n-1) x 25 pts	Disqualification
Towing: early or late release	Warning	(n-1) x 25 pts	Disqualification
Towing: pull-up before release	Warning	Day Disqual.	Disqualification
Finish: crossing below height or altitude limit	Warning	(n-1) x 25 pts	Disqualification
Finish: hazardous manoeuvre	Warning	(n-1) x 25 pts	Disqualification
Landing: incorrect landing lane	Warning	(n-1) x 25 pts	Disqualification
Flying above the absolute altitude limit (defined at briefing) if excess altitude < 100m	1 pt/m	n pts/m.	Day Disqual.
Flying above the absolute altitude limit (defined at briefing) if excess altitude > 100m	Outlanded at the point of airspace entry	Day Disqual.	Disqualification
Starting above the altitude limit	1 pts/m	n pts/m	Day Disqual.
Entering restricted or closed airspace	Outlanded at the point of airspace entry	Day Disqual.	Disqualification
Landing after legal daylight	10 pts/min	Day Disqual.	Disqualification
Cheating or falsifying documents			
Falsifying documents	Disqualification	Disqualification	Disqualification
Attempt to obtain external help for finding lift from non competing glider or airplane	Day Disqual.	Disqualification	Disqualification
Other Violations			
Flying under influence of alcohol	Day Disqual.	Disqualification	Disqualification
Positive doping control	See FAI policy	See FAI policy	
Wing Span Penalty in 15m & STD Class (#)	1 pt/cm	1 pt/cm	1 pt/cm

(#) If the span of a glider in the 15 m Class or in the Standard Class exceeds 15,000 mm, a penalty of a fixed number of points shall be subtracted from the daily score. The number of daily penalty points is obtained by subtracting 0.3 cm from the measured overspan, then rounding this number to the nearest whole cm.

Examples:

(i) A 2.7 cm overspan will give daily penalty points of 2.7 - 0.3 = 2.4 which is then rounded down to 2 points.

(ii) A 3.9 cm overspan will give daily penalty points of 3.9 - 0.3 = 3.6 which is then rounded up to 4 points.

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Appendix 2

Rule 5 of the Rules of the Air (Amendment) Regulations 2005

Low Flying

5. (1) The prohibitions to be observed are -

(a) an aircraft shall comply with the low flying prohibitions set out in paragraph (2) subject to the low flying exemptions set out in paragraph (3).

(b) where an aircraft is flying in circumstances such that more than one of the low flying prohibitions apply it must fly at the greatest height required by any of the applicable prohibitions.

(2) The low flying prohibitions

(a) Failure of power unit

An aircraft shall not be flown below such height as would enable it, in the event of a power unit failure, to make an emergency landing without causing danger to persons or property on the surface.

(b) The 500 feet rule

Except with the permission in writing of the CAA, an aircraft shall not be flown closer than 500 feet to any person, vessel, vehicle or structure.

(c) The 1,000 feet rule

Except with the permission in writing of the CAA, an aircraft flying over a congested area of a city town or settlement shall not fly below a height of 1,000 feet above the highest fixed obstacle within a horizontal radius of 600 metres of the aircraft.

(d) The land clear rule

An aircraft flying over a congested area of a city town or settlement shall not fly below such height as will permit, in the event of a power unit failure, the aircraft to land clear of the congested area.

(e) Flying over open air assemblies

Except with the permission in writing of the CAA, an aircraft shall not fly over an organised open-air assembly of more than 1,000 persons below -

(i) a height of 1,000 feet, or

(ii) such height as will permit, in the event of a power unit failure, the aircraft to alight clear of the assembly,

whichever is the higher.

Appendix 2 cont

(f) Landing and taking off near open air assemblies

An aircraft shall not land or take-off within 1,000 metres of an organised open-air assembly of more than 1,000 persons, except -

(i) at an aerodrome, in accordance with procedures notified by the CAA, or

(ii) at a landing site other than an aerodrome, in accordance with procedures notified by the CAA and with the written permission of the organiser of the assembly.

(3) Exemptions from the low flying prohibitions

(a) Landing and taking off

(i) Any aircraft shall be exempt from any low flying prohibition in so far as it is flying in accordance with normal aviation practice for the purpose of taking off from, landing at or practising approaches to landing at or checking navigational aids or procedures at a Government or licensed aerodrome.

(ii) Any aircraft shall be exempt from the 500 feet rule when landing and taking-off in accordance with normal aviation practice.

(b) Captive balloons and kites

None of the low flying prohibitions shall apply to any captive balloon or kite.

(c) Special VFR flight and notified routes

Any aircraft shall be exempt from the 1,000 feet rule when flying on a special VFR flight, or when operating in accordance with the procedures notified for the route being flown; provided that when flying in accordance with this exemption landings may not be made other than at a licensed or Government aerodrome, unless the permission of the CAA has been obtained.

(d) Balloons and helicopters over congested areas

(i) A balloon shall be exempt from the 1,000 feet rule when landing because it is be-calmed.

(ii) Any helicopter flying over a congested area shall be exempt from the land clear rule.

(e) Police air operator's certificate

Any aircraft flying in accordance with the terms of a police air operator's certificate shall be exempt from the 500 feet rule, the 1,000 feet rule, the prohibition on flying over open air assemblies and the prohibition on landing and taking off near open air assemblies.

Appendix 2 cont

(f) Flying displays etc

An aircraft taking part in a flying display, air race or contest shall be exempt from the 500 feet rule when within a horizontal distance of 1,000 metres of the gathering of persons assembled to witness the event.

(g) Glider hill soaring

A glider when hill-soaring shall be exempt from the 500 feet rule.

(h) Picking up and dropping at an aerodrome

Any aircraft picking up or dropping tow ropes, banners or similar articles at an aerodrome shall be exempt from the 500 feet rule.

(i) Manoeuvring helicopters

A helicopter shall be exempt from the 500 feet rule when conducting manoeuvres in accordance with normal aviation practice, within the boundaries of a licensed or Government aerodrome, or at other sites with the permission of the CAA: provided that when flying in accordance with this exemption the helicopter must not be operated closer than 60 metres to persons, vessels vehicles or structures located outside the aerodrome or site.

(j) Dropping articles with CAA permission

(i) Any aircraft shall be exempt from the 500 feet rule when flying in accordance with article 56(3)(f) of the Order, and

(ii) Any aircraft shall be exempt from the 500 feet rule when flying in accordance with an aerial application certificate issued by the CAA under article 58 of the Order."

Appendix 3

Extract from BGA Competiton Rules 2005

34.7. Excess span. Up to 50 mm: 1 point per mm per day. Greater than 50 mm: disqualification. Measurement to be made with the wings supported to allow the glider to match its unloaded shape. This depends on the design of the glider, but will generally mean that the trailing edge is straight along the length of the wing.

34.8. Airspace. Each infringement is assessed vertically and horizontally and the lower figure applied. The vertical penalty is 1 point for every 5 feet or part thereof.

Horizontally the penalty is 1 point per 10 metres or part thereof measured to the nearest edge of the Airspace. For an active parachute zone specified by the competition organisation the penalty is 2 points per 5 metres or part thereof for the first 500 metres plus a further 300 points if the infringement exceeds 500 metres.

The Airspace penalty applied will be the sum of all offences during the day. For a second day of infringement the penalty will be doubled with further days being quadrupled.

Any glider incurring 200 or more airspace penalty points on more than two days will be disqualified from the competition.

34.9. Dangerous Flying. 100 points. Included in this is exceeding the gliders limitations.

34.10.Cheating. Day disqualification.

All other penalties are applied after scores have been calculated and, except for Airspace infringements, will not result in a negative score.

The following Penalties should be applied.

34.1. Loss of flight recorder evidence. Periods exceeding 60 seconds during which it cannot be established that airspace was not infringed and an engine not operated: Landed out at that point.

34.2. Self-sustainer engine running. Exceeding the 30 second testing limit: 1 point per second

34.3. Start. Starting from within the Horizontal Penalty Area: 50 points. Starting within the Vertical Penalty Volume: 2 points per 10 feet, or part thereof, above Start Height. Exceeding Start Height by more than 100 feet in the 2 minutes prior to Starting: 1 point per 10 feet or part thereof above Start Height. In cases where more than one infringement has been committed, only the greater Penalty will be applied.

34.4. Procedural rules. Failure to comply: 20 points.

34.5. Turnpoint error. Controlled within the Turnpoint Penalty Area without having entered the Turnpoint zone: 50 points.

34.6. Weight. Glider overweight: 2 points per kg above their permitted weight times the number of similar offences.

Appendix 4

Extract from BGA Competition Rules 2006

34. LIST OF APPROVED PENALTIES

Type of offence	First offence	Second offence	Further offence
Wrong, late or missing information			
Notification of start time > 30 minutes after start	Warning	10 points	25 points
Declared start time differs from real time >2 minutes	Warning	10 points	25 points
Changing FR without advising the Organisers	10 points	20 points	25 points
FR fix interval set greater than required	Warning	10 points	25 points
Late delivery of FR or other docs. > 60 minutes	Warning	10 points	25 points
Late delivery of back-up FR or docs. >60 minutes from receipt of request	Warning	10 points	25 points
Missing FR evidence – exceeding 60 seconds, where it cannot be reasonably established that airspace was not infringed or engine not operated	Outlanded at that point	Outlanded at that point	Outlanded at that point
Incorrect start or rounding of TP or Areas			
Starting from within Horizontal Penalty Area	50 points	50 points	50 points
Starting from within Vertical Penalty Volume	1 point /5ft. or part	1 point /5ft. or part	1point /5ft. or part
Exceeding start height by more than 100 feet in the 2 minutes prior to Starting	1 point /10ft. or part, above start height	1 point /10ft. or part, above start height	1 point /10ft. or part, above start height
Controlled only within Turnpoint Penalty Area	50 points	50 points	50 points
Dangerous or hazardous flying			
Cloud flying – incorrect radio protocol	Warning	100 points	Day Disqualification
Cloud flying – within 10km. of airfield centre or any start zone of any class	100 points	Day Disqualification	Disqualification
Flying outside glider's C of A limits	100 points	Day Disqualification	Disqualification
Airspace – each infringement is assessed vertically and horizontally and the lower penalty applied. Horizontal distance is measured to the nearest edge of the airspace. The penalty applied will be the sum of all infringements in a day. Multiple infringements on any day are classed as one offence.	1 point per 5 ft. vertically 1 point per 10m.horizontally	2 points per 5 ft. vertically 2 points per 10m.horizontally	4 points per 5ft. vertically 4 points per 10m.horizontally
Briefed Parachute zone infringement	2 points/5m if <500m. If >=500m, 500 points.	4 points/5m if <500m. If >=500m, 1000 points.	8 points/5m if <500m. If >=500m, 2000 points.
Persistent infringement of airspace and/or briefed parachute zones of more than 200 points per day on more than two days	Disqualification		
Finish – crossing below height limit for go around - if specified	Warning	100 points	Disqualification

Appendix 4 cont

Type of offence	First offence	Second offence	Further offence
Finish – incorrect landing pattern - if specified	Warning	100 points	Day Disqualification
Finish and approach to finish – hazardous manoeuvre, including :- 1) any sudden change of attitude other than for the purpose of avoidance of other aircraft, airfield objects or people. 2) proximity to ground and obstacles of less than 30ft. except when landing (characterised specifically by cracked airbrakes and wheel down or low energy < 70 knots IAS).	Warning	100 points	Disqualification
Hazardous/dangerous flying recommended by PSC for penalty, if not covered by other penalty	100 points	Day Disqualification	Disqualification
Cheating or falsifying documents			
Falsifying electronic files or paper documents	Disqualification		
Attempt to obtain help for finding lift from non competing glider or aircraft	Day Disqualification	Disqualification	
Use of any non-approved radio frequency for communication of any sort whilst airborne except with Air Traffic Services, or in emergency	Day Disqualification	Disqualification	
Non-approved data transmission	Day Disqualification	Disqualification	
Other violations			
Glider overweight to class and/or C of A limit	W x 2 points	n x W x 2 points	n x W x 2 points
Positive doping control	see FAI policy	see FAI policy	see FAI policy
Excess wing span when measured with wings supported to match unloaded shape with 0.3cm. allowance. The excess is rounded to the nearest cm.	1 point per cm.	1 point per cm.	1 point per cm.
Self-sustainer engine test running >30 seconds	1point per second	1 point per second	1 point per second
Failure to comply with specific single procedure not covered elsewhere.	25 points	100 points	Day Disqualification

For scoring purposes disqualified competitors will be deemed not to have flown on the day(s).

All other penalties are applied after scores have been calculated and, except for Dangerous/Hazardous flying infringements, will not result in a negative score.