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BHPA Incident Report: GBR-2022-27371

INCIDENT

Aircraft Type:	Powered paraglider. Paraglider wing: BGD Luna 2, size 23 (serial number (BG0920021A). Paramotor: Vittorazi Moster 185 engine with an E-Prop carbon fibre propeller and right-hand mounted hand throttle, fitted to Condor XS 93 frame by Hs COM; an Apco harness including a harness mounted Apco Mayday emergency parachute.
Certification:	DGAC. Not certified to EN 926-2.
Location:	Field belonging to New Church Farm, Tong Lane, Bradford.
Date and Time:	9th August 2022, approximately 18:00 UTC.
Type of Flight:	Local flight.
Persons Involved:	Pilot A
Injuries:	Cause of death listed as multiple injuries.
Nature of Damage:	Damage to the paraglider. Substantial damage to the paramotor.
Pilot's Rating/Licence:	None.
Pilot's Age:	54
Pilot's Experience:	No logbook available.
Information Source:	Police Witness Statements from Pilots B and C, Witnesses D, E, and H. A report and diagrams from Pilot B; reports from Witnesses F and G, a photo provided by Witness G; paraglider inspection report from an independent service centre; a Met Office aftercast. RASP aftercast from Stratus.org.uk. Scene details provided by West Yorkshire Police. Video footage from Pilot B' s and Pilot C's mobile phones.

The objective of this investigation is to prevent future accidents and incidents. It does not seek to ascertain blame or apportion legal liability for claims that may arise.

The report is presented in de-gendered format to protect identities.

In this report the term "paraglider" refers to the wing or canopy, its lines and risers; "paramotor" refers to the engine unit and harness worn by the pilot. The whole assembly is referred to as a "powered paraglider" or "aircraft".

1.0 Synopsis.

Pilot A was making a flight on their powered paraglider from a field at Holme Farm, near Tong, a village between Leeds and Bradford. Pilot A was accompanied by two flying friends (Pilots B and C) who were on the ground when Pilot A launched. The conditions at the time of the incident flight were clear with light winds, described as “perfect for flying”.

Pilot A launched and climbed away from the ground, performing circuits of the launch field and surrounding area. They were estimated to be between 200 and 400ft above take-off altitude when their paraglider was seen to commence a left-hand turn. The turn steepened in bank angle and the wing entered a spiral dive which continued to the ground. Pilot A impacted the ground, sustaining fatal injuries.

2.0 History of the flight.

Pilot A and two flying friends (Pilots B and C) met at a field near the village of Tong at about 18:00 (local time) with the intention of flying their powered paragliders. The launch and landing field at Holme Farm was a field used with regularity by local paramotor pilots.

The pilots described the conditions as “hot” and “bumpy”, and they noted that conditions were thermic. They decided to wait until they had determined the conditions were more suitable.

At 19:00 the pilots checked the wind speed and direction, and noted from apps on their smartphones that the forecast windspeed was “no more than 5mph which is perfect for flying.” The pilots prepared their equipment. Pilot A had decided not to wear a helmet on this flight, although they were known to sometimes wear a helmet.

Pilot A launched using a forward inflation, videoed by the two other pilots from their positions either side of Pilot A. The aircraft climbed and Pilot A flew circuits of the field. Pilot A was seen to wiggle their legs – a signal that they were ok, pre-arranged between the pilots.

Two or three minutes into the flight, Pilot A was noted to be between 200ft and 400ft above take-off altitude, above a field on the southwest side of Tong Lane road (on the other side of the road from the launch and landing field). Their engine was heard to stop, and their paraglider was observed to begin a left-hand turn which progressed into a nose-down spiral dive to the ground. Pilot A was heard by witnesses to impact the ground. They were attended to by a number of witnesses. The emergency services arrived, and Pilot A was pronounced dead at the scene.

3.0 Focus.

Based on the information available, the Investigation considered the flying area and local flying conditions; Pilot A’s experience and currency; their equipment; and the part of Pilot A’s flight prior to their impact with the ground.

3.1 The flying area and local conditions.

3.1.1 The site from where the incident flight took-off is a flat field to the southwest of the village of Tong, on the corner of Tong Lane and New Lane. The field is evidently regularly used by paramotorists. Pilot A was known to have flown from this field on several occasions.

The crash landing occurred in a field on the opposite side of Tong Lane to the take-off field. This grassed field slopes from the roadway at its northwestern end gently to the southeast. The field’s border with Tong Lane is lined with trees.

The airspace above the field is within Leeds Bradford Control Region (CTR), classified as Class

D airspace, from the surface to 8,500ft[1]. The Investigation could not establish whether Pilot A had obtained permission to operate in this airspace.

The site location is shown on Fig. 1.

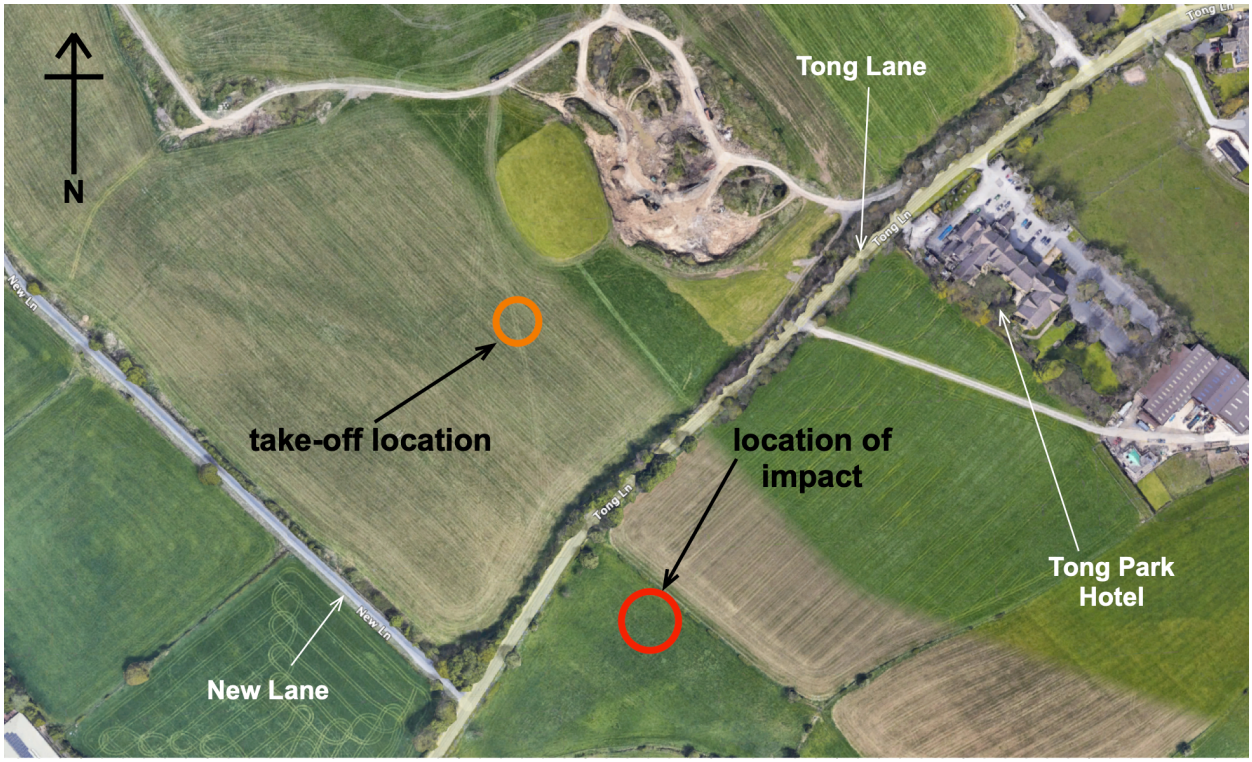

Fig. 1. The take-off and impact locations. Source: Google Maps 2022.

3.1.2 The conditions stated on the Met Office Aftercast for the incident day were as follows:

> The surface analysis chart shows that the UK was within an anticyclonic synoptic setup, with a dual-centre zone of high pressure situated across the country. This would suggest stable weather conditions with light and perhaps variable winds.
>
> The nearest coordinates with data on the F214 low-level winds chart are N5230 W00230. Here, the forecast winds were northerly 5KT at 1000FT, then variable 5KT at 2000-5000FT.
>
> …it is evident that conditions at the time and place of the incident were fine and dry with light and variable winds, and very little or no cloud below 5500FT. There was likely an elevated subsidence inversion, but the wind strength would suggest significant lee wave activity was unlikely.

The RASP historical forecast[2] for the afternoon of 9th August shows that winds were light and variable. The thermal updraft velocity was forecast to be greater than 400ft/min at the hottest part of the day. This could be expected to lessen in late afternoon or early evening; however, thermic activity in the area between Leeds and Bradford was forecast to remain into the evening.

It is of note that the pilots were aware of the thermic activity on the incident day and had elected to wait until they considered the activity had lessened as the day progressed into evening. The pilots did not report they had any way of measuring the wind speed or associated gusts at the site.

[1] FL85. This Flight Level is 8500 feet above the International Standard Atmosphere (ISA) sea-level pressure setting of 1013.2 hPa. It is of note that on a day of high or low pressure this reference datum may be significantly above or below mean sea level.

[2] http://rasp.stratus.org.uk

The Investigation determined from the reported conditions that even though the thermic activity had been noted by the pilots to have calmed down, the presence of turbulence associated with thermic activity could not be ruled out.

3.2 Pilot A's experience and currency.

3.2.1 Pilot B stated they had known Pilot A since their childhood. Pilot A had been paramotoring for between eight to ten years, however they took a break from flying in the middle of this period due to a motorcycle accident.

Pilot B stated that Pilot A initially learned to paramotor by watching Youtube videos. Around the start of the Covid pandemic Pilot A took lessons (described by Pilot B as a "refresher") with a local instructor who operated an independent (non-BHPA) school. Pilots A and B regularly flew together, sometimes as often as twice a week. They had regularly flown together for about two years.

Witness H (a relative of Pilot A) stated that Pilot A had previously "had some near misses where [they have] had a bad landing or had to make an emergency landing".

Witness D, local to the area, had last seen Pilot A flying their distinctively coloured paraglider wing approximately six weeks prior to the incident. Witness D had been told by a relative that Pilot A had been flying from the take-off field the weekend before the incident.

The Investigation cannot comment on Pilot A's flight currency as it could not established with accuracy when they had most recently flown, how often they flew, and in what conditions they had flown in. Evidence points to reasonably regular flight activity although this cannot be qualified without logbook evidence, which was not available to the Investigation.

Witness H stated that Pilot A left the house for work at 03:00 on the morning of the incident. It is not known whether Pilot A was able to get some rest after work and before setting off to fly. The Investigation considered that fatigue from a long period awake, exacerbated by the heat during the day, may have a bearing on piloting and decision making, and could not be ruled out as a contributory factor in the incident.

3.3 Pilot A's equipment.

3.3.1 The BGD Luna 2 paraglider is specified as suitable for "intermediate pilots up to competition racers" by the manufacturer BGD. The weight range is listed by the manufacturer as 90 – 140kg total weight in flight.

The Investigation used the following calculation to determine the approximate total weight in flight:

Pilot A	80.0kg
Summer clothing, footwear estimation	3.0kg
Paraglider	5.5kg
Paramotor including fuel (estimate) and ancillary equipment	29.0kg
Total weight in flight	117.5kg

The Investigation determined that Pilot A was within the manufacturer's listed weight range. It is of note that the total weight in flight was just into the upper half of the weight range. The user manual states that in this sector of the weight range the wing will have greater stability in turbulence but will be less damped in turns and collapses, and is recommended for pilots who prefer dynamic flight characteristics. The Investigation concluded that a wing of this size and wing loading would expose the pilot to rapidly building g force in the event of an induced tight turn or spiral dive.

3.3.2 An independent service centre inspected the paraglider and found that it had sustained minor

damage to the wing. The suspension lines on the left-hand side appeared to have been evenly and cleanly cut by an intentional manual action, evidently by Witness D during an attempt to move Pilot A from the aircraft wreckage. They were therefore incapable of being measured. The service centre reported that the right-hand side of the wing was in trim. The right-hand control line was slightly long (3cm). The Investigation determined that this would not have a significant effect on the flight characteristics.

3.3.3 The paraglider was visually inspected. Pilot B stated that Pilot A had recently acquired the paraglider and had made four or five flights on it. The material of the canopy showed signs of moderate use, and this was assumed to be from use by its previous owner or owners. The trim tabs on the risers were both set in the closed configuration for take-off and landing.

The left-hand control line was severed. The line had a different break type from the cleanly cut suspension lines. This line is shown in Fig. 2. The cut had occurred approximately 89 cm from the control handle. Fraying of the sheath (fluorescent yellow) and structural core (white) can be clearly seen. This suggests a different mechanism of damage from the cutting that had been performed to sever the suspension lines. The Investigation determined that the damage to the left-hand control line of the paraglider was consistent with contact with a rotating propeller.

Fig. 2: left hand control line cut, approximately 89 cm from the control handle.

3.3.4 Paramotor: Witness H stated that Pilot A acquired the motor and frame from new, having previously bought second-hand paramotors. Witness H stated that the flight on the incident day was the second flight Pilot A had made using this paramotor. Pilot B stated that Pilot A had made about three flights using this paramotor before the incident.

Pilot A evidently acquired the paramotor frame and engine from separate suppliers. Pilot B stated that the paramotor was assembled by Pilot A, who was known to be “good at the mechanical side”.

Pilot C stated that Pilot A had acquired the paramotor about six weeks prior to the incident. Pilot C made reference to an incident during Pilot A’s first attempt at flight with this paramotor, the launch being aborted as “loose cage netting caught the propeller blades and snapped them”.

3.3.5 The paramotor was made available to the Investigation and was visually inspected in its post-incident state.

The paramotor was fitted with a two bladed counter-clockwise turning carbon fibre propeller made by “E-Props”. In several areas, electrical insulation tape had been applied to propeller cage spar joints. The paramotor was fitted with a tachometer displaying 3.5 hours. An Apco “Air Comfort” harness was fitted to the paramotor. An emergency parachute in an outer container was mounted on the right-hand side of the harness.

Significant damage to the paramotor was evident, including bending of the main frame, fracturing of the propeller cage, fracturing of the left-hand suspension arm, rupturing of the fuel tank and damage to the starter cord assembly. Both propeller blades were broken in the same position, approximately 1/3 of the blade length from the hub.

The harness straps had been cut in several locations, evidently by a cutter used by the emergency services to remove Pilot A from the equipment.

The aluminium suspension arm (left-hand side) was broken in two, suggesting it had been subject to a significant force to the front-left of the assembly, commensurate with a left-hand turn whilst in rapid descent. Witness D reported seeing only a little amount of fuel in the tank, and a fuel smell (although they reported that nothing was wet below the tank). The damage to the fuel tank suggests it was subject to rapid deceleration and ruptured on impact, allowing the contents to drain rapidly.

3.3.6 The Investigation reviewed the condition of the carbon fibre propeller, the segments recovered from the scene, and the scene photos taken by the Police. The propeller debris was reportedly found in close proximity to the locus of impact.

Witnesses reported the noise from Pilot A's paramotor was heard to abruptly cease. Pilot B noted that the engine was still ticking over during the left-hand turn and had not cut out. The evidence suggests that the propeller blades were broken when they rotated into the ground under power, the engine spinning up because of an involuntary squeeze of the throttle at impact. The Investigation determined that the propeller being broken whilst airborne was extremely unlikely to have occurred and ruled out an airborne mechanical failure.

The Investigation noted that both blades of the propeller showed signs of a repair having previously been made, following damage evidently across the full width of both blades. This is illustrated on Fig. 3. A fibre mat had been used to re-join the broken blade sections. It is not known whether the repair was made following the incident described by Pilot C (see 3.3.4), or was made after another incident. Given the nature of the damage that the repair endeavoured to make good, it is apparent that in this previous incident the blades had been severed half way along their length, and had incurred considerable damage.

The repair to both propellers was uneven and had areas of sharp edges, rough and uneven surfaces, and surface crevices. On close inspection, strands of paraglider line core material (white in colour) could be seen embedded in a repaired section of the blade's leading edge, within a crevice formed by a repair. This can be seen on Fig. 4.

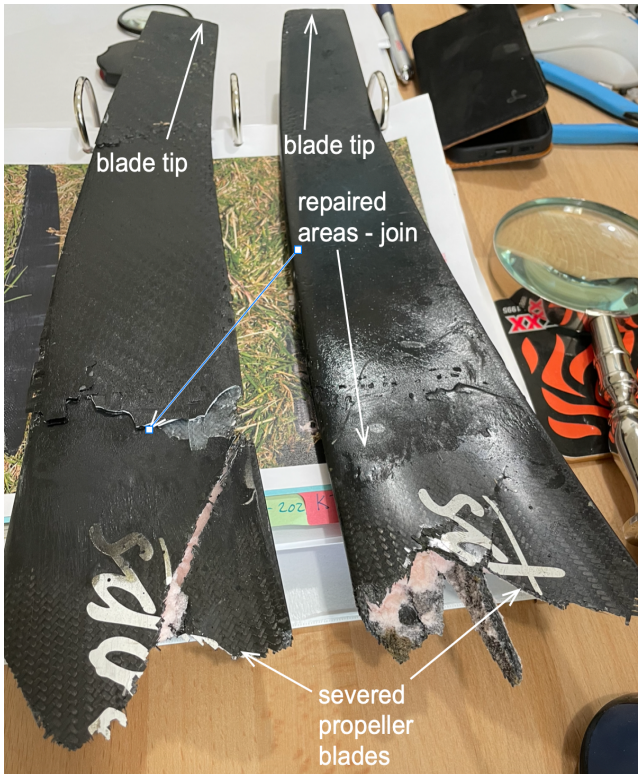

Fig. 3. Broken propeller blades and previously repaired areas.

Fig. 4. The repaired section of propeller blade, and an enlargement of one area of propeller leading edge, with embedded control line fragment.

From this evidence the Investigation determined that the left-hand control line came into contact with an uneven and previously repaired section of the propeller. The propeller was turning under power at the time, causing the line to be entrapped and eventually severed.

3.3.7 A test deployment of the emergency parachute was performed (extracting the folded emergency parachute from the outer container). To the extent of the deployment test performed, the Investigation determined that the emergency parachute was installed correctly and was capable of deploying.

3.4 The incident.

The Investigation considered the flight leading to the incident and ground impact.

3.4.1 Pilot B stated that they had seen Pilot A make pre-flight checks, checking trimmers and lines once buckled in (to the harness). Pilot C stated that they did not observe Pilot A performing any pre-flight checks.

3.4.2 Pilot A was filmed launching their paraglider by Pilots B and C. Pilot B was filming from Pilot A's left-hand side. Pilot C was filming from Pilot A's right-hand side. Pilot A made a forward launch in a westerly direction, in conditions that were evidently light wind with good visibility. The two videos last for 27 seconds and 17 seconds respectively, and end with Pilot A flying away from the launch area, captured at approximately 80 to 100ft above ground level. They can be seen to have assumed a seated position in the harness, normal for cruising flight.

3.4.3 Pilots B and C described the flight made by Pilot A. Following the launch, Pilot A made three circuits of the take-off field and surrounding fields, crossing New Lane and Tong Lane but evidently keeping within the area local to the flying field. Pilot B noted that Pilot A "wiggled [their] legs, which was our signal to say that we're ok." Pilot C stated that Pilot A's flight was "around 2-3 small circles".

Pilot B described the third circuit as being over Tong Park Hotel, before turning along Tong Lane.

Pilot A was variously described as being “400ft (maybe a bit lower)” and 200ft above ground level. Pilot B’s statement notes that Pilot C remarked “what [are they] doing?”. It was not possible to explore this further with Pilot C. It is however of note that in Pilot C’s witness statement, they did not remark on noticing anything unusual before they suddenly ceased to hear the engine.

3.4.4. Pilots B and C noted that the incident occurred between 2 and 4 minutes after take-off. The noise from Pilot A’s paramotor was heard to abruptly cease. Pilot B noted that the engine was still ticking over and had not cut out. Pilot C stated that it was not possible to ascertain whether the engine had cut out, or the throttle had been released (the engine remaining on tick-over).

Pilots B and C noted the paraglider made a left-hand turn which tightened so that the paraglider entered a full spiral dive, descending towards the ground rapidly and impacting in the field on the other side of the road from the take-off field.

3.4.5 The photograph in Fig. 5 was provided by Witness G, situated on the golf course approximately 750m to the south of the incident location. They stated that “Shortly after the photo was taken at 7:01pm we noticed the motor noise cut out” and seconds later the paraglider “then started spiralling”. Witness F stated they saw Pilot A “swaying” after the engine cut out. They did not see any “spiralling…or any sense of an emergency” before “the machine dipped out of sight and a second or so later we heard a ‘crumping’ sound”, evidently the noise of the impact.

Fig. 5

3.4.6 It is clear from the injuries sustained by Pilot A and the damage to the paramotor frame that the descent resulted in an impact of considerable force, an impact evidently heard by witnesses several fields away. The Investigation determined from the evidence that the direction of impact was “frontal”, consistent with a nose-down wing attitude of a developed spiral dive.

A spiral dive is a corkscrew-like turning manoeuvre, which may be intentionally initiated by a control input on one side of a paraglider. During a spiral dive the paraglider assumes a nose-down attitude and descends at vertical speeds of up to 4000 feet per minute, exposing the pilot to the effects of high g forces which include disorientation and blackout. The BHPA has previously issued a Safety Notice concerning the manoeuvre[3].

[3] https://www.bhpa.co.uk/documents/safety/safety_notice/index.php?doc=sn031.pdf

A paraglider under high wing loading such as the one used by Pilot A would enter a spiral dive quickly, the rate of rotation and rapid height loss exposing the pilot to high g force. It would be disorientating for any pilot not well-acquainted with the dynamic nature of the manoeuvre.

The Investigation concluded that the spiral dive on this paraglider would have exposed Pilot A to rapidly building g force, leading to disorientation and possible loss of consciousness. Correction to normal flight, or the successful deployment of the emergency parachute would have been unlikely, due to the aircraft's proximity to the ground when the incident occurred.

3.4.7 The Investigation considered the circumstances in this incident that brought about the spiral.

In the event of a paraglider line coming into contact with a rotating propeller, the line may be severed. In this scenario the pilot may use an alternative means of control to pilot the paraglider to land. Alternatively, a line (or a control handle) may be caught (ingested) by the rotating propeller. In this scenario the control line may be wound around the propeller hub, or ensnared on a propeller blade (if the blade has an uneven surface). In either scenario, the control line may be drawn under such tension that the wing would enter a turn, induced by the control input made to the wing's trailing edge via the ensnared line. A control line ingestion when the propeller is turning under power may result in a large control input to the wing's trailing edge, bringing about a rapid and dynamic turn, and leading to a spiral dive.

The scene photos do not show that the line was wound around the propeller hub at impact. Whilst this cannot be ruled out, the Investigation determined from the available evidence that the left-hand turn and subsequent spiral dive was caused by the uneven surface of the propeller blade ensnaring the control line.

3.4.8 The Investigation considered how the left-hand control line was ingested by the propeller.

3.4.8.1 In normal flight, paraglider suspension lines are taut, as they are under load. When a pilot is flying with a paramotor, the lines are approximately 75cm (or more) away from the propeller at the closest point (in a properly set up and normal flying configuration).

The Investigation determined that it was not possible to ascertain from the inspected wreckage, nor from the videos from the incident flight, the position of the pilot and paramotor unit relative to each other. Further, several joints on the paramotor cage were taped up, and it cannot be ruled out that a loose or incorrectly installed piece of spar enabled or contributed to the ingestion of the control line.

3.4.8.2 The Investigation considered whether Pilot A released the left-hand control in a way that enabled its ingestion. The paraglider was fitted with magnets on the risers enabling the pilot to "park" the control handles securely when flying "hands off". The Investigation determined from the measurements taken on the right-hand side of the paraglider by the service centre (see 3.3.2) that on the balance of probability the left-hand control line would have been in a similar condition - at, or negligibly outside its factory determined trim position. There would not have been significant slack in the line that enabled its ingestion with the control handle in its "parked" position. The Investigation took the view that line ingestion due to incorrect stowage of the control handle by Pilot A was unlikely to have occurred.

3.4.8.3 The Investigation considered whether turbulence may have induced a departure from normal flight, allowing momentary slack in the lines such that the risk of line ingestion into the rotating propeller was increased.

The pilots had described the conditions as being gusty an hour before Pilot A's flight, and for this reason they waited until they considered that the conditions had calmed. The Investigation determined that thermals and associated turbulence may still have been present, due to the convective activity over course of the day. Thermic turbulence may have brought about or contributed to a departure from normal flight, such as a partial wing

collapse known as an asymmetric tuck. Although witnesses did not state they witnessed an asymmetric tuck, this cannot be ruled out as enabling the line ingestion.

Pilot A was evidently flying circuits around the take-off field. The conditions were reportedly light wind. In these conditions, wake turbulence behind an aircraft is not dissipated as quickly as it is by stronger wind conditions. From a sketch provided by Pilot B, showing Pilot A's flight route, it is evident that Pilot A made two previous passes of the same area before making a 180 degree turn over Tong Park hotel to fly back to this area. Given the short duration of the flight, the Investigation determined that Pilot A may have encountered their own wake turbulence from their previous pass, and this brought about or contributed to a departure from normal flight.

3.4.8.4 The Investigation determined that on the balance of probability the precipitating event that brought about the ingestion of the control line was that Pilot A encountered their wake turbulence from their previous circuits, and / or thermic turbulence. The turbulence brought about a departure from normal flight allowing the left-hand side lines to momentarily slacken, enabling ingestion of the line closest to the propeller blades.

4.0 Findings

The Investigation concluded that the incident occurred when Pilot A's paraglider was induced into a turn by the ingestion of the left-hand control line into the turning propeller. The turn developed into a spiral dive, from which Pilot A was unable to recover before impacting the ground.

On the balance of probability, the precipitating event that enabled the ingestion of the control line was that Pilot A's paraglider encountered turbulent air that led to a departure from normal flight.

5.0 Recommendations.

The BHPA shall remind all members through Skywings magazine the importance of awareness of wake turbulence, particularly the dangers of encountering one's own wake when flying 360 degree turns.