AIRCRAFT SERIOUS INCIDENT REPORT AND EXECUTIVE SUMMARY

			Reference:	**CA18/3/2/1398**	
Aircraft Registration	**ZU-FWM**	**Date of Incident**	4 July 2022	**Time of Incident**	1645Z
Type of Aircraft	Windlass Aquila 912		**Type of Operation**	Training (Part 141)	
Pilot-in-command Licence Type	National Pilot Licence		**Age**	63	**Licence Valid**	Yes
Pilot-in-command Flying Experience	**Total Flying Hours**		7850	**Hours on Type**	3000
Last Point of Departure	Oudtshoorn Aerodrome, Western Cape Province				
Next Point of Intended Landing	Oudtshoorn Aerodrome, Western Cape Province				
Damage to Aircraft	Minor				

Location of the incident site with reference to easily defined geographical points (GPS readings if possible)

Oudtshoorn Aerodrome in the Western Cape Province, at Global Positioning System (GPS) co-ordinates determined to be 33°36′05.97″ South 022°11′10.94″ East, at an elevation of 1063 feet (ft)

Meteorological Information	Wind direction: 120; Wind speed: 8kts; Visibility: CAVOK; Temperature: 20ºC; Cloud cover: 0 OCTAS; Cloud base: Clear; Dew point: 11ºC; QNH: 1021hPa

Number of People On-board	2+0	**Number of People Injured**	0	**Number of People Killed**	0	**Other (On Ground)**	0

Synopsis

On Monday, 4 July 2022, a flight instructor and a student pilot on-board a Windlass Aquilla 912 Trike with registration ZU-FWM took off on a circuit training flight from Oudtshoorn Aerodrome (FAOH) in the Western Cape province, with the intention to land at the same aerodrome. According to the flight instructor, they flew one circuit and landed uneventfully on Runway 22. However, whilst taxiing the trike to the apron on taxiway Alpha, the engine mount that supports the engine and the seats frame broke off, which caused the seats to drop down a margin. This led to the throttle cable being pulled down before it got stuck in the open position (80% power). As a result, the trike accelerated sharply. The instructor steered the trike away from possible hazards before he brought it to a stop on a nearby field.

The flight instructor and the student pilot disembarked from the trike without sustaining injuries. During this incident, the engine mount (Pylon) failed, the rear axle and the radiator bracket bent, and the carburettors fell off.

Probable Cause

The engine mount Pylon failed during taxi due to a fatigue fracture. The engine mount Pylon that supports the engine and seat frame broke off and, subsequently, caused the seat to drop down a margin. This led to the throttle cable being pulled down before it got stuck in the open position, accelerating the trike sharply. The pilot lost control during the ground roll before he brought the aircraft to a stop.

Contributing Factors:

- Fracture adjacent to the engine mount vertical square tube/cross member welded joint.
- Burn-through welding as a result of excessive heat exposure during welding which blew holes through the centre of the metal and, consequently, reduced its thickness.
- Used spar tube had 1.6mm wall thickness whilst the current drawing requires 3mm wall thickness.

SRP Date	12 September 2023	Publication Date	15 September 2023

Occurrence Details

Reference Number	**:** CA18/3/2/1398
Occurrence Category	**:** Serious Incident
Type of Operation	**:** Training (Part 141)
Name of Operator	**:** Centurion Flight Academy
Aircraft Registration	**:** ZU-FWM
Aircraft Make and Model	**:** Solo Wings Windlass Aquila 912
Nationality	**:** South African
Place	**:** Oudtshoorn Aerodrome, Western Cape Province
Date and Time	**:** 4 July 2022 at 1645Z
Injuries	**:** None
Damage	**:** Minor

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.

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.

Investigation Process

The Accident and Incident Investigations Division (AIID) of the South African Civil Aviation Authority (SACAA) was notified of the occurrence on 4 July 2022 at 1700Z. The occurrence was classified as a serious incident according to the CAR 2011 Part 12 and ICAO STD Annex 13 definitions. The notifications were sent to the State of Registry, Operator, Design and Manufacturer in accordance with the CAR 2011 Part 12 and ICAO Annex 13 Chapter 4. No accredited representative and advisor were appointed for this incident. Investigator was not dispatched to the incident site for this serious incident.

Notes:

1. *Whenever the following words are mentioned in this report, they shall mean the following:*
   Serious Incident — this investigated serious incident
   Aircraft — the Windlass Aquila 912 involved in this serious incident
   Investigation — the investigation into the circumstances of this serious incident
   Pilot — the pilot involved in this serious incident
   Report — this serious incident report

2. *Photos and figures used in this report were taken from different sources and may have been adjusted from the original for the sole purpose of improving clarity of the report. Modifications to images used in this report were limited to cropping, magnification, file compression; or enhancement of colour, brightness, contrast; or addition of text boxes, arrows, or lines.*

Disclaimer

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Abbreviation	Description
º	Degrees
ºC	Degrees Celsius
AIID	Accident and Incident Investigations Division
ACCID	Accident
AMO	Aircraft Maintenance Organisation
AP	Approved Person
CAR	Civil Aviation Regulations
C of R	Certificate of Registration
CRS	Certificate of Release to Service
CVR	Cockpit Voice Recorder
E	East
FAOH	Oudtshoorn Aerodrome
FDR	Flight Data Recorder
FI	Flight Instructor
ft	Feet
GPS	Global Positioning System
hPa	Hectopascal
ICAO	International Civil Aviation Organisation
kt	Knots
m	Metres
METAR	Meteorological Routine Aerodrome Report
MPI	Mandatory Periodic Inspection
NPL	National Pilot Licence
QNH	Query Nautical Height
RWY	Runway
SACAA	South African Civil Aviation Authority
SACAR	South African Civil Aviation Regulation
SAWS	South African Weather Service
SP	Student Pilot
UTC	Co-ordinated Universal Time
Z	Zulu (Term for Universal Co-ordinated Time - Zero Hours Greenwich)

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1. On Monday, 4 July 2022, a flight instructor (FI) and a student pilot (SP) on-board a Windlass Aquilla 912 Trike with registration ZU-FWM took off on a circuit training flight from Runway (RWY) 22 at Oudtshoorn Aerodrome (FAOH), Western Cape province, with the intention to land at the same aerodrome. No flight plan was filed for the flight. The flight was conducted under visual meteorological conditions (VMC) by day and under the provisions of Part 141 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.1.2. The FI conducted a pre-flight inspection on the trike, and all checks were satisfactory. The trike had approximately 40 litres (l) of Mogas 95 Unleaded fuel in the tank before take-off. The FI stated that he ensured that the SP was properly harnessed to his seat (front seat) before he (FI) boarded the trike. After starting the engine and, once the indications were within the acceptable limits in accordance with (IAW) the Rotax Operator's Manual, he taxied to the threshold of Runway 22 and flew one circuit, followed by an uneventful landing back on RWY 22.

1.1.3. The FI reported that whilst taxiing the trike to the apron on taxiway Alpha, the engine mount Pylon that supports the engine and the seats frame broke off and dropped approximately 10 centimetres, which then caused the seats to drop down. This led to the throttle cable being pulled down; it got stuck in the open position at approximately 80% power. This further caused the magneto earthing cable to pull apart which caused a "live" engine and, as a result, the trike got into a high-speed taxi. The FI was unable to close the throttle because it was stuck in the open position. He then opted to steer the trike away from possible hazards and obstacles. Whilst the trike careered through the rugged terrain, both carburettors fell off which led to the engine stoppage. The trike came to a halt approximately 300 metres (m) on the right of Runway 22. The FI and the SP disembarked from the trike without sustaining injuries. The engine mount (Pylon) failed, the rear axle and the radiator bracket bent, and the carburettors fell off during the incident.

1.1.4. The incident occurred during daylight at Global Positioning System (GPS) co-ordinates determined to be 33º36'05.97" South 022º11'10.94" East, at an elevation of 1063 feet (ft).

Figure 1: Oudtshoorn Aerodrome where the incident occurred. (Source: Google Earth)

1.2. Injuries to Persons

Injuries	Pilot	Crew	Pass.	Total On-board	Other
Fatal	-	-	-	-	-
Serious	-	-	-	-	-
Minor	-	-	-	-	-
None	2	-	-	2	-
Total	**2**	**-**	**-**	**2**	**-**

Note: Other means people on the ground.

1.3. Damage to Aircraft

1.3.1. The engine mount that supports the engine and the seats frame failed, the rear axle and radiator bracket bent, and the two carburettors fell off.

1.4. Other Damage

1.4.1. None.

1.5. Personnel Information

Flight Instructor:

Nationality	South African	Gender	Male	Age	63
Licence Type	National Pilot Licence (Aeroplane)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Instructor rating				
Medical Expiry Date	4 August 2022				

Restrictions	Corrective lenses
Previous Accidents	None

Note: Previous serious incidents/accidents refer to past serious incidents/accidents the pilot was involved in, when relevant to this incident.

Flying Experience:

Total Hours	7850
Total Past 24 Hours	0.3
Total Past 7 Days	1.5
Total Past 90 Days	50.4
Total on Type Past 90 Days	50.4
Total on Type	3000

1.5.1. The FI was initially issued a National Pilot Licence (NPL) on 11 November 2011 in accordance with Part 62 of the South African CAR 2011 as amended. His licence was revalidated on 9 July 2021 with an expiry date of 31 July 2023.

1.5.2. The FI was issued a Class 4 medical certificate on 4 August 2021 in terms of Part 67 of the CAR 2011 with an expiry date of 4 August 2022, and with the restriction to wear suitable corrective lenses.

Student Pilot:

Nationality	Jamaican	Gender	Male	Age	28
Licence Type	Student Pilot Licence (Aeroplane)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	None				
Medical Expiry Date	30 June 2027				
Restrictions	None				
Previous Serious Incidents	None				

Note: Previous serious incidents refer to past serious incidents the pilot was involved in, when relevant to this incident.

Flying Experience:

Total Hours	4
Total Past 24 Hours	0.8
Total Past 7 Days	1.0
Total Past 90 Days	2.2
Total on Type Past 90 Days	2.2
Total on Type	4

1.5.3. The SP was initially issued a recreational Student Pilot Licence (SPL) on 14 June 2022 in accordance with Part 62 of the South African CAR 2011 as amended, with an expiry date of 13 June 2023.

1.5.4. The SP was issued a Class 4 medical certificate on 8 June 2022 in terms of Part 67 of the CAR 2011 with an expiry date of 30 June 2027, and with no restrictions.

Approved Person:

Nationality	South African	Gender	Male	Age	63
Licence Type	Approved Person				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Aeroplanes (including microlights), Maintenance, Repair and Inspection				
Restrictions	None				
Previous Accidents	None				

1.5.5 The Approved Person (AP) who conducted the last maintenance inspection prior to the incident flight had an AP certificate that was issued by the Regulator (SACAA) on 10 August 2006 with an expiry date of 18 November 2022.

1.6. Aircraft Information

1.6.1. The Windlass Aquila 912 Standard Equipment (Source: http://solowings.co.za/#trikes)

The trike is fitted with a Rotax 912 UL– 4 stroke engine with a stainless steel exhaust, as well as an electric starter. The power plant is fitted with a three-bladed propeller made of composite materials. It has a hinged pylon with a fairing and is fitted with front brakes. The trike also has a radio bracket and power points. In the system, there is a battery with a battery box and a rectifier.

The trike comes with bucket seats designed for spaciousness and comfort. The trike is also fitted with a custom-designed 50-litre fuel tank. The instrument panel features altitude, vertical speed, engine hours, flight duration, fuel level and other engine parameters.

Airframe:

Manufacturer/Model	Solo Wings, Windlass Aquila 912 UL
Serial Number	WA 1216
Year of Manufacture	2012
Total Airframe Hours (At Time of Serious Incident)	451.5

Last Inspection (Date & Hours)	6 June 2022	425.9
Hours Since 50Hour Inspection	25.6	
CRS Issue Date	6 June 2022	
Authority to Fly (Issue Date & Expiry Date)	12 April 2019	30 April 2023
C of R (Issue Date) (Present Owner)	3 May 2022	
Operating Category	Training (Part 141)	
Type of Fuel Used	Mogas 95 Unleaded	
Previous Serious Incidents	None	

Note: Previous serious incidents refer to past serious incidents the aircraft was involved in, when relevant to this incident.

Engine:

Manufacturer/Model	Rotax 912 UL
Serial Number	4409332
Part Number	912 ULS
Hours Since New	451.5
Hours Since Overhaul	TBO not reached

Propellor blade:

Manufacturer/Model	Warp Drive
Serial Number	C19165
Hours Since New	451.5
Hours Since Overhaul	TBO not reached

1.6.2. The last 50-hour inspection prior to the incident flight was conducted on 6 June 2022 at 425.9 airframe hours. The trike was issued a Certificate of Release to Service (CRS) on 6 June 2022 with an expiry date of 6 June 2023 or at 475.9 hours, whichever occurs first. The trike had accumulated an additional 25.6 airframe hours in operation since the last inspection. There were no defects recorded in the flight folio since the last inspection.

1.6.3. The aircraft was issued an Authority to Fly (ATF) on 12 April 2019 with an expiry date of 30 April 2023.

1.6.4. The aircraft was issued a Certificate of Registration (C of R) on 31 May 2022.

1.6.5. The manual stipulates that the life of the engine mounting bracket assembly is 1500 hours, and the airframe had 451.5 hours at the time of the incident.

1.7. Meteorological Information

1.7.1. The weather information below was obtained from the Meteorological Aerodrome Report (METAR) that was issued by the South African Weather Service (SAWS), recorded on 4 July 2022 at 1645Z at Oudtshoorn Aerodrome (FAOH).

Wind Direction	120°	Wind Speed	8kt	Visibility	CAVOK
Temperature	20°C	Cloud Cover	0 OCTAS	Cloud Base	Clear
Dew Point	11°C	QNH	1021hPa		

1.8. Aids to Navigation

1.8.1. The Windlass Aquilla 912 Trike is equipped with standard navigational equipment as approved by the Regulator (SACAA). There were no records indicating that the navigational equipment was unserviceable prior to the incident.

1.9. Communication

1.9.1. The Windlass Aquilla 912 Trike is equipped with a standard communication system as approved by the Regulator. There were no recorded defects with the communication system prior to the incident.

1.10. Aerodrome Information

1.10.1. The incident occurred at FAOH in the Western Cape Province, 300 metres (m) to the right of Runway 22.

Aerodrome Location	Oudtshoorn Aerodrome (FAOH), Western Cape Province
Aerodrome Status	Registered
Aerodrome GPS coordinates	33º36’25.08” S 022º11’20.32” E
Aerodrome Elevation	1063 feet
Runway Headings	22 and 04
Dimensions of Runway Used	1664m x 30m
Heading of Runway Used	22
Surface of Runway Used	Asphalt
Approach Facilities	None
Radio Frequency	115.50

1.11. Flight Recorders

1.11.1. The trike was neither equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR), nor was it required by regulation to be fitted.

1.12. Wreckage and Impact Information

1.12.1. The aircraft landed on RWY 22 and, after exiting the active RWY whilst being taxied back to the apron on taxiway Alpha, the engine mount that supports the engine and the seats frame broke off, which caused the seats to drop down a margin. This led to the throttle cable being pulled down before it got stuck in the open position (80% power). As a result, the trike got into a high-speed taxi. The FI was unable to close the throttle because it was stuck in the open position. The FI then opted to steer the trike away from possible hazards and obstacles. Whilst the trike was careering through the rugged terrain, both carburettors fell off which caused the engine to stop operating. The trike came to a halt approximately 300 metres (m) to the right of Runway 22 at FAOH. The engine mount (Pylon) failed, and the rear axle and the radiator bracket bent during the taxi.

Figure 2: The trike on an open field post-incident. (Source: Operator)

Figure 3: Bird's eye view of the incident site. (Source: Google Earth)

1.13. Medical and Pathological Information

1.13.1. None.

1.14. Fire

1.14.1. There was no evidence of a pre- or post-impact fire.

1.15. Survival Aspects

1.15.1. The incident was considered survivable because the cockpit area was not compromised.

1.16. Tests and Research

1.16.1 Common Welding Defects (Source: Report from the University of Pretoria)

A weld defect results from a poor weld, weakening the joint. It is defined as the point beyond the acceptable tolerance in the welding process. Imperfections may arise dimensionally, wherein the result is not up to standard. They may also take place in the form of discontinuity or in material properties. Common causes of welding defects come from incorrect welding patterns, material selection, skill, or machine settings, including welding speed, current, and voltage. When a welded metal has a welding defect present, there are multiple options for resolving the issue. In some cases, the metal can be repaired, but at other times the metal itself has melted and the welding procedure needs to be restarted. Welding defects (Image 1) can be classified into two major categories: ***internal welding defects*** *and* ***external welding defects.***

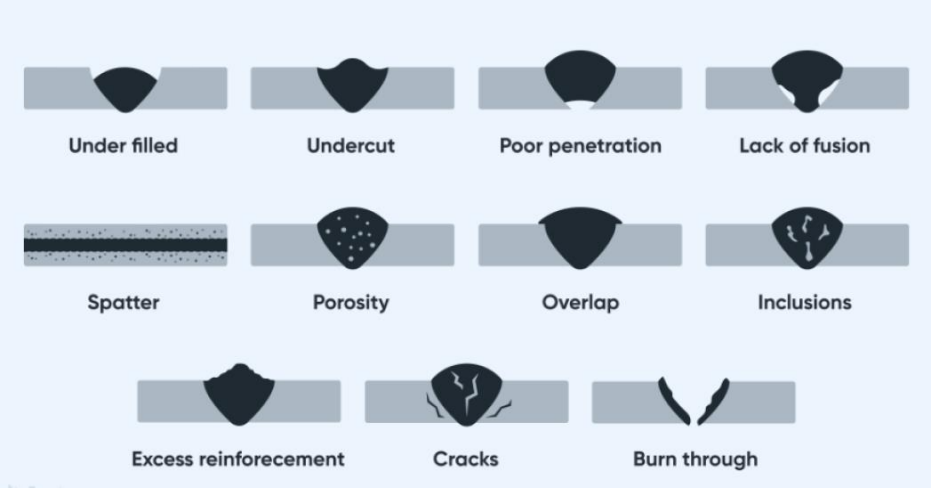

Figure 4: Welding defects. (Source: University of Pretoria)

1.16.2 Internal Welding Defects (Source: Report from the University of Pretoria)

Internal defects occur within the metal material and are usually not open to the weld's surface. It is often difficult to detect these defects with visual inspection and some non-destructive tests. However, they are detectable using methods like Ultrasonic Testing and Radiographic Testing (RT). Common examples include slag inclusions, incomplete penetration, incomplete fusion, etc.

1.16.3 Burn through (Source: Report from the University of Pretoria)

When there is an application of excessive heat during welding, the process may blow holes through the centre of the metal. This type of weld defect is called a ***burn-through****. It's a common welding defect for thin metal sheets with less than 1/4-inch thickness. It might occur when the welding settings are too high and/or the torch movement is too slow.*

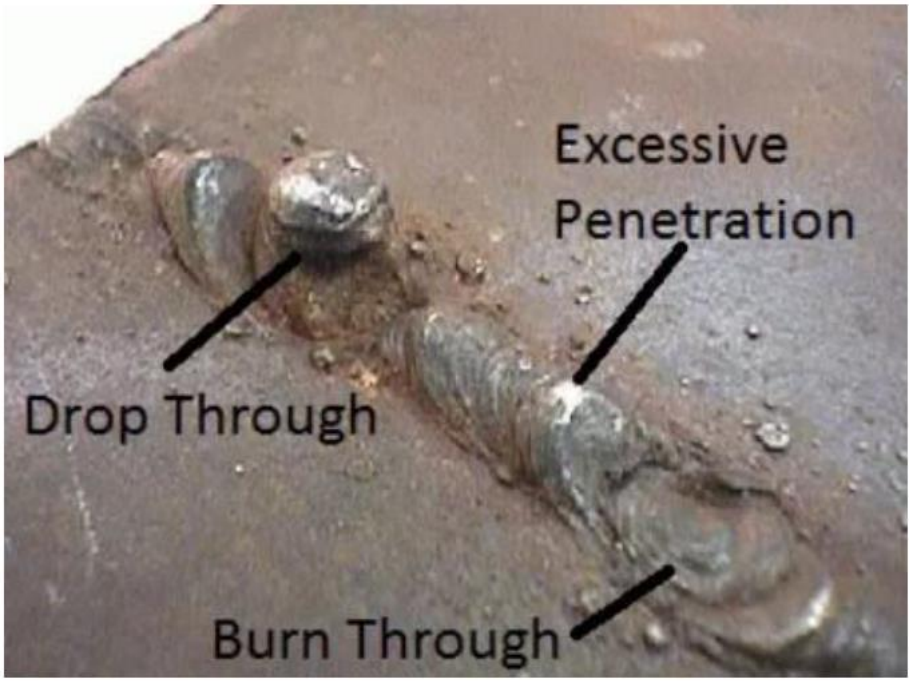

Figure 5: Appearance of Burn-Through. (Source: University of Pretoria Report)

1.16.3 *Visual inspection*

The visual inspection revealed a fracture within the vertically orientated square tube section of the engine mount (Figure 6, red arrow; Figure 7, red circles). The fracture initiated adjacent to the square tube/cross-member welded joint.

The inner area of the tube revealed clear signs of material loss (Figures 8 and 9, red dashed circles) consistent with a 'burn through' type of welding defect.

This defect resulted in a significant loss of wall thickness to the square tube (Figure 10) of ***±78 %.***

At low magnifications clear indications 'beach-marks' were noted with a progression direction expanding from the weld defect. This is indicative of a ***fatigue*** *failure mode.*

1.6.4 *High magnification inspection*

The higher magnification inspection confirmed the extensive loss of wall thickness.

The presence of fatigue induced striations supports the conception of a predominant ***fatigue*** *failure mode.*

The EDS MAP result revealed extensive fracture surface contamination consistent with environmental exposure. This, combined with the noted mechanical damages to

the fracture surface, support the notion that the fracture progressed over an undetermined period till final fracture.

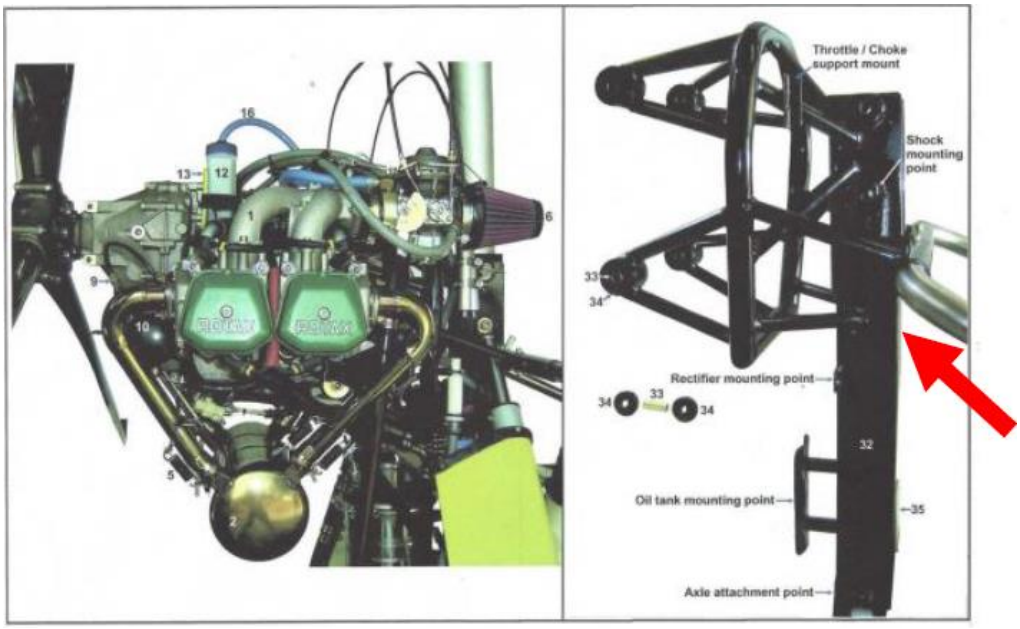

Figure 6: Engine mount assembly. (Source: University of Pretoria Report)

Figure 7: Engine mount fracture location. (Source: University of Pretoria Report)

Figure 8: Inner tube area at fracture initiation point. (Source: University of Pretoria Report)

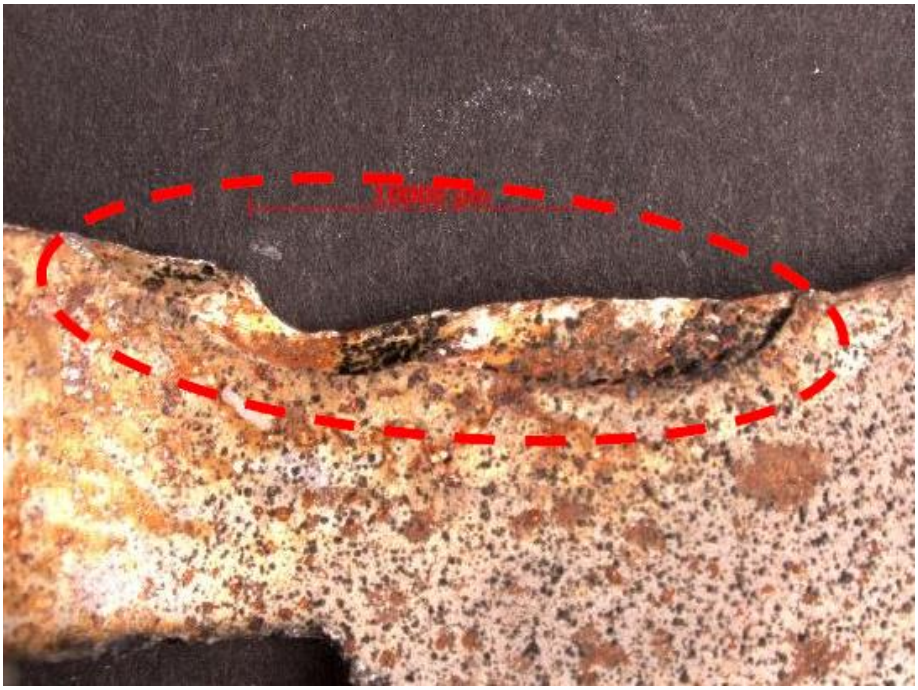

Figure 9: Inner tube area showing signs of burn-through. (Source: University of Pretoria Report)

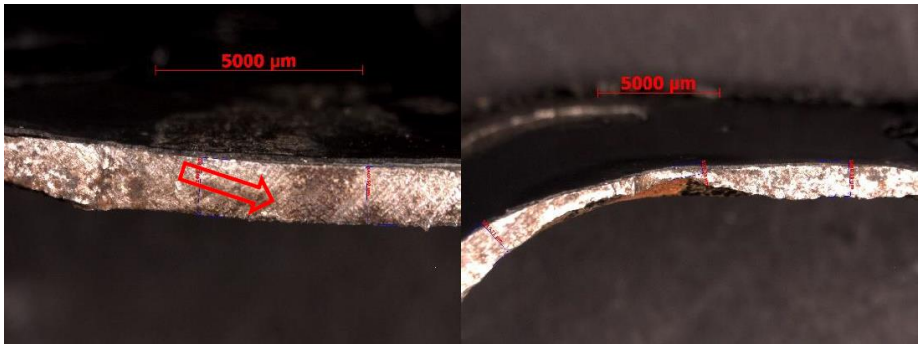

Figure 10: Dimensions, loss of wall thickness. (Source: University of Pretoria Report)

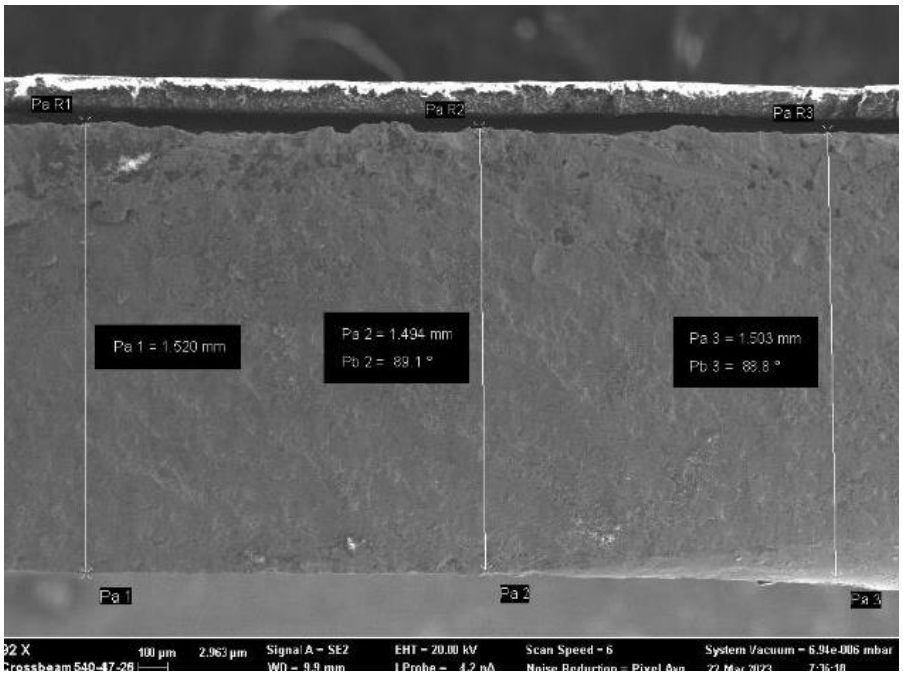

Figure 11: Original wall thickness (92X,20kV, SE, FEGSEM).
(Source: University of Pretoria Report)

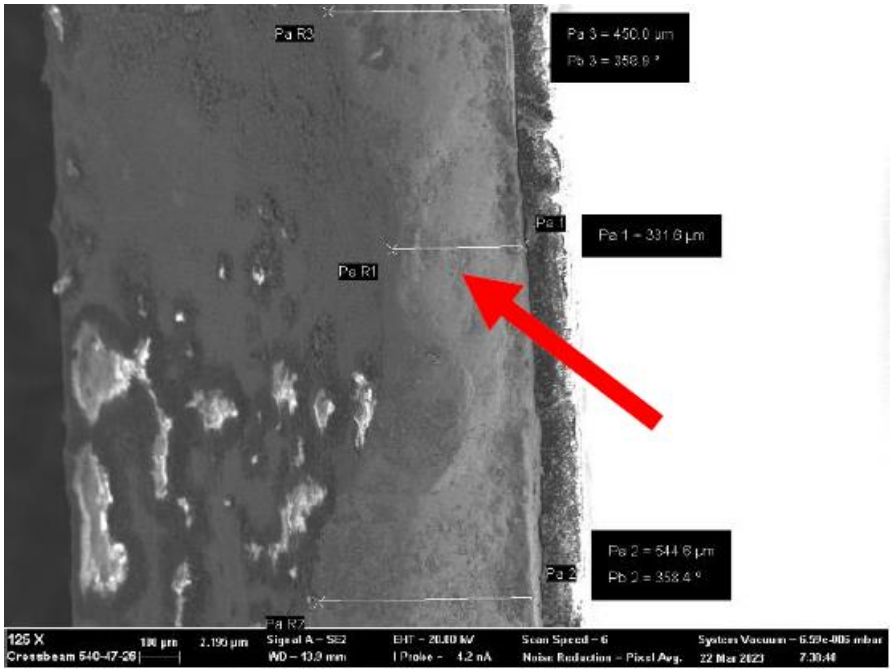

Figure 12: Loss of wall thickness (125X, 20kV, SE, FEGSEM).

(Source: University of Pretoria Report)

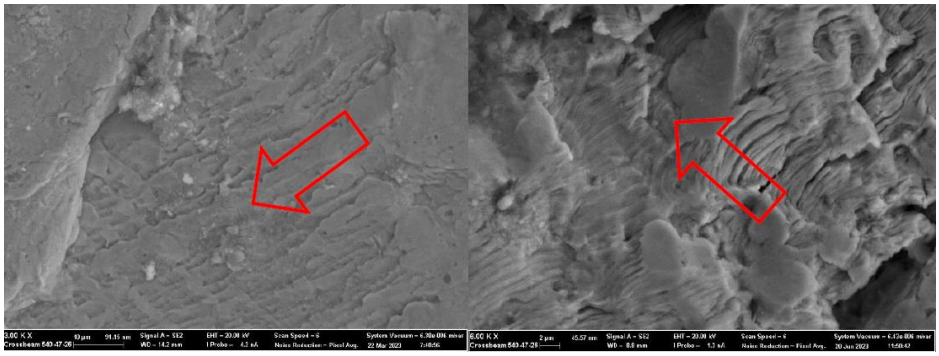

Figure 13: Fatigue induced striations (3000-6000X, 20kV, SE, FEGSEM).

(Source: University of Pretoria Report)

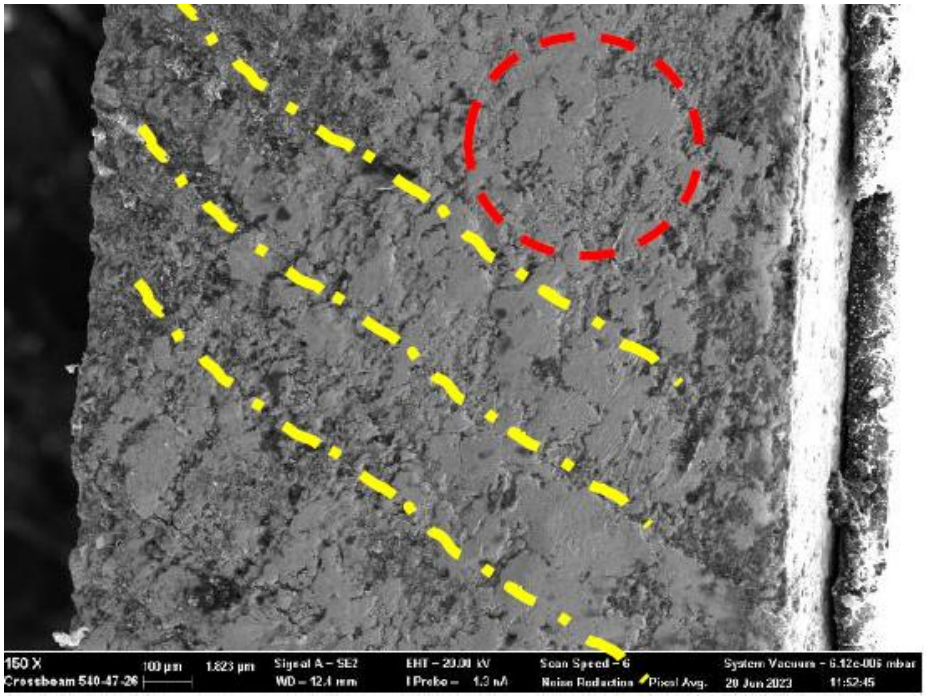

Figure 14: Surface beach marks and mechanical damage (150X, 20kV, SE, FEGSEM). (Source: University of Pretoria Report)

1.6.5 *Discussion*

The visual inspection revealed a fracture adjacent to the engine mount vertical square tube/cross-member ***welded joint.***

A welding defect closely corresponding to 'burn-through' resulted in a localized ***loss of wall thickness to a maximum of ±78%.*** *This resulted in an increase in the* ***localized stress*** *(Stress = Load/Area) during operation which in turn resulted in the initiation of a fracture. On reaching* ***critical-crack-size****, the fracture progressed under a predominantly* ***fatigue mode*** *over an undetermined period till final fracture.*

Due to the welding defect manifesting primarily within the inner square tube area, it would ***not have been visually detectable*** *during post-manufacturing and/or scheduled inspections.*

1.17. Organisational and Management Information

1.17.1. The flight was conducted in accordance with the provisions of Part 141 (Training) of the CAR 2011 as amended.

1.17.2. The approved training organisation (ATO) that conducted training during the incident flight had an approved ATO certificate that was issued by the Regulator on 10 May 2022 with an expiry date of 31 July 2023.

1.17.3. The AP who carried out the last maintenance inspection prior to the incident flight had an approved AP certificate that was issued by the Regulator on 10 August 2006 with an expiry date of 18 November 2022.

1.18. Additional Information

1.18.1 Retirement Life of Critical Components (Source: Aquilla Maintenance Manual)

Replace the following components at the hours or landings (whichever comes first) as indicated.

After the first 1000 hours and at every 500 hours thereafter, the entire undercarriage must be stripped down a complete inspection of every part. If components are corroded, the replacement period must be shortened by 50%, and all bolts and nuts must be replaced as soon as excessive corrosion is noticed.

PART	HOURS	LANDINGS
Hang block	1 000	10 000
Pylon	1 000	10 000
Brake cable assembly	1 000	10 000
Throttle cable assembly	1 000	10 000
All hang bolts, nuts and rubbers	1 000	10 000
Boom	1 500	10 500
Rear shock tube	1 000	10 000
Prop bolts and nuts	1 000	10 000
Engine bracket	1 500	15 000
Engine mounting plate	1 000	10 000
Exhaust rubber mounts	1 000	10 000
Engine rubber mounts	1 000	10 000

Table 1: Extract of the component life list with highlights.
(Source: Aquilla 912 Maintenance Manual)

1.18.2 When the manufacturer was asked about the engine mount Pylon, they stated that the current supplier, upon inspection, found that the main square tube spar (Pylon) was manufactured using approximately 1.6 millimetres (mm) wall thickness tubing and the current drawing requires a 3mm wall thickness which they are using.

1.19. Useful or Effective Investigation Techniques

1.19.1 (a) The apparatus employed for this investigation included Stereo and Electron Microscopes (with EDS) and Digital Camera.

(b) The methodology included a visual examination of supplied parts, sectioning for sample preparation purposes, followed by a Light and Scanning Electron Microscope investigation.

2. ANALYSIS

2.1. General

From the available evidence, the following analysis was made with respect to this incident. This shall not be read as apportioning blame or liability to any organisation or individual.

2.2. Analysis

2.2.1 <u>Man</u>

The FI was initially issued a National Pilot Licence (NPL) on 11 November 2011 in accordance with Part 62 of the South African CAR 2011. His licence was revalidated on 9 July 2021 with an expiry date of 31 July 2023. The FI was issued a Class 4 medical certificate on 4 August 2021 in terms of Part 67 of the CAR 2011 with an expiry date of 4 August 2022, and with the restriction to wear suitable corrective lenses.

The SP was initially issued a recreational Student Pilot Licence (SPL) on 14 June 2022 in accordance with Part 62 of the South African CAR 2011, with an expiry date of 13 June 2023. The SP was issued a Class 4 medical certificate on 8 June 2022 in terms of Part 67 of the CAR 2011 with an expiry date of 30 June 2027, and with no restrictions.

The AP who carried out the last maintenance inspection prior to the incident flight had an AP certificate that was issued by the Regulator on 10 August 2006 with an expiry date of 18 November 2022.

2.2.2 Mission

The flight was conducted in accordance with the provisions of Part 141 (Training) of the CAR 2011 as amended.

2.2.3 Machine

The aircraft was issued an Authority to Fly (ATF) on 12 April 2019 with an expiry date of 30 April 2023. The owner of the aircraft was issued a C of R on 31 May 2022. The manual stipulates that the life of the engine mounting bracket is 1500 hours and the airframe had 451.5 hours at the time of the incident, which was still within limits. The last 50-hour inspection prior to the incident flight was carried out on 6 June 2022 at 425.9 airframe hours. The aircraft was issued a CRS on 6 June 2022 with an expiry date of 6 June 2023 or at 475.9 hours, whichever occurs first. The trike had accumulated an additional 25.6 airframe hours in operation since the last 50-hour inspection. There were no defects recorded in the flight folio since the last MPI. The current supplier stated that upon inspection they found that the main square tube spar was manufactured using approximately 1.6mm wall thickness tubing and the current drawing calls for 3mm wall thickness. The trike was manufactured in 2012 and had never been returned to the factory for repairs, maintenance or service; therefore, the manufacturer did not have a detailed history other than what was documented in the trike logbook.

2.2.4 Approved Training Organisation (ATO)

The ATO that conducted the training during the incident flight had an ATO certificate that was issued by the Regulator on 10 May 2022 with an expiry date of 31 July 2023.

2.2.5 Conclusion

The aircraft maintenance manual states that the engine mounting bracket life span is 1500 hours. The trike had flown a total of 451.5 hours since new, which were well within limits by 1048.5 hours.

2.2.6 The engine mount Pylon failed during taxi due to a fatigue fracture. This caused the engine mount that supports the engine and seat frame to break off and, subsequently, caused the seat to drop down. This led to the throttle cable being pulled down before it got stuck in the open position and, as a result, it accelerated sharply and the pilot lost control.

3. CONCLUSION

3.1. General

From the available evidence, the following findings, causes and contributing factors were made with respect to this incident. These shall not be read as apportioning blame or liability to any organisation or individual.

To serve the objective of this investigation, the following sections are included in the conclusion heading:

- **Findings —** are statements of all significant conditions, events, or circumstances in this incident. The findings are significant steps in this incident sequence, but they are not always causal or indicate deficiencies.
- **Causes —** are actions, omissions, events, conditions, or a combination thereof, which led to this incident.
- **Contributing factors —** are actions, omissions, events, conditions, or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the incident occurring, or would have mitigated the severity of the consequences of the incident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil, or criminal liability.

3.2. Findings

3.2.1. The FI was initially issued a National Pilot Licence (NPL) on 11 November 2011 in accordance with Part 62 of the South African CAR 2011. His licence was revalidated on 9 July 2021 with an expiry date of 31 July 2023.

3.2.2. The FI was issued a Class 4 medical certificate on 4 August 2021 in terms of Part 67 of the CAR 2011 with an expiry date of 4 August 2022, and with the restriction to wear suitable corrective lenses.

3.2.3. The SP was initially issued a recreational Student Pilot Licence (SPL) on 14 June 2022 in accordance with Part 62 of the South African CAR 2011 with an expiry date of 13 June 2023.

3.2.4. The SP was issued a Class 4 medical certificate on 8 June 2022 in terms of Part 67 of the CAR 2011 with an expiry date of 30 June 2027 and with no restrictions.

3.2.5. The flight was conducted in accordance with the provisions of Part 141 (Training) of the CAR 2011 as amended.

3.2.6. The AP who carried out the last maintenance inspection prior to the incident flight had an AP certificate that was issued by the Regulator on 10 August 2006 with an expiry date of 18 November 2022.

3.2.7. The ATO that conducted the training during the incident flight had an approved ATO certificate that was issued by the Regulator on 10 May 2022 with an expiry date of 31 July 2023.

3.2.8. The aircraft was issued an Authority to Fly (ATF) on 12 April 2019 with an expiry date of 30 April 2023.

3.2.9. The aircraft was issued a C of R on 31 May 2022.

3.2.10. The last 50-hour inspection prior to the incident flight was conducted on 6 June 2022 at 425.9 airframe hours. The aircraft was issued a CRS on 6 June 2022 with an expiry date of 6 June 2023 or at 475.9 hours, whichever occurs first. The trike had accumulated an additional 25.6 airframe hours in operation since the last 50-hour inspection. There were no defects recorded in the flight folio since the last MPI.

3.2.11. The maintenance manual stipulates that the life of the engine mounting bracket is 1500 hours or 15 000 landings (whichever comes first). The airframe had logged 451.5 hours at the time of the incident which was still within limits.

3.2.12. The aircraft maintenance manual states that the engine mounting bracket's life span is 1500 hours. The trike was flown a total of 451.5 hours since new which was well within limits by 1048.5 hours.

3.2.13. The current aircraft parts supplier who inspected the component found that the main square tube spar was manufactured using approximately 1.6mm wall thickness tubing, and the current drawing requires a 3mm wall thickness.

3.2.14. The trike was manufactured in 2012 and had never been returned to the factory for repairs, maintenance or service.

3.2.15. The engine mount Pylon failed during taxi due to a fatigue fracture. The engine mount Pylon that supports the engine and seat frame broke off and, subsequently, caused the seat to drop down a margin. This led to the throttle cable being pulled down before

it got stuck in the open position and, as a result, the trike accelerated sharply. The pilot lost control during the ground roll before the trike came to a stop.

3.3. Probable Cause/s

3.3.1. The engine mount Pylon failed during taxi due to a fatigue fracture. As a result, the engine mount that supports the engine and seat frame broke off and, subsequently, caused the seat to drop down a margin. This led to the throttle cable being pulled down before it got stuck in the open position; and the trike accelerated sharply. The pilot lost control of the trike during the ground roll before it came to a stop.

3.4. Contributory Factor/s

3.4.1 Fracture adjacent to the engine mount vertical square tube/cross member welded joint.

3.4.2 Burn-through welding as a result of excessive heat during welding which blew holes through the centre of the metal and, consequently, reduced the thickness of the metal.

3.4.3 Used spar tube had 1.6mm wall thickness whilst the current drawing requires 3mm wall thickness.

4 SAFETY RECOMMENDATIONS

4.1 General

The safety recommendations listed in this report are proposed according to paragraph 6.8 of Annex 13 to the Convention on International Civil Aviation and are based on the conclusions listed in heading 3 of this report. The AIID expects that all safety issues identified by the investigation are addressed by the receiving States and organisations.

4.2 Safety Recommendation/s

4.2.1 The manufacturer issued an Alert Service Bulletin 0001 for the inspection of the 912 series, engine bracket mounts advising owners and operators to conduct a thorough inspection for any cracks on the engine bracket and specifically along all welding joints. Owners are to pay careful attention for fatigue corrosion, and any form of burn-through

which may cause loss of wall thickness on material, and which would result in a weaker joint along the engine bracket. The SB was released on 3 August 2023 and effective from 3 August 2023.

5 APPENDICES

5.1 None.

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