

الهيئة العامة للطيران المدني
GENERAL CIVIL AVIATION AUTHORITY



Air Accident Investigation Sector

Accident

- Summary Report -

AAIS Case N° AIFN/0011/2024

AutoGyro Loss of Control

Operator:	Al Jazirah Aviation Club (JAC)
Make and Model:	AutoGyro, MTO Sports
Place of Occurrence:	Al Jazeera Al Hamra Industrial, Ras Al Khaimah
State of Occurrence:	The United Arab Emirates
Date of Occurrence:	12 October 2024



This Investigation is conducted pursuant to the United Arab Emirates (UAE) *Federal Act No. 20 of 1991*, promulgating the *Civil Aviation Law, Chapter VII- Aircraft Accidents*, Article 48. It is in compliance with the *Air Accident and Incident Investigation Regulation (AAIR)*, and in conformity with *Annex 13* to the Convention on International Civil Aviation.

The sole objective of this Investigation is to prevent 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 practices. 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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Investigation Process

The occurrence involved a gyrocopter flight operated by a cadet pilot performing his third solo from Al Jazirah Aviation Club's Runway 28.

The gyrocopter lifted off at a steep pitch angle, causing the rotor blades to strike the runway. It then rolled to the left, veered off the runway, and came to rest on the sand. The cadet pilot exited the gyrocopter on his own, suffering a leg injury.

The Air Accident Investigation Sector (AAIS) Duty Investigator was notified about the occurrence via the hotline at +971 50 641 4667.

After the initial on-site investigation, the event was classified as an "Accident" due to the total loss of the gyrocopter and open an investigation case.

This investigation is focused on the events leading up to the occurrence. There is no in-depth analysis of non-contributing factors.

Notes:

- Whenever the following words are mentioned in this Report with a first letter **Capitalized**, they shall mean the following:
 - (Accident) – this investigated accident
 - (Club) – Al Jazirah Aviation Club
 - (Investigation) – the investigation into this accident
 - (Pilot) – the cadet pilot involved in the accident.
 - (Instructor) – the instructor responsible for training the cadet pilot.
 - (Gyrocopter) – Autogyro MTO Sport involved in the accident.
 - (Report) – this accident investigation Summary Report.
- Unless otherwise mentioned, all times in the Report are the United Arab Emirates local time (LT = UTC plus 4 hours).
- The structure of this Summary Report is an adaptation of the Annex 13 Final Report format.

¹ Magneto check: A pre-flight test in which each magneto is turned off individually to ensure independent operation and reliable engine performance.

Factual Information

History of the Flight

On 12 October 2024, a Pilot was scheduled for his third solo flight. Upon arriving at the Club, he contacted his Instructor by phone for a flight briefing.

The Pilot conducted the pre-flight check and start-up as required, then taxied to backtrack on Runway 28 via taxiway Charlie. He paused in the loop for magneto checks¹, which were within limits.

After another aircraft completed its landing and vacated the runway, the Gyrocopter lined up on Runway 28, stopped at the threshold, and completed the pre-take-off checklist.

The CCTV² footage from the airfield recorded the sequence of events: at 1138, the Gyrocopter aligned on the runway; at 1139, another aircraft landed on the same runway; at 1140, the gyrocopter commenced forward motion to generate power; forty-six seconds later, it entered a steep vertical climb (figure 1)



Figure 1. Gyrocopter moving into a steep, vertical angle

Two seconds later, the Gyrocopter struck the runway, veered to the left, and came to rest on the sand (figure 2).

² CCTV: Closed-circuit television



Figure 2. Gyrocopter resting on the sand

The Pilot exited the Gyrocopter on his own, while the Club's ground controller rushed over to assess the situation. The Pilot sustained a leg injury.

At 12:23, an ambulance arrived, took a few minutes to assess the Pilot on-site, and then transported him to Saqr Hospital for medical care, where his leg wound required stitches.

Damage to the Gyrocopter and Property

The Gyrocopter sustained substantial damage due to ground impact involving its main rotor, propeller blades, nose gear, which was completely detached, and the right-side structure (figure 1).

The rotors struck Runway 28, creating six slashes (figure 3).



Figure 3. Runway 28 slashes

Personnel Information

The general data of the Pilot are shown in table 1.

Table 1. Pilot data	
Age	30
Type of license	CPL-A – Commercial Pilot License for fixed-wing aircraft
Valid to	31 October 2025
Rating	IR/ME/SPA ³ , DHC6
Total hours on all type	3205.7
Total hours Command on all type	1042.2
Total hours on this type (Gyrocopter)	9
Total hours command on this type (Gyrocopter)	1.6
Total hours last 7 days all type	23.6
Total hours last 7 days on this type (Gyrocopter)	7.5
Last recurrent training	17 September 2024
Medical class, validity	Class 1, 13 July 2025

³ IR: Instrument Rating – Certification allowing the pilot to fly under Instrument Flight Rules (IFR), enabling flight in low-visibility conditions using only instruments.
ME: Multi-Engine – Endorsement allowing the pilot to operate multi-engine aircraft.

SPA: Single-Pilot Aircraft – Certification for operating an aircraft that requires only one pilot for safe operation.



Medical limitation	VDL ⁴
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The Pilot works as a captain for Skydive Dubai, commanding Twin Otter aircraft. He practices gyrocopter training as a leisure activity. According to his logbook, he began gyrocopter training on 18 September 2024.

The Pilot's last day in command was 10 October 2024, and he was not performing any fixed-wing flights on the day of the Accident.

In a post-Accident interview, the Pilot demonstrated insufficient knowledge regarding gyrocopter take-off techniques.

Injuries

The Pilot's medical report indicated wounds on both legs that required stitches. There was no toxicology test performed.

Gyrocopter Information

General data

Table 2 illustrates the Gyrocopter general details:

Table 2. Gyrocopter details	
Gyrocopter	
Manufacture	AutoGyro
Model	MTO Sports
MSN	M011080
year of manufacture	2014
Nationality and registration marks	United Arab Emirates, A6-XNG
Name of the Operator	Al Jazirah Aviation Club
Engine	
Manufacture	Rotax Aircraft Engines
Model	Rotax 912 ULS
MSN	6782800
Limitation	
Maximum wind speed or gust intensity (kts)	40
Maximum demonstrated crosswind component for take-off and landing(kts)	20

Certificate of registration	
Certificate NO.	21/15
Issuing authority	General Civil Aviation Authority
Issuance date	07 October 2015
Operational data	
Time since new (hours)	976.30
Last inspection check, type, date and hours/cycles	100FH/Annual inspection, 3 October 2024, 968.20
Time operated since last major inspection (hours)	8.10
Maximum take-off weight (kg)	450
Fuel tank capacity (ltr)	68
Take-off weight (kg) (on the Accident flight)	336
Fuel tank capacity (ltr) (On the Accident flight)	34

Gyrocopter construction

In general, gyrocopters consist of several key parts, including the fuselage, which houses the pilot and controls, and the rotor system with blades that spin freely within the rotor disc to generate lift.

The engine powers a propeller (in a pusher configuration) that provides forward thrust. The mast supports the rotor system, while the landing gear includes main wheels and a nose wheel for ground stability.

Control is performed by a cyclic stick, which tilts the rotor disc for pitch and roll, and rudder pedals for yaw. A tail assembly with a rudder and horizontal stabilizers aids stability, while the fuel tank and instrumentation panel support operation and monitoring. (Figure 4)

⁴ VDL: Valid only with correction for defective distant vision; requires corrective lenses for pilots who don't meet uncorrected distance vision standards, along with a spare set onboard.

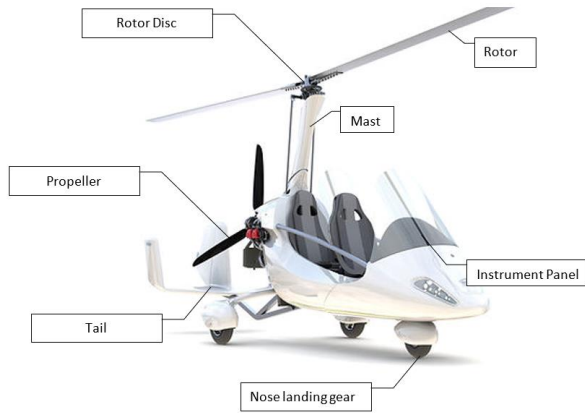


Figure 4. Gyrocopter construction

Gyrocopter power generating mechanism⁵

The gyrocopter's power-generating mechanism utilizes an engine-driven propeller in a coordinated system combining forward thrust and autorotation. The engine powers a rear-mounted propeller, which provides the forward thrust essential for flight.

As the gyrocopter moves forward, airflow over the rotor blades initiates autorotation—a condition in which the rotor spins freely due to the oncoming air, thereby generating lift.

To optimize take-off conditions, gyrocopters are typically equipped with a pre-rotation mechanism. This system temporarily engages the engine to spin the rotor to a specified revolution per minute (RPM) before the take-off roll, ensuring adequate rotor speed for lift generation at lower airspeeds.

During flight, the engine continuously supplies forward thrust via the propeller, sustaining the airflow over the rotor blades necessary for autorotation. The pilot maintains control by adjusting speed, pitch, and yaw, effectively managing airflow dynamics to ensure stable and efficient flight performance.

Gyrocopter take-off techniques⁶

The take-off procedure for a gyrocopter requires careful coordination of rotor speed, airspeed, and cyclic control. The process starts with the pre-rotation phase, where the rotor is spun up to about 200-220 RPM to prevent blade flapping during the initial roll. At this stage, the cyclic is held fully forward and angled into the wind to maintain stability as the rotor reaches the desired speed, then the pre-rotator is disengaged. The pilot then pulls the cyclic fully back to the centered

position, releases the wheel brakes, and gradually increases throttle to start forward acceleration. This rearward cyclic position effectively loads the rotor system, allowing the rotor to reach its maximum RPM while the gyrocopter is still on the ground.

As the gyrocopter picks up speed, the rotor generates enough lift to raise the nose wheel. At this point, the pilot carefully moves the cyclic slightly forward to gain airspeed while keeping the nose wheel off the ground. The gyrocopter continues to accelerate on the ground toward lift-off speed. Small coordinated adjustments to the cyclic and throttle help balance the gyrocopter on its main wheels, maintaining control of forward speed and achieving the right angle of attack for take-off—a technique known as “balancing on the tires,” which is crucial for stability and optimal lift.

Once the gyrocopter reaches sufficient airspeed, it gently lifts off. The pilot then levels off while moving the cyclic forward to accelerate in ground effect. Upon reaching V_x (best angle of climb speed) and V_y (best rate of climb speed), the pilot establishes a steady climb at around 500 feet per minute, with an airspeed of approximately 100-110 km/h.

Comparing take-off dynamics: Gyrocopter vs. fixed-wing aircraft

Gyrocopter and fixed-wing aircraft takeoffs differ fundamentally due to unique aerodynamic principles, especially in how they generate lift and, in the control inputs involving the stick.

For a fixed-wing aircraft, takeoff is achieved by accelerating down a runway, allowing air to flow over the wings and generate lift. This design relies on forward motion to create sufficient lift, with the wings needing to reach a specific minimum speed for takeoff. As the aircraft gains speed, the lift produced by the wings eventually exceeds the aircraft's weight, allowing it to smoothly leave the ground. Thrust is provided by a propeller or jet engine, and the pilot controls takeoff by adjusting pitch and speed.

In contrast, a gyrocopter uses an unpowered rotor, rather than fixed wings, to generate lift. The rotor blades spin freely and need to reach a certain rotational speed for takeoff. While an engine-driven propeller provides forward thrust, airflow caused by forward motion makes the rotor spin, creating lift. Many gyrocopters use a process called “pre-rotation” to spin the rotor up to speed before takeoff, reducing the takeoff roll. Once the rotor reaches sufficient speed and forward momentum is achieved, the gyrocopter lifts off. The take-off roll is typically shorter than that of

⁵ FAA, *Rotorcraft Flying Handbook*, FAA-H-8083-21, accessed November 3, 2024, page20-3.

⁶ FAA, *Rotorcraft Flying Handbook*, FAA-H-8083-21, accessed November 3, 2024, page20-3.

fixed-wing aircraft, and gyrocopters can often take off at lower speeds due to the lift generated by the rotor.

Regarding the Accident, the Pilot completed the pre-takeoff checklist and noted the rotor RPM was slightly above 200. He then shifted his focus to the airspeed indicator and the external view. As he centralized the stick in anticipation of lifting the nose, he noticed the stick shaking. Following his recall actions, he pushed the stick forward.

Rotor flap phenomena⁷

In a gyrocopter, rotor flap describes the vertical movement of rotor blades as they rotate, balancing lift across the rotor disc. This phenomenon is particularly significant in gyrocopters, given their unpowered rotors, which rely on autorotation—where airflow, rather than an engine, drives the blades. Blade flap is especially prominent during takeoff or rapid acceleration.

Blade flap generally occurs when the gyrocopter accelerates forward before the rotor has reached the optimal rotational speed. Under these conditions, the advancing rotor (moving in the direction of the aircraft's forward motion) generates significantly more lift than the retreating rotor, causing an upward flapping motion. This lift imbalance can lead the rotors to reach the maximum allowable teeter range, impacting the teeter stops and creating vibrations felt in the cyclic control. Without proper management, these vibrations may intensify, as low rotor RPM reduces centrifugal force, making the rotors less rigid and more prone to flexing. (Figure 5).



Figure 5. Blade flap

To prevent rotor flap, gyrocopter pilots should increase forward speed gradually, allowing the rotor to

reach adequate rotational speed for stable flight before takeoff. This gradual acceleration helps balance lift across the rotor disc, minimizing excessive rotor flap and enhancing overall stability and control. Additionally, factors like wind speed and direction should be considered; for example, a headwind increases airflow through the rotor, necessitating a slower taxi speed to maintain control.

In the Accident, the rotor flap condition was identified as “high-speed blade flap”, a phenomenon that occurs when the gyrocopter is at high ground speed but with relatively low rotor RPM. This condition can cause the gyrocopter to flip onto its side if corrective action is not taken.

Maintenance record

The Gyrocopter's 100-hour/annual maintenance inspection was carried out on 3 October 2024, at 968.20 flight hours, involving a series of critical checks and tasks to ensure its operational integrity. The inspection began with Gyrocopter preparation, including thorough cleaning, identifying relevant airworthiness directives (AD) and service bulletins (SB), reviewing maintenance records, and removing necessary access covers.

The nose gear inspection included checks of tire pressure, wheel security, and bearing condition. In the cockpit, functional tests were performed on all critical systems, including instruments, the pneumatic system, the backup fuel pump, and all lighting components, ensuring cockpit reliability and functionality. Flight control and rudder system inspections covered control rods, rudder pedals, and control cyclic, with checks on movement freedom and secure installation.

Airframe and fuselage inspections focused on seat and seatbelt security, windshield condition, and fuselage alignment, ensuring structural integrity and passenger safety. Fuel, oil, and coolant systems were assessed, with a thorough inspection of the fuel tanks, oil cooler, and hoses to confirm secure installation, absence of leaks, and overall system integrity. The propeller and pre-rotator systems were also examined, including visual checks of the propeller rotors and hub, and lubrication of pre-rotator components.

The engine inspection covered the exhaust system, oil and air filters, and synchronization of throttle and choke levers.

Following the inspection, the Gyrocopter completed eight flight hours without any malfunctions or pilots' remarks.

⁷ FAA, Rotorcraft Flying Handbook, FAA-H-8083-21, accessed November 3, 2024, page20-1.

Meteorological Information

The investigation reviewed weather information provided by Ras Al Khaimah International Airport and cross-checked it with data from the Club's weather station. All data are presented in Table 4.

Table 4. METAR at 11:30	
Wind	Direction 300 degrees, speed 6 knots
Visibility	CAVOK (Clear and Visibility OK), at least 10 kilometres
OAT	37°C
Dew point	12°C
Pressure (Altimeter)	1010 mbar
Condition	No significant change in the weather

Weather conditions were suitable for gyrocopter flight, as the crosswind was below the gyrocopter's maximum allowable crosswind component of 20 knots.

Aerodrome Information

Al Jazirah Airport (OMRJ) is a privately owned facility operated by the Club focused on light sports aviation. Located approximately 25 kilometres southwest of Ras Al Khaimah, the United Arab Emirates, the airport sits at a latitude of 25°39'55"N and a longitude of 55°46'27"E, with an elevation of 10 feet above mean sea level (AMSL).

The airport includes two runways: Runway 16/34, measuring 500 meters in length and 8 meters in width, and Runway 10/28, which is 768 meters long and 14 meters wide (figure 6). The facility operates only during daylight hours.



Figure 6. Runways and wreckage position

The accident occurred on Runway 10/28 as the pilot was attempting to take off.

Organizational and Management Information

The Club operates under the Light Sports Aircraft Organization (LSA) approval, issued by the General Civil Aviation Authority (GCAA) of the United Arab Emirates, in accordance with *Civil Aviation Regulations – Light Sport Aircraft (CAR-LSA)*.

Organization structure

According to the Club's organisation structure, the following job roles are designated for the organization operations:

- Chairman
- Board of Management
- Accountable Manager
- Operations Manager
- Safety Officer
- Security Officer
- Chief Flight Instructor (CFI)
- Flight Instructors
- Examiners
- Chief of Maintenance
- Mechanics

The designated roles involved in overseeing training and authorizing solo flights are as follows:

Chief Flight Instructor (CFI)

The CFI is responsible for upholding the Club's high standards in pilot training, ensuring compliance with safety and regulatory protocols, and overseeing the safety of flight operations, particularly in training and solo flight authorizations.

Reporting to the Operations Manager, the CFI's key responsibilities include:

- Maintaining rigorous standards for both pilot and student proficiency.
- Authorizing flights and actively monitoring flying conditions to ensure safe operations.
- Supervising all training staff and assigning responsibilities as needed.
- Managing student pilot training programs, conducting proficiency evaluations, and recommending qualified students for the LSA Pilot Permit.
- Keeping accurate and up-to-date records of all club pilots.



- Acting on behalf of the Operations Manager during their absence to ensure continuity in training and operational oversight.

The CFI assigned an examiner to conduct a solo check on the Pilot and subsequently approved him for his first solo flight.

Flight Instructors and Examiners

Flight Instructors and Examiners play essential roles in the practical and theoretical development of students. Both report to the CFI, and their responsibilities are as follows:

Flight Instructors:

- Conduct flight and ground training, ensuring students acquire the necessary skills and knowledge.
- Provide pre- and post-flight debriefing, offering constructive feedback to students.
- Verify and maintain accurate entries in student logbooks.
- Ensure all training activities adhere to club safety protocols and regulatory standards.

Examiners:

- Conduct official flight assessments and certification checks to validate student proficiency.
- Collaborate with the CFI to uphold consistent training standards.
- Perform proficiency and certification checks for pilots, ensuring ongoing compliance with required skill levels and regulations.

Prior to the day of the Accident, the Pilot completed an evaluation with an examiner, meeting the required standards to be released for a solo check on 9 October 2024. On the day of the Accident, the Instructor conducted a briefing with the pilot over the phone, providing instructions to begin the pre-flight check. During the accident flight, the Instructor was not on the radio telephony (RT) transceiver while the student was on his solo flight.

Training

The Club offers a diverse range of training programs, including comprehensive courses in microlight training, gyrocopter training, and powered parachute instruction. These programs provide instructors with thorough knowledge and hands-on experience in various aspects of aircraft operation. The training covers key areas such as flight dynamics, safety protocols, emergency procedures, and advanced manoeuvres tailored to each type of aircraft.

The Pilot was in the process of completing his gyrocopter training program and working towards his rating.

Gyrocopter pilot licensing program

The gyrocopter pilot licensing program offers a comprehensive blend of theoretical and practical training. It includes a minimum of 25 hours of ground instruction and 30 hours of flight training. For candidates with relevant licenses, such as ATPL, CPL, or PPL, a streamlined version of the program may be available, requiring at least 10 hours of flight training and 5 hours of ground instruction, depending on prior experience.

Training begins with ground instruction on key subjects, including flight principles, navigation, meteorology, and aviation law, laying a solid foundation for safe operation. Practical training then follows, comprising both dual instruction and solo flight hours. This phase focuses on essential skills such as take-off, landing, circuit flying, and emergency procedures. Only after demonstrating proficiency in independently managing the gyrocopter is the student allowed to conduct solo flights, further building confidence and capability.

The program concludes with a final handling test, during which an examiner assesses the pilot's ability to operate the gyrocopter safely and effectively under various conditions. Upon completing all requirements, the candidate is awarded the Light Sport Aircraft (LSA) pilot license for gyrocopters, valid for two years, with revalidation required for license maintenance.

The Pilot held a CPL-A rating, which, according to the training manual, required at least 10 hours of flight training and 5 hours of ground instruction. The Pilot completed the ground training portion and began practical training, logging 6.5 flight hours before the solo check.

Theoretical training

According to the Club's training manual, the Gyrocopter course ground school covers essential topics, including principles of flight, aviation law, navigation, meteorology, airframes, engines, aircraft instruments, fire safety, first aid, safety equipment, and human performance limitations, with a total ground school time of 40 hours.

During the Investigation, it was noted that the required ground school materials needed verification. The Club relies on the Instructor to provide these materials. As he did not provide any specialized material for the Club. In addition, the Pilot confirmed receiving a digital copy of the *pilot's operating handbook* and several other documents from the instructor, such as UAE route map, the Club's basic



flight training manual covering radio telephony and aerodrome information, along with links to YouTube videos on the history and principles of autogyros for self-reading. Then the Instructor and Pilot briefly discussed the flight plan before starting dual flight sessions, a process that did not fully meet professional standards for theoretical training delivery.

Releasing to Solo flight

The authorization process for a pilot's solo flight in a gyrocopter at the Club involves several critical steps, outlined as follows:

Solo check

The examiner conducts a pre-solo check flight with the student pilot (SP) to determine solo readiness. During this evaluation, the examiner assesses the SP's control over different flight modes, responses to simulated emergency situations, and ability to follow circuit patterns. To qualify for solo flight, the SP must demonstrate proficient control, achieving a minimum assessment score of 4 out of 5.

Pre-flight briefing and preparation

Before the first solo flight, the instructor provides an in-depth briefing on the specific handling characteristics of a gyrocopter during solo operations. This briefing covers increased power requirements during takeoff, landing adjustments, and essential emergency procedures, particularly for engine failure at different stages of flight. This preparation ensures that the pilot is fully aware of the unique demands of solo flight.

Supervision during initial solo flight

Once the assessment and briefing are successfully completed, the pilot may be cleared for an initial solo flight. This flight is generally limited to three circuits around the airfield, closely supervised by the instructor from the ground. Throughout the solo flight, the instructor maintains radio contact with the pilot to offer real-time guidance and ensure compliance with safety protocols.

Ongoing solo circuit training

Following a successful initial solo, the pilot may proceed with additional solo circuits and local area flights. These subsequent flights are intended to strengthen the pilot's skills in general flying and circuit procedures, allowing for greater proficiency in fundamental tasks before advancing to more complex training stages.

Dual training requirement prior to solo flights

All SPs must complete dual flight training before being authorized for solo flights for the first three solo flight. This requirement ensures each pilot meets the Club's

competency standards, maintaining high safety and skill levels before solo operations.

The Pilot completed his solo check on 9 October 2024, with a 20-minute flight involving four landings. On the same day, he performed his first solo flight, lasting 15 minutes with one landing.

Following this, the Pilot undertook a dual flight with an instructor, lasting 30 minutes and including six landings. He then completed his second solo flight on 11 October 2024, with a duration of 1.5 hours and seven landings. On the day of the Accident, the Pilot performed the solo flight without the required prior dual training flight.

Additional Information

Gyroplane Dynamic rollover

During a gyrocopter takeoff, dynamic rollover, although less common than during landing, remains a risk if specific precautions are not carefully observed. As the rotor spins at high speed to generate lift, the gyrocopter's triangular landing gear and high center of gravity can contribute to conditions that may result in rollover if the pilot applies improper control inputs or encounters strong crosswinds.

To mitigate the risk of dynamic rollover during takeoff, the pilot must maintain precise control of the rotor and avoid aggressive or premature movements of the control cyclic. Gradual power application while keeping the control cyclic centered supports stability. In crosswind conditions, cautious steering inputs are essential, as even minor adjustments at high rotor speeds can exert significant lateral forces on the wheels.

As the gyroplane gains speed, the rotor lift force increases. Moving the control cyclic forward too early can cause the nose to dip, heightening susceptibility to side-loading forces from slight steering inputs or wind gusts, potentially leading to a rollover. Proper take-off procedure involves allowing the gyroplane to gradually reach take-off speed, maintaining a steady control cyclic position, and following a straight runway path until lift-off. (Figure 7)

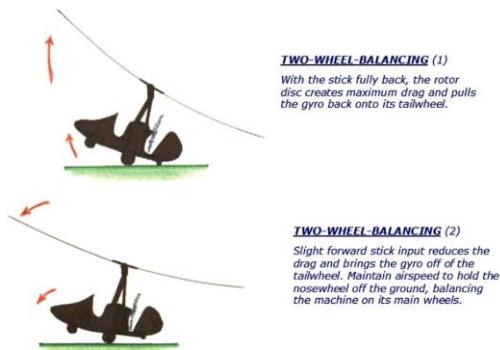


Figure 7. Movement of cyclic and its effect in the takeoff

Analysis

The Pilot

The Pilot possessed a valid CLP-A license for fixed-wing aircraft and had professional experience as a skydiver pilot. He had logged a total of 1,046.2 hours as pilot-in-command across different aircraft types, though his experience with gyrocopters was limited to 1.5 hours as pilot-in-command in that category.

On 27 September 2024, he completed his last command flight. Then, on 10 October 2024 (two days before the Accident), he conducted training for another pilot on a Twin Otter aircraft. According to his duty roster, he did not operate both fixed-wing aircraft and gyrocopters on the same day.

His gyrocopter training began on 18 September 2024. He passed his solo check and conducted his first solo flight on 9 October 2024, followed by a dual flight and a second solo flight on 11 October 2024.

On the day of the Accident, he was performing his third solo gyrocopter flight. After a phone briefing from his Instructor, he proceeded without any dual flight that day. By this point, the Pilot had accumulated a total of 9 hours and 5 minutes of flight experience in gyrocopters before the Accident sortie.

Pilot Performance During Take-off

The Pilot was actively engaged in the professional operation of a fixed-wing, turboprop aircraft while simultaneously pursuing recreational training on a gyrocopter.

Despite shared objectives of achieving controlled flight, the aerodynamic principles and control mechanisms between fixed-wing aircraft and gyrocopters exhibit significant divergences. In fixed-wing aircraft, lift is generated through airflow over

stationary wings, with control over pitch, roll, and yaw achieved through ailerons, elevators, and rudder systems. These controls rely on consistent forward propulsion to maintain stability and facilitate manoeuvring. In contrast, gyrocopters generate lift through unpowered, freely rotating rotor, which is driven by forward movement. Control of a gyrocopter primarily involving adjusting the rotor disc, offering a unique method of aircraft handling.

Transitioning between fixed-wing and gyrocopter operations within short timeframes introduces specific risks due to the distinct control and stability characteristics inherent to each type. Such a transition can lead to "cognitive interference," wherein the pilot's procedural and muscle memory developed for one aircraft type inadvertently influences reactions in the other. This challenge is especially pronounced during critical flight phases, such as takeoff and landing, where rapid response to control inputs is required. Differences in control feedback and timing between fixed-wing and gyrocopter handling increase the likelihood of momentary misinterpretation, potentially impacting safe aircraft operation.

Theoretical Training

Self-reading, while beneficial for reinforcing knowledge, cannot replace formal ground school in pilot training. Ground school provides structured, interactive learning under the guidance of qualified instructors, ensuring that students receive essential information, engage in discussions, ask questions, and clarify complex topics. This approach enables instructors to assess comprehension in real-time, address any knowledge gaps, and prepare students for real-world applications and critical decision-making.

The Investigation identified a gap in the provision of required ground school materials, crucial for consistent and structured pilot training. Reliance on self-study materials, such as a digital pilot's handbook, a route map, basic manuals, and online videos, does not provide the thorough theoretical foundation essential for a professional training environment.

Although self-study can support formal instruction, it cannot replace structured ground school sessions led by qualified instructors. A brief discussion of the flight plan before dual flights, without in-depth coverage of key theoretical concepts, does not meet the standards required for effective pilot training.

Dual Solo Circuit

According to the Club's training procedures, the instructor is required to conduct a minimum of 15 circuit sessions with the student and must perform dual circuit

sessions before authorizing the pilot's first three solo flights.

On the day of the Accident, the Instructor was not present at the Club and conducted the briefing over the phone. Additionally, the Instructor was not available on the radio telephony transceiver during the Pilot's solo flight.

Gyrocopter Examination

The teardown report of the Gyrocopter revealed that the engine and cyclic control mechanism were inspected after the Pilot reported unusual stick vibrations. During the inspection, the engine cylinder compression was tested and measured between 75 and 78 PSI, confirming it was within the acceptable range and showing no immediate compression issues.

Both the oil filter and magnetic plug were examined, with no metal particles detected, suggesting minimal internal wear. The exhaust assembly and spark plugs were also inspected for damage, leaks, and general condition, all of which were satisfactory. Additionally, the propeller shaft was checked and found intact and free to rotate smoothly.

For the control cyclic mechanism, it was noted that the push rods operating the rotor were bent as a result of the Accident. While the main rotor operation mechanism remained intact and functional, some push/pull rods exhibited bending marks (Figure 8). This deformation in the control cyclic mechanism affected the system's efficiency.



Figure 8. deformation in the cyclic

Ground markings

The rotors struck Runway 28, creating six slashes (figure 9).



Figure 9. deformation in the cyclic

Runway Details and Incident Sequence:

- Runway Length: 768 meters
- Distance from Runway 28 to First Impact: 173.5 meters
- Distance from Threshold to Wreckage: 239.9 meters
- Sequential Impact Distances from First Impact:
 - Second Impact: 6.20 meters
 - Third Impact: 9.25 meters
 - Fourth Impact: 12.35 meters
 - Fifth Impact: 15.35 meters
 - Sixth Impact: 18.40 meters

Given the distance from the first impact to the wreckage position (239.9 meters) and the time from the first impact to the wreckage (5 seconds), and applying kinematic equations, the initial speed and deceleration were calculated to be 12,38 m/s, and - 5.31 m/s², respectively.⁸

⁸ The Gyrocopter travelled a total deceleration distance of $239.9 - 173.5 = 66.4$ meter over 5 seconds, from the first impact to the wreckage.

The formula for average velocity v_{avg} is:

$$v_{avg} = \frac{\text{Total Distance}}{\text{Time}} = \frac{66.4}{5} = 13.28 \text{ m/s}$$



The Gyrocopter's initial velocity at the first impact was approximately 26.56 m/s (approx. 95.62 Km/h), with a deceleration rate of -5.31 m/s^2 over the 239.9 meters from the first impact to the wreckage position. This high deceleration rate suggests a significant loss of control and rapid reduction in speed, likely due to the "high-speed rotor flap" condition.

Conclusions

Based on the available evidence, the following findings, causes, and contributing factors were identified in relation to this accident. These findings are presented without assigning blame or liability to any specific organization or individual:

- Findings: Statements of all significant conditions, events, or circumstances pertaining to this Accident. These findings highlight crucial steps in the accident sequence but are not necessarily causal or indicative of deficiencies.
- Causes: Actions, omissions, events, conditions, or combinations thereof that directly led to the Accident.
- Contributing Factors: Actions, omissions, events, conditions, or combinations thereof that, if eliminated, avoided, or absent, would have decreased the likelihood of the Accident occurring or mitigated the severity of its consequences. The identification of contributing factors does not imply fault or liability, whether administrative, civil, or criminal.

Findings

- The Club operated under a valid Light Sport Aircraft (LSA) authorization issued by the GCAA.
- The Pilot possesses a valid CPL-A (Commercial Pilot License - Airplane) for fixed-wing aircraft with ratings in IR/ME/SPA and DHC6.

- The Pilot had accumulated a total of 3,205.7 flight hours across various aircraft types.
- The Pilot began gyrocopter training on 18 September 2024.
- The Pilot completed his solo check and first solo flight on 9 October 2024.
- The Pilot had logged 1.6 hours of solo command time on the gyrocopter.
- The Accident flight was the Pilot's third solo on the gyrocopter.
- The theoretical material was covered through self-reading, and no additional materials were provided during ground schooling.
- The Instructor briefed the Pilot over the phone before the flight.
- The Pilot did not conduct a dual flight on the day of the Accident.
- The Instructor was not present on the radio telephony transceiver during the Pilot's solo flight.
- The Pilot did not accurately recall his cyclic movement actions during takeoff.
- The Gyrocopter underwent a 100-hour/annual inspection on 3 October 2024.
- The Gyrocopter had operated for 8.10 hours following the inspection.
- The crosswind was 6 knots, well below the Gyrocopter's maximum limit of 20 knots.
- The Gyrocopter examination did not reveal any malfunctions.

Causes

The Air Accident Investigation Sector determines that the cause of the Accident was the improper Gyrocopter's take-off handling. During takeoff, sudden rotor lifts and nose-up attitude, combined with rotor mismanagement, caused the Gyrocopter to roll left, leading to ground impact. This flight control input

Calculate Deceleration, $v_{avg} = \frac{v_{initial} + v_{final}}{2}$ the initial velocity equation

$$v_{initial} = 2(v_{avg}) - v_{final}$$

$$\rightarrow v_{initial} = 2(13.28) - 0 = 26.56 \text{ m/s}$$

The deceleration,

$$v_{final} = v_{initial} + (a \times t)$$

$$\rightarrow a = \frac{v_{final \text{ at the wreckage}} - v_{initial}}{t}$$

$$a = \frac{0 - 26.56}{5} = -5.31 \text{ m/s}^2$$



resulted from the Pilot's inadequate control techniques and potential confusion with fixed-wing operations.

Contributing Factors

The Air Accident Investigation Sector identify the following as contributing factors:

- (a) Operating fixed-wing flights while undergoing gyrocopter training
- (b) The lack of structured ground school materials compromised the quality of pilot training, as relying solely on self-study aids is insufficient. Self-study cannot replace formal sessions led by qualified instructors, and brief flight plan discussions without thorough theoretical review do not meet training standards.
- (c) The Pilot briefing was conducted over the phone, and the Instructor was not available on the radio telephony transceiver during the Pilot's solo flight. Additionally, no dual flight briefing was conducted before authorizing the pilot for solo flight.

Safety Recommendations

Safety Actions Taken

In response to the Accident, the Club outlined the following safety improvements and corrective actions planned for implementation.

Emergency response:

The emergency response plan (ERP) is made accessible to all staff in both digital and printed formats. Instructors are required to be present and monitor pilots' performance via RT during solo flights to ensure immediate support if needed.

Enhanced training:

The training program includes additional rotor management and emergency procedures, with solo flight clearances contingent on crosswind handling and rotor control assessments. The Club new policy required instructor oversight during all solo phases to be mandatory.

Conversion training for fixed-wing pilots:

The Club requires students to avoid fixed-wing flights during gyrocopter, ensuring full focus on rotorcraft skills. Crosswind handling evaluations and in-depth pre- and post-flight briefings emphasize critical handling differences.

Dual-Qualified Pilot Protocols:

The Club established a new policy for pilots'; categorization by experience, with set currency

periods to maintain proficiency. Mandatory pre-flight briefings highlight essential differences in control, reinforcing best practices across aircraft types.

Safety Recommendations

The Air Accident Investigation Sector recommends that:

Al Jazirah Aviation Club

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As the ground training materials were not specifically customized for the Club and instructors relied on general self-study resources that lacked interactive and discussion-based components, the Investigation recommends that the Club enhance theoretical training and ground instruction by providing dedicated, comprehensive materials and fully equipped classrooms that facilitate engagement and active discussion for pilots.

SR02/2025

The Instructor permitted the Pilot to perform a solo flight early in their training without proper monitoring or a supervised solo circuit on the day of the flight. Therefore, the Investigation recommends that the Club ensure that students' solo flights are actively monitored and prohibit clearance for taxiing or takeoff without the instructor or examiner availability on the radio for guidance.

SR03/2025

The Pilot was actively operating fixed-wing aircraft while also training on gyrocopters, which contributed to confusion in his responses due to the differing handling characteristics of each aircraft type. Therefore, the Investigation recommends that the Club update its policy to limit simultaneous operation of fixed-wing aircraft and gyrocopters for trainees. Furthermore, increasing the number of supervised solo circuits for pilots who are operating both types of aircraft would help reinforce specific handling skills, minimizing the risk of confusion and enhancing safety during solo flights.

This Summary Report is issued by:

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