British Hang Gliding and Paragliding Association

REPORT

**Investigation of a paragliding (mini-wing) accident
which occurred at Pendle Hill, Nr Clitheroe
on 4th December 2013
which involved the death of the pilot.**

Introduction

On 4th December 2014 the British Hang Gliding and Paragliding Association (BHPA) received reports of an air accident at Pendle Hill, Nr Clitheroe, which had resulted in the death of the pilot. The BHPA tasked Mr Mark Dale, BHPA Technical Manager, to investigate the accident and submit a report to the Flying and Safety Committee (FSC) of the BHPA for ratification.

Note: The sole objective of the investigation of an accident or incident by the BHPA is the prevention of future accidents and incidents. It is not the purpose of such an investigation to apportion blame or liability.

BHPA investigation serial number: IR 13/155

Summary

On 4th December 2014, a paraglider (mini-wing) pilot came in for a top landing at Pendle Hill. His glider suffered a collapse and he fell to the ground, sustaining fatal injuries.

The investigation found that the untrained pilot was attempting a circuit style landing approach to a top landing, in winds that had rapidly increased to being fresh/strong and gusty, and the 16m^2 paraglider departed from normal flight at a position from which there was insufficient height and time to recover.

This document is confidential until ratified.

Date ratified by the BHPA Flying and Safety Committee:

THE STRUCTURE OF THE REPORT

The structure of this report conforms to that recommended in the BHPA Technical Manual and follows the principles pertaining to AAIB reports. It is divided into four sections.

Section 1 - Factual information

Section 2 - Analysis

Section 3 - Conclusions

Section 4 - Safety Recommendations

SECTION 1 - FACTUAL INFORMATION

1.1 History of the flight

On Wednesday 4th December 2013, Pilot A and Pilot B met at the car park at Pendle Hill, Lancs with the intention of flying their mini-wing paragliders. They noted that the wind conditions seemed lighter than expected. After walking up the hill with their equipment, they arrived at the Mearley Moor launch point at roughly 1145hrs. After evaluating conditions, Pilot B prepared to make a top-to-bottom speed flight on his 9m wing. Pilot A positioned himself some ten metres down the slope to video the flight. His video shows that Pilot B made eleven attempts to get his canopy stable above his head, mainly using the reverse launch method. But due to the light wind conditions he was unable to achieve this. Eventually he forward launched successfully, but after approximately three seconds of flight, impacted the hill below take off where the slope flattened out a little, having failed to out-glide the slope of the hill. Pilot B realised that his ankle was sore as a result of this impact and decided to rest where he was.
Pilot A helped Pilot B pack his equipment away, and in discussing this minor injury, Pilot B declined the option of them ceasing activities for the day.
Pilot A then went back to his equipment at the hill top and prepared for flight. The wind had increased in strength and when Pilot A launched his 16m wing at approximately 12:10pm he was able to ridge soar as planned.

Pilot C arrived at the Well Springs Car Park at about this time, and walked up onto the fell just above the car park to assess conditions. He states: '*I decided pretty quickly that it wasn't flyable as the wind was varying from 8mph to 21mph on a lower shallow part of the hill with a sharp feel to the gusts.*' He noted '*a lone pilot bobbing about on what looked like a blue mini wing on the west corner of the main face but the way his wing was pitching about didn't look like a lot of fun. He managed to land the wing on the hill after doing a few smallish wingovers but then surprised me by taking off again within a minute. I had seen enough to decide to go home.'*

Pilot B witnessed Pilot A's flight from his position slightly down the slope, and describes Pilot A make several soaring beats across the face of the hill. These beats were approximately 60 metres long, and he was maintaining a position 30-40ft in front of the ridge and approximately 10-15ft above the height of the ridge. He estimated Pilot A's speed over the ground to have been 10-15mph. He states that Pilot A then brought his glider into a hover, two or three feet above the ridge, just behind the lip, for a period of 5-10 seconds. This was some 20m N of his launch position. Pilot A then flew forwards and commenced a beat to the South. He gained height on this beat and then turned left and flew back over the hill, on what appeared to be part of a top landing circuit. He was approximately 30ft above the ridge and 30m back from the ridge. His canopy was then seen to suffer a deflation of the entire right side of the wing. The canopy dived forward and fell to the ground.

The flight had lasted somewhere around 10 minutes in total.

Pilot B reached Pilot A, who was unresponsive. He summoned the emergency services by mobile telephone at 12:19 and then, because a helicopter was being sent, stowed Pilot A's canopy. After a few minutes it became clear that Pilot A was not breathing and Pilot B then carried out CPR under instruction from the emergency services operator. All branches of the Emergency Services involved had considerable difficulties locating the scene. The Air Ambulance eventually landed close by and the paramedic reached the casualty at the same time as the Police (who had climbed the hill on foot), both arriving fifty one minutes after the initial call. The police and paramedic took over resuscitation efforts. Pilot A was pronounced dead at the scene at 13:25.

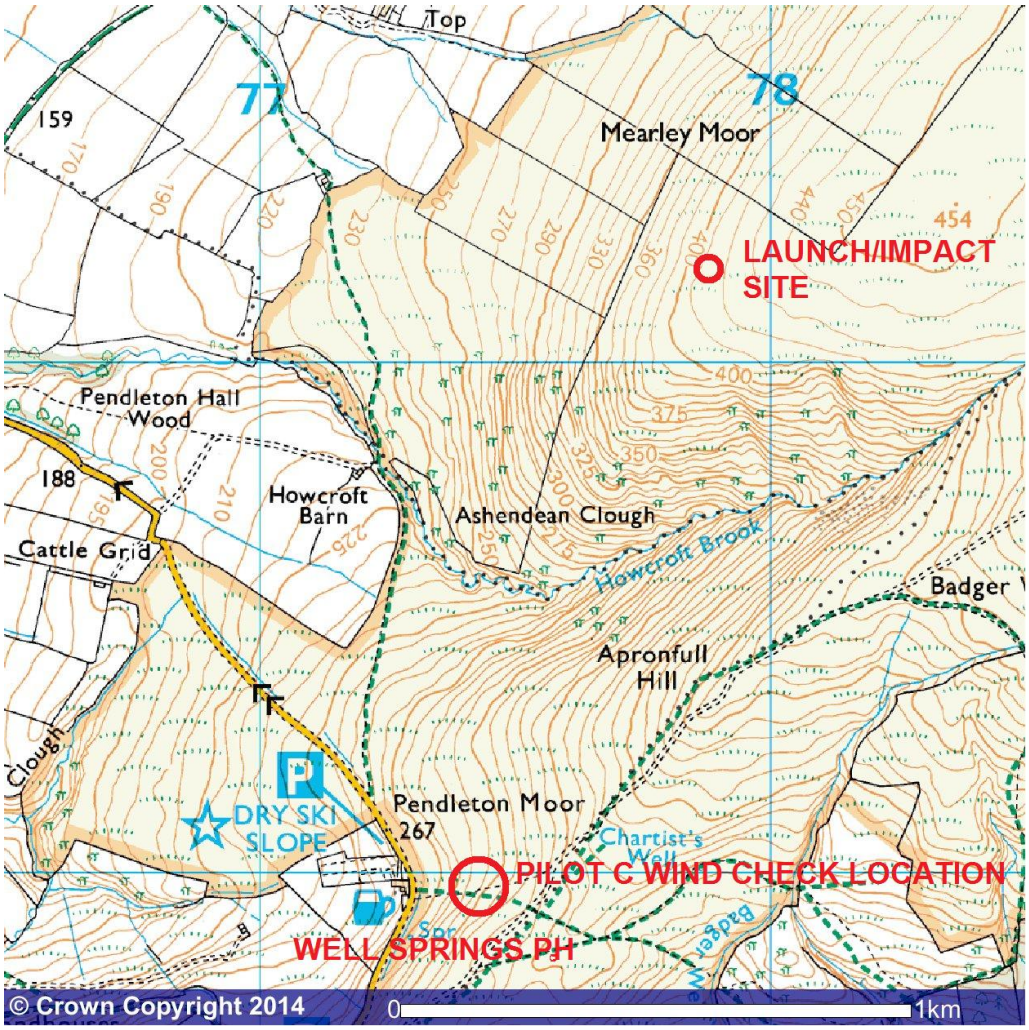

Fig 1: Map.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	1	-	-
Serious	-	-	-
Minor / None	-	-	-

1.3 Damage to the aircraft

None.

1.4 Personnel information

Pilot A.
DOB: 11/06/1965

Pilot A was a keen kite surfer, who started paragliding (mini wing) around May 2013, and was self-taught. He is known to have flown at least two sites in addition to Pendle hill which he had flown on four or five occasions. He normally ridge soared his glider, and had top landed during some of his previous flights at other sites. (It is not known whether he had top landed at Pendle Hill previously.) It is estimated that he had about 4 hours experience on mini-wing paragliders.
Pilot A is also known to have been a keen paramotor pilot. He was again self-taught in this discipline. He had applied to join the BHPA on 6/11/2013 and as part of this had indicated that he started paramotoring in April 2012 and had a total of 79 hours.

Pilot C is a paraglider and mini-wing pilot with 11 years experience on paragliders and over 1000 hours, and seven years experience on mini-wing paragliders.

1.5 Aircraft information

Ozone Firefly2 16m2
Serial Number FF-N-24D-009
Max total weight in flight: 110kg
Min total weight in flight: 55kg
The glider type is not certified.

The glider was manufactured in June 2012. Pilot A bought it brand new and unflown in November 2013, to replace his existing glider which was an identical make and model. He had flown the new glider on a small number of occasions prior to the accident.

A detailed examination of the glider was carried out after the accident. It conformed to specification in every respect, with no defects.

The glider had a warning placard attached, with information which was also included in the Owner's Handbook for the glider. This is reproduced below:

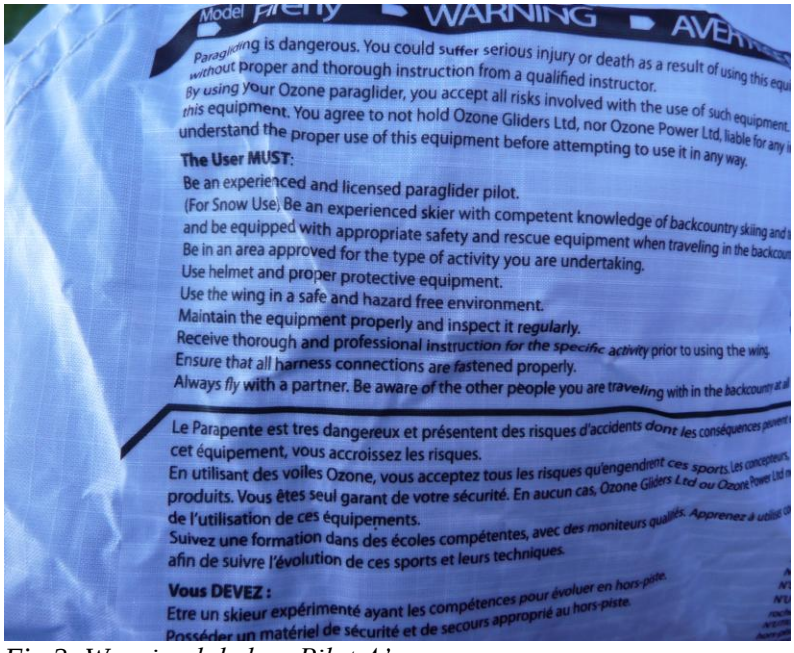

Fig 2: Warning label on Pilot A's canopy.

Fig 3: Data placard on Pilot A's canopy.

The full text of the 'warning' notice is reproduced below.

WARNING
Paragliding is dangerous. You could suffer serious injury or death as a result of using this equipment. Using this equipment improperly greatly increases the risks involved. Never use this equipment without proper and thorough instruction from a qualified instructor.
By using your Ozone paraglider, you accept all risks involved with the use of such equipment. The designer, manufacturer, distributor, and retailer cannot and will not guarantee your safety when using this equipment. You agree to not hold Ozone Gliders Ltd, nor Ozone Power Ltd, liable for any injuries to yourself or to third parties resulting from the use of this equipment. It is essential that you understand the proper use of this equipment before attempting to use it in any way.
***The User MUST**:*
Be an experienced and licensed paraglider pilot.
(For Snow Use) Be an experienced skier with competent knowledge of backcountry skiing and terrain, and be equipped with appropriate safety and rescue equipment when traveling in the backcountry.
Be in an area approved for the type of activity you are undertaking.
Use helmet and proper protective equipment.
Use the wing in a safe and hazard free environment.
Maintain the equipment properly and inspect it regularly.
Receive thorough and professional instruction for the specific activity prior to using the wing.
Ensure that all harness connections are fastened properly.
Always fly with a partner. Be aware of the other people you are traveling with in the backcountry at all times. Use the buddy system.
NEVER use your wing in turbulent wind conditions.
NEVER use your wing in a populated area or an area not approved for Flying.
NEVER use your wing in a ski area or on a ski slope / ski piste.
NEVER use your wing around hazardous obstacles such as ski lifts or trees or rocks.
NEVER use your wing unless you have adequate safety and rescue equipment for winter backcountry travel such as avalanche transceiver, shovel, probe, and other avalanche safety equipment.
NEVER use equipment if there is any damage to harness, risers, webbing, lines, cloth or stitching.

Harness GIN Speedrider harness.
The GIN Speedrider Harness was found to be in as new condition, with no defects.

Helmet Kiwi full face. The helmet has sustained severe impact damage to the front top right.

Instruments: None

1.6 Meteorological information

Pilot B has stated that the wind direction was WNW (West-North-West) and the wind speed estimated at 5-10mph on arrival at the launch point and 12-17mph at time of Pilot A's launch/accident. (The video evidence supports the 5 – 10mph initial wind strength estimate.) He noted that the wind was increasing in strength from the time of arrival at the hill top to the time of the accident.

Fig 4: Weather conditions as Pilot B prepared for flight.

Pilot C assessed the weather conditions from his position above the car park and stated: '*I decided pretty quickly that it wasn't flyable as the wind was varying from 8mph to 21mph on a lower shallow part of the hill with a sharp feel to the gusts.'* He further stated: *'I didn't entertain any thoughts of should I fly myself as I only had my paraglider with me and the wind was gusting from 8 to 21 mph at the car park let alone the added strength of wind with extra height and venturi on the main face. I would not have flown on my mini wing either even if I had it with me on that day as it was too gusty.'*

A Met Office aftercast was obtained for the area at the time of the accident. This states that: *in the hour preceding 1300 UTC, the surface observations show a west to north-westerly wind with reports of between 10 and 15KTmean speeds inland, and 15 to 20 KT along the west coast. A gust of 25KT was reported at Blackpool and a gust of 30KT was reported at Bingley (860 feet high). An estimated gradient (approx 2000FT) wind is north-westerly 30 KT.*

The accident location was approximately 1400 feet amsl. From the information above, the expected mean free air wind speed at 1400feet would be likely to have been somewhere around 25KT – and considerably stronger in the gusts.

Air flowing over hills is accelerated by venturi effect. It is therefore normally the case that the wind speed on the windward face of a hill is greater than the free air speed. So the expectation would be that 25KT is a conservative mean wind speed estimate for the accident location.

1.7 Aerodrome and approved facilities

Pendle Hill is a WNW facing inland ridge.

1.8 Medical and pathological information

The Post Mortem revealed that the pilot had died instantly from neck injuries.

1.9 Survival aspects

a. Pilot A was not equipped with an emergency parachute. This is normal with mini-wing paragliders, which rarely, if ever, operate at a height where the pilot would have time and space to deploy an emergency parachute.

b. All branches of the Emergency Services involved had considerable difficulties locating the scene. Because of this, it was some fifty one minutes after the initial call before the paramedic reached the casualty. The Incident Log shows that Pilot B had accurately described the location as being on the 'Clitheroe side of Pendle' and then 'where the road goes over the Nick of Pendle, where the Wells Springs and Ski club is'. And then 'summit of the hill facing Clitheroe – Mearley Moor'. This will be discussed further in the Analysis section.

1.10 Flight recorders

The pilot had a helmet-mounted GoPro camera, and was in the habit of filming his flights. He had filmed Pilot B's flight, with the camera hand held, and this was recorded on the SD card. He had then reinstalled the camera in the helmet mount. However, no further recordings were found. The SD card was analysed by the Police in case a recording of the accident flight was present but corrupted due to the impact or camera battery failing, but nothing was found.

1.11 Organisational and management information

Mini-wing paragliders.

Small paragliders are a relatively new branch of paragliding, having been introduced in Europe around 2005. Originally they were ski launched, but very rapidly people started hill launching them. They are now seen and used in most countries around the world.

There are two key strands to paragliding with small/mini wings. Some enthusiasts use the small wings to fly down steep slopes at high speed, very close to the surface, before landing at the bottom of the hill – rather like skiing but without the snow. This is known as 'speed flying' or 'speed-gliding'. The other strand is those enthusiasts who operate their small paragliders exactly like regular paragliders, to soar above the hill on flights lasting thirty minutes or more. (The difference from normal paragliders being that the glider is smaller and therefore requires higher wind speeds to generate the necessary 'hill lift'.)

The BHPA recognised these two distinct strands and agreed two systems for small gliders to exist within the BHPA. A new, special system of training was introduced for those who wished to fly down the slope

to the bottom. For those pilots who wished to soar like 'normal' paragliders, then normal paragliding skills and knowledge were required, and therefore the normal paragliding Club Pilot training course has to be completed.

There is no legal requirement for the pilot of any type of paraglider to have undergone training or to hold any type of qualification.

There is a trend for kite surfers to move into mini-wing paragliding. These enthusiasts are likely to approach this form of aviation with little or no flight training and little awareness of the very different risk profile when moving from a water sport to aviation.

1.12 Additional information

The flying site is on land managed by Lancashire County Council, and the Pennine Soaring Club have a negotiated licence for its members to use it, subject to certain conditions. Neither Pilot A nor Pilot B were members of the Pennine Soaring Club.

SECTION 2 – ANALYSIS

There are discrepancies between Pilot B's and Pilot C's accounts of the flight. This is not unusual. Both witnesses were only casually observing the flight, intermittently. Pilot B had some of the flight obscured by the terrain, and Pilot C was just over a kilometre away. It seems probable that the 'hovering' episode that Pilot B mentioned was actually the re-launch of the canopy that Pilot C observed.

A: The Incident

The canopy suffered an asymmetric collapse whilst the pilot was making a top landing approach. This collapse was at a very low height – 20 to 30 feet or less. There was therefore no height available for recovery.

A mini-wing will suffer collapses if it flies into sufficiently turbulent air. The likelihood of a collapse is increased if the pilot makes large steering inputs whilst in turbulent air. It is considered probable that both of these factors may have played a part in this accident.

Wind Speed and Turbulence:

The video evidence tallies with Pilot B's assessment of the wind speed being approximately 5 – 10mph when they first arrived at the take-off location. Pilot B mentions the wind speed then increasing. Given the weather aftercast and Pilot C's wind assessment it seems certain that during Pilot A's flight the mean wind speed at the time and exact location of the accident was at least 18 to 25mph. (It is not possible to soar the 16m mini-wing paraglider in lower windspeeds.) Quite probably it became even stronger than this – and the aftercast and Pilot C both indicate that strong gusts were present. So the evidence suggests that the wind conditions seemed suitable for flight initially, but very rapidly became unsuitable.

The air close to the ground can be affected by mechanical turbulence – and the effects of mechanical turbulence are much greater when wind speeds are higher. Doubling the wind speed results in a quadrupling of the turbulence. The shape of the hill face at Mearley Moor is nearly ideal for paragliding, being smoothly rounded. But there are changes of curvature near the top, and some 'scallops', and it is quite possible that these will have produced mechanical turbulence (in the form of rotor) in the wind strength at the time of the accident. Paraglider pilots who fly the site regularly state that the site is normally free from these effects – but normal paragliders (typically $26m^2$ wing area) fly in lower wind speeds than were present at the time of the accident. It is quite possible that Pilot A was the first pilot to ever attempt to top land that part of the hill in those wind strengths.

Another related factor is wind gradient, where the air in contact with the ground is slowed up by mechanical friction, and the next layer of air above it slowed up by contact with that layer and so on. These effects can be pronounced close to the surface.
The headcam footage available from just before the accident show the weather on the day. The cloudbase is a few hundred feet above the hill top, and there are large cumulus present. There would therefore almost certainly have been significant convective effects (vertical currents and wind shears).
In addition there are signs that the approaching weather is being organised into bands, at right angles to the general flow. This would indicate the presence of wave. This is an effect where the air flows up and over a range of hills upwind, and then continues to oscillate downwind. Depending on the position of these 'waves', a pilot flying on a hill downwind of the initiating ridge could be in an area of smooth rising air, strong horizontal air, light winds, or turbulent descending and rotating air. These waves can change 'phase' very rapidly, with a similarly rapid change in flying conditions on the hill downwind.
The four factors mentioned (mechanical turbulence, wind gradient, convection and wave effects) all appear to have been present on the day, and it is considered probable that one or more of these effects was a major factor in the asymmetric collapse of the canopy.

It is noted that the very experienced Pilot C had assessed the weather conditions as being unsuitable for flying.

Top Landing Approach and steering inputs:
Pilot B states that Pilot A had commenced what is believed to have been a landing approach by flying downwind from the ridge face. This would presumably have been followed by two left 90^0 turns to bring him back into wind for landing. This is the classic aircraft type landing circuit. (It is also possible that Pilot A was planning to make a single 180^0 turn back into wind.) Experience from over thirty years with hang gliders and paragliders has shown that the classic aircraft circuit type approach and the 180^0 turn variant are both totally unsuitable for top landings. They both involve the glider flying downwind, generally at very low altitude, and having to make significant steep turns whilst descending in wind gradient. Also, the vastly increased speed over the ground (in this case in the order of 50mph when flying downwind), and resulting space used when making a turn, leads to pilots making increased aggressive control inputs, which can in themselves lead to departures from controlled flight. Many accidents resulted from this in the early days of the sports. Trained paraglider pilots are taught a method of top landing that is called the 'crosswind crabbing approach'. At all stages during this type of approach the canopy is flying facing largely into wind. Only one very small turn is required.

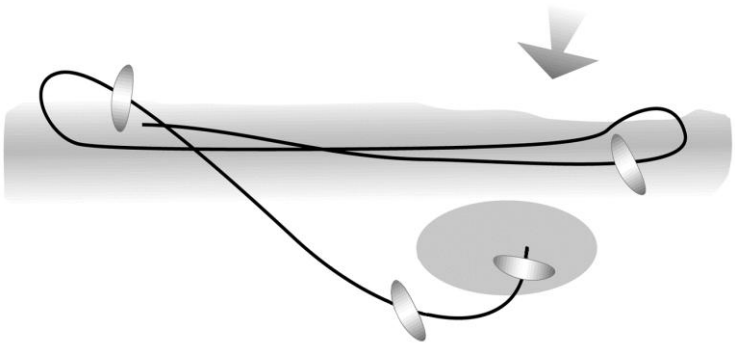

Fig 5: The 'Crosswind Crabbing Approach'.

The manufacturer of the wing has commented: *In our experience this sort of wing only collapses in very turbulent air or because the pilot made an input at a time when the flow over the wing was not consistent.* He added that if the collapse occurred*: whilst flying wholly or partially down-wind* [then we]

would think that as travelling with greater speed (over the ground) than normal, any input is often more aggressive than normal. That may have caused the collapse.

B: The delayed arrival of the Emergency Services

All branches of the Emergency Services involved had considerable difficulties locating the scene. Because of this, it was some fifty one minutes after the initial call before the paramedic reached the casualty. (Apparently the Air Ambulance was circling the area for twenty five minutes, trying to visually acquire the casualty.)

The Incident Log shows that Pilot B had accurately described the location as being on the 'Clitheroe side of Pendle' and then 'where the road goes over the Nick of Pendle, where the Wells Springs and Ski club is'. And then 'summit of the hill facing Clitheroe – Mearley Moor'. Unfortunately these are all local landmarks, and proved to be of little use to the emergency services. (Air Ambulances may fly in from 50 miles away: the crews are unlikely to know local landmarks.)

In general the emergency services use post codes as their primary location identifiers. Obviously, for walkers, ramblers, mountain bikers, paraglider pilots etc, who are often in remote locations, post codes are of no value. The alternatives are using Latitude and Longitude or the Ordnance Survey grid system. (Unfortunately there have been anecdotal reports of Control Centre operatives insisting on a Post Code and refusing to accept OS grid coordinates.)

This investigation has been able to confirm that whilst, as stated above, post codes are the primary location identifiers used by the various UK Emergency service call centres, all are equipped to deal with locations passed using the OS Grid system. It has also been confirmed that some, if not all, Air Ambulances (and all Search and Rescue helicopters) are equipped with a device that can read OS grid references and feed that information into the aircraft's navigations system.

The issue of directing the emergency services to accidents in remote locations has arisen previously in paragliding accidents, and several paragliding clubs have issued their members with a credit card sized 'Emergency Action Card', which gives OS grid references for all their sites. The Pennine Soaring Club 'Emergency Action Card' is reproduced in figure 6.

EMERGENCY ACTION CARD

1. **GIVE FIRST AID** – ***secure the wing first*** to prevent dragging injury
2. **GET HELP**: Dial 999 and ask for Ambulance. To ambulance dispatcher, advise "***Fall from height, suspected significant injury, difficult access, helimed needed***." Give OS grid reference (see over) and local radio frequency 143.950MHz. When helimed is confirmed on the way, give phone to person administering first aid – dispatcher can advise them.
3. **PREPARE FOR HELICOPTER**: Clear airspace. Two whistle blasts means "HELI COMING, LAND NOW!". Repeat at 1 minute intervals until everyone is down. When on the ground, secure all loose objects, including any debris. If possible notify Bowland Gliding Club on 01995 61267 or 07779 44128. When heli arrives…
4. **INDICATE CASUALTY**. Stand with arms in a Y shape. Don't wave.

PENNINE SOARING CLUB AIR AMBULANCE GRID REFERENCES

Postcodes are no good. Do not give site name – just Grid Reference.

Parlick	Sierra Delta 598 451
Pendle	Sierra Delta 782 403
Longridge	Sierra Delta 644 406
Winter Hill	Sierra Delta 660 150
Edenfield	Sierra Delta 818 179
Nont Sarahs	Sierra Echo 018 137
Pule	Sierra Echo 033 104
Larkhill	Sierra Delta 997 075
Millstone Edge	Sierra Echo 012 105
Balladen	Sierra Delta 815 215

Fig 6: Pennine Soaring Club 'Emergency Action Card'.

The Pendle Hill site is some 3 kilometres long, so a central grid reference may not be the precise accident location. In this particular accident, the Emergency Action Card grid location would have got the Air Ambulance straight to a location 450 metres from the accident.

Recently, various Apps for smart phones have become available, which use the smart phone's in-built GPS to give a location accurate to a few metres. (E.g. The Devon Air Ambulance Trust app which covers the whole of the UK.)

It seems probable that the Air Ambulance crew would also have had earlier success at spotting the casualty if the 16m^2 paraglider had been left opened out as a visual marker. There is a conflict here between the need to make sure that there are no loose objects around on the ground which could be sucked into the helicopters rotors or engine, and the need to do everything possible to ensure an early sighting. In this particular accident the helicopter had to land a few hundred metres away, where the ground was more level. It appears to be the case that Air Ambulances always land a hundred metres or more away from the casualty, to minimize the dangers and disruption. It would only be winch equipped Search and Rescue helicopters that would hover directly overhead – and even then they would normally land some distance away and the winchman/paramedic would access the casualty by foot and prepare them for winching up if this was required.

SECTION 3 – CONCLUSIONS

The investigation found that the untrained pilot was attempting a circuit style landing approach to a top landing in winds that had rapidly increased to being fresh/strong and gusty, and the mini-wing paraglider departed from normal flight at a position from which there was insufficient height and time to recover.

SECTION 4 - SAFETY RECOMMENDATIONS

The BHPA FSC should consider updating the advice on ‘Action in an Emergency’ to include spreading the paraglider out as a visual marker, next to the casualty, until it is certain that the helicopter crew have identified the location.