AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/9269		
Aircraft Registration	ZU-FXI	**Date of Accident**	5 January 2014			**Time of Accident**	0630Z
Type of Aircraft	Bat Hawk (Aeroplane)		**Type of Operation**	Private			
Pilot-in-command Licence Type	NPL Airplane		**Age**	55	**Licence Valid**	Valid	
Pilot-in-command Flying Experience	Total Flying Hours		935,48		Hours on Type	202,0	
Last point of departure	Andrew's Field (FAAF)- Western Cape						
Next point of intended landing	Andrew's Field (FAAF)- Western Cape						
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)							
Suiderstrand near Struis Bay (fynbos) at GPS position: S 34°49'02.65", E 019°57'28.38"							
Meteorological Information	Wind direction: SWS, Wind speed: 6 knots, Visibility: Good. Temperature: 19 ºC, Cloud base: 2 000 ft						
Number of people on board	1+1	**No. of people injured**	0	**No. of people killed**	0		

Synopsis

An aircraft with two occupants on board experienced an engine failure during a scenic flight. The pilot initiated a glide to execute a forced landing onto the beach, which was approximately 49,2 feet (ft.) from the bush. During the glide, the pilot was unable to clear the bush. The undercarriage, keel bar, right wing and fuselage nose section were substantially damaged during the accident sequence.

The pilot and his passenger sustained no injuries during the accident sequence. The aircraft was recovered by the insurance company and sent to Micro Aviation based in Mpumalanga for further investigation.

The investigation found that the loss of engine power was probably due to interruptions of fuel flow to the engine, but could not conclusively determine the reason. The aircraft also stalled at a height insufficient to allow the pilot to recover.

Probable Cause

Unsuccessful forced landing following of loss engine power inflight due to fuel starvation

Contributory Factor

1 Improper operating procedure of electrical fuel booster pump within restricted height

2 Dislodged fuel supply valve

3 Poor technique

IARC Date		Release Date	

AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator : WILLOWVALE PRODUSENTE CC
Manufacturer : MICRO AVIATION SA
Model : BAT HAWK
Nationality : SOUTH AFRICAN
Registration Marks : ZU-FXI
Place : Suiderstrand near Struis Bay (fynbos) at GPS position: S 34°49'02.65", E 019°57'28.38"
Date : 5 January 2014
Time : 0630Z

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 accidents 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 accompanied by a passenger departed from FAAF with the intention of completing a scenic flight. During the flight, at approximately 600 feet (ft) above ground level (AGL), the aircraft experienced an engine failure and the pilot elected to execute a forced landing.

1.1.2 The pilot initiated the glide but the rate of descent was too quick. The aircraft landed in the Fyn-bush. During a forced landing, the aircraft sustained substantial damage to the airframe nose section, right wing, keel bar and undercarriage.

1.1.3 The pilot and his passenger evacuated the aircraft unassisted with no injuries sustained during the accident sequence.

1.1.4 The aircraft remained at a state of rest 49.2 ft from the beach in the bush (Suiderstrand near Struis Bay) with GPS co-ordinates S 34°49'02.65", E 019°57'28.38".

1.1.5 An insurance company recovered the aircraft to Micro Aviation aircraft maintenance organisation (AMO) in Mpumalanga for further investigation.

1.2 Injuries to Persons

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

1.3 Damage to Aircraft

1.3.1 The aircraft sustained substantial damage to the airframe nose section, right wing and undercarriage.

Figure 1: Damage to aircraft

1.4 Other Damage

1.4.1 None

1.5 Personnel Information

Nationality	South African	Gender	Male	Age	55
Licence Number	0270400427	Licence Type	National Pilot Licence		
Licence valid	Valid	Type Endorsed	Yes		
Ratings	Conventionally controlled microlight, light sport aeroplane and weight-shift controlled microlight				
Medical Expiry Date	31 October 2015				
Restrictions	None				
Previous Accidents	None				

Flying Experience:

Total Hours	935,48
Total Past 90 Days	90,05
Total on Type Past 90 Days	90,05
Total on Type	202,0

1.5.1 The pilot, who is also the conducted several general maintenance inspections on the aircraft and the engine. On 17 June 2013, the owner carried out an engine oil change 50-hour service. He then carried out a 100-hour service on 13 September 2013 in accordance with the Jabiru maintenance manual of procedures. On 12 November 2013 an engine oil change, oil filter cleaning and a breather bottle service was carried out at 140 hours. A 150-hour service on 14 December 2013 was followed by a 200-hour service on 1 January 2014.

1.5.2 All the services were conducted in accordance with Jabiru maintenance manual. According to the Jabiru maintenance manual procedures, 100-hour and 200-hour services involve fuel pump inspections.

1.6 Aircraft Information

Airframe:

1.6.1 The aircraft was a an amateur-built type model

Type	Bat Hawk	
Serial Number	MA-13-16	
Manufacturer	MICRO AVIATION SA	
Date of Manufacture	2013	
Total Airframe Hours (At time of Accident)	200,9	
Last Annual Inspection (Date & Hours)	2 March 2013	23,73
Hours since Last Annual Inspection	177,17	
C of ATF (Issue Date)	11 April 2013	
C of R (Issue Date) (Present owner)	20 March 2013	
Operating Categories	Standard Part 94	

Engine:

Type	Jabiru 3300 A
Serial Number	33A874
Hours since New	777,5
Hours since Overhaul	200,9

1.6.2 The Jabiru 3300 is a lightweight four-stroke, horizontally opposed "flat-six" air-cooled aircraft engine produced by Jabiru Aircraft. The engine is direct drive and is fitted with alternators, silencers, vacuum pump drives and dual ignition systems as standard. According to the Jabiru engine manufacturer's service letter, it is recommended that the fuel used must be according to the manufacturer's recommendation. The owner of the accident aircraft informed the investigator that he was using the combined mixture of avgas and mogas (95 unleaded) fuel, which was in accordance with manufacture's recommendation.

1.6.3 Investigation discovered that the engine had previously been fitted to a Bantam B22J aircraft S/N: 05-0279 registered ZU-EAX, which was involved in an accident in Mozambique on 25 September 2011. According to the previous owner, aircraft ZU-EAX was flying to Pemba in Mozambique on 23 September 2011. En route the aircraft landed at Quelimane for refuelling. The refuelling station did not have avgas fuel. After two days, the pilot opted to uplift mogas 95 unleaded fuel grade on 25 September 2011, but the wrong fuel grade (unspecified) was uplifted. During the flight the aircraft encountered an engine failure in which the engine dropped a valve. The pilot then executed a forced landing on a beach located at a desert area. The aircraft was later pulled into the sea by the sea waves. No evidence was found of the accident notification by either the State of Occurrence or the owner.

According to communications between SACAA Registration and the owner with regard to the cancellation of aircraft ZU-EAX registration, the owner stated that the aircraft data plate could not be recovered as the airplane was lost in the Indian Ocean. The aircraft cancellation application of ZU-EAX was completed on 23 November 2011.

The aircraft engine was later recovered without the knowledge of SACAA and Accident Investigation and Division and sent to Shadow Lite CC T/ A Jabiru Aircraft SA for rebuilding, which was completed on 25 January 2013. The engine had done 576,6 hours before rebuild. On completion of the rebuild, the engine was issued with a new logbook and zero hours and was installed to a new aircraft as a new component. It was fitted to aircraft ZU-FXI on 19 February 2013.

Propeller:

Type	Wooden Laminated
Serial Number	456 64×41
Hours since New	200,9
Hours since Overhaul	Unknown

Weight and Balance

1.6.5 The weight and balance were within limits during flight.

1.7 Meteorological Information

1.7.1 The weather information was obtained from the pilot's questionnaire.

Wind direction	sws	Wind speed	6 knots	Visibility	good
Temperature	19 ºC	Cloud cover	yes	Cloud base	2 000 ft.
Dew point	unknown				

1.8 Aids to Navigation

1.8.1 The aircraft was equipped with the standard factory-fitted navigational equipment approved by the Regulator. There were no recorded defects to navigational equipment prior to flight.

1.9 Communications

1.9.1 The aircraft was equipped with one VHF (Very High Frequency) radio approved by the Regulator. There were no recorded defects regarding the communications equipment prior to flight.

1.10 Aerodrome Information

1.10.1 The accident occurred in a location approximately three nautical miles southwest of the aerodrome at GPS position S 34°49'02.65", E 019°57'28.38".

1.11 Flight Recorders

1.11.1 The aircraft was not equipped with a flight data recorder or a cockpit voice recorder. Neither recorder was required by the relevant aviation regulations.

1.12 Wreckage and Impact Information

1.12.1 The place at which the aircraft crashed was a bushy environment. The accident site is not suitable for landing.

Figure 2: Google view of accident site

Figure 3: View of exact location of accident terrain

1.12.2 The observation of the impact of the aircraft with the terrain was at a slightly high angle of descent and low speed. During impact with the terrain, the aircraft sustained damage to the nose section, landing gears, right wing tip and the keel pipe.

Figure 4: Damage to nose landing gear

Figure 5: Left main wheel broken off

1.12.3 All damage is attributed to impact forces experienced by the aircraft.

1.13 Medical and Pathological Information

1.13.1 No medical attention was required.

1.14 Fire

1.14.1 There was no pre- or post-impact fire.

1.15 Survival Aspects

1.15.1 The aircraft accident was considered survivable. The impact force was too low to cause any injuries.

1.15.2 The aircraft is equipped with both safety shoulder harnesses which were used during the flight.

1.16 Tests and Research

Tests

1.16.1 During investigation, the aircraft was recovered to the approved AMO for further investigation.

1.16.2 The engine was inspected and tested in accordance with the Jabiru engine runs procedures for functional tests. Engine test runs were carried out with both fuel pumps running and were satisfactory. During engine runs, the electronic fuel booster pump was switched “OFF” to determine the fuel supplied by the mechanical fuel pump.

1.16.2 With both fuel pumps engaged, the engine functioned at all power setting ranges. As soon as the electrical (back-up) booster fuel pump was switched “OFF”, the engine failed after 20 to 30 seconds depending on the power settings.

Figure 6: Mechanical pump

Figure 7: Dislodges one-way valve

1.16.3 The pump was removed and dismantled. It was discovered that the one-way valve was dislodged, causing fuel flow disruption during operation.

Research

1.16.4 Many airworthiness categories require that a backup fuel pump be fitted in case the primary pump fails. Jabiru Aircraft recommend fitting an electrical boost pump. If fitted, this pump must also fulfil the fuel input criteria for the carburetor. Some airworthiness categories also require an additional drip tray fitted to the fuel pump.

Note: It is also recommended that flight within 1 500 ft AGL must be conducted with electrical booster pump in operation.

1.17 Organizational and Management Information

1.17.1 This was a private flight.

1.17.2 The aircraft was operating under Standard Part 24 and Part 94.

1.18 Additional Information

1.18.1 Mechanical Fuel Pump

Information was extracted from Jabiru 3300 Aircraft Installation Manual

The mechanical fuel pump is mounted on the engine crankcase and is camshaft driven. Two different fuel pumps have been used on Jabiru Engines. Both pumps are driven by pushrods acting from a special lobe of the camshaft; however, the Type 2 pump requires a different length pushrod to the Type 1.To prevent fuel vaporization in the fuel pump a small amount of air directed onto the pump is advised, especially when using mogas. Electric Boost Pump must also be capable of no more than 3 lb pressure.

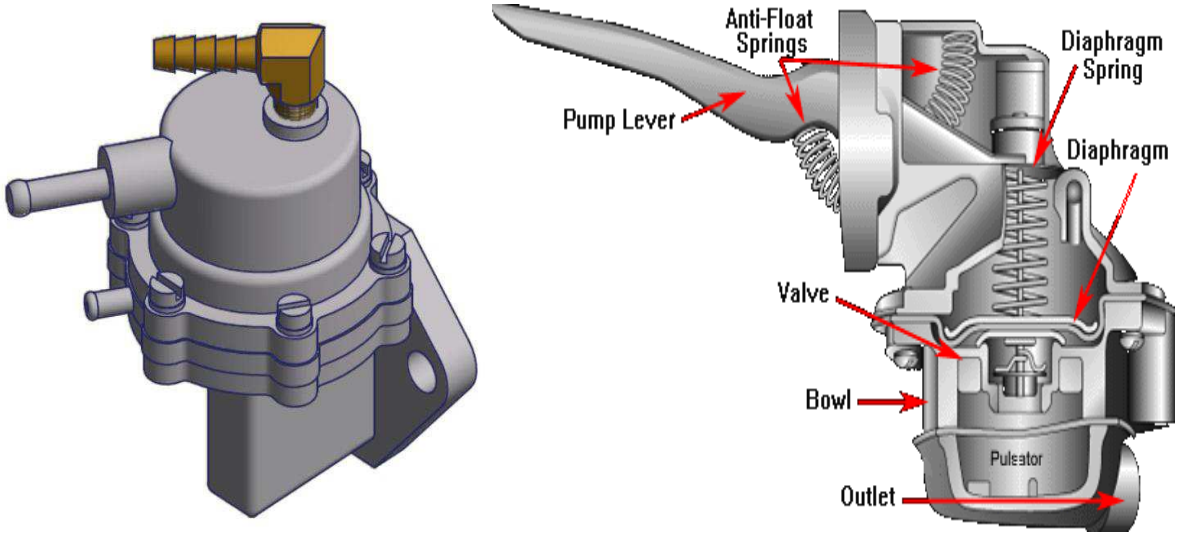

Figure 7: Typical mechanical fuel pump

Mechanical fuel pumps are used on older engines that have carburettors (though some may have a low-pressure electric fuel pump mounted in or near the gas tank). The pump siphons fuel from the gas tank and pushes it to the carburettor when the engine is cranking or running.

Mechanical fuel pumps use a lever that rides on the camshaft to pump a rubber diaphragm inside the pump up and down. This creates suction that pulls fuel into the pump, and then pushes it along. A pair of one-way valves inside the pump allows the gas to move in one direction only (toward the engine).

The output pressure of a mechanical fuel pump is typically quite low: only 4 to 10 psi. Little pressure is needed to keep a carburettor supplied with fuel.

Fuel Pump Problems

A leak in the diaphragm or one-way valve inside a mechanical fuel pump will cause a loss of fuel pressure and starve the carburettor for fuel. This may cause the engine to run lean, misfire, hesitate or stall. If the pump fails entirely, no fuel will be delivered to the carburettor and the engine will not start or run.

Fuel leaks are another common problem, usually due to cracks or holes in the rubber diaphragm, or loose inlet or outlet fittings.

1.19 Useful or Effective Investigation Techniques

1.19.1 None

2. ANALYSIS

2.1 The aircraft owner carried out general maintenance on the aircraft. Although it is indicated that a qualified person conducted the annual inspection, it was concluded that the mechanical fuel pump's dislodged one-way valve could only have occurred during an improper assembly during the 100-hour inspection or initial installation. The pilot was not qualified to carry out maintenance in accordance with existing regulatory procedures.

2.2 During aircraft starting, the electrical (fuel) booster pump is first switched on to help supplying fuel when the mechanical pump is not working. When the mechanical fuel pump is fully functional, it is recommended that the electrical fuel booster pump be switched off at a safe height of above 1 500 feet (ft) AGL. The pilot will have enough time to recover the engine power in case of mechanical fuel pump malfunctioning. The electric fuel booster pump is not restricted or limited to operate for the entire flight duration.

2.3 It is the investigator's opinion that the pilot might have switched off the electrical booster pump within 1 500 ft at approximately 600 ft AGL. However, the electrical fuel booster pump was not operative prior to engine failure. It was discovered during the engine run test that if the mechanical fuel pump had been malfunctioning, the electrical fuel booster pump could deliver sufficient fuel for the entire flight operation. This proves that if both fuel pumps are operative, it is difficult to notice any defect on the mechanical fuel pump.

2.4 According to aircraft registration records, the engine does not exist. On the cancellation of the registration of the previous aircraft ZU-EAX, the component was reported unrecovered as it was lost in the Indian Ocean.

2.5 The height at which the engine failed did not afford the pilot enough time to recover the aircraft's engine power during glide.

2.6 The environment they were flying over at the time of the engine failure was not suitable for a safe forced landing.

2.7 The prevailing weather conditions were not considered a contributory factor to the accident.

2.8 If the electronic booster pump had not been switched off at the restricted height, the aircraft's loss of engine power might have not led to the unsuccessful landing.

3. CONCLUSION

3.1 Findings

3.1.1 The pilot was licensed and qualified for the flight in accordance with existing regulations.

3.1.2 The pilot carried out maintenance service on the aircraft, but was not qualified in accordance with existing regulations.

3.1.3 The pilot's aviation medical certificate was still valid at the time of the accident.

3.1.4 The maintenance records indicated that the aircraft was not equipped and maintained in accordance with existing regulations and approved procedures.

3.1.5 The aircraft had a valid authority to fly certificate.

3.1.6 The pilot was the regular operator of the accident aircraft and was also the owner.

3.1.7 All control surfaces were accounted for, and all damage to the aircraft was attributable to the severe impact force.

3.1.8 The fuel pump's one way-valve was dislodged.

3.1.9 The electrical booster pump was not operative during engine power loss.

3.1.10 Fuel use on the aircraft was sufficient with a correct grade and contained no contaminants.

3.1.11 Weather conditions were good and were not considered a factor during the accident.

3.1.12 Weight and balance were within prescribed limits at the time of the accident.

3.1.13 Aircraft engine was previously involved in an accident on 25 September 2011 with a different aircraft, which was never notified or reported to Accident Investigation Division. According to aircraft registration records, the engine does not exist. On the cancellation of the registration of the previous aircraft ZU-EAX, the component was reported unrecovered as it was lost in the Indian Ocean..4 should also be in the finding (Add)

3.1.14 Engine was rebuilt after it had been immersed in salty sea water for a long time.

3.2 Probable Cause/s

3.2.1 Unsuccessful forced landing following engine power loss in flight due to fuel starvation.

3.3 Contributory Factor

3.3.1 Improper operating procedure of electrical fuel booster pump within restricted height

3.1.2 Dislodged fuel supply valve

3.3.3 Poor technique

4. SAFETY RECOMMENDATIONS

4.1 SACAA aircraft registration must establish a system to confirm with Accident and Incident Investigation Division-AIID (if reason given was accident involved) upon aircraft registration cancellation application of any state-registered aircraft whether the aircraft accident was reported in accordance with civil aviation regulations, 2011, Part 12 Subpart 2. 12.02.1, 12.02.2 and 12.02.3.

4.2 SACAA must establish a system that can report records of any re-use of aircraft components that have not been properly approved. This is a system control that can during registration of any aircraft detect and condemn components registered under any airframe data plate that are declared unapproved installations.

5. APPENDICES

5.1 None