SOUTH AFRICAN CIVIL AVIATION AUTHORITY

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

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10177						
Classification	Accident		**Date**	31 October 2022		**Time**	1210Z
Type of Operation	Private (Part 94)						
Location							
Place of Departure	Nieu-Bethesda Airfield, Eastern Cape Province		Place of Intended Landing	New Tempe Aerodrome (FATP), Free State Province			
Place of Occurrence	On an uneven terrain, approximately 90 metres from the threshold of Runway 28 at FATP						
GPS Co-ordinates	Latitude	29°01'44.1" S	Longitude	26°10'11.4" E		Elevation	4 547 ft
Aircraft Information							
Registration	ZU-EWZ						
Make; Model; S/N	PPHU Ekolot; KR-030 Topaz (Serial Number: 30-01-05)						
Damage to Aircraft	Substantial		Total Aircraft Hours	1001.8			
Pilot-in-command							
Licence Type	National Pilot Licence (NPL)		Gender	Male		Age	59
Licence Valid	Yes	Total Hours	532.37	Total Hours on Type		15.8	
Total Hours Past 30 Days	15.8		Total Flying Hours on Type Past 90 Days	15.8			
People On-board	1 + 0	**Injuries** 0	**Fatalities**	0	**Other (on ground)**		0

What Happened

On Monday, 31 October 2022, a pilot on-board an Ekolot KR-030 Topaz aircraft with registration ZU-EWZ was on a private flight from Nieu-Bethesda Airfield in the Eastern Cape province to Eagle's Creek Aerodrome in Gauteng province. The pilot was accompanied by a friend who was flying an Alto 912 TG light-sport aircraft (LSA) with registration ZU-IEA. The pilots had planned to fly in a loose formation (some distance apart) via New Tempe Aerodrome (FATP) in the Free State province with the intention to have lunch and uplift fuel before proceeding to Eagle's Creek Aerodrome. No flight plan was filed. The flight was conducted under the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended.

According to available information, the pilots made a detailed assessment of the weather conditions before the flight. The ZU-EWZ had a total of 53.1 litres (l) of Avgas 100 LL fuel in the tanks (3 hours endurance). A pre-flight inspection was conducted on both aircraft, and no anomalies were detected. Later, the pilots boarded their respective aircraft and started the engines. The ZU-EWZ pilot taxied the aircraft to the threshold of Runway 13, a gravel runway, followed by the ZU-IEA aircraft. The pilots performed pre-departure checks and the ZU-EWZ pilot took off first. Both aircraft climbed to 6 500 feet (ft), flying in a loose formation.

The pilots continued to communicate en route with the ZU-EWZ pilot responsible for the radio work. After flying over the Gariep Dam, approximately 4 nautical miles (nm) east of FATP, the ZU-EWZ pilot felt minor vibration emanating from the propeller. A few minutes later, the vibration intensified, however, the engine indications remained within limits. The pilot reduced the engine power from 5 200 revolutions per minute (RPM) to 4 200 RPM, this seemed to reduce the intensity of the vibration. However, he could not maintain the aircraft's height due to reduced power. The pilot radioed the ZU-IEA pilot, directing him to take over the radio work whilst he tried to figure out how best to handle the aircraft. After the aircraft had descended to 6 000ft, the pilot opened the throttle to regain height, but the vibration intensified.

The pilot reduced the engine power to 3 000 RPM and lined up the aircraft for Runway 28 at FATP. He reported that on final approach, the engine was set to idle power and the aircraft was on glide. After realising that the aircraft would not reach the runway, the pilot opted to perform a forced landing on an uneven terrain, approximately 90 metres (m) from the threshold of Runway 28. After landing, the nose wheel dug into the soft ground and the spring-loaded nose gear strut collapsed. The aircraft was substantially damaged; however, the pilot was not injured. The pilot of the ZU-IEA aircraft landed safely on Runway 28. The duration of the flight was 1.9 hours and approximately 35l of fuel remained in the ZU-EWZ aircraft tanks.

The accident occurred during daylight at Global Positioning System (GPS) determined to be 29°01'44.1" South and 26°10'11.4" East, at an elevation of 4 547ft.

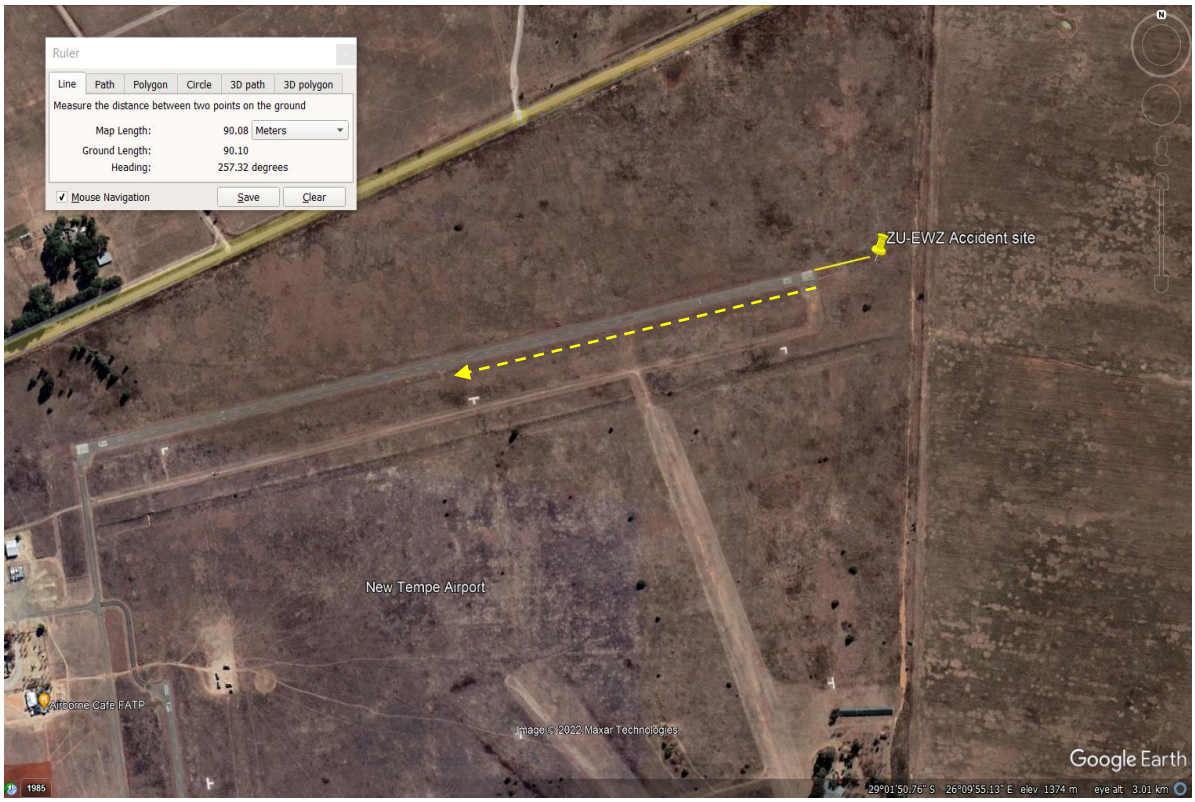

Figure 1: Distance from the accident site to the runway threshold. (Source: Google Earth).

Figure 2: Touchdown point and the final position of the ZU-EWZ aircraft post-accident.

The Pilot

The pilot was initially issued a National Pilot Licence (NPL) by the South African Civil Aviation Authority (SACAA) on 9 January 2006. The NPL was reissued by the SACAA on 22 January 2022 with an expiry date of 21 January 2024. The pilot's logbook was examined, and it was found that at the time of the accident, the pilot had flown a total of 532.37 hours, of which 15.8 hours were on the aircraft type. The pilot had the aircraft type endorsed on his licence. The aircraft type conversion/rating was conducted and overseen by the SACAA's certified Designated Flight Examiner (DFE) on 22 January 2022. The pilot had a valid Class 4 aviation medical certificate, which was issued on 12 June 2021 with an expiry date of 30 June 2024. The pilot had a restriction to wear suitable corrective lenses.

The Aircraft

The Ekolot KR-030 Topaz is a single-engine, two-seat in side-by side configuration, cantilever high-wing aircraft with tricycle fixed landing gear made of composite material. The aircraft is manufactured in Poland and the design complies with the Federation Aeronautique Internationale microlight rules and Federal Aviation Administration (FAA) light sport aircraft (LSA) rules. The aircraft comprises two connected fuel tanks of 18.5 US gallons (70l) total capacity, mounted in the cockpit floor behind the seats. Fuel consumption is estimated at 13.6l per hour. It is powered by a four-cylinder, four-stroke, horizontally opposed Rotax 912 UL carburetted engine with serial number 4408789. The engine is equipped with a single central camshaft with hydraulic tappets.

The cylinder heads are liquid cooled, and the cylinders are ram air cooled. The oil system is a dry sump forced lubrication system. The engine utilises a reduction gearbox to drive the three-blade ground adjustable Peszke AS-1700/1950-50 propeller. The propeller is 64.96 inches in diameter and is attached to the engine reduction gearbox flange by six bolts. The propeller blades are constructed of carbon fibre and composite and are clamped between two aluminium alloy half-hubs to form the propeller assembly. The engine has a maximum take-off power output of 100 horsepower (hp) and continuous power of 80hp. The maximum engine static RPM for take-off is 5 800.

Figure 3: The design of the propeller.

A review of the aircraft's maintenance records indicated that the last 100-hour annual inspection prior to the accident flight was certified on 20 March 2022 at 959.00 airframe hours. The aircraft had logged 1001.8 total hours at the time of the accident flight; meaning that it had been flown a further 42.8 hours since the last inspection. The aircraft's Authority to Fly (ATF) certificate was issued on 12 April 2022 with an expiry date of 31 May 2023. The Certificate of Registration (C of R) was issued to the current owner on 22 September 2021. The Certificate of Release to Service (CRS) was issued on 22 March 2022 with an expiry date of 31 May 2023 or at 1059 hours, whichever occurs first.

An official weather report was obtained from the South African Weather Service (SAWS). The weather information entered in the table below was captured at 1200Z at Bram Fischer International Airport (FABL) weather station, which is the closest weather station to the accident site.

Wind Direction	220°	Wind Speed	9 knots	Visibility	> 10km
Temperature	27°C	Cloud Cover	Nil	Cloud Base	Nil
Dew Point	-2.9°C	QNH	1018 hPa		

Post-accident examination of the wreckage and analysis

The aircraft was visually examined at FATP to assess the damage sustained during the accident sequence. The condition of the propeller was consistent with the engine not producing power at the time of the accident. Pre-impact control integrity and normal operation were established. The flaps were set to +40° in a landing position. Damage was observed on the nose gear strut and wheel fairing, nose gear wheel hub, left main gear wheel fairing and the pitot tube. The spinner was properly fitted and showed no sign of a heavy spot/s. The engine was intact and properly secured to the cradle and firewall. All the engine elastomeric vibration rubber mounts were in a good condition. The propeller was properly fitted to the reduction gearbox flange. The propeller was turned by hand and compression was attained on all four cylinders. A chip detector was removed from the engine casing; no evidence of metallic debris was found.

Propeller blade number 1 was found in a good condition and undamaged. The damaged propeller blades number 2 and 3 were analysed; both propeller blade tips showed chip marks or nicks associated with stones that were swept up in the prop wash during operation. The blade number 2 contacted the ground first after the collapse of the nose gear strut, before it broke off about midspan. The blade number 3 contacted the ground last with the already fractured tip. The blade number 3 cord area showed a fractured surface, consistent with a backward bend load as the aircraft slid on the soft ground before it broke off at the root. The broken-off parts of the fractured blade number 3 tip were not found.

Figure 4: The propeller blades post-accident.

All three blades showed no evidence of abnormal play within the hubs. The hub bolt torques were checked by unscrewing the bolts with a calibrated torque wrench. All six hub bolts were found to be within the required tightening torque value of 20 Newton meter (Nm) as recommended in the overhaul manual.

Examination of the aircraft's technical documentation indicated that the propeller had accumulated 1001.8 hours since new, and 42.8 hours since the last 100-hour annual inspection was conducted on 20 March 2022.

The propeller was removed from the engine by the South African Civil Aviation Authority (SACAA) approved person (AP) for examination. The propeller blade pitch angles on all blades were measured in accordance with (IAW) the procedures in the overhaul manual. The results showed pitch angles of 20.5° on all three blades and were statically balanced, meaning that all three blades were moving evenly when they were rotating. Examination of the internal faces of the hub bores indicated normal contact marks made from the clamping of the propeller blade roots, and no visible evidence of rotation of the blade roots within the hub. The clearance between the hub halves when assembled were also within the prescribed limits as recommended by the overhaul manual. About 100 millimetres (mm) of the blade number 3 tip had fractured.

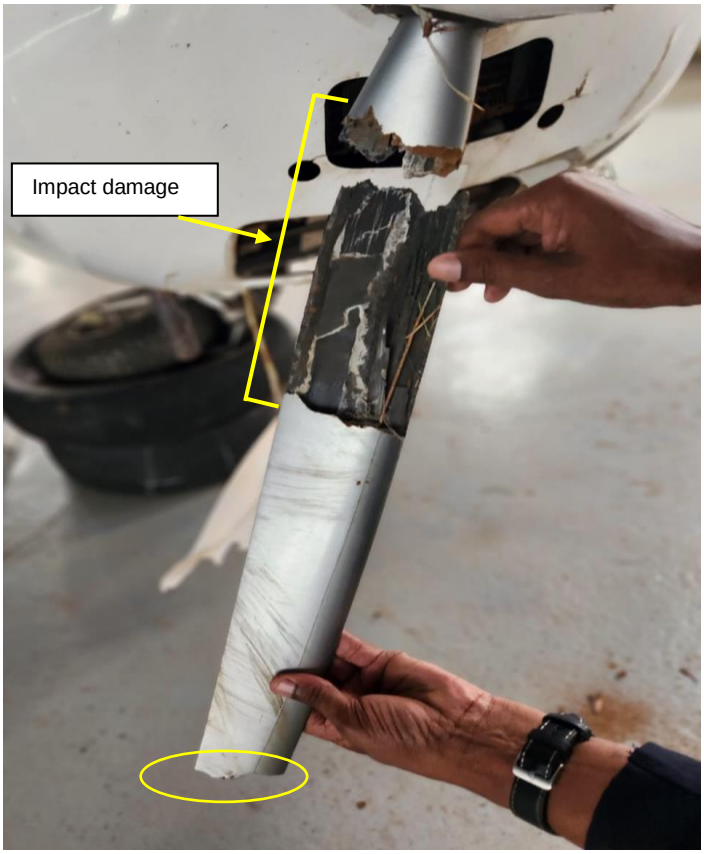

Figure 5: Reconstructed blade number 3 showing damage sustained on the cord and the tip that had fractured.

The investigation concluded that the fractured blade number 3 tip seemed to have occurred after hitting a stone that could have been swept up in the propeller wash during take-off from the gravel runway. During the latter stages of the flight, the weakened blade tip separated due to centrifugal forces imposed on it. Examination of the fractured surface on blade number 3 tip showed evidence of carbon fibre pulling apart as it separated.

Figure 6: An enlarged blade number 3 tip showing carbon fibre layers.

A review of the aircraft's maintenance records did not show any evidence of the propeller having suffered an overspeed condition, or of any damage having occurred to the blades during the life of the propeller. The aircraft was regarded as fully serviceable at the time of the flight. A review of the maintenance records showed no discrepancies that could have affected its operation or performance.

Findings

(i) The pilot was issued the NPL by the SACAA on 22 January 2022 with an expiry date of 21 January 2024.

(ii) At the time of the accident, the pilot had flown a total of 532.37 hours, of which 15.8 hours were on the aircraft type.

(iii) The pilot had a valid Class 4 aviation medical certificate, which was issued on 12 June 2021 with an expiry date of 30 June 2024. The pilot had a restriction to wear suitable corrective lenses.

(iv) This flight was conducted under the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended.

(v) Based on the weather report from the SAWS, no significant weather was present at the time of the flight.

(vi) The last 100-hour annual inspection prior to the accident flight was certified on 20 March 2022 at 959.00 airframe hours. The aircraft had logged 1001.8 total hours at the time of the accident flight; meaning that it had been flown a further 42.8 hours since the last inspection.

(vii) The Authority to Fly (ATF) was issued on 12 April 2022 with an expiry date of 31 May 2023.

(viii) The Certificate of Registration (C of R) was issued to the current owner on 22 September 2021.

(ix) The Certificate of Release to Service (CRS) was issued on 22 March 2022 with an expiry date of 31 May 2023 or at 1059 hours, whichever occurs first.

(x) The duration of the flight was 1.9 hours and approximately 35l of fuel remained in the ZU-EWZ aircraft tanks.

(xi) The pilot was not injured.

Probable Cause

The blade number 3 tip separated due to centrifugal forces after it had hit a stone that was likely swept up in the prop wash during take-off from an unpaved runway.

Contributing Factor

Operating the aircraft from a gravel runway.

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