

الهيئة العامة للطيران المدني
GENERAL CIVIL AVIATION AUTHORITY



Accident

- Summary Report -

AAIS Case N° AIFN/0009/2022

Loss of Control-Inflight (LOC-I)

Operator:	Paramotor Desert Adventures Aviation Club
Make and Model:	Fly Products (Paramotor) and Vittorazi Moster (Engine)
Nationality and Registration:	United Arab Emirates – No registration
Place of Occurrence:	Dubai - Margham
State of Occurrence:	The United Arab Emirates
Date of Occurrence:	4 September 2022



This Investigation was conducted by the Air Accident Investigation Sector of the United Arab Emirates pursuant to Civil Aviation Law No. 20 of 1991, in compliance with Air Accident and Incident Investigation Regulation, and in conformance with the provisions of Annex 13 to the Convention on International Civil Aviation.

This Investigation was conducted independently and without prejudice. The sole objective of the Investigation is to prevent future aircraft accidents and incidents. It is not the purpose of this activity to apportion blame or liability.

The Air Accident Investigation Sector issued this Summary Report in accordance with national and international standards and best practice. Consultation with applicable stakeholders, and consideration of their comments, took place prior to the publication of this Report.

The Summary Report is publicly available at:

<http://www.gcaa.gov.ae/en/epublication/pages/InvestigationReport.aspx>

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The United Arab Emirates**

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Investigation Process

The occurrence was notified to the Air Accident Investigation Sector (AAIS) Duty Investigator (DI), at Hotline Number (+971 50 641 4667).

After the initial on-site investigation phase conducted in accordance with the *Air Accident and Incident Investigation Regulation (AAIR)* of the United Arab Emirates, the occurrence was classified as “Accident” as it has resulted in fatal injuries to the pilot.

The scope of this Investigation is limited to the events leading up to the occurrence; no in-depth analysis of non-contributing factors was undertaken.

Notes.

1. Whenever the following words are mentioned in this Report with the first capital letter, they shall mean the following:
 - (Accident). The accident subjected to this investigation
 - (Club). Paramotor Desert Adventures Club (the flying club in which the pilot had registered his paramotor and flown under its licence)
 - (Investigation). The Investigation into the circumstances of this Accident
 - (Paramotor). The paramotor involved in this accident
 - (Pilot). The pilot of the Accident Paramotor
 - (Report). This investigation Summary Report.
2. Photos and figures used in this Report are taken from different sources and are adjusted from the original for the sole purpose to improve the clarity of the Report. Modifications to images used in

this Report are limited to cropping, magnification, file compression, or enhancement of colour, brightness, contrast, or addition of text boxes, arrows, or lines.

3. Unless otherwise mentioned, all times in this Report are given in 24-hour clock in UAE local time which is Coordinated Universal Time (UTC) plus 4.
4. The structure of this Summary Report is an adaptation of the ICAO Annex 13 Final Report format.

Factual Information

History of the Accident

In the morning of 4 September 2022, a Paramotor Pilot arrived at Paramotor Desert Adventures Club to conduct a leisure flight with his personal Paramotor departing from the Club's field.

At 06:58 local time (LT), the Pilot completed the pre-flight daily registration as per the Club's administrative procedures through the tablet stationed at the reception of the Club. He confirmed in the registration that his tracking software application¹ is switched ON and is connected to the Club's tracking system.

As per the pre-flight procedures, the Field Safety Officer verified the documents, the tracking system, and the Paramotor's airworthiness.

As per the statement of the Field Safety Officer, the Pilot's plan was to fly for about 45 minutes in the OMD26² flying zone designated for the Club's flying activities.

The Field Safety Officer provided clearance for the take off and established radio communication after the take off as shown in figure 1.

¹ The tracking system used by the Club is a mobile software application connected to the Club's computer. It provides instant location of the pilot by using the pilot's mobile GPS.

² OMD26 is an airfield that has two asphalt runways: 17 and 35, with a runway length of approximately 1,550 meters and 19 meters wide. Runway 35 is commonly used for takeoff and runway 17 for landing.



Figure 1. Aerial view of the Club and the field, the arrow shows the take-off direction

The Pilot took off at about 07:23, and the first radio communication with the Field Safety Officer was made at 07:25 to confirm that the radio is working, which was confirmed.

According to the video recording device attached to the Pilot, during the flight, and while the Pilot was heading southwest with a ground speed of about 23 kilometers per hour, the canopy (wing) partially collapsed to the left. The Pilot reacted by applying excessive brake to both sides of the wing leading to its stall and lagging behind the Pilot. Simultaneous to that, the Pilot was applying maximum power by pressing the hand throttle lever and excessive brakes, causing the Paramotor pilot seat to lean and turn right and create a spiral turn, which twisted the lines in the second spiral turn before impact (figure 2).

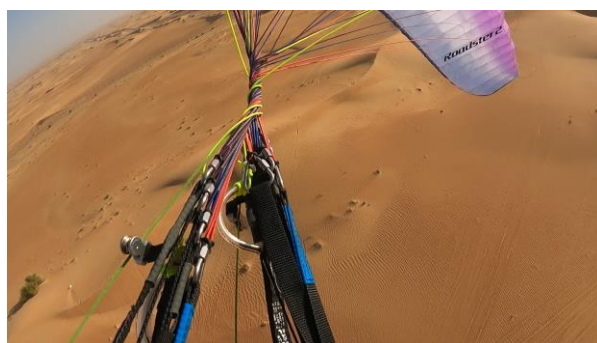


Figure 2. Spiral turn

During the period from 07:48 to 08:03, the Field Safety Officer attempted several times to communicate with the Pilot to check the status of the flight, but there was no response.

Thereafter, one of the Club's instructors volunteered to fly and search for the Pilot. After about 15 minutes, the instructor reported seeing the Pilot on ground at approximately 5 kilometres northeast (figure 3) the Club. The instructor landed near the Pilot and confirmed that he was totally unconscious.

Consequently, and based on the instructor's report, the Field Safety Officer initiated the Club's emergency response plan. He notified Dubai Police, paramedics, search and rescue, and the AAIS Duty Investigator.



Figure 3. Aerial view of the Club's and the Accident's locations

The paramedics reached the site and confirmed that the Pilot had suffered fatal injuries.

Damage to Aircraft

As a result of the impact, the propeller's blades broke and the cage bent (figure 4).



Figure 4. Damage to propeller's blades and cage

The wing torn in the middle of the leading edge as shown in figure 5.



Figure 5. Damage at the leading edge of the wing

Personnel Information

The Pilot

The Pilot received his training at the same Club. He had completed both theory and practical training, before released to fly unassisted by the Club.

The Pilot was granted a certificate by the Club in March 2021 after the successful completion of the initial training which included theory and practical. His training records showed that he successfully completed upset recoveries during different types of abnormal events.

Moreover, the Pilot was certified as a skydiver with more than 300 jumps. He was practicing both skydiving and paramotor flying.

Paramotor Information

Paramotor construction and flight theory

The paramotor, also known as a powered paraglider, consists of a fabric inflatable wing, a pilot seat, engine, propeller and cage. Figure 6

At full power, the propeller tends to generate a torque that causes the paramotor to veer right. Therefore, the manufacturer fitted the engine with torque compensation mechanism which reduces the torque to a negligible level called 'residual torque'. This residual torque requires minimal counter action from the pilot.

The paramotor is configured similar to a pendulum, and the wing must be inflated and pressurized for each takeoff. The wing is connected to the paramotor via risers and suspension lines and flies at a relatively constant speed.

Pilots change the speed by adjusting the position of the wing tip trim on the rear risers, or by pushing down on the speed system on the front riser by means of a bar with lines that the pilot rests his feet on.



Figure 6. Pilot seat, propeller, and cage

Using brake lines and brake handles is the primary method for turning the wing during flight. It is also the primary method to control the glider on the ground. The pilot uses his left and right brake handles to control the direction of the paramotor. Pulling the left brake handle causes the trailing edge of the left wing to deflect downwards causing drag on this side. This deflection causes the paramotor to turn to the left. The opposite is true to turn to the right. Turning also can be accomplished by body weight shifting towards the side of the turn or by trimming the wing tips.

The paramotor's flight controls comprise brake handles, trims, stabilizer lines, a speed bar and the tip steering lines. The lines are colour coded to indicate which line set they belong to, typically one colour for either A, B, C, or D and the brake lines for easy recognition and to prevent pilot's confusion. Figure 7

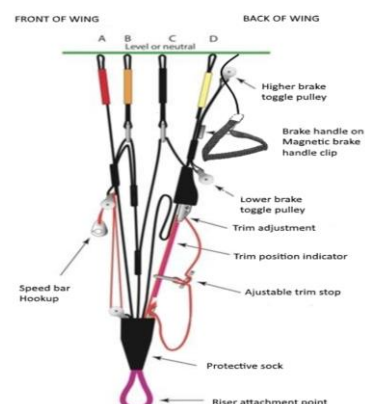


Figure 7. Wing lines description

Angle of Attack

The angle of attack is the angle between the incoming airflow towards the wing and the chord line. The more the angle of attack increases the more lift is generated. If the angle of attack maximum limit is exceeded, the wing will stall and lift will not be generated.

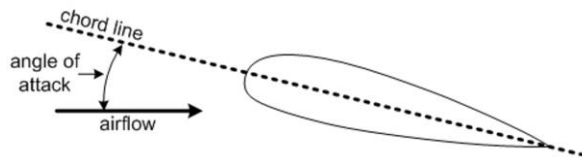


Figure 8. Angle of attack

As mentioned in the Club's paramotor manual, the angle of attack can be increased either by pulling both brakes which then will lower the trailing edge of the wing and rise the leading edge, or by increasing the engine power which will act as a pendulum and forward the seat of the paramotor to the front which will rise the wing's leading edge (figure 9).

According to the Club's paramotor manual, to avoid stall, the angle of attack shall not exceed 18 degrees.

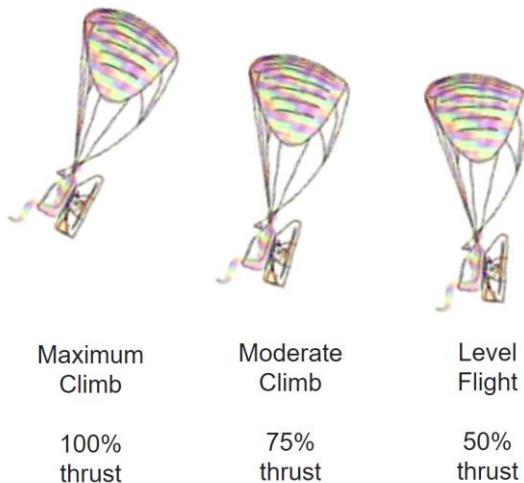


Figure 9. The relation between angle of attack and engine power

Wingtip Steering

As mentioned in the Club's paramotor manual, wingtip steering is one of the means for making turns. Lines are attached to the wingtips. These lines are connected both left and right to one down-going line called the wingtip line. By

pulling down on this line, the effective surface of the wing will be reduced, increasing the wing loading on that side of the wing resulting in a turn towards that side. (Figure 10)

As stated in the Club's paramotor manual, turning with the wingtip gives a slightly flatter turn because no extra drag is induced like with the use of brakes. Wingtip steering is mostly used when flying reflex-type wings in reflex mode, where the brakes become ineffective and should not be used.

The steering is engaged by pulling down the line itself or pulling on a specially designed small steering toggle that is attached to the line. Wingtip steering toggle can be used as well during flight to flatten the wing in order to gain more speed.

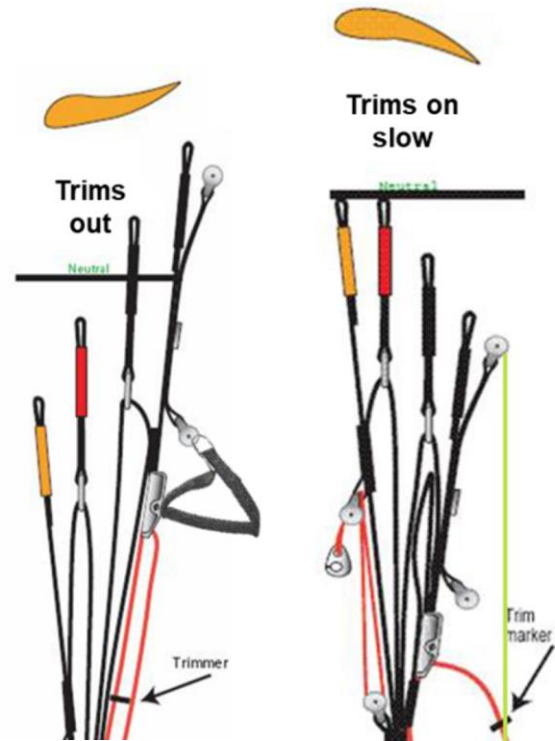


Figure 10. Wingtip steering trim toggle effect

Propeller Torque Force Effect

The propeller rotation induces a torque in the opposite direction. According to the Club's paramotor manual, when the propeller rotates anti-clockwise, the torque will be to the right, lifting the pilot's left shoulder and lowering the right shoulder, leading the pilot to veer to the right.

In order to counter the torque effect, the Club's paramotor manual states the following actions:



- Left-side weight shift
- Left counter-steer
- Asymmetric trim setting
- Differential speed-bar (more weight on the left side)
- Reducing the power level.

Weight Shifting Manoeuvres

During the flight, turning to the left and right can be accomplished by body weight shifting. According to the Club's paramotor manual, when a pilot wants to turn to the left by weight shifting, the right leg should be lifted and positioned on the left leg knee in order to bank to the left. The opposite is applicable for right turns.

The Accident Paramotor Airworthiness

As per the Club's operational procedures, the Field Safety Officer shall inspect the paramotor before the flight to ensure it is airworthy.

The pre-flight inspection checklist includes the wing, propeller, fuel and air system, engine, exhaust, gearbox, belt drives, starter system, frame, and harness.

The Accident Paramotor was inspected by the Field Safety Officer and declared airworthy for the flight.

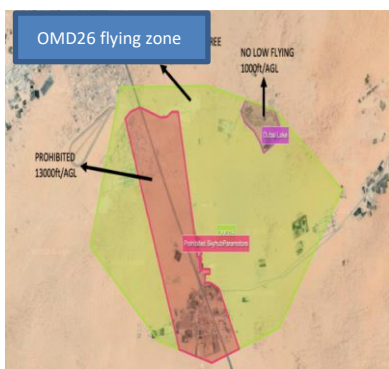


Figure 11. Club's flying area OMD26 highlighted in green

Airfield Information

The Club uses a designated area for its flying activities. The flying area is referred to as area OMD26 which is located in the emirate of Dubai. Takeoffs and landings are conducted from a grassy field that is surrounded by sand dunes.

All flying activities require the permission of the Field Safety Officer as outlined in the Club's standard operating procedures (SOP).

Weather Information

The weather information was checked by the Club through a mobile software application. The weather forecast stated that the wind condition is within the Club's take off wind speed limits.

Table 1 illustrates the weather conditions prevailing at the time of the Accident.

Table 1. Margham Meteorological Conditions	
Time	07:45 LT
Wind	189 degrees / 10 knots
Visibility	6 kilometres
Clouds	CAVOK
Air temperature	31 degrees Celsius
Dew point	19 degrees Celsius
Pressure (altimeter)	1005 Hectopascal

Organizational and Management Information

History of the Club

In 2013, Skyhub was established as a paramotor club operating under SHAMAL Group until it was shut down in 2019.

Later in 2019, a new owner took over the premises and established Paramotor Desert Aviation Club which was granted a *no objection letter* issued by Dubai Civil Aviation Authority (DCAA) to establish the company.

The General Civil Aviation Authority (GCAA) issued *security clearance* to the Club on 17 July 2021 as one of the requirements that the Club needs in order to obtain *flying club approval* under *CAR Part II - Chapter 10 Light Sports Aviation Activities (LSA)*. At the time of the Accident, the Club was not yet issued an approval by the GCAA.

Ground Support

As per the Club's SOP, the Field Safety Officer shall be present at the field to supervise all the flying activities

The Club's SOP outline the responsibilities of the Field Safety Officer as follows:

- Designation of an area to test/prepare the gear
- Designation of take-off and landing area
- Providing clearance to pilots during flying to enter the circuit of the club
- Providing landing clearances



- Maintaining radio contact with pilots at all times during the flight.

The Pilot registered through a smart tablet stationed in the Club's reception that serves as a registration log.

The Field Safety Officer was available on the field to supervise the flying activity on the day of the Accident.

Training

Club's practical test to obtain paramotor certification

After completing the training, the trainees go through practical test in order to obtain the license. The Club's test form includes certain safety checks and practical movements that the pilots have to perform in order to pass. The examiner appointed by the Club evaluates the examinee according to his performance during the test whether the movement performed is good, satisfactory or bad. There was no documentation of the examinees' behaviour or any other remarks during conducting each movement in the test.

Upset recovery

According to the Club's paramotor manual, when slowing down using the brakes, adding power using the engine throttle and turning against the engine torque, the pilot is subjected to have a full stall or a side collapse. To recover the wing and return to normal flying, the pilot should release the brakes and the engine throttle in order for the wing to restore the in-flight normal shape. If the pilot does not release the brakes and the throttle, the torque induced by the propeller will cause negative spin³. Negative spin can be recovered by releasing the brakes and the engine throttle. The Club's paramotor manual states that by applying the brakes with increasing the engine power, a lines twist will be created causing a spiral dive towards the ground.

the Club's training syllabus specifies that, during the training, the trainee pilots are trained to encounter different abnormal situations that may occur during flights. They are instructed to

intentionally stall and collapse the wing in order to learn how to recover and go back to normal flight position without panicking. The training standards used by the Club are the standards adopted by the European Union Aviation Safety Agency (EASA).

Pilot's training and flying skills

The Pilot received his skydiver license in the 2013 and performed 300 jumps. Thereafter, the Pilot started his paramotor training in 2019 and completed in 2021. The Pilot's paramotor training records revealed some gaps between his classes and tests due to the Club's closure and due to COVID-19 restrictions.

The Pilot had never performed upset recovery maneuvers from abnormal events during flights since he completed his training and obtained his license back in 2021.

As per the Club's practice, once passing the certification practical test, a pilot will never be required to perform upset recoveries unless he encounters abnormal events. Also, as per the General Manager statement, pilots discuss about their flights voluntarily after they land. Pilots are not required to brief the Club regarding their flights and what they had encountered during them.

The Pilot's skydiving jumps and the paramotor flights logs show that the Pilot was performing both activities at the same time. As stated by the Club's instructor, the parachute used by skydivers is slightly different than the paramotor's wing in regards to brakes application, turning, and upset recoveries. The parachutes used by skydivers rarely stall and are less reactive compared to the paramotor's wing in terms of the break lines. The Club's instructor statement reveals that the skydiver's parachutes break lines can be applied down to reach the pilot's knees whereas the paramotor's wing break lines can be applied only till the pilot's shoulder. In addition, as no engines are used by the skydivers, there will be no torque.

³ A negative spin is developed by flying the paramotor with deep brake pressure slowing the airspeed right down and

then stalling only one half of the wing. The wing will fall back while the opposite side will still be flying causing it to rotate above the pilot's your head



Analysis

Flight Analysis

The wing can be stalled with minor application of the brakes as the propeller will induce pendulum effect which brings the wing to higher angle of attack and closer to stall.

If the wing stalled, the propeller torque will have a major effect as it will turn the pilot to the opposite side of the propeller rotation.

Unlike skydive parachutes where a skydiver can stall the parachute by applying brakes to the maximum and recover by only releasing the brakes; recovery from paramotor's wing stall requires reducing engine power to the minimum and releasing the brakes simultaneously in order to prevent inducing torque.

After reviewing the video recordings captured by the camera attached to the Pilot during the Accident flight, the Investigation could identify the sequence of events and how the paramotor was controlled by the Pilot.

The Pilot was flying normally and then the wing turned left slightly due to partial collapse in left side of the wing. The Pilot then reacted by pulling both brakes down below his chest level.

In addition, the Pilot was seen grasping the throttle consistent with applying engine power to the maximum while pulling the right brake to a position lower than his shoulder (which was beyond the limits). At this point, the wing entered into a stall which indicated by seeing the Pilot's knees elevating up while the wing falls down behind him.

This combined application of brakes and engine power to the maximum at this point made the Pilot tilting towards right due to the propeller torque and resulting in twisting of the wing lines and moving the wing towards the right side of the Pilot in parallel to the ground. This movement initiated a clockwise spiral turn until impact.

The Investigation reviewed video recordings of the Pilot's previous flights and identified that he

used to maneuver the turns by weight shifting or by using the wing tip steering toggles, and he uses brake handles only during takeoffs and landings. Both practices were consistent with the SOP. However, the Accident flight video revealed that the Pilot applied excessive brakes by excessively pulling both brake handles which induced spiral turns.

The mix of parachute jumping and flying the paramotor most probably put the Pilot in cognitive stress⁴ during the flight. It was probably hard for the Pilot to quickly and accurately switch between different standard recovery procedures during a highly demanding emergency situation.



Figure 12. The shadow of the Paramotor during the stall point

Moreover, the Pilot's training records show time gaps between ground school, practical test, and flying as a member. The gap was induced by personal reasons as well as the closure of the Club because of COVID-19, which kept the Pilot not current in reacting to abnormal events. The only training the Pilot had received in handling emergencies was during the initial training.

Tracking System

As mentioned in the Club's SOP, it is mandatory for pilots to maintain connection to the tracking system when flying. The tracking system projects instant location of the pilot on a map displayed on the Club's computer screen.

The Pilot reported to the airfield and confirmed with the Field Safety Officer that the location-tracking application was operating normally.

⁴ Cognitive stress refers to the cognitive (or mental) demands of the task itself. [Source: ICAO Document 9683 – *Human Factors Training Manual*]



The tracking system recordings show that the Pilot's turned ON the tracking software application at the Club's car parking area, and it was working normally in the airfield. However, the recordings revealed that the device stopped working before takeoff.

The Field Safety Officer was not aware of the tracking system malfunction until he verified on the Club's computer screen after losing communication with the Pilot. The Investigation could not determine the reason for the tracking system malfunction and the route of the flight path.

In further interviews with the Flight Safety Officer, the Investigation identified that the tracking system had suffered from similar inflight technical disconnection anomalies with other pilots due to weak mobile signal at OMD26 area.

Conclusions

Findings

- (a) Paramotor Desert Adventures Club was not approved by GCAA at the time of the Accident to practice flying operation.
- (b) On the day of the Accident, the Pilot registered in the Club's daily registration system as per the Club's SOP.
- (c) The Paramotor was inspected before the flight and confirmed airworthy by the Field Safety Officer.
- (d) Weather was not a contributing factor to the Accident.
- (e) The tracking application software that is installed on the Pilot's mobile phone malfunctioned most probably due to network coverage.
- (f) The Pilot's training records show time gaps between initial training and flying as a member in the Club.
- (g) The Pilot flying records show that he practiced both skydiving and paramotor flying.
- (h) The Pilot reacted to the wing stall by excessive brakes and engine maximum power.
- (i) The torque caused by the engine propellers turned the Pilot's seat and led to wing lines twist.
- (j) The Paramotor entered into a negative spin until impact.

- (k) The Flight Safety Officer initiated the Club's emergency response plan immediately after he has been notified about the Accident.

Causes

The Air Accident Investigation Sector determines that the cause of the Accident was the excessive application of brakes and engine power for recovery from wing stall. This action caused the wing lines to twist and then to unrecoverable spiral dive until impact.

Contributing Factors

The Air Accident Investigation Sector identifies the following contributing factors to the Accident:

- (a) The Pilot was practicing paramotor flying and skydiving which most probably led to cognitive overload during recovering from abnormal event.
- (b) The Pilot, most probably, was not current with upset recovery practices since he the only identical situation was handled during his initial training which he received one and a half years before the Accident.

Safety Recommendations

The Air Accident Investigation Sector recommends that Paramotor Desert Adventures Club:

SR09/2023

Raise the awareness of the pilots before flights, in regards to the correct standard recovery procedure by means of briefing, video, written cautions, or any other media that the Club determine suitable for awareness.

SR10/2023

Enhance the Club's capability in tracking the flying paramotors. More specifically to address the gap of weak network signal of the current system used. As a result, enhance the oversight within the flying area.

**This Report is issued by:
Air Accident Investigation Sector
The United Arab Emirates**

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