British Hang Gliding and Paragliding Association

REPORT

Investigation of a powered paragliding accident
which occurred at Cheriton, Hampshire,
on 29th August 2009
in which the pilot suffered injuries from which he later died.

Introduction

On 29th August 2009 the British Hang Gliding and Paragliding Association (BHPA) received reports of an air accident at Cheriton, Hampshire involving a powered paraglider. The BHPA was requested by the Air Accident Investigation Branch of the Department for Transport to carry out an investigation and produce a report under its delegated authority. 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.

BHPA investigation serial number: 09/102

Summary

After waiting for the weather conditions to moderate the paramotor pilot took off. After a few minutes of flight he returned to the field at approximately 100feet agl and killed the motor, preparatory to landing. The canopy rocked forward and suffered a large asymmetric collapse. The canopy dived and turned through 180 degrees as it re-inflated but there was not sufficient height to fully recover.

The investigation concluded that the cause of the accident was that the pilot lost control of his wing in pitch in demanding weather conditions.

This document is confidential until ratified.

Date ratified by the BHPA Flying and Safety Committee: 4th December 2009

THE STRUCTURE OF THE REPORT

The structure of this report conforms to that recommended in the BHPA Technical Manual and is intended to follow 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 Saturday the 29th August 2009 the annual Cheriton village August bank holiday beer, music, cricket and balloon festival was taking place.

The balloons had been unable to fly in the morning due to strong winds. At about 17:00 hrs, hoping for the wind to drop off in the evening, about six balloon crews from the Mid Hants Balloon Club drove their vehicles and trailers into the field adjacent to the village and, after an informal met briefing, began to set up their equipment. Small helium 'met' balloons were released periodically to check the winds – these showed some turbulence at approximately 100 feet agl and that the wind was still too strong for the balloons to fly. The balloon pilots continued to prepare their equipment so that they would be ready to fly if the wind dropped.
Several other cars and spectators also gathered in the field. This totalled approximately sixty people and ten vehicles.

The paramotor pilot was known to several of the balloon pilots as he was also training as a balloon pilot and had flown his paramotor with them before. After attending the Met briefing he had prepared his equipment in the field and carried out a power check. A few minutes later he was seen to take off towards the West and climb to approximately three hundred feet agl. The take off and climb out were unremarkable. He then flew over in the direction of the cricket field where a match was in progress. A witness reports seeing the paramotor 'sway from side to side a little' at this point. Shortly afterwards the pilot turned back and arrived over his take-off field, heading downwind at approximately 100 agl. He then made a tight 180 degree turn to the left, over the middle of the field, with the motor running and developing power. This positioned him slightly to the North West of the centre of the field. As the paramotor completed the turn and faced back into wind its groundspeed dropped to nearly zero with the wing pitched back approximately 20 degrees. The wing rocked to the right and then, as the engine was cut, it pitched smoothly forward and left, reaching a position approximately 40 degrees forward before the left hand wing collapsed. The machine then fell, turning left. The wing quickly re-inflated but was then diving vertically, having turned through 180 degrees. The wing was beginning to pull out of the dive when ground impact occurred.

The accident happened at about 18.45. The entire flight lasted approximately three minutes.

Onlookers ran over to assist and administer First Aid and the emergency services were summoned. The pilot was cut from the wreckage and was taken by ambulance to Hospital.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others

Fatal	1	-	-
Serious	-	-	-
Minor / None	-	-	-

1.3 Damage to the aircraft

The paramotor frame suffered some distortion and disruption in the ground impact. There was no evidence of any pre-impact failures.

1.4 Other damage

None

1.5 Personnel information

The pilot had undertaken a two week paramotor training course in Slovakia in 2003 with additional practical flying lessons with an unidentified Instructor in the UK. Since that time he had amassed a total of 42 hours experience (67 flights).

The pilot was 176 cms (5'9") tall and weighed approximately 96 kg (15 stone)). His D.o.B. was 25:04:77.

The pilot had been a BMAA member – this expired in 2007.
The pilot was undertaking training as a balloon pilot.

The pilot had never been a member of the BHPA.

1.6 Aircraft information

Canopy
Powerplay Sting 160 (This is a power version of the Swing Arcus paraglider wing.)
Serial Number 35 231 18488
Max total weight in flight DULV: 160kg
Min total weight in flight DULV: 95kg
Wing Area 27.4m2
The canopy type is certified DHV 1-2 (with closed trimmers) and DULV (suitable for schools).

It is believed that the canopy was supplied brand new to the pilot.

The canopy was examined after the accident and found to be in very good condition. The trimmers were both closed (increased angle of attack).

Paramotor
Walkerjet Simon 210 fitted with a two blade wooden propeller.

Helmet

Lynx open face and ear defenders/headset.

Emergency Parachute
No emergency parachute was carried.

Instruments
A Brauniger AV-Pilot alti vario was carried.

1.7 Meteorological information

The Met briefing that was discussed by the pilots in the field included the Met Office 'Evening balloon wind forecast', the Met Office 'Afternoon balloon wind forecast', Airmet and the 'XC Weather' wind observations.

- Met Office 'Evening balloon wind forecast' forecast a wind speed of 16knots at 500feet.
- Met Office 'Afternoon balloon wind forecast' forecast a wind speed of 10-14kt, becoming 6-9 knots.
- Airmet forecast a windspeed of 20knots at 1000ft.
- The 'XC Weather' wind observations gave 15:50 wind speed of 14mph (having dropped from 17mph at 14:50) and predicted this dropping to 10mph at 19:00 and 7mph at 22:00.

A spectator at the field described the weather conditions at the time of the accident as follows: *'At this time the sun was out to the west, and apart from a few periods of cloud which obscured the sun the sky was clear. Visibility was good. The temperature was cool and there was a strong breeze blowing across the field.'*

One of the balloon pilots reported that the wind in the field was *'in excess of 10knots, with gusts'*.

An aftercast was obtained from the Met Office for the date, time and location of the accident. Using a wide variety of data sources this showed that at the time and location of the accident, the weather was dominated by an unstable northwesterly flow. Immediately to the north was a band of deep convection with reported cumulonimbus clouds and heavy precipitation evident on the radar.

A summary of the observations for 1800 UTC and 1900 UTC at RAF Odiham and Boscombe Down are shown in the following tables:

Measurement Type	***Value at 1800 UTC***	***Value at 1900 UTC***
Air temperature	*16 deg C*	*15 deg C*
Dew point temp	*07 deg C*	*09 deg C*
Visibility	*35 KM*	*30 KM*
Cloud extent & height (AGL)	*3 octas at 4800 ft, CU.*	*3 octas at 2200 ft, CB*
QNH	*1014.3 hPa*	*1015.3 hPa*
Surface wind	*270/20KT gust 32KT*	*270/15KT gust 31KT*
Weather	*NIL*	*Precipitation observed but not reaching the station*

Table 1. Surface observation from RAF Odiham on 28/08/2009 (manual observation).

Measurement Type	***Value at 1800 UTC***	***Value at 1900 UTC***
Air temperature	*15 deg C*	*11 deg C*

Dew point temp	*09 deg C*	*09 deg C*
Visibility	*35 KM*	*10 KM*
Cloud extent & height (AGL)	*1 octa at 3100 ft*	*1 octa at 400ft* *5 octas at 2900 ft*
QNH	*1015.2 hPa*	*1016.7 hPa*
Surface wind	*270/15KT gust 31KT*	*290/20KT gust 36KT*
Weather	*NIL reported*	*NIL reported*

Table 2. Surface observation from Boscombe Down on 28/08/2009 (automatic observation).

RAF Odiham is 16 miles to the NE of the accident site. Boscombe Down is 26 miles WNW of the accident site.

Of particular interest are the observations of actual surface wind strengths of 15 to 20Kt, gusting 31 to 36Kt.

The aftercast also includes the following: '*The wind was a strong west to northwesterly, with gusts in the local area reported up to 36KT. This would have caused wind-induced (mechanical) low level turbulence.'*

1.8 Aids to navigation

Not applicable.

1.9 Communications

Not applicable.

1.10 Aerodrome and approved facilities

The accident occurred in a roughly triangular shaped field with its base facing North. It is bordered on its North side by Hill House Lane, on its South East side by houses, the churchyard, tennis courts and then further houses, and on its South West side by agricultural land and the cricket field.
The field surface was short grass pasture with patches of 'stinging nettles'. The field sloped uphill in the west corner.
The village of Cheriton is located on the northern edge of the South Downs. The village lies in a shallow valley, with a stream (the origin of the River Itchen) running through it. The valley runs almost due North. The valley side slopes up to the West some 150 feet over a distance of 500 yards. Mature trees line both sides of the road to the North West of the accident location, with other rows of trees on field boundaries further up the slope.

1.11 Flight recorders

N/a

1.12 Wreckage and impact information

The paramotor frame had sustained some breakages and twisting in the impact. The propeller was intact, indicating that the engine was not running at impact. Several litres of fuel were in the fuel tank (it was approximately half full) and some had leaked out of a ruptured pipe. The canopy was undamaged.

1.13 Medical and pathological information

The pilot suffered multiple fractures in the accident. He died in hospital six days later as a result of medical complications.

1.14 Fire

None.

1.15 Survival aspects

The pilot did not carry an emergency parachute. In the general circumstances of this particular accident it was considered extremely unlikely that the pilot would have been able to deploy an emergency parachute in the time available between losing control of the canopy and ground impact.

1.16 Tests and research

As part of this investigation the paramotor engine and fuel system were recovered and mounted on a test frame. The engine started and ran faultlessly, using the original fuel.

1.17 Organisational and management information

Not applicable.

1.18 Additional information

It is known that the pilot would normally, when preparing to land, cut his motor when above the field and then glide down to land. This is common paramotor practice.

The pilot's most recent flight prior to the accident was on Tuesday 11th August 2009. This was a five minute flight, cut short because *'he did not feel that the wind conditions were in his favour.... the wind was too strong'*.

1.19 Useful or effective investigation techniques

A spectator had videoed the proceedings and had captured the paramotor's launch and the accident. This footage proved invaluable.

SECTION 2 – ANALYSIS

Three principal causal factors are involved in this accident: the weather, the flying site and the pilot's handling of the paramotor.

The pilot returned to the field after a very short flight and turned back into wind at approximately 100 feet agl in a position slightly to the North West of the centre of the field. The paramotor engine then stopped. As no defects have been found with the power unit (which has been successfully run since the accident) it is assumed that the pilot intentionally cut the motor. This was his normal method of setting up a final approach for landing.

It is not certain why the pilot chose to land so soon after taking off – but given the report of the aircraft swaying from side to side when over the cricket field and the aftercast weather report, it is highly likely that he was unhappy with the weather conditions. The behaviour of the paramotor as seen in the video also is consistent with turbulent conditions. It is known from his penultimate flight that he would cut a flight very short if unhappy with the conditions.

It is not entirely clear why the pilot chose to commence a landing approach from this position in the field – as this placed him closer to the tree line that would have been likely to cause turbulence. It also necessitated a tight left turn against the torque of the power unit. Normally a position downwind of the centre of the field would be favoured for the landing' target' and a wider, more structured approach path chosen. It is possible that he was avoiding positioning himself downwind of a balloon which had been inflated as well as positioning for a space in the field that was unoccupied.

The weather and flying site:
The forecasts used by the pilots gave some room for optimism that the winds would ease towards evening. This is often the case on summer evenings: as the thermals die away into the evening there is less vertical mixing of the airflow and very light wind conditions can ensue on the surface. However, the aftercast clearly shows that the actual weather at the time of the accident was unsuitable for flying a paramotor. Normally these machines are operated when winds at ground level are very light. At the time of the accident the measured ground level wind speeds at nearby airfields was 15 to 20 knots, gusting 31 to 36 knots. (The degree of mechanical turbulence increases as the square of the wind speed increase.) But it is also clearly the case that the wind speeds at ground level at the field in use were not as strong as those measured at surrounding airfields: video analysis of the behaviour of the balloons on the ground and the paramotor's take off and climb out would indicate a surface wind at that moment of approximately 5 to 10 knots. The discrepancy is almost certainly due to the topography of the Cheriton area and the resulting wind gradient. The village and field are located in a hollow, and with the wind and weather prevailing on the day the conditions on the ground would have provided a false indication of the true flying conditions existing a hundred feet or so above the field. The fact that the paramotor had virtually zero groundspeed when it turned into wind above the field indicates that it had encountered a wind speed of approximately 20 knots, either as a gust or as the true wind at that height. The westerly wind would have mainly been blowing across the top of the valley, with a lesser amount of flow running down the slope towards the field, almost certainly as a series of turbulent eddies. This flow would then have met the rows of large trees on the valley side and field boundary, producing further mechanical turbulence. So the field would have experienced 'sheltered' conditions – which are very dangerous for aviating. Any flight at low level in the vicinity of the village in the prevailing weather conditions would have been expected to encounter very turbulent air.

The pilot's handling of the paramotor:
Analysis of the video show that the pilot made a tight turn to the left, against the torque of the power unit, and as he straightened up facing into wind and removed the left brake input, the torque rocked the wing to the right. At this instant the pilot switched off the engine – whilst it had been at a moderate throttle setting. When a paramotor is flying under power, the low thrust line results in the pilot swinging fractionally forward of the wing. When power is removed then the wing swings forward over the pilot. If the reduction in power setting is rapid then the wing will pitch forward more dramatically. It is therefore necessary to make power changes smoothly and progressively – and to be ready to control the wing in pitch with the brakes. With paramotors the trailing edge 'brakes', the throttle and the wing momentum all have to co-ordinated. In this accident the wing was pitched back approximately 20 degrees and rolled a few degrees to the right at the moment when the engine was cut. The wing then rocked smoothly forward and left, reaching a position approximately 40 degrees forward before the left hand wing collapsed. There was no sign of application of the brakes which should have stopped the wing's progress forward. Once the wing reached a pronounced forward position then a collapse was inevitable: paraglider/paramotor wings remain inflated when the airflow around them is at a positive angle of attack.

At reduced or negative angles of attack they will collapse, in much the same way as a sailing boat's sails will luff if held too close to the wind.
If the wing had pitched forward with no roll then it would almost certainly have suffered a symmetric frontal collapse, which would have self-recovered with very little height loss.

'Active Flying':
In this accident the pilot lost control of his wing when it pitched forward, almost certainly as the result of a too rapid reduction in motor power. (Turbulence may also have played a part in this.) The pilot did not appear to apply brake which would have limited the pitch forward, and so prevented the collapse. Under the British Hang Gliding and Paragliding Association's (BHPA's) Training Programme, student paramotor pilots are taught 'active flying' which is the process of exercising constant accurate pitch control to keep the canopy above the pilot's head and to maintain the canopy's internal pressure. This involves applying brake to stop the canopy if it tries to rock forward (which can lead to a low angle of attack and collapses) and reducing brake if the canopy attempts to rock back (which can result in high angles of attack and stalls). Timely, smooth, instinctive, minimal inputs are the key. It is not known whether the pilot's training course in Slovakia included this content. It is also noted that the 42 hours experience the pilot had gained in six years was a very modest amount. (The 'average' UK pilot flies approximately 25 hours per annum.) The ability to recognise and deal with events instinctively when flying increases with experience and practice.

SECTION 3 – CONCLUSIONS

The accident was the result of the pilot losing control of his wing in pitch in demanding weather conditions.

SECTION 4 - SAFETY RECOMMENDATIONS

None.