SOUTH AFRICAN CIVIL AVIATION AUTHORITY

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

LIMITED ACCIDENT INVESTIGATION REPORT

Reference Number	CA18/2/3/10083										
Classification	Accident	**Date**	19 November 2021	**Time**	0802Z						
Type of Operation	Remotely Piloted Aircraft (Part 101)										
Location											
Place of Departure	Andrew's Field (FAAF), Western Cape province		Place of Intended Landing		Andrew's Field (FAAF), Western Cape province						
Place of Accident	Runway 11 FAAF										
GPS Co-ordinates	Latitude	S 34° 45' 47"	Longitude	E 20° 2' 13"	Elevation	35 ft					
Aircraft Information											
Registration	ZT-UOI										
Model/Make	Astus II Tellumet (Serial Number: 301)										
Damage to Aircraft	Substantial		Total Aircraft Hours		1876.2						
Pilot-in-command											
Licence Valid	Yes		Gender		Male		Age	28			
Licence Type	Remote Pilot Licence (RPL)										
Total Hours on Type	41.6			Total Flying Hours			41.6				
Pilots Controlling	2 + 0	Injuries	0	Fatalities	0		Other (On Ground)	0			
What Happened											

On 19 November 2021, two pilots (internal and safety) operating an Astus II unmanned aerial vehicle (UAV) with registration ZT-UOI took off on a test flight for automatic take-offs and landings (ATOLs) at Andrew's Field (FAAF) in the Western Cape province. A flight plan was not filed. The flight was conducted under visual flight rules (VFR) by day and under the provisions of Part 101 of the Civil Aviation Regulations (CAR) 2011 as amended.

The internal pilot stated that the aircraft had an automatic take-off from Runway 11 at 0754Z to the take-off Loiter position where the aircraft maintained its current location and altitude of 600 feet (ft) above mean sea level (AMSL) (see Figure 1). The aircraft remained at the take-off Loiter position until the change to Setpoint flight mode was activated by the internal pilot for an automatic land command on Runway 11. A few seconds later, the pilot noted that the aircraft was longer on Differential Global Positioning System (GPS) lock but switched to a 3D GPS fix, which is slightly less accurate. The aircraft

proceeded to the landing Loiter position and completed two patterns before continuing to long final for Runway 11.

Figure 1: Flight pattern of the automatic take-off and landing circuit. (Source: Operator)

The approach for landing was uneventful until the flare phase, which was approximately 5ft above ground level (AGL) whereupon the safety pilot observed the aircraft yaw to the left and drifted away from the centreline. The safety pilot switched from ATOL to Manual mode via remote-controlled transmitter to execute a manual go-around; he observed the aircraft correcting for the heading drift based on the manual control inputs. Approximately a second later, the internal pilot switched from Manual mode to Setpoint mode via the container-based main controller with the same intention as the safety pilot, which was to conduct a go-around. In the Setpoint mode, the aircraft was being commanded to pitch up with no guidance control on banking. The safety pilot immediately noticed that his manual inputs differed from what the aircraft was doing and that he had lost control of the aircraft. Due to a crosswind from the right, the aircraft drifted to the left of the runway and the left-wing tip impacted shrubs, resulting in the aircraft flipping over and impacting the ground. The aircraft came to a halt on the left of the runway in an inverted position.

Figure 2: The aircraft at the accident site. (Source: Operator)

What was found:

- Weather as reported by the pilots

Wind Direction	190˚	Wind Speed	6kts variable 170°-205°	Visibility	9999m
Temperature	22˚C	Cloud Cover	Broken (5-6 oktas)	Cloud Base	3000 ft
QNH	1021hPa				

- Differential GPS vs 3D Fix (Source: The GPS Dictionary)
  Differential GPS (DGPS) is a technique used to improve positioning or navigation accuracy by determining the positioning error at a known location and subsequently incorporating a corrective factor (by real-time transmission of corrections or by post processing) into the position calculations of another receiver operating in the same area and simultaneously tracking the same satellites. Also, a system of beacons which broadcasts signals to help increase the accuracy of GPS positioning.
  A 3D (Three Dimensional) is when the horizontal and vertical position with latitude/longitude/altitude (northing/easting/altitude or X/Y/Z) is called 3D coordinate.

- Flight Modes (Source: Astus Flight Manual)
  Manual: Utilising a RC control box to control UAV pitch, bank and rudder / nose-wheel angle and throttle within control limits.
  Set-point: Utilising software menu to set UAV altitude, airspeed and heading within control limits.

- Minimum Crew Requirement (Source: Astus Manual)
  Pilot Operator: The pilot operator is responsible for mission planning, co-ordination and control, communications, flight control and UAV monitoring.
  Safety Pilot: The safety pilot is responsible for the take-off and landing phases of the flight if Automatic Take-Off and Landing (ATOL) is not utilised as well as the UAV electrical maintenance.

- The safety pilot was positioned next to the runway, utilising a Spektrum remote controller transmitter, whilst the internal pilot was stationed inside the container with the main controller. The pilots used an intercom system to communicate with each other and only one pilot had control of the system at a time.

Figure 3: Remote controller utilised by the safety pilot. (Source: spektrumrc.com)

Figure 4: Main controller utilised by the internal pilot. (Source: Pilot)

Probable Cause:

Loss of control of the aircraft in an abrupt manoeuvre due to conflicting control inputs by the internal and safety pilots, resulting in the aircraft impacting the shrubs.

Contributory Factor:

Lack of communication between the internal and safety pilot.

Crosswind conditions.

Safety Action/s

None.

Safety Message

Pilots should communicate clearly as to who has control of the aircraft at a given time.

Purpose of the Investigation

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011, 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****.*

About this Report

Decisions regarding whether to investigate, and the scope of an investigation are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, no 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 brief report. The report has been compiled using information supplied in the initial notification, as well as follow-up information 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 accident. *This report provides an opportunity to share safety message/s in the absence of an investigation.* *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.*
Disclaimer
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This report is issued by:

Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa