SOUTH AFRICAN CIVIL AVIATION AUTHORITY

Section/division **Accident and Incident Investigations Division** Form Number: CA 12-57

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10254						
Classification	Accident		**Date**	14 December 2022		**Time**	0900Z
Type of Operation	Remotely Piloted Aircraft System (RPAS) Training (Part 101)						
Location							
Place of Departure	Houtkop AH near Vereeniging, Gauteng Province		Place of Intended Landing	Houtkop AH near Vereeniging, Gauteng Province			
Place of Occurrence	At Houtkop AH near Vereeniging						
GPS Co-ordinates	Latitude	26° 35' 31.21" S	Longitude	025° 53' 19.59" E		Elevation	5024ft
Aircraft Information							
Registration	ZT-WGG						
Make; Model; S/N	UAV Drone Solutions; Kestrel (Serial Number: K0015)						
Damage to Aircraft	Substantial		Total Aircraft Hours	472.29			
Pilot-in-command							
Licence Type	Remotely Pilot Licence		Gender	Male		Age	26
Licence Valid	Yes	Total Hours	1.37	Total Hours on Type			1.37
Total Hours 30 Days	1.37		Total Flying on Type Past 90 Days	1.37			
People On-board	0	**Injuries** 0	**Fatalities**	0	**Other (on ground)**		0

What Happened

On Wednesday, 14 December 2022, a Kestrel 2 remotely piloted aircraft (RPA) with registration ZT-WGG was involved in an accident at Houtkop AH training field near Vereeniging in Gauteng province. The flight was conducted under visual line of sight (VLOS) and under the provisions of Part 101 of the Civil Aviation Regulations (CAR) 2011 as amended.

The pilot reported that a pre-flight inspection and functional checks were conducted, and no anomalies were observed. The RPA was launched from the dedicated launch area at the training field for training exercises which involved point of interests using the Altitude Hold mode. As the RPA was flying in a south-easterly (SE) direction with the nose facing north-west (NW), the pilot lost control due to the wind which caused it to drift towards the eastern side of the training field. As the RPA drifted further, the pilot panicked and, thus, delayed executing other means of correcting the RPA's drift or to switch off the Global Positioning System (GPS) mode. The RPA drifted towards the trees and got trapped in one of the tree branches. During recovery, the RPA dislodged from the branch and fell to the ground. It sustained damage to the rear arm and the right-side rear landing gear. No person was injured during the accident sequence.

When the RPA maintenance records were scrutinised, no defects were recorded.
The following weather report was obtained from the pilot questionnaire. Good weather conditions prevailed at the time of the flight. The weather conditions were as follows:
Wind direction: southwest; Wind speed: 6.7kt; Air temperature: 28°C; Cloud cover: None; Dew point: 16.6°C.
The RPA type could be operated in windy conditions of 14 miles per second (m/s) or 27.21 knots (kts).

The RPA was flown sideways towards the left-side of the training field with its nose facing 90° from where it was headed.

Figure 1: The view of the training field and the accident site.

Figure 2: The damage on the right-side rear arm of the RPA.

The information below is an extract from the UAV & Drone Solution's Kestrel User Manual:

Kestrel 2 is a remotely piloted aircraft system (RPAS) has a powerful motor and a high-speed propeller. Never place your hands near the propeller while the motor is armed, and the safety button displays solid red. Always press and hold the safety button until it displays blinking red before handling the propeller. Fly in an open area away from people and buildings; do not attempt to fly indoors or in a confined space. Do not fly over people, near airports, or in any situation that could pose a hazard to those around you. Always fly within your line of sight and in compliance with local regulations. The Kestrel will not avoid obstacles on its own. As the pilot, it is your responsibility to avoid obstructions while flying. Do not fly in heavy wind or rain. Always follow the prefight and post flight steps in the order described in this manual and the flight checklist and attentive at all times while flying. The batter powering the RPAS is rechargeable lithium polymer and has an endurance of approximately 45minutes. Full manual of control surface and fly by wire A mode, full attitude stabilization, manual throttle. The RPAS has an operating maximum range of 5kilometer (km) and an altitude of 10 000feet (ft). Airspeed for (take-off, cruise, landing, stall, maximum) are limited to 16meter per second(m/s/). The maximum operating wind conditions are 14m/s. The RPAS is equipped with location sensors, antennas, radios and navigation equipment. Full automated mode flight to pre-programmed waypoints through the command mode it will enter an automatic flight the specific pattern until otherwise directed. The return to launch mode uses the position where it acquired GPS lock and into a circle pattern an pre-determine altitude. The RPAS is equipped with both VLOS and BVLOS mode. A mode of UAS operation in which it is not possible for the flight crew to maintain separation and collision avoidance through direct, unaided visual contact with the aircraft.

Manual control mode:
Fly with fine-tuned manual control without autopilot assistance. Manual mode gives you the most direct input to the control surface, resulting in precise in-flight adjustment. Try manual mode if you're an experienced RC plane operator

Findings

1. The pilot was issued a Remote Pilot Licence (RPL) by the Regulator (South African Civil Aviation Authority) on 31 October 2022 with an expiry date of 31 October 2024. The pilot's Class 3 medical certificate was issued on 1 October 2022 with an expiry date of 31 October 2026. The pilot had a visual line of side (VLOS) rating endorsed on his licence.

2. The RPA was issued a Remotely Piloted Aircraft Systems (RPAS) Letter of Approval (LOA) by the Regulator on 13 September 2021 with an expiry date of 30 September 2022. The last periodic maintenance conducted on the RPA was carried out on 15 November 2022 at 456.08 hours; however, there was no submission to the Regulator for the renewal of the RPAS LOA. Therefore, the RPA was operated with an invalid RPAS LOA.

3. The RPA maintenance was carried out by an approved person (AP) with a Remote Maintenance Technician Certificate (RMT) that was issued by the Regulator on 4 April 2022 with an expiry date of 3 April 2024.

4. The operator had an Approved Training Organisation (ATO) certificate No: SACAA/1572/ATO that was issued by the Regulator on 23 September 2022 with an expiry date of 30 September 2027. The operator's operational specification endorsements included the RPA type. The endorsement was valid from 23 September 2022 to 30 September 2023.

5. The pilot stated that he was engaged in RPA training exercises when it suddenly drifted towards the eastern side of the training field. He panicked and delayed correcting the drift. The RPA type could be operated in windy conditions of 14m/s (27.21kt). The prevailing weather conditions at the time of the flight were calm and could not have contributed to the unstable operation of the RPA.

6. It is evident that the pilot operated the RPA with its nose facing the opposite direction to where it was headed. As such, the pilot's flight inputs were disorientated. The RPAS's heading was facing a different direction to the one he intended, and gave inputs expecting the RPAS to fly towards him, but it went the opposite direction. It is likely that the pilot's inputs caused the RPA to travel facing the opposite direction and, in an attempt to correct the anomaly, the pilot further made inputs which caused the RPA to fly towards the trees where it got caught on one of the branches.

7. The pilot had limited experience with 1.37 hours of the RPA type. This likely contributed to lack of sufficient control during operation.

8. The aircraft accidentally fell to the ground during recovery. It sustained damage to its rear arm and right-side rear landing gear.

Probable Cause(s)

The pilot made a command input error as he did not consider the RPA's orientation (the direction the RPA was facing) and it got caught in a tree branch.

Contributing Factor(s)

The pilot flew the RPA with its nose facing a different direction to where it was headed and made normal commands without considering its orientation (directional disorientation).

Safety Action(s)

None.

Safety Message and/or Safety Recommendation/s

None.

About this Report

The decision to conduct a limited investigation is based on factors including whether the cause is known and the evidence supporting the cause is clear, the level of safety benefit likely to be obtained from an investigation and that will determine the scope of an investigation. For this occurrence, a limited investigation has been conducted, and the Accident and Incident Investigations Division (AIID) has relied on the information submitted by the affected person/s and organisation/s to compile this limited report. The report has been compiled using information supplied in the initial notification, as well as from follow-up desk top enquiries to bring awareness of potential safety issues to the industry in respect of this occurrence, as well as possible safety action/s that the industry might want to consider in preventing a recurrence of a similar occurrence.

All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Purpose

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011 and ICAO Annex 13, this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and not to apportion blame or liability.

Disclaimer

This report is produced without prejudice to the rights of the AIID, which are reserved.

This report is issued by:
Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa