AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:		CA18/2/3/10413	
Aircraft Registration	**ZU-VDD**	**Date of Accident**		25 January 2024		**Time of Accident**	0728Z
Type of Aircraft	Pioneer FlightStar			**Type of Operation**		Proving Flight (Part 24)	
Pilot-in-command Licence Type	National Pilot Licence (NPL)			**Age**	70	**Licence Valid**	No
Pilot-in-command Flying Experience		**Total Flying Hours**		642.2		**Hours on Type**	274.3
Last Point of Departure	Devondale Private Airstrip, Barkley West, Northern Cape Province						
Next Point of Intended Landing	Devondale Private Airstrip, Barkley West, Northern Cape Province						
Damage to Aircraft	Substantial						

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

Ploughed field, approximately 500 metres south-east of Devondale private airstrip, Barkley West, at Global Positioning System (GPS) co-ordinates determined to be 28º29'17.11" South 024º39'16.86" East, at an elevation of 3 615 feet (ft)

Meteorological Information	Wind direction: 030º at 03 knots, temperature: 26ºC, dew point: 16º, visibility: 9999m: QNH: 1023 hPa						
Number of People On-board	1+0	**Number of People Injured**	0	**Number of People Killed**	1	**Other (On Ground)**	0

Synopsis

On Thursday morning, 25 January 2024 at 0728Z, a pilot on-board a home-built Pioneer FlightStar microlight aircraft with registration ZU-VDD took off on a proving flight from Devondale private airstrip in Barkley West, Northern Cape province, with the intention to return to the same airstrip. Visual meteorological conditions (VMC) prevailed at the time of the flight which was conducted under the provisions of Part 44 of the Civil Aviation Regulations 2011 (CAR) as amended.

Witnesses reported that the engine became silent shortly after take-off; however, the pilot continued with the flight. The aircraft made a left turn, and the engine was heard revving up again. The aircraft was seen in a left-wing low attitude, it then turned right with the right-wing low and, later, the left wing dropped before the aircraft descended towards the ground and crashed on a ploughed field, approximately 500 metres south-east of Devondale private airstrip. The pilot was fatally injured, and the aircraft was substantially damaged.

The engine stopped shortly after take-off and the pilot restarted it. However, the pilot had trouble controlling the aircraft due to loss of forward speed and it stalled before it impacted the ground. It is probable that during the stall, the left aileron which attaches to the hardware failed, worsening the loss of control state in which the pilot found himself. This led to the microlight impacting the ground nose first.

Probable Cause/s and/or Contributory Factors

The aircraft lost forward speed which resulted in a stall and a crash. This was preceded by the restoration of engine power after it had stopped in-flight and as well as loss of control.

Contributory Factors

- Disregard of the standard maintenance procedures recommended by the manufacturer.
- Lack of maintenance skill, knowledge and experience.
- Disregard of Part 62.01.2 1(a) and Part 62.01.9(1), (2)(a) & (12), Part 62.01.10. 6(a.) (i.aa), Part 44.01.11 and Part 24.01.4 of the CAR 2011 as amended.

SRP Date	11 June 2024	Publication Date	14 June 2024

Occurrence Details

Reference Number	**:** CA18/2/3/10413
Occurrence Category	**:** Category 3
Type of Operation	**:** Private Part 94
Name of Operator	**:** Peter Viljoen
Aircraft Registration	**:** ZU-VDD
Aircraft Make and Model	**:** Pioneer FlightStar
Nationality	**:** South African
Place	**:** Devondale private farm, Barkley West, Northern Cape Province
Date and Time	**:** 25 January 2024, 0728Z
Injuries	**:** 1 Fatality
Damage	**:** Substantial

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) was notified of the occurrence on 25 January 2024 at 0730Z. The occurrence was classified as an accident according to the CAR 2011 Part 12 and the International Civil Aviation Organisation (ICAO) STD Annex 13 definitions. Notification was sent to the State of Registry and Operator in accordance with the CAR 2011 Part 12 and ICAO Annex 13 Chapter 4. The States did not appoint an accredited representative and/or advisor. Investigators were dispatched to the accident site for this accident.

Notes:

1. *Whenever the following words are mentioned in this report, they shall mean the following:*
   Accident — this investigated accident
   Aircraft — the FlightStar involved in this accident
   Investigation — the investigation into the circumstances of this accident
   Pilot — the pilot involved in this accident
   Report — this accident 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
‘	Minutes
“	Seconds
°	Degrees
°C	Degrees Celsius
AIID	Accident and Incident Investigations Division
AP	Approved Person
ATF	Authority to Fly
C of R	Certificate of Registration
CAR	Civil Aviation Regulation
CPR	Cardiopulmonary Resuscitation
CRS	Certificate of Release to Service
CVR	Cockpit Voice Recorder
EMS	Emergency Medical Service
FDR	Flight Data Recorder
ft	Feet
GPS	Global Positioning System
HP	Horsepower
hPa	Hectopascal
Kt	Knots
KW	Kilowatts
m	Metres
METAR	Meteorological Aerodrome Report
MHz	Megahertz
PIC	Pilot-in-Command
QNH	Barometric pressure adjusted to sea level
RAA	Recreational Aviation Australia
SACAA	South African Civil Aviation Authority
SACAR	South African Civil Aviation Regulations
SAPS	South African Police Service
SAWS	South African Weather Service
UTC	Co-ordinated Universal Time
VMC	Visual Meteorological Conditions
Z	Zulu (Term for Universal Co-ordinated Time - Zero Hours Greenwich)

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1 On Thursday, 25 January 2024 at 0728Z, a pilot on-board an amateur-built Pioneer FlightStar microlight aircraft registered ZU-VDD took off from Devondale private airstrip in Barkley West, Northern Cape province, to conduct a maiden proving flight. Visual meteorological conditions (VMC) prevailed at the time of the flight which was conducted under the provisions of Part 44 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.1.2 One of the pilot's family members stated that the pilot had purchased a disassembled aircraft from a person in Cape Town, Western Cape province, and that he had spent two years assembling the aircraft on his own, only seeking manpower help from time to time. The pilot also used parts from various aircraft to complete the assembly. The family member stated that once fully assembled, the pilot would start the engine and taxi the aircraft around the farm.

1.1.3 According to the eyewitness, a general worker at the farm, the pilot had refuelled the aircraft before the flight on the day of the accident. On the morning of the flight, the pilot performed the pre-flight checks, taxied to the start of the gravel runway strip, and took off in a north-easterly direction. Thereafter, he made a left turn and flew west, then changed direction to fly south and over the hangar towards the crops. At that point, the engine sound stopped. The aircraft was then seen flying towards south-east. The eyewitness stated that the pilot restored the engine power after he heard the revving sound. Shortly after, the eyewitness saw the left wing dropped, and then the right wing dropped; thereafter, the left wing dropped again. The aircraft descended towards the ground and crashed. The eyewitness and other bystanders rushed to the scene of the accident to render assistance to the pilot.

1.1.4 The South African Police Service (SAPS) and the Emergency Medical Service (EMS) personnel were notified of the accident; they arrived at the scene within an hour. The EMS personnel administered cardiopulmonary resuscitation (CPR) to the pilot. However, after 15 minutes of the effort to resuscitate the pilot, they declared him deceased. The aircraft was substantially damaged.

1.1.5 The accident occurred during daylight at a farm in Barkley West, Northern Cape province, at Global Positioning System (GPS) co-ordinates determined to be 28º29'17.11" South 024º39'16.86" East, at an elevation of 3 615 feet (ft).

Figure 2: Aerial view of the accident site and the approximate flight path. (Source: Google Earth)

1.2. Injuries to Persons

Injuries	Pilot	Crew	Pass.	Total On-board	Other
Fatal	1	-	-	1	-
Serious	-	-	-	-	-
Minor	-	-	-	-	-
None	-	-	-	-	-
Total	**1**	**-**	**-**	1	**-**

Note: Other means people on the ground.

1.3. Damage to Aircraft

1.3.1. The aircraft was substantially damaged.

Figure 3: The aircraft after the crash.

1.4. Other Damage

1.4.1. None.

1.5. Personnel Information

Nationality	South African	Gender	Male	Age	70
Licence Type	National Pilot Licence (NPL)				
Licence Valid	No	Type Endorsed	No		
Ratings	None				
Medical Expiry Date	20 May 2023				
Restrictions	Corrective lenses				
Previous Accidents	Unknown				

Note: Previous accidents refer to past accidents the pilot was involved in, when relevant to this accident.

Flying Experience:

Total Hours	642.20
Total Past 24 Hours	0.1
Total Past 7 Days	Unknown

Total Past 90 Days	Unknown
Total on Type Past 90 Days	Unknown
Total on Type	274.3

Note: The hours depicted on the table above were taken from the last application for renewal of the licence on 1 October 2006. The flight hours “past 24 hours” were flown on the day of the accident.

1.5.1. The pilot was initially issued a Microlight Aeroplane Licence on 18 August 1998; the last renewed licence which was an NPL had an expiry date of 19 October 2008. At the time of the accident flight, the pilot’s licence had expired. This was not in line with the provisions of Part 62.01.2 1(a) and Part 62.01.9(1), (2)(a) & (12) which state:

62.01.2 Authority to Act as Pilot

(1) No person shall act as the pilot of an aircraft whilst in or over any part of the Republic or the territorial waters thereof unless such person—

(a) holds a valid appropriate pilot licence and rating issued in terms of this part or part 61;

62.01.9.1.1.1 Competency

(1) No holder of a national pilot licence or rating shall exercise the privileges granted by the licence or rating unless such holder maintains competency by complying with the appropriate requirements prescribed in these regulations.

(2) (a) The holder of a national pilot licence shall undergo a general proficiency check for each category rating he or she may hold no later than 12 months from the initial issue, and thereafter within a period of 24 months of each previous proficiency check.

(12) The holder of a lapsed or expired pilot licence issued in terms of part 61 or part 62, or where such holder may not exercise the privileges of his or her licence due to non-compliance with the currency requirement, may for the purpose of renewing his or her licence or rating as contemplated in subregulation (2) above, exercise the privileges of the national pilots learner certificate provided for in part 62 provided that the holder have an appropriate current medical certificate.

1.5.2 The pilot was issued a Class 4 aviation medical certificate on 20 May 2021 with an expiry date of 20 May 2023. The medical certificate restricted the pilot to wear corrective lenses when operating an aircraft. However, at the time of the accident, the medical certificate had expired, which was not in line with the provisions of Part 62.01.10. 6(a.)(i.aa) which provides the following:

62.01.10 Medical Fitness

(6) The holder of a national pilot licence issued in terms of this part shall—
(a)not exercise the privileges of that licence—

(i) unless that person—

(aa) holds an appropriate valid medical certificate or medical fitness certificate, as the case may be;

1.5.3 There were no records in the Regulator's (SACAA) database to indicate that the pilot was an approved person (AP) or a test pilot.

1.5.4 Persons to Carry Out Maintenance (Source: Part 44.01.4)

(1) No person may carry out maintenance on an amateur-built aircraft or a production-built non-type certificated aircraft, or any component thereof, unless such person—

(a) is appropriately rated or approved on type by the Director or the organisation designated for the purpose in terms of part 149, as the case may be, to carry out maintenance; or

(b) carries out the maintenance under the prescribed supervision of a person authorised by the Director or by the organisation referred to in paragraph (a). A dual check of the maintenance carried out must be performed by a person referred to in subparagraph (a); or

(c) is the owner of the aircraft provided that an appropriately rated approved AMO, AME or Approved Person, rated in accordance with subpart 4 of part 66, performs a dual check on the maintenance which was carried out; or

(d) is an appropriately rated approved AMO, AME or approved person, rated in accordance with subpart 4 of part 66.

(2) (a) Components and parts intended to be used on non-type certificated aircraft may be fabricated by a person or organisation not licensed in terms of part 66 or part 145.

(b) The owner of the aircraft must provide the Director, or the organisation designated for the purpose in terms of part 149, as the case may be, with evidence that the components or parts meet the minimum specification for the component or part as specified by the Original Equipment Manufacturer.

(c) An appropriately rated approved AMO, AME or approved person, rated in accordance with subpart 4 of part 66 shall sign off the component or part in the appropriate logbook.

1.5.5 *Proving flight authority (SACAR Part 24.02.2)*

(6) A proving flight authority shall show the base from which the proving flights are to be carried out.

(7) A proving flight authority may be extended for further periods at the discretion of the Director, or if applicable, the organisation designated for the purpose in terms of part 149 of these regulations, as the case may be, on the submission of an inspection report equivalent to an annual inspection.

(8) The constructor, as required, may effect modifications and repairs during the periods of validity of the proving flight authority. However, should a major modification or repair be required, the Director or the organisation designated in terms of part 149 of these regulations, may require that the proving flights be commenced anew.

(9) Proving flights shall be carried out as prescribed in document SA-CATS 24.

(10) Flights conducted in terms of a proving flight authority—

(a) are limited to an area not exceeding 100 km radius from the specified base from which such flights are to be undertaken, unless stated otherwise on the proving flight authority;

(b) may only be conducted under VMC by day;

(c) are forbidden over open-air assemblies of persons; and

(d) are forbidden over built-up areas, except where necessary for take-off and landing.

(11) Only essential crew members, including those persons assigned to carry out in-flight inspections, may be carried on board the aircraft during flights conducted in terms of a proving flight authority.

(12) Where a proving flight authority is issued in respect of an aircraft of a new design, or of w hich the originally-approved design has undergone major modification, the first flight or flights shall be conducted by a pilot with the appropriate test flight rating.

(13) With the approval of the Director, the flight or flights referred to in subregulation (12), the owner of the aircraft, if suitably qualified, may carry out additional proving flights. For the purpose of this subregulation, where the 'owner' consists of more than one natural person, one of these persons shall be designated by the test pilot to carry out the proving flights.

(14) The owner, referred to in subregulation (13), shall be a licensed pilot, holding the appropriate category and class rating, and having been converted on type by an appropriately rated flight instructor.

(15) Apart from any conversion training, which may be required in terms of subregulation (14), no flight training may be conducted on an aircraft, operated in terms of a proving flight authority.

(16) Where the limitations for flight still have to be established, such proving flight or flights shall be carried out by a pilot with the appropriate test flight rating.

(17) The final proving flight for the issue of an authority to fly shall be carried out by a pilot with the appropriate test flight rating who, if applicable, shall be the pilot who carried out the proving flights, referred to in subregulation (16).

1.6 Aircraft Information

1.6.1. Pioneer FlightStar (Source: FlightStar Assembly Manual)

The FlightStar is an ultralight airplane with a conventional three-axis flight control system with full-span ailerons. All ailerons and lifting surfaces are gap sealed and double surfaced. The engine, located in front and slightly above the pilot's seat, is a two-cylinder, two cycled, horizontal output shaft system. A pulley attached to the engine output shaft transmits rotational energy via a drive belt to the pulley on the reduction drive. The throttle and ignition switch are located on the left side of the cage, control pitch and roll axes. Rudder pedals control the yaw axis and a steerable nose wheel. All flight controls utilise Teleflex push-pull cables to transmit flight control input to their respective control surface.

Airframe:

Manufacturer/Model	Pioneer International Corporation/FlightStar	
Serial Number	624	
Year of Manufacture	1984	
Total Airframe Hours (At Time of Accident)	264.5	
Last Inspection (Date & Hours)	Unknown	Unknown
Airframe Hours Since Last Inspection	Unknown	
CRS Issue Date	Unknown	
ATF (Issue Date & Expiry Date)	6 October 2003	6 October 2004
C of R (Issue Date) (Present Owner)	Unknown	
Operating Category	Part 94	
Type of Fuel Used	Unleaded 95 Octane	
Previous Accidents	According to the aircraft file, the aircraft was involved in an incident on 7 February 1987.	

Note: Previous accidents refer to past accidents the aircraft was involved in, when relevant to this accident.

1.6.2 According to available information, the aircraft was registered to the previous owner on 26 November 1987. There was no record of de-registration by the previous owner on the Regulator's database.

1.6.3 There were no records of the last annual inspection conducted on the aircraft, and the airframe hours were also unknown.

1.6.4 There were no documents (aircraft logbook and flight folio) found in the hangar where the assembly took place. This was not in line with the provisions of Part 24.01.4.

1.6.5 There was no paperwork or assembly manual found in the hangar where the assembly took place.

1.6.6 According to available information, the aircraft was first registered to the previous owner on 4 September 1984 after which a ZS-VDD registration mark was issued. No records were found relating to the change of registration to ZU-VDD.

1.6.7 On 7 February 1987, the aircraft was involved in an incident, and repairs were made to the aircraft by an AP. A post-maintenance flight was conducted, and the aircraft was declared serviceable. The origin of the repair scheme was not found as stated in the aircraft's file, and the aircraft was grounded by the Regulator pending outstanding documents.

Figure 4: The repair scheme conducted after the incident on 7 February 1987.

1.6.8 On 5 April 1988, the previous owner applied for renewal of the Authority to Fly (ATF). The aircraft was issued a proving flight authorisation by the SACAA on 21 April 1988 with an expiry date of 20 October 1988. The aircraft underwent an annual inspection on 10 June 1989 at 163 hours, and another proving flight was issued on 3 July 1989 with an expiry date of 2 September 1989. On 29 January 1990, the aircraft was issued another proving flight with an expiry date of 26 September 1990.

1.6.9 On 5 October 1990, the owner applied for the ATF; the aircraft had 172.4 total hours. A test flight was conducted as part of the requirement stated in form TV2/130. On 15 January 1991, the aircraft was issued the ATF certificate. The following year on 30 April 1992, the

Regulator issued a letter to the owner to inform him that the ATF was invalid due to the annual inspection that was not conducted. Thereafter, the owner conducted an annual inspection on the aircraft on 7 July 1992 at 217.45 hours.

1.6.10 There were no records found to confirm that the annual inspection was conducted in 1993, 1996, 1997 and 1998. This was not in line with the provisions of Part 24.01.2. On 8 January 1999, the Regulator grounded the aircraft due to discrepancies in the aircraft's physical addresses/location. According to the file kept at the Regulator's facility, the last annual inspection renewal was conducted on 6 October 2003 and no records were found after this date to indicate that the aircraft was kept in an airworthiness state.

1.6.11 The last change of ownership was made on 20 September 1987.

1.6.12 Efforts were made to contact the previous owner on the number that was on the Regulator's file. But these efforts were to no avail.

Engine:

Manufacturer/Model	Bombadier Rotax GMBH GUNSKIRCHEN
Serial Number	4158475
Hours Since New	Unknown
Hours Since Overhaul	Unknown

Propeller:

Manufacturer/Model	Wood 2 Blade
Serial Number	Unknown
Hours Since New	Unknown
Hours Since Overhaul	Unknown

1.6.13 There were no records of the previous engine serial numbers or propeller serial numbers for this aircraft.

1.6.14 According to available information, the pilot replaced the original engine that was fitted (Kawasaki TA 440 A) to the aircraft with a Rotax engine; the details of how the Rotax engine was acquired are unknown.

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 at FAKM

on 25 January 2024 at 0700Z. FAKM is located 14 nautical miles (nm) south-east of the accident site.

Wind Direction	030°	Wind Speed	3 kt	Visibility	9999m
Temperature	26°C	Cloud Cover	Unknown	Cloud Base	Unknown
Dew Point	16°C	QNH	1023 hPa		

1.8 Aids to Navigation

1.8.1 The aircraft was equipped with standard navigational equipment as approved by the Regulator (SACAA). There were no records to indicate that the navigational equipment was unserviceable before the flight.

1.9 Communication

1.9.1 The aircraft was equipped with a standard communication system as approved by the Regulator. There were no recorded defects with the communication system before the flight.

1.10 Aerodrome Information

1.10.1 The accident occurred on a farm in Barkley West, Northen Cape province.

1.11 Flight Recorders

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

1.12 Wreckage and Impact Information

1.12.1 The aircraft impacted the vegetation-covered ground at a private farm in Barkley West, Northern Cape province. Ground scars showed that the aircraft impacted the ground in a near nose-down attitude and came to rest upright. The accident site was confined to an area of approximately 30m in diameter. The aircraft rested facing a south south-westerly direction.

Figure 5: The aircraft at the accident site.

1.12.2 The Airframe

The nose section, which is made of a composite material, showed signs of deformation due to impact. The instrument panel sustained damage from the impact which caused the associated instruments to dislodge from their positions; they were found near the nose section. Both wings remained attached to the mainframe; the left wing was bent toward the mid-section on the leading and trailing edge structures, as well as at the bottom rear supporting beam. The fabric covering the structure was undamaged with no signs of separation. Both wing-tips fabric was covered in dirt and grass, an indication of contacting the ground. The main keel tube was still intact but was bent in the middle. The engine mounting position was deformed and had a 90-degree approximate bend to the right. The fuel tank remained intact; it contained ample clean fuel. A fuel sample was taken from the tank; it showed no signs of contaminants. The tricycle-type landing gear sustained impact damage. The nose gear had separated and was found near the nose section. Pieces of the Perspex were found around the front section.

Figure 6: The deformed left wing.

1.12.3 The Flight Controls

The nose section and cabin were heavily damaged. The flight controls were checked for continuity. The tail section, including the elevator and rudder flight control surfaces had remained intact, and any up or down movement was transferred to the cabin through the Teleflex cable. The right-side aileron was secure with four attachments (bolt, nut and safety ring) on the trailing edge, and the left aileron was secured with two attachments on the outboard side (pin and safety ring). The impact caused the mid-section of the left aileron to bend. Due to the missing attaching hardware, functionality of the ailerons was not possible, however, continuity was confirmed via Teleflex cables. The aileron mixture plate was still secured, and all attaching hardware was in place.

Figure 7: The orange circle shows the unsecured left aileron inboard attachment points.

Figure 8: Right-side aileron attached with a bolt, nut and safety ring.

Figure 9: The orange circle shows the second unsecured attachment point of the left aileron.

Figure 10: Attaching hardware found on the left aileron.

1.12.4 The Engine

The engine had dislodged from its attaching points. Both carburettors had dislodged from their respective positions and were found suspended by the throttle cables and fuel pipes. Two of the wooden propeller blades had disintegrated; a piece of one of the blades was buried in the sand and the other blade was retrieved on the right side of the aircraft. Examination of the engine revealed that it was operating at full power during impact. One carburettor had soil and dirt on the intake side. The bowls were opened, and one carburettor

bowl had fuel and the other was dry. The carburettor filter looked clean and free of sediments. The fuel pipes were intact and showed no signs of rupture. The engine turned freely by hand.

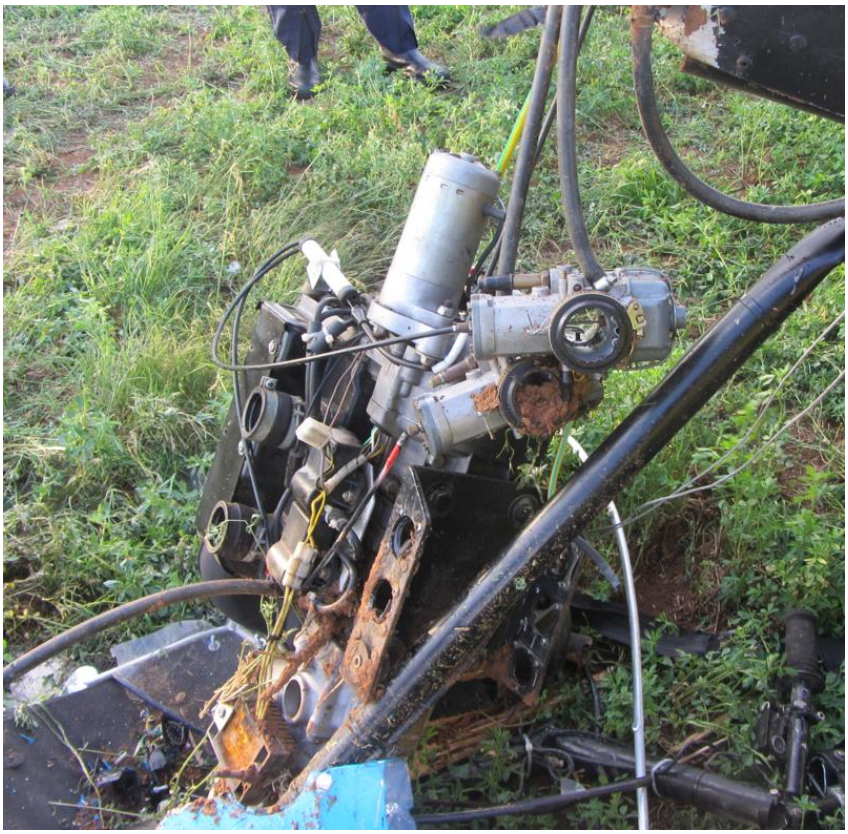

Figure 11: The engine with soil and dirt on the front surface.

Figure 12: The dislodged carburettors.

Figure 13: The dirt-free carburettor filter.

Figure 14 (left and right): One of the fragmented blades was buried on the ground with the hub (left), and the pieces of the fragmented blades spread out on the ground (right).

1.13 Medical and Pathological Information

1.13.1 The post-mortem report was not available at the time of completion of this report. Should the post-mortem results have a bearing to this accident after being released, the information will be treated as new evidence and the investigation will be re-opened.

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 accident was considered not survivable because the aircraft cabin structure was destroyed during the accident sequence.

1.16 Tests and Research

1.16.1 None.

1.17 Organisational and Management Information

1.17.1 The flight was conducted under the provisions of Part 24 (proving flight) of the CAR 2011 as amended.

1.18 Additional Information

1.18.1 General (Source: Assembly Manual)

A. The following sections contain the procedures necessary to assemble the FlightStar from the kit parts. Tables in each section list all of the parts used to assemble the FlightStar and reference the figure in which they are illustrated.

B. All references to the direction used in the assembly procedure are relative to the individual sitting in the pilot's seat looking forward.

C. When assembling the FlightStar it is important to note that there are only a few situations where torque is required. All other fasteners (nuts, bolts) need only to be tightened securely. This means that when 1-1/2 to 3 threads are exposed and mating surfaces are in contact, the nut is properly tightened. Care should be used to ensure the correct bolt was chosen. Any further tightening may damage FlightStar components.

D. When assembling the FlightStar it is important that the assembler pay special attention to the bolt sizes called out in the procedures. In the event that a question arises as to whether a bolt is an AN3-7 or an AN3-11, line-up the blot in question with the indicating mark in the figure to determine actual bolt shank diameter as well as bolt length.

E. All bolts and/or nuts must be protected from backing off by one of the following means:

- *"Nyloc" type nut (most places)*
- *Safety ring, pin, or cotter pin (from parts to be removed from breakdown)*

- *Removable Loctite such as "Loctite Blue" or "Pro-lock 1" applied to threads (blind nuts, anchor nuts etc.*
- *Safety wire.*

1.18.2 Assembly Procedure of the Aileron (Source: Assembly Manual)

1. *Position front aileron spar (1) on a flat surface. Install six 3/16" pop rivets (2) in front aileron spar.*
2. *Install the 4 plates nuts (4) on inside of leading-edge spar. (Where the seven rib holes are). Place over bushes holes. Thread eyebolt into plate nut through insert to help align.*
3. *Drill 3/32 holes through one wall of spar using plate nut as a guide. Install pop rivets (3) into nut plate, (4) remove eyebolts.*
4. *Be sure aileron compression strut length starts largest at root to smallest at tip (5 through 5E)*
5. *Line up six aileron ribs (5E) with their respective holes in aft aileron spar (7A). Make sure aft aileron spar splice is towards tip.*
6. *Position front of ailerons tip plate (6) over end of front aileron spar (1). Line up radius on aileron tip plate (6) with radius one end of front aileron spar (1). Carefully bend edges of aileron tip plate to conform to curve of the front aileron spar (1).*
7. *Using a carpenter's square or any other suitable tool, ensure that a right angle exists between front aileron spar (1) and edge of aileron tip plate (6). While maintaining right angle, sight down rear spar to confirm that rear spar is straight. Drill four 1/8-inch diameter holes using holes in aileron tip plate (6) as a guide. Install four pop rivets (7). Verify that right angle still exists between front aileron spar (1) and aileron tip plate (6) and that rear spar is straight and no deflection is present.*
8. *Position rear of aileron tip plate (6) over the end of the rear aileron spar (7a). Flatten the tip of the rear tube slightly to fit in the plate if required. Line up the aileron tip plate (6) with a radius on the end of the rear aileron spar. Measure from outside-to-outside spars, spacing has to be 7 11/16". Cover sharp corners with tape to prevent snagging fabric later. Carefully bend edges of aileron tip plate (6) to conform to curve of the rear aileron spar (7A)*
9. *Drill four 1/8-inch diameter holes using holes in aileron tip plate (6) as a guide. Install four pop rivets (7).*
10. *Install the aileron anchor plug (8A) into the end of the torque tube where the hole for bolt (12) is located. 10A Temporarily install bolt (12) so that plug (8A) does not spin inside the torque tube.*
11. *Insert the end of torque tube (8) into front aileron spar (1). Rotate the torque tube (8) such that the angle at the opposite end mates with the rear aileron spar (7A). Install bolt (9) and tighten it securely, using blue Loctite.*

CAUTION: *EXERCISE EXTREME CAUTION WHEN INSTALLING THE SAILOR DAMAGE TO THE SAIL MAY RESULT.*

12. *Silicone front (1) and rear (7a) aileron spar to allow the sail to slide freely. Use silicone dry lubricant only. Any other lubricant will damage the sail fabric.*
13. *When installing the sail over the frame be sure the Velcro seam is centred on the leading-edge spar for full length. Carefully pre-bend outward the 5/8" trailing edge tube 1/4" between rib 5 and the torque tube (8) to preload the sail fabric in this location.*
14. *There will be a large gap that will be pulled closed by a nylon cord. The cord should be laced double for pulling through grommets where they are parallel to the aileron length. See the figure below.*

    NOTE: *We have found two hooked-shaped tools (rigger's hooks or roller skate hooks) that work best for pulling the Xs of lacing. The double lacing prevents slippage.*

15. *The aileron should be pulled to where the bottom surface velcro can be closed with no velcro visible. Tie off with a square knot.*
16. *Locate eyebolt holes from root approximately 2", 52', 107', 158". Using a sailmaker's hot knife (similar to a small soldering iron), burn a hole the same size as the bolt hole in the spar. Cut the Velcro gap seal with a knife (approximately 1" X 1' centered over the hole). Be sure not to cut stitching. Install 4 eyebolts (10) in aileron front spar.*
17. *Secure the aileron control horn (11) to torque tube (80 with bolt (12). Make sure the longest hole-to-hole measurement is pointing down and is on the laced side.*
18. *Locate the hole in the aileron torque tube. Use a hot knife (See step #16) to open the bolt hole. Install bolt (14) and standoff (13) (Standoff goes between aileron plate and torque tube). Tighten bolt (12) and nut (15) securely. Tighten the remaining bolt into the torque block with blue Loctite.*
19. *Secure flap on aileron sail with Velcro sewn to sail.*
20. ***Secure aileron to rear wing spar with four bolts (16), and four nuts (17). Tighten nuts finger tight and install four safety rings (18).***
21. *Repeat for the second aileron.*

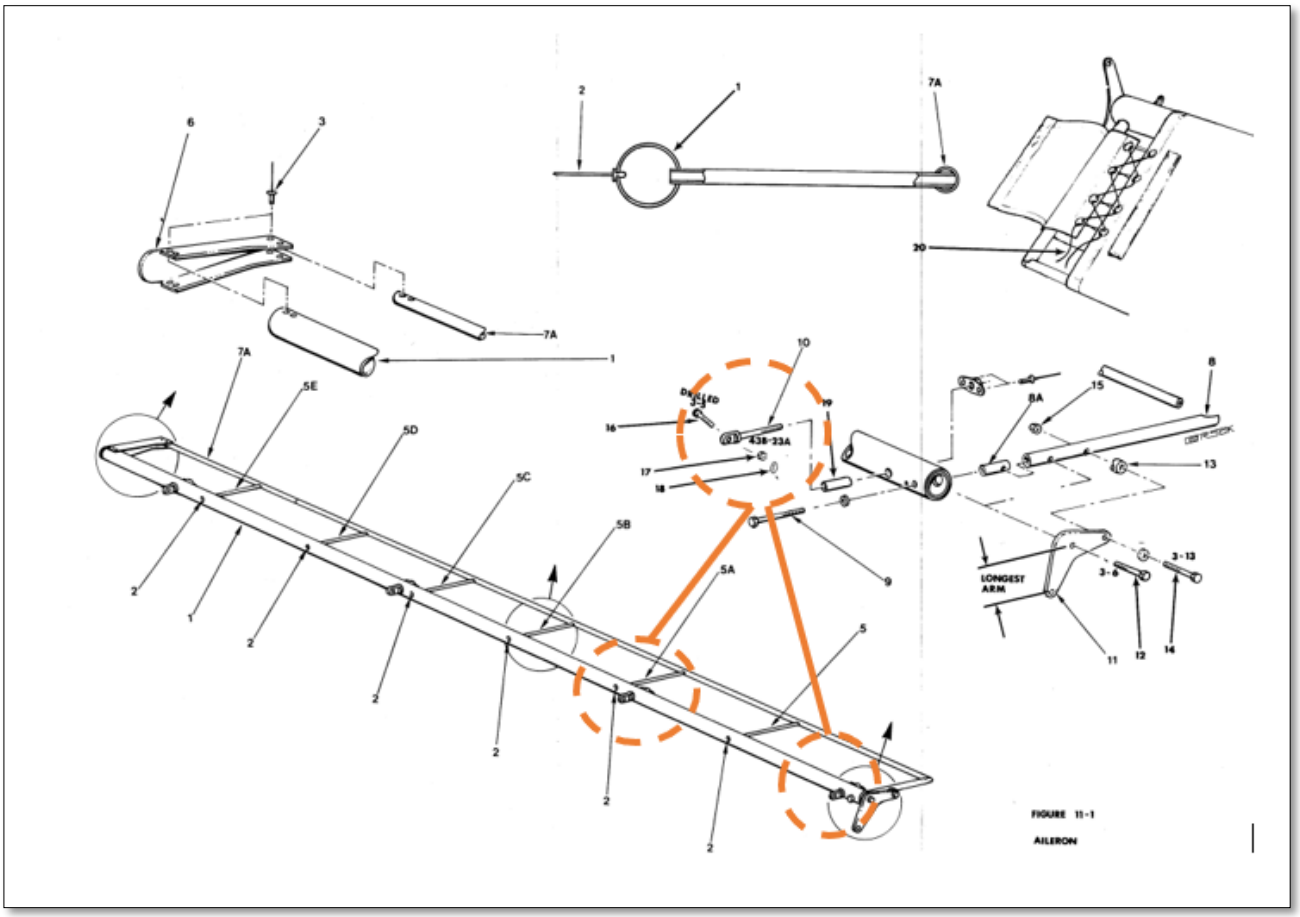

Diagram 1: The position of the missing hardware on the left aileron.

AILERON
KEY TO FIGURE 11-1

Index Number	Part Number	Quantity Per Aileron	Quantity Per Aircraft	Nomenclature
1	W-41-3	1	2	Front Aileron Spar
2	SB6-4	6	12	Pop Rivet
3	SB3-2	8	16	Pop Rivet
4	MS21048-14	4	8	Plate Nut
5	W-41-7	1	2	Aileron Rib (Strut No. 1)
5A	W-41-9	1	2	Aileron Rib (Strut No. 2)
5B	W-41-11	1	2	Aileron Rib (Strut No. 3)
5C	W-41-13	1	2	Aileron Rib (Strut No. 4)
5D	W-41-15	1	2	Aileron Rib (Strut No. 5)
5E	W-41-17	1	2	Aileron Rib (Strut No. 6)
6	W-42	1	2	Aileron Tip Plate
7	AB4-2A	8	16	1/8 X 1/8 Aluminum Pop Rivet
7A	W-41-5	1	2	Rear Aileron Spar
8	W-125	1	2	Torque Tube
8A	W-40	1	2	Aileron Anchor Plug
9	AN4-7A	1	2	Bolt
10	AN43B-23A	4	8	Eyebolt
11	W-2B	1	2	Aileron Control Horn
12	AN3-6A	1	2	Bolt
13	SO2-4	1	2	Standoff
14	AN3-13A	1	2	Bolt
15	AN365-1032	1	2	Nut
16	AN3-5	4	8	Bolt
17	AN310-3	4	8	Nut, Castellated
18	AN416-2-	4	8	Safety Ring
19	1/4 x 2	4	8	Instabush Insert
20	Nylon, 1/8 x 5'	1	2	Aileron Lacing Cord (in sail bag)

Table 1: Illustrated Parts Catalogue indicating hardware to be used. (Source: Assembly Manual)

1.18.3 Release to Service (Source: Part 44.01.13)

(1) The release to service for an aircraft shall be issued in the prescribed format subject to compliance with the accepted maintenance schedule as prescribed in regulation 44.02.1 or 44.03.1, as applicable.

(2) In the case of a non-type certificated aircraft operated in terms of

(a) Part 94, the service release shall be confirmed by the aircraft owner following simple line maintenance or the annual inspection.

(b) Part 96 or part 141, the release to service shall be issued by an appropriately rated approved AMO, AME or approved person, rated in accordance with subpart 4 of part 66.

(3) The format for the issuing of the release to service shall be that as prescribed.

1.18.4 Spin Awareness (Source: FAA-H8083-3C Airplane Flying Handbook)

If a spin is entered, most manufacturers recommend immediately retarding both throttles to idle, applying full rudder opposite the direction of rotation, and applying full forward elevator/stabilator pressure (with ailerons neutral). These actions should be taken as near simultaneously as possible. The controls should then be held in that position until the spin has stopped. At that point adjust rudder pressure, back elevator pressure, and power as necessary to return to the desired flight path. Pilots should be aware that a spin recovery will take considerable altitude; therefore, it is critical that corrective action be taken immediately.

1.18.5 Adverse Yaw (Source: FAA-H8083-3C Airplane Flying Handbook)

Since the downward deflected aileron produces more lift as evidenced by the wing raising, it also produces more drag. This added drag causes the wing to slow down slightly. This results in the aircraft yawing toward the wing which had experienced an increase in lift (and drag). From the pilot's perspective, the yaw is opposite the direction of the bank. The adverse yaw is a result of differential drag and the slight difference in the velocity of the left and right wings. [Figure 15] Adverse yaw becomes more pronounced at low airspeeds. At these slower airspeeds, aerodynamic pressure on control surfaces is low, and larger control inputs are required to effectively manoeuvre the aircraft. As a result, the increase in aileron deflection causes an increase in adverse yaw. The yaw is especially evident in aircraft with long wing spans. Application of the rudder is used to counteract adverse yaw. The amount of rudder control required is greatest at low airspeeds, high angles of attack, and with large aileron deflections. Like all control surfaces at lower airspeeds, the vertical stabilizer/rudder becomes less effective and magnifies the control problems associated with adverse yaw.

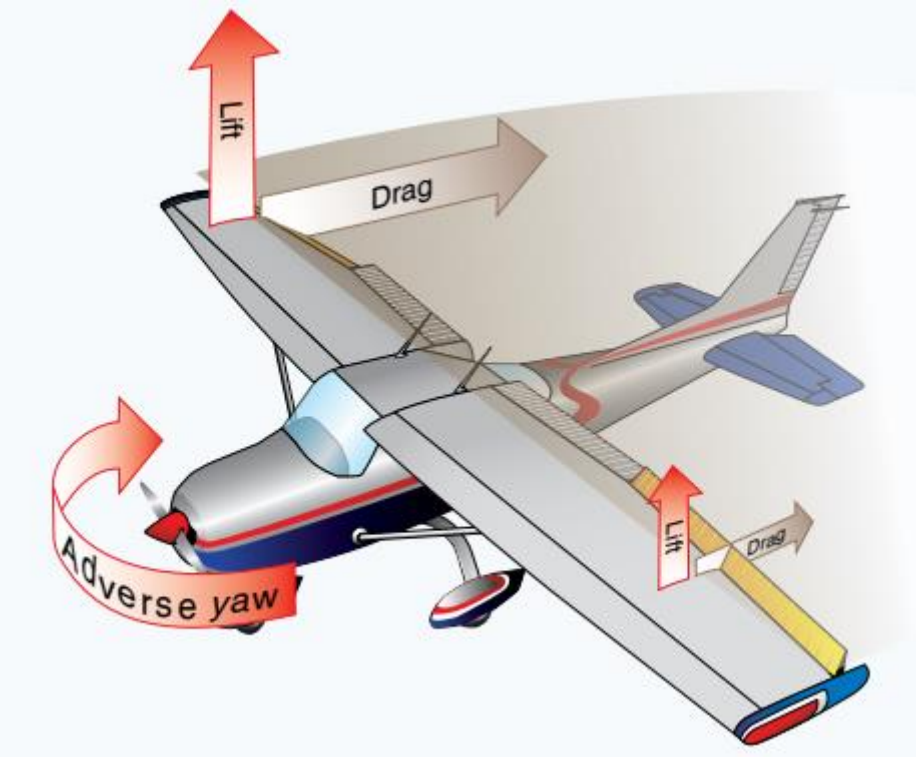

Figure 15: Adverse yaw is caused by a higher drag on the outside wing that is producing more lift.

1.18.6 Stall Characteristic (Source: FAA- H8083-3C- Airplane Flying Handbook)

The factors that affect the stalling characteristics of the airplane are balance, bank, pitch attitude, coordination, drag, and power. The pilot should learn the effect of the stall characteristics of the airplane being flown and the proper correction. It should be reemphasized that a stall can occur at any airspeed, in any attitude, or at any power setting, depending on the total number of factors affecting the particular airplane.

1.18.7 Stall Recovery (Source: FAA- H8083-3C- Airplane Flying Handbook)

Recovery from the stall should be accomplished by immediately reducing the angle of attack by positively releasing back-elevator pressure and, in the case of a departure stall, smoothly advancing the throttle to maximum allowable power. In this case, since the throttle is already at the climb power setting, the addition of power will be relatively slight. The nose should be lowered as necessary to regain flying speed with the minimum loss of altitude and then raised to climb attitude. Then, the airplane should be returned to the normal straight-and-level flight attitude, and when in normal level flight, the throttle should be returned to cruise power setting. The pilot must recognize instantly when the stall has occurred and take prompt action to prevent a prolonged stalled condition.

1.19 Useful or Effective Investigation Techniques

1.19.1 None.

2. ANALYSIS

2.1. General

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

2.2. Analysis

2.2.1. Man

The pilot was issued a Microlight Aeroplane Licence on 18 August 1998 with an expiry date of 19 October 2008. The pilot was issued a Class 4 aviation medical certificate on 20 May 2021 with an expiry date of 20 May 2023 with medical restrictions. At the time of the accident, the pilot was flying the aircraft type for the first time after its assembly. The pilot flew the aircraft without a valid licence and a valid medical certificate which was not in line with Part 62.01.1 1(a) read together with Part 62.01.10. The pilot assembled the aircraft on his own. It is not known what led to the decision to assemble the aircraft on his own. There was no dual inspection conducted on the flight control surfaces and engine controls. This was not in line with the provisions of Part 44.01.4 1(b). The investigation established that the pilot's decision to embark on flying the aircraft without a valid licence and medical certificate was a serious safety concern and a disregard for aviation safety and the applicable regulations.

2.2.2 Machine

The last annual inspection renewal was conducted on 6 October 2003. Records were not available to indicate that the aircraft was maintained to ensure airworthiness after the inspection on 6 October 2003. According to available information, the aircraft assembly was completed a day before the accident flight, and no evidence was found that the annual inspection was conducted. There were no records available for the assembly of the aircraft, or for the airframe and engine logbook. This is not in accordance with the provisions of Part 24.01.4. The unavailability of the aircraft logbooks created difficulties to verify information during the investigation process. When work is conducted on the engine and flight controls, it is required that a dual inspection be carried out by a qualified person; this was not adhered to. The left-side aileron was missing two of the attaching hardware on the inboard side of the wing. The remaining attaching hardware was incorrect and did not match the required part numbers as specified in the Assembly Manual (Diagram 1 and Table 1). It is likely that the hardware failed in-flight, however, this could not be confirmed with certainty. If an annual inspection was conducted, and a dual inspection and proper pre-flight had been carried out,

it would have been noticed that the left aileron was not properly secured. The lack of maintenance experience and the unavailability of the Assembly Manual during the aircraft assembly contributed to poor maintenance practices. There was no proving ATF, and there was no Certificate of Release to Service (CRS) issued by the pilot/owner/AP before the flight. This was not in line with the provisions of Part 44.01.13.

2.2.3 Investigation

The engine stopped for unknown reasons, and the pilot was able to restart it. Thereafter, the pilot had trouble controlling the aircraft due to loss of forward speed and the aircraft stalled and crashed. During the stall, it is probable that the left aileron attaching hardware failed, thus, worsening the loss of control state in which the pilot found himself. This led to the aircraft impacting the ground, nose section first.

The investigation determined that at the time of the accident, the aircraft was not airworthy as it was not maintained using the manufacturer recommended practices and the regulations were not complied with or followed.

3. CONCLUSION

3.1. General

From the available evidence, the following findings, causes and contributing factors were made with respect to this accident. 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 accident. The findings are significant steps in this accident sequence, but they are not always causal or indicate deficiencies.
- **Causes —** are actions, omissions, events, conditions, or a combination thereof, which led to this accident.
- **Contributing factors —** are actions, omissions, events, conditions or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the accident occurring, or would have mitigated the severity of the consequences of the accident. 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 pilot was initially issued a Microlight Aeroplane Licence on 18 August 1998 with an expiry date of 19 October 2008 under Part 62 of the South African CAR 2011. The pilot embarked on this flight with an expired licence. This was not in line with the existing regulatory requirements of Part 62.01.2.

3.2.2 The pilot was issued a valid Class 4 aviation medical certificate on 20 May 2021 with an expiry date of 20 May 2023. The pilot embarked on this flight with an expired medical certificate. This was not in line with the existing regulatory requirements.

3.2.3 According to available information, the aircraft was registered to the previous owner on 26 November 1987, the ownership of the aircraft was not transferred to any person or entity since the said registration date.

3.2.4 There were no records found of the last annual inspection that was conducted on the aircraft, and the airframe hours are unknown.

3.2.5 There were no records found of the Authority to Fly (ATF). This was not in line with the provisions of Part 24.02.2.

3.2.6 There were no records found of the Certificate of Registration (C of R).

3.2.7 It could not be determined if there were any recorded defects with the navigational equipment before the flight because there was no flight folio for this aircraft.

3.2.8 There were no records found of the assembly of the aircraft or drawings. This was not in line with the provisions of Part 44.01.14.

3.2.9 The aircraft did not have the required documentation – flight folio, engine, airframe and propeller logbooks as required by the provisions of Part 24.01.4.

3.2.10 The pilot assembled the aircraft without proper documentation from the manufacturer and he did not have a qualified approved person to assist in the assembly of the aircraft.

3.2.11 The pilot did not contact the SACAA to seek advice on how to proceed with the project and to ascertain if all regulations relating to home-built aircraft were adhered to.

3.2.12 There were no records found that the pilot was a test pilot as required by the regulation. This was not in line with the provisions of Part 62.01.9.

3.2.13 There were no records found that the pilot had an AP certificate to permit him to build the aircraft. This was not in line with the provisions of Part 44.01.4.

3.2.14 There were no records found that the annual currency fee was paid to the Regulator as required by the provisions of Part 24.02.8.

3.2.15 The left aileron had missing attaching hardware which likely failed during the stall. The attaching hardware that was used on the aircraft was not the approved hardware for the aircraft, according to the Assembly Manual.

3.2.16 The aircraft was considered not airworthy due to noncompliance with the manufacturer recommended maintenance practices and the regulations. This was not in line with Part 44.01.4. 1(c).

3.2.17 Examination of the engine revealed that it was operating at full power at the time of impact.

3.2.18 The weather was considered to not have contributed to this accident.

3.2.19 The engine stopped in-flight, and the pilot restored it. Thereafter, the aircraft stalled and the pilot could not recover from the stall; the aircraft crash on the ground.

3.3. Probable Cause/s

3.3.1. The aircraft lost forward speed which resulted in a stall and a crash. This was preceded by the restoration of engine power after it had stopped in-flight, as well as loss of control.

3.4. Contributory Factor/s

3.4.1. Disregard of the standard maintenance procedures recommended by the manufacturer.
3.4.2. Lack of maintenance skill, knowledge and experience.
3.4.3. Disregard of the Part 62.01.2 1(a), Part 62.01.9(1), (2)(a) & (12), Part 62.01.10. 6(a.) (i.aa), Part 44.01.11 and Part 24.01.4 of CAR 2011, of CAR 2011 as amended.

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. In the interest of safety, it is recommended that owners of aircraft adhere to the manufacturer recommended maintenance practices and the provisions of the CAR 2011 as amended with regards to the operation and maintenance of aircraft.

5. APPENDICES

5.1. None.

This report is issued by:

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