GLIDER ACCIDENT REPORT BGA NO. 90/04

Aircraft manufacturer: -	Schemp-Hirth
Model: -	Std. Cirrus
BGA Number: -	1624
Fin Number: -	252
Year of manufacture:-	1971
Owner: -	Three man syndicate including the deceased pilot.
Place of Accident: -	Nympsfield Airfield, Nr. Stonehouse, Gloucestershire
Date of Accident: -	7 August 2004
Time of Accident: -	Shortly after 14:00 hrs local

Synopsis

The Bristol & Gloucestershire Gliding Club (BGGC) alerted the Emergency Services immediately after the accident. Subsequently, at 14:36 hrs, Mr. Ian Smith, the Safety officer of the BGGC reported the accident to the AAIB Duty officer. At 15:00 hrs the accident was reported to Mr J W Hoskins of the British Gliding Association Accident Investigation Team who then arrived at the scene at 17:00 hrs that day. Liaison was maintained with DS Steve Bean of the Gloucestershire CID.

A winch from the airfield at Nympsfield was launching the glider when it was seen to climb more steeply than normal after it left the ground. It then began to yaw and turn to the left and by the time the glider reached about 150 to 200 feet above ground level, it was banked steeply to the left. It was seen to disconnect from the winch cable at the glider release mechanism following which it recovered to a relatively normal pitch attitude, but heading some 20° or 30° degrees to the left of the take off path. The glider continued the left turn through some 150 degrees, with a gradually reducing speed and, at the end of the turn, it was then seen to sharply drop the left wing and enter a spin. After approximately 180° degrees of rotation in this spin, the glider crashed into trees at the side of the runway in a very steep nose down attitude. The pilot was pronounced dead on arrival at the Gloucester Royal Hospital.

1 FACTUAL INFORMATION

1.1 History of the Flight.

The pilot of the glider was a member of the Bristol & Gloucester Gliding Club that operates from Nympsfield, Nr. Stroud, Gloucestershire. He had prepared the glider to fly in the morning of 7 August 2004 by washing it and carrying out a Daily Inspection that would have included checking the control circuits for integrity and correct function. He signed for this action in the Daily Inspection booklet allocated to the glider and had then taken the glider to the winch launch waiting area on the field. A gliding competition was taking place from Nympsfield on that day, and the pilot waited until tug aircraft had launched all competition gliders before taking his place in the winch launch queue. There was further delay due to minor problems with equipment and it was not until 14:00 hrs that the glider took to the air on the accident flight.

The day was very hot and a witness commented that he did not notice the pilot drinking any water while he waited; however, an empty coffee flask was found in his car. According to the pilot's wife, this flask had contained caffeinated coffee which he habitually drank before flying. A full container of water was found in the wreckage.

A previous launch had been a little abrupt and had resulted in a cable overrun by the glider concerned, so the winch driver had been instructed to make the initial acceleration with single seater gliders a little gentler. The launch of the accident glider was seen to comply with this instruction but still giving apparently, adequate acceleration. Various witnesses reported the glider leaving the ground quite early in the launch and rotating into the climbing attitude almost immediately. At the same time it yawed and rolled slightly to the left. By the time the glider reached 150 to 200 feet above the ground, it was pointing some 20 to 30 degrees to the left of the winch cable track and was markedly left wing low. The cable released from the glider release mechanism but it was not possible to determine if this was inadvertently through automatic operation of the emergency 'back release'[1] mechanism or whether the pilot had initiated the release himself. Because the observed glider attitude at this point of the launch was such that the cable had most probably not reached the critical 80 degrees, it seems more likely that the pilot himself released the cable.

The glider recovered to controlled flight but in a gentle left turn. It continued the turn to the left through some 180° and appeared to decelerate. The left wing dropped and the aircraft entered a spin to the left. After a further 150° to 180° of the spin, it entered trees at the south side of the runway in a marked nose down attitude. One very experienced gliding instructor witness states that the glider may have recovered from the spin in the last second or so of flight and this was supported by the fact that the pilot was found unconscious in the aircraft with his feet on the controls, his right leg fully extended and his left leg bent at the knee. This partial recovery may have resulted in a faster entry to the trees than might have been the case had the glider remained in the spin.

[1] A mechanism which allows the launch cable to automatically release the cable from the machine should the angle between the cable and the fore and aft axis of the glider become greater than 80 degrees or so.

1.2 Injuries to Persons.

The pilot suffered multiple injuries and, after being released from the wreckage, was transferred to hospital where he was pronounced dead on arrival.

1.3 Damage to Aircraft.

The glider entered the edge of a wood on the boundary of the airfield in a steep dive. The left wing struck the trees first and the drag of it travelling downwards through the substantial branches of the tree caused the aircraft to yaw to the left. It is likely that this yawed the aircraft through almost 90°, as the right wing tip then struck the ground sending a shock wave along the entire right wing. A break occurred in an upward and rearwards direction some 50 centimetres from the tip. There is evidence of the main spar then hitting the ground and breaking the wing a second time in an upward and rearwards direction just inboard of the aileron. The final break of the right wing occurred at the root rib and this was mainly in a rearwards direction, fracturing the main spar and crushing the rear root rib and skin outwards at approximately 45 degrees.

The fuselage then struck the ground on its right side breaking the rear section halfway between the wing trailing edge and the leading edge of the fin. The left wing however, having slid through several branches remained caught in the tree and was standing almost vertically, resting against the trunk. It showed evidence of striking green wood during its passage downwards. The cockpit was not extensively damaged although the canopy and canopy frame was shattered.

The shock from the right wing hitting the ground travelled through the fuselage wing mounts and sprang the left wing outwards. This had two effects. The first was to dislocate the airbrake connection on the left side and the second was to force the wing away from the fuselage. This movement dislocated the forward wing support spigot which then sprang back inwards but this time some 20 mm above the location bearing, puncturing the fuselage skin.

1.4 Other Damage.

There was minor impact damage to the surface of the airfield and to the branches of the tree.

1.5 Pilot information

Male:	Aged 50 years
Medical:	Self declared (4 December 2003).
Licence:	Full Silver ‘C’ certificate completed in August 2002
Instructors rating:	Basic Instructor (23 February 2004)
Last check flight: -	11 June 2004
Total Flying Experience:	125 hours
Hours on type:	27 hours 50 mins.

1.5.1. In February 2004, the pilot had recently completed a Basic Instructors course at the Bristol & Gloucestershire Gliding Club. Apart from the instructional technique aspect of the course, pilots are given considerable training in the conduct of launch failures. However, these are usually from a straight and undeviated launch, variations being only in the height and speeds at which the failure is initiated. The deceased pilot had received this training and it is reported that he had absorbed the lessons well. His Chief Flying Instructor reported that he had complete confidence in the pilot's ability to handle power or cable failures, as practised, at any point during a launch from the site at Nympsfield.

1.5.2. Pilot's Medical History.

The pilot's medical history was significant for migraine for which he had been prescribed a number of medications. He also had a history of mild depression, which seemed to have been largely resolved by May 2004.

Under current licensing regulations, migraine is not a condition which would have precluded him from flying as a solo glider pilot. He had suffered migraine for many years, and as his attacks were fairly stereotyped, he was presumably well aware of the symptoms of an impending attack. In later discussion with his wife, she supported the presumption that he would not have flown had he developed such symptoms. The time between the initiation of the winch launch and the accident would have been very short, and it is highly unlikely that he would have become incapacitated due to migraine in this short time.

1.6 Aircraft Information.

Article 8(2)(a) of the Air Navigation Order provides that the normal requirement for an aircraft to have a valid Certificate of Airworthiness (C of A) does not apply to a glider on a private flight in the U.K. However, nearly all gliding in the U.K. takes place under the auspices of the British Gliding Association (BGA), which regulates the sport, and which requires all gliders operating from BGA affiliated sites to possess a valid BGA C of A.

The glider had been maintained in accordance with the BGA requirements and had been issued with a BGA Certificate of Airworthiness, valid for twelve months, on 10 February 2004, in accordance with BGA regulations. There were no known reported defects immediately prior to the accident. The glider's mass and Centre of Gravity were within limits.

The glider, although privately owned, had routinely been kept hangared. It was therefore in very good condition for it's age and had obviously been well looked after. Total flying hours were 5,179 and 2,538 launches had been carried out up to the day of the accident.

1.7 Meteorological Information.

The wind at the time of the accident was 170°/5 kt, resulting in a left crosswind with very slight tailwind component for the launch direction of 280°. There was no significant weather.

1.8 Aids to Navigation.

Not relevant.

1.9 Communications.

No radio transmissions were received from the glider.

1.10 Site Information.

The grass airfield at Nympsfield is at the top of the Cotswold Ridge approximately three miles southwest of the town of Stroud. It is of irregular shape with the main launching directions of 100/280°. On the day of the accident the launching direction was 280° and the length of the airfield available for operations in this direction is 1,400 yards. On the Southern side, the ground slopes steeply away to a wood and then a steep sided valley. There is also a bulge of sloping grass on the south side of the field very close to the commencement point of winch launches in the 280° direction. As explained later in the analysis, these slopes and the bulge may have played significant parts in the decisions of the pilot after cable release.

1.11 Flight recorders.

A flight logger was carried but had no flights recorded on the day of the accident.

1.12 Site and Aircraft Examination.

1.12.1. The glider came to rest on the edge of the wood bounding the southern side of the airfield which, at this point, is some 60 feet below the launch point in use on the day of the accident. The left wing, still attached to the fuselage, was almost vertical and supported by a tree. The right wing had been broken in two places and was all but detached from the fuselage. The inner part of the wing had broken rearwards and lay alongside the fuselage. The fuselage was broken between the trailing edge of the wing and the leading edge of the fin, with the forward part, including the cockpit, lying on its right side.

Examination of the wreckage showed all flying controls to have been correctly connected at the time of impact. The left airbrake 'Hotelier' quick release connection had become disconnected by the forces generated during the impact. Cockpit disruption caused during the accident and removal of the pilot prevented any reliable information on control column position being obtained, but the elevator trim was in the expected position (neutral) and the rudder pedals suggested that right rudder had been applied at the time of the impact. No parts of the airframe were missing and no items were found (other than personal items and documentation in the pockets of the cockpit) which did not belong to the airframe.

On examination the altimeter had a positive reading of 240 feet, with a barometric sub-scale setting of 982 millibars.

1.12.2. The launching winch had been operating satisfactorily in all previous flights on that day, and the correct weak link assembly had been used. This had not failed.

1.13. Medical and Pathological Information.

The pilot died primarily from multiple injuries, the most significant were head injuries but there was also some bruising and abrasion to the right thigh. The pathologist reported that there were no suspicious findings, evidence of any disease, alcohol, drugs or any toxic substance which may have caused or contributed to the accident.

1.14 Fire.

There was no fire.

1.15 Survival Aspects.

1.15.1. The accident was not survivable.

1.15.2. The instrument panel fitted to the aircraft was constructed from 3 mm aluminium sheet. Although in this particular accident there was only minor abrasion and bruising to the pilot's right thigh, there is some concern that hard-edged, solid metal instrument panels in gliders can lead to more serious injuries in even minor accidents.

1.15.3. The Aviation Pathologist has raised a concern over the severe damage to the skull of the pilot. Rudimentary research into the RAF Aviation Pathology database has shown that in 118 glider fatalities investigated by the department, 76 pilots had fractures of the skull. Whilst acknowledging the reluctance of glider pilots to wear head protection, he recommends that the BGA revisit the issue of de-lethalising the cockpit environment with respect to head injuries.

1.16 Tests and Research.

None.

1.17 Organisational and management information.

None relevent.

1.18 Additional information.

None.

1.19 Useful or effective investigation techniques.

None.

2. ANALYSIS

The analysis of this accident covers more than one aspect; the winch launch, the recovery and physiological factors.

2.1. The Winch Launch.

Despite the fact that the winch driver had been given previous instructions to give a gentler acceleration at the start of the launch, according to witnesses, the acceleration provided was perfectly adequate for the conditions. No specific aft movements of the control column should normally be necessary to achieve flight and rotation into the normal climb – the increasing airspeed and aerodynamic characteristics of the glider achieve this almost automatically. In fact, frequently, an application of down elevator is needed to prevent a too rapid nose up rotation. Nevertheless, as the glider was seen to rotate into a steeper than normal attitude immediately after it left the ground, the actions of the pilot, in allowing this to happen, could indicate that he was concerned that he was not achieving flight as rapidly as he thought necessary, and that he took positive action to get the glider airborne.

This has two main consequences if this situation is allowed to happen. Firstly, the angle of attack (AoA) of the wings to the airflow is increased, thereby approaching more closely the stalling angle of the aerofoil section. Secondly, the pull from the winch cable begins to operate at an increasingly steep angle to the longitudinal axis of the glider, thus markedly increasing the wing loading and drag. This raises the stalling speed of the glider and, consequently, the flying speed required for safe flight. The longitudinal accelerating force is also reduced and, coupled with the increased drag, the glider is slower to reach a safe flying airspeed. The wing therefore is at risk of stalling, not because of a reducing airspeed at constant wing loading (which is the phenomena most demonstrated during training and therefore readily recognised by pilots), but because the stalling speed is increasing faster than the glider's airspeed and eventually overtakes it. Should any yaw or wing asymmetry be present, one wing is likely to stall before the other leading to a rapid wing drop with the glider rolling and yawing.

This was observed to happen in the early stages of the launch, as the glider did commence a roll and yaw to the left. By the time the glider had reached some 150 ft above the ground, witnesses saw that the pilot probably appreciated what had gone wrong, released the winch cable, (immediately decreasing the wing loading) partially levelled the wings and pitched nose down in an attempt to achieve controlled flight.

2.2. The Recovery.

At this point the glider appeared to be under full control, although now heading some 30° or so to the left of the line of the winch launch and still turning slowly to the left. The recommended recovery technique from this position would be a landing back on the airfield along the line of the airfield/winch launch run. However, to achieve this the pilot would have needed to turn right through approximately 90°, fly some distance and then execute a left turn, again of some 30°, and land ahead. This would have been feasible from his position immediately after cable release but, shortly thereafter, this option would have been impracticable.

Ahead of the pilot and immediately below the nose of the glider, a bulge in the airfield surface led to the ground sloping steeply away into a deep valley. Had he looked down to visually assess his height above the ground, the recommended procedure[2], he may have gained the impression he was much higher above the surface of the airfield than he actually was. This could have encouraged him to continue his turn to either land back across the airfield,[3] or perhaps complete a turn of some 330° to the left and land in the normal location. It may also have discouraged him from attempting the flight pattern described in the paragraph above since this pattern is normally only carried out from a relatively low height.

[2] Altimeters suffer from 'stiction'. This causes lag in the movement of the indicating needle which can become critical at low level.

[3] The pilot would have had ample room available to him, and although this would not have been a normal procedure at this site, as a possibility, it cannot be ruled out.

The altimeter readings and settings bear some analysis. At the previous C of A, the altimeter had been tested and found perfectly serviceable with a subscale-setting accuracy within two millibars. After the accident it was found to have a 9 millibars (270 feet) discrepancy [4]

Two other gliders on the day in question had set their sub-scales to 990 and 994 respectively (average 992). After the accident, the glider's altimeter showed a subscale setting of 982 mb, 10 millibars different, or in effect a reading 300 feet higher than was correct. It is likely, in an accident of this nature and if the instrument is not destroyed, that the shock of the impact can often cause the indication on an altimeter to 'jump' and hence cause an inaccuracy in relation to the sub-scale setting. It is possible that the subscale mechanism might also be affected and, therefore, any speculation that the altimeter in the glider whilst it was in flight could have been reading some 300 feet high is not considered likely.

Whatever his reasoning, the pilot continued the turn until he was facing 180° or thereabouts from his release direction. He would then have been faced with trees much closer below the glider than perhaps expected, and ground that sloped further upwards. The glider was seen to decelerate. A pilot has to guard against his instincts to raise the nose of the glider when the visible, but false, horizon rises in front of the machine. It encourages raising of the nose to follow the horizon and to give greater clearance to obstacles close below. At this point a stall and spin become likely and this is subsequently what was seen to occur. The glider stalled and began to spin to the left, but only through some 180°, before striking a tree at the edge of the wood in a steep nose down attitude and with considerable speed.

One witness, a professional gliding instructor, states that he thought the aircraft had stopped spinning to the left before it hit the tree. This view is supported by the fact that, after the accident, the pilot was found unconscious with his feet on the rudder pedals with full right rudder applied. (Full right or opposite rudder applied is the immediate remedial action in the event of a spin to the left.) The glider was too low for this recovery to be fully effective (a height loss during recovery of some 200 to 300 feet are normally required for a glider of this type) but an attempted recovery may have contributed to the relatively high speed of entry into the trees.

2.3 Physiological Factors.

The pilot had been observed to be on the airfield for some considerable time before he finally launched. Opinions of the exact time vary, but witnesses have said that the weather was very hot and the pilot was not seen to drink any water between arriving at the airfield mid-morning and taking a launch, a period of approximately 4 hours. A completely full water container was found in the glider after the accident but his wife has stated that he normally kept this container full for use in the air. He was also known to have consumed a flask of coffee (not decaffeinated) during this time. Although there is no pathological evidence to support this contention, it is possible that the pilot had become sufficiently dehydrated to cause some loss of concentration.

[4] An altimeter senses pressure changes which are then displayed as altitude. In the lower layers of the atmosphere as altitude increases, pressure drops by approximately one millibar per 30 feet,. As local pressure varies from hour to hour and day to day, these readings are meaningless unless a zero can be established. To do this an adjustable subscale is provided on all altimeters to enable the pilot to set his altimeter to zero before departure for local flight. His altimeter will then read aircraft height above the point of take off. (There are other sub-scale settings which are not pertinent to this accident.)

3.0 CONCLUSIONS

a. Findings.

1. The pilot had a medical history of migraine and was taking medication. However, it is considered most unlikely that the pilot would have flown had he been suffering from any symptoms of migraine before launch.
2. The pilot had suffered mild depression in the past. However this was considered to be much improved since at least May 2004 after an improvement in his working conditions and therefore was also unlikely to have been a contributory factor in the accident.
3. The pilot may have lost some degree of concentration as a result of the high air temperatures on the day of the accident.
4. The pilot was qualified to carry out the flight.
5. The glider was normally kept in a hangar. It had made 25 flights since it had last been rigged (February 2004) and no control problems had been reported.
6. The glider was below the maximum permissible weight and within centre of gravity limits.
7. The glider had been correctly serviced, the Daily Inspection had been carried out satisfactorily and all applicable mandatory inspections had been complied with.
8. Post accident inspection showed that, apart from impact damage, the main flight control systems (ailerons, elevator, elevator trim, and rudder) had been correctly connected.

b. Causal Factors.

1 During the initial part of the winch launch the pilot had allowed the glider to attain too steep a nose up attitude and this had caused the glider wings to reach a stalled condition. This in turn led to the glider yawing and turning to the left – a situation the pilot recognised and from which he recovered.

2. At this point, faced with a difficult situation, the pilot elected to continue his left turn and had the choice to either land diagonally across the airfield or complete a full 360° turn and land at the normal location.
3. On turning towards the airfield he was faced with rising ground and trees closer beneath the glider than he probably expected. This prompted him to raise the nose of the glider to clear the obstacles, the airspeed decayed and the aircraft entered a spin to the left from which it did not recover.
4. There is a strong possibility that the pilot attempted to recover from the spin by making the necessary control inputs. Unfortunately there was insufficient height available to fully effect recovery but this probably resulted in a higher impact speed than would have occurred in a full spin.

4. SAFETY RECOMMENDATIONS

4.1 Winch Failure Training.

Training for the rare event of actual winch launch failure is now a very refined skill in all clubs employing this method of launching. However, the profile of a practise failure is almost always from a straight launch where the glider has not strayed far from the direct line between launch point and winch. The options are very clear, in that an initial decision is always to land ahead if sufficient length of field is available, followed by alternatives if not. This procedure and training method applies well to the majority of club sites where they fly from flat airfields, and where there is plenty of room available to recover from for this type of situation. However, other sites are not so fortunate in the topography of their field and visiting pilots may well be unaware of and unaccustomed to the associated problems.

A premature termination of a launch that has occurred on a narrow field having a steep drop off to one side or the other or, where obstacles such as tall trees and unusable but obtrusive side areas of grass are a part of the topography, is rarely practised from a position when the glider's heading has wandered more than a few degrees from the 'straight ahead' direction. The pilot in this accident may therefore have been faced with a situation totally unfamiliar to him. To practice winch launch failures under such conditions would require careful consideration since the likelihood is that this could lead to more accidents in training than in actual emergency situations. However, it is thought that this subject requires further investigation and therefore the following recommendation is made: -

> It is recommended that the BGA examine the glider pilot training syllabus with a view to making pilots aware of the problems of premature terminations of cable launches where the glider has deviated from the straight ahead before the termination, and where topography of the site and its immediate environs presents further problems for the recovery.

Safety recommendation No. 2004/02/BGA

4.2 It was possible that the bruising and abrasion to the pilot's right thigh may have been caused by contact with the edge of the 3mm thick instrument panel. Although this was probably not of significance in this particular accident, it is generally of concern that such hard edges in the cockpit could cause serious injuries in even minor accidents. Therefore the following recommendation is made.

> It is recommended that the BGA provide guidance material to the gliding community on ways of reducing the likelihood of serious injury to the pilot's legs from hard fixed objects, such as fixed metal instrument panels, in glider cockpits, in the event of an accident or during emergency evacuation of the glider.

Safety recommendation No. 2004/03/BGA

4.3. During this investigation, the Aviation Pathologist expressed concern over the number of head injuries associated with fatalities in glider accidents. Therefore the following recommendation is made.

> It is recommended that the BGA provide advice to the gliding community with respect to ways of de-lethalising the cockpit environment with respect to head injuries in the event of an accident.

Safety recommendation No. 2004/04/BGA

J W Hoskins

Senior Accident Investigator

British Gliding Association

9 December 2004