SOUTH AFRICAN CIVIL AVIATION AUTHORITY

Section/division **Occurrence Investigation**

Form Number: CA 12-12a

AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/8507		
Aircraft Registration	**ZU-BCA**	**Date of Accident**	14 June 2008		**Time of Accident**	0715Z	
Type of Aircraft	Windlass Trike (microlight)		**Type of Operation**		Private		
Pilot-in-command Licence Type	Private		**Age**	36	**Licence Valid**	YES	
Pilot-in-command Flying Experience	Total Flying Hours		1 094.1		Hours on Type	483.6	
Last point of departure	Ballito Microlight Aerodrome, KwaZulu-Natal Province						
Next point of intended landing	Ballito Microlight Aerodrome, KwaZulu-Natal Province						
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)							
Salt Rock beach (GPS position: S 29º29'909" E 031º14'560")							
Meteorological Information	Surface wind: 135º/5 kts; Temperature: 17ºC; Visibility: 10 km						
Number of people on board	1 + 1	**No. of people injured**	2	**No. of people killed**	0		

Synopsis

The micro-light, with two people on board, took off from Ballito Microlight Aerodrome for an introductory flight over Salt Rock beach. During the flight, the right wing of the aircraft failed at the spreader bar attachment point, and the microlight crashed into the sea approximately fifty feet from the shore. Both occupants sustained serious injuries and the aircraft was destroyed.

The micro-light was based and operated in the vicinity of Ballito, where it is hot and humid throughout the year. The presence of moisture, plus the corrosive nature of sea air, greatly contributed to the corrosion of the aircraft's metal structure.

Probable Cause

Failure of the right wing at the spreader bar attachment point due to excessive corrosion or a pre-accident overload damage in the right wing main tubing.

IARC Date		Release Date	

SOUTH AFRICAN CIVIL AVIATION AUTHORITY

Section/division **Occurrence Investigation**
Telephone number: **011-545-1000**
E-mail address of originator: **thwalag@caa.co.za**

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AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator : Anthony Richard Weaver
Manufacturer : Solo Wings CC
Model : Windlass Trike
Nationality : South African
Registration Marks : ZU-BCA
Place : Salt Rock Beach
Date : 14 June 2008
Time : 07:15 Z

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 of the Investigation

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (1997), 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 establish legal liability****.*

Disclaimer

This report is given without prejudice to the rights of the CAA, which are reserved.

1. FACTUAL INFORMATION

1.1 History of Flight

1.1.1. The pilot and passenger took off from Ballito Microlight Aerodrome at 06:50Z for an introductory flight. They climbed to an altitude of 1 000 ft above mean sea level (AMSL) and routed towards Salt Rock beach.

1.1.2. At approximately 06:55Z, while passing over the Salt Rock Hotel, the pilot broadcast his intention to descend to 500 ft AMSL. The descent was carried out by reducing engine power and making medium to steep turns.

1.1 3. While passing between 800 and 700 ft AMSL, and coming out of a turn, the pilot felt a sharp jerk and saw the leading edge of the right wing collapsing. The aircraft entered a slow spin to the right which accelerated into a faster, flat spin.

1.1.4. The pilot was unable to bring the aircraft under control and crashed into the sea.

1.1.5. People swimming nearby rescued the pilot and passenger and summoned emergency services. Both were taken to hospital where they were treated for their injuries.

1.1.6. Witnesses in the vicinity confirmed that they had seen the right wing of the micro-light fold upwards, and the aircraft spiralling into the sea. The wreckage was brought to shore by the swimmers.

1.2 Injuries to Persons

Injuries	Pilot	Crew	Pass.	Other
Fatal	-	-	-	-
Serious	1	-	1	-
Minor	-	-	-	-
None	-	-	-	-

1.3 Damage to Aircraft

1.3.1 The aircraft was destroyed in the accident.

1.4 Other Damage

1.4.1 None.

1.5 Personnel Information

Nationality	South African	Gender	Male	Age	36
Licence Number		Licence Type	Private		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	Nil				
Medical Expiry Date	31 May 2010				
Restrictions	Nil				
Previous Accidents	Nil				

Flying Experience

Total Hours	1 094.1
Total Past 90 Days	166.4
Total on Type Past 90 Days	85.4
Total on Type	483.6

1.6 Aircraft Information

Airframe

Type	Windlass Trike	
Serial Number	WL 568	
Manufacturer	Solo Wings CC	
Date of Manufacture	1996	
Total Airframe Hours (at time of accident)	3 006.3	
Last Annual Inspection (Date & Hours)	18 May 2008	2 786.1
Hours since Last MPI	220.2 (Annual Inspection)	
Authority to Fly (Issue Date)	21 Nov 2007 (Authority to Fly)	
C of R (Issue Date) (Present Owner)	6 February 2007	
Operating Categories	Private and Training	

Engine

Type	Rotax 912 UL
Serial Number	4406485
Hours since New	657.75
Hours since Overhaul	TBO not yet reached

Propeller

Type	Aero Prop
Serial Number	Aero Prop
Hours since New	1 947.85
Hours since Overhaul	TBO not yet reached

1.7 Meteorological Information

Wind direction	S/SE	Wind speed	Calm	Visibility	>10 km
Temperature	17℃	Cloud cover	Nil	Cloud base	N/A
Dew point	11℃				

1.7.1 This meteorological information, collected from Ballito Aerodrome's mini weather station, was supplied by the pilot.

1.8 Aids to Navigation

1.8.1 The flight was operated under visual flight rules.

1.8.2 The aircraft was equipped with an airspeed indicator, an altimeter and a compass.

1.9 Communications

1.9.1. The pilot made all radio transmissions on 124.8 MHz

1.10 Aerodrome Information

1.10.1 The aircraft crashed into the Indian Ocean.

1.11 Flight Recorders

1.11.1 The aircraft was not fitted with flight recorders as this was not required by South African Civil Aviation Regulations.

1.12 Wreckage and Impact Information

1.12.1 This was an in-flight breakup.

1.12.2 The end section of the aircraft's wing did not fully detach on impact, being attached to the canvas wing covering. The result was that the wreckage was confined to a small area.

Figure 1. The main wreckage.

1.13 Medical and Pathological Information

1.13.1 The pilot and passenger were both seriously injured in the accident and had to undergo surgery.

1.13.3 The aircraft struck the water in a flat spin, and the occupant's seats thus absorbed most of the impact and prevented head and upper body injuries.

1.13.4 Both occupants suffered lower back injuries in the impact.

1.13.5 The passenger suffered more injuries than the pilot due to the fact that he was seated higher and the micro-light struck the water in a slightly nose-high attitude.

1.14 Fire

1.14.1 There was no evidence of in-flight or post-impact fire.

1.15 Survival Aspects

1.15.1 The accident occurred near a crowded beach, with many people in the water at the time.

1.15.2 Several holidaymakers witnessed the accident and saved the pilot and passenger from drowning.

1.15.3 The occupants' seats absorbed the brunt of the impact forces and prevented upper body and head injuries.

1.15.4 The water at the point of impact was only about a metre deep, making rescue relatively easy and helping to prevent drowning.

1.15.5 Both occupants were properly restrained by seatbelts.

1.15.6 All of the above render this a survivable accident.

1.16 Tests and Research

1.16.1 The leading edge that had failed was taken for metallurgical testing, and there was presence of corrosion. The report is attached as Appendix A.

1.17 Organisational and Management Information

1.17.1 The accident aircraft was privately owned and used by the Ballito Microlight Training School for training purposes.

1.17.2 The aircraft was also used for crop spraying.

1.18 Additional Information

1.18.1 None

1.19 Useful or Effective Investigation Techniques

1.19.1 None.

2. ANALYSIS

2.1 The accident aircraft operated in the Ballito area of Kwazulu-Natal, where it is hot and humid throughout the year. The presence of moisture, plus the corrosive nature of sea air, greatly contributed to corrosion of the metal structure of the aircraft.

2.2 The leading edge of the wing is made up of reinforced tubing with two smaller tubes inserted into a larger diameter outer tube. This arrangement allows corrosion to go undetected as it is not readily visible during pre-flight inspections.

3. CONCLUSION

3.1 Findings

3.1 This was an introductory flight with one passenger.

3.2 The aircraft was operated mainly in the coastal area of Ballito.

3.3 The pilot's licence was valid at the time of the accident.

3.4 The aircraft's authority to fly was valid at the time of the accident.

3.2 Probable Cause/s

3.2.1 Failure of the right wing in the spreader bar attachment area due to excessive corrosion or a pre-accident overload damage in the right wing main tubing.

4. SAFETY RECOMMENDATIONS

4.1 It is recommended that the SACAA keep a database to monitor trends of micro-light accidents caused by corrosion in South Africa.

4.2 It is recommended that the SACAA take out AIC warning micro-light operators at coastal areas of the dangers caused by corrosion especially when carrying oxidising agents, and to have regular inspections at corrosion prone areas.

4.3 It is recommended that CAA and microlight manufacturers investigate the possibility of using corrosion inhibitors on all microlight.

5. APPENDICES

5.1 Appendix A – Metallurgy report from Crash Lab (6 pages)

Report reviewed and amended by the Advisory Safety Panel on18 May 2010

-END-

(Appendix A)

LEADING EDGE, WINDLASS TRIKE, ZU-BCA

1. INTRODUCTION

1.1 The fractured right-hand leading edge from a crashed Windlass Trike, aircraft number ZU-BCA (Figure 2), was submitted to determine the possible reason/s for failure during operation. The fuselage had been exposed to seawater before recovery.

Figure 2. Crash site,showing the fuselage as found

1.3 This report is divided into the following sections:

2. APPLICABLE DOCUMENTS

(a) None.

3. DEFINITIONS

(a) OEM Original Equipment Manufacturer
(b) CAA Civil Aviation Authority
(c) SEM Scanning Electron Microscope
(d) CIC Corrosion-Inhibiting Compounds

4. PERSONNEL

(a) The investigative member and compiler of this report is Mr C.J.C. Snyman, ID no. 6406105057080, who is a qualified physical metallurgist (H.N.Dip Metallurgical Engineering, Tech. PTA), a radiation protection officer (RPO) registered with the National Nuclear Regulator (NNR), and an aircraft accident investigator (SCSI).

5. APPARATUS AND METHODOLOGY

(a) Stereo and scanning electron microscopes and a digital camera were employed for this investigation.

(b) The methodology included a visual investigation of supplied parts, followed by a microscopic investigation.

6. INVESTIGATION

6.1 Visual, stereo- and SE microscope investigation. The visual inspection revealed that the three-sleeved leading edge failed at the bolt position in an outward direction (Figure 3, blue arrow). Fracture B can be attributed to impact. The relevant connecting bracket is displayed as found. Note the score marks on half of the inner contact area of the profile (Figure 4, red arrow). These can be attributed to the movement of the outer section of the leading edge after partial failure at position A. Inter-sleeve corrosion damage was detected in the vicinity of the bolthole at position A (Figure 5, blue arrows). Corrosion damage was also noted on the bracket (Figure 4, blue arrow). Although some of the bracket corrosion damage may be attributed to seawater submersion after the impact, the inter-sleeve, crevice-type corrosion damage is of concern.

The SEM fractograph revealed some evidence of an overload type of fracture geometry (Figure 6), combined with extensive damage to most of the fracture surfaces. This included corrosion (Figure 7). The bolthole area on the innermost tri-sleeve leading edge revealed signs of secondary crack formation (Figures 8, 9 and 10). The crack geometry indicates slow propagation over a period.

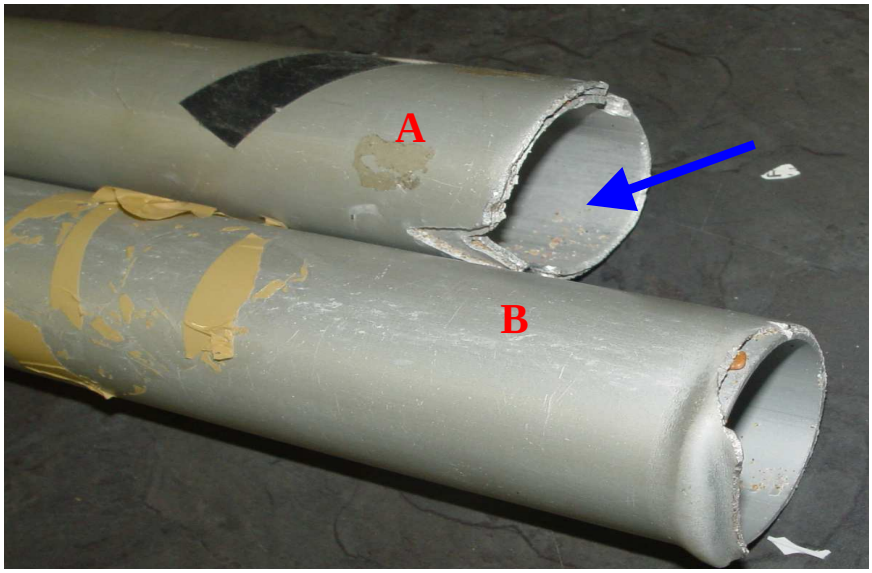

Figure 3. Fracture surfaces at point A and B (digital).

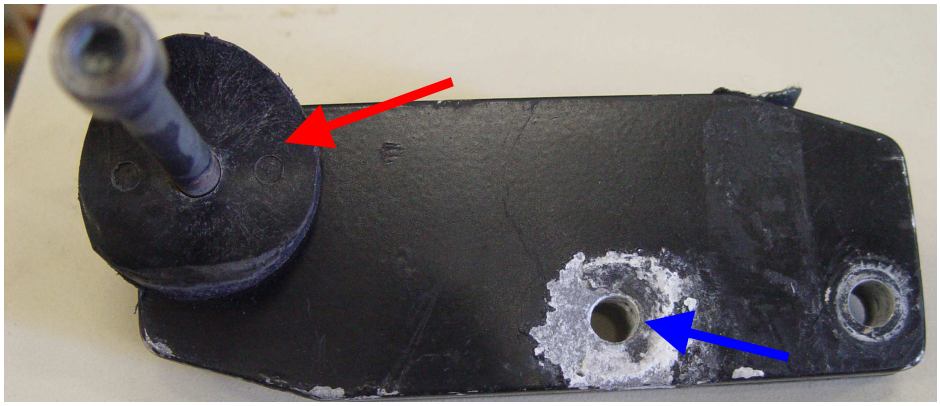

Figure 4. Connecting bracket, bolt and profile at position A (digital).

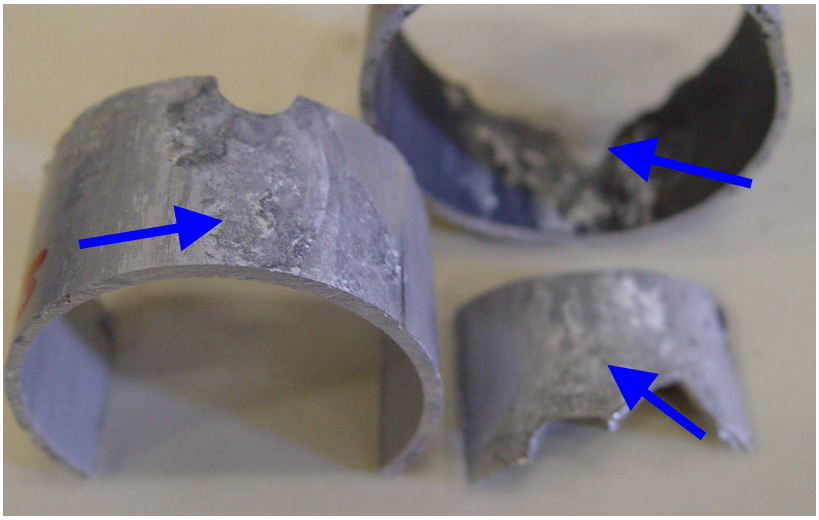

Figure 5. Corrosion damage, position A (digital).

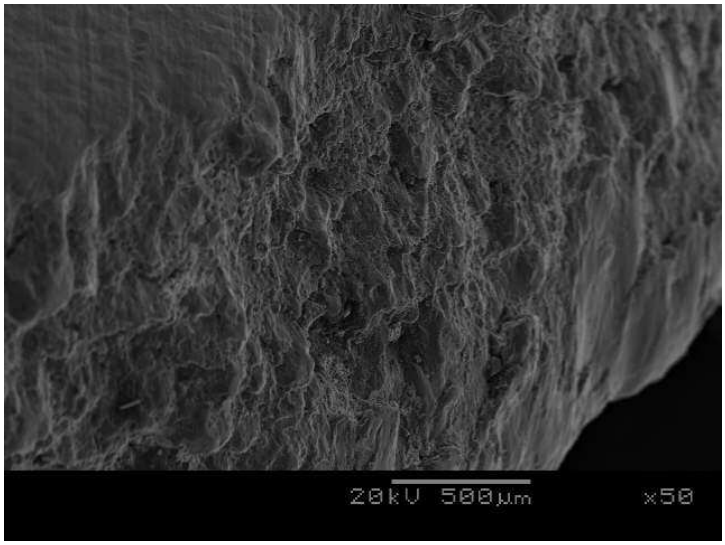

Figure 6. Fracture surface adjacent to bolt hole, position A (x50, SEM).

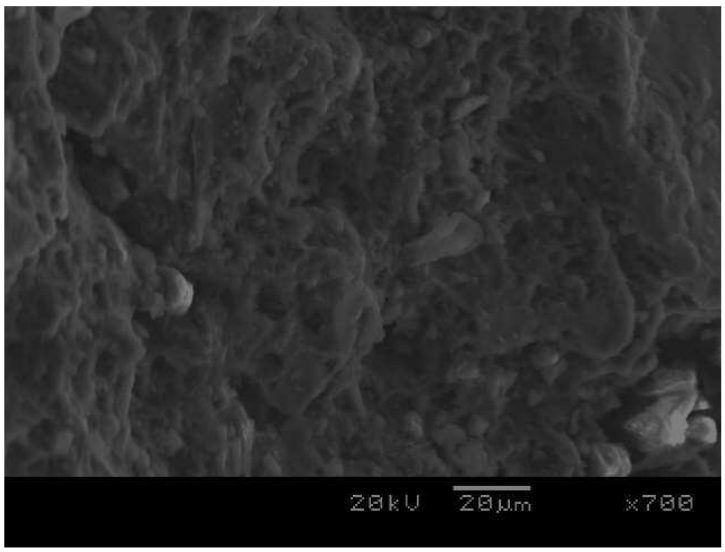

Figure 7. Corrosion products on fracture surfaces (x700, SEM).

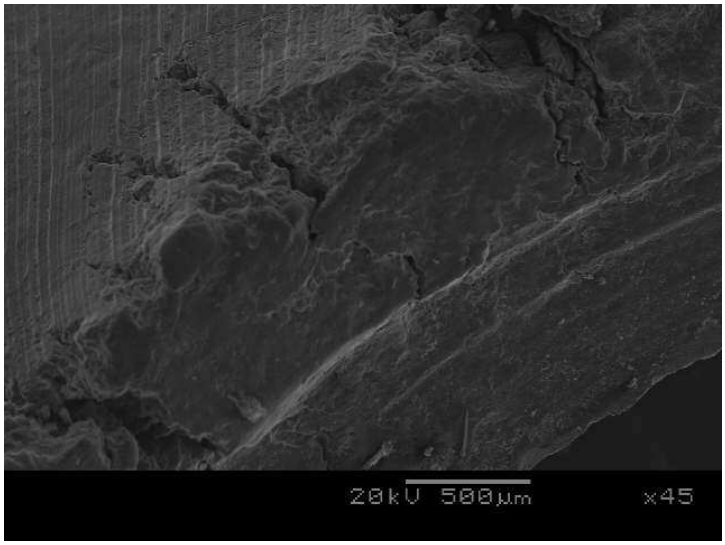

Figure 8. Secondary crack formation, inner sleeve, position A (x45, SEM)

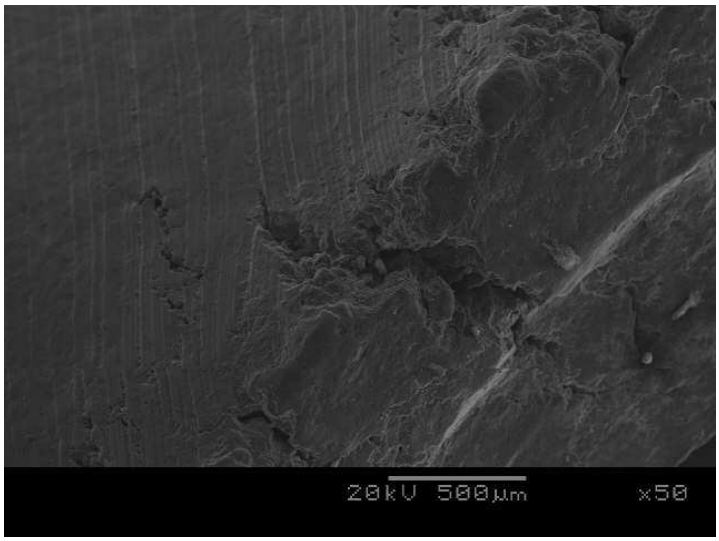

Figure 9. Secondary crack formation, inner sleeve, position A (x50, SEM).

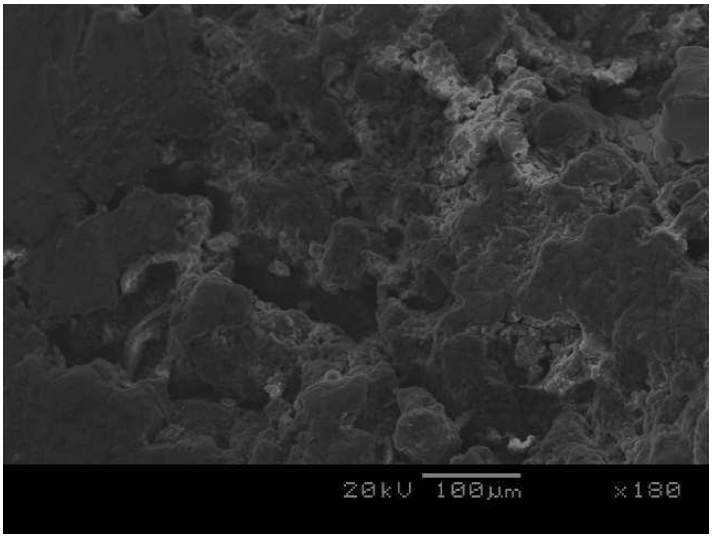

Figure 10. Secondary crack formation, inner sleeve, position A (x180, SEM).

7. DISCUSSION AND CONCLUSIONS

Note: All deductions and conclusions are based on the investigation results obtained from the supplied parts only.

7.1 The investigation revealed that the relevant component failed over an undetermined period.

7.2 Taking into account the amount of corrosion damage detected in the adjacent bolt hole areas (Figure 6), corrosion-induced crack formation can be considered a causational factor. Pre-failure overload damage to this vulnerable area, enhancing corrosion-induced crack formation, can also not be ruled out. This weakening of the leading edge at position A could have led to its failure under normal loading during the final flight.

8. RECOMMENDATIONS

8.1 The aircraft's operating environment was an area rated as "severe corrosive" (see CSIR ratings). Furthermore, the position of the crack formation, being the inner-sleeve areas, cannot be visually inspected during normal pre-flight inspections. It is strongly recommended that a comprehensive corrosion inspection schedule, in conjunction with the OEM, of this and other corrosion-prone areas based not only on operational hours and operating environment, but also on lifetime of the aircraft frame, be researched and implemented as soon as possible.

8.2 It is also recommended that the application of corrosion-inhibiting compounds CICs) in corrosion-prone areas, particularly crevices, be researched in conjunction with the OEM.

8.3 Furthermore, it is suggested that all clubs and flight schools operating in corrosive environments implement a detailed corrosion control programme (CCP) to enhance flight safety.

9. DECLARATION

9.1 All digital images have been acquired by the author and are displayed in an untampered state.