

AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/9000	
Aircraft Registration	ZU-BPC	Date of Accident	6 January 2012		Time of Accident	0800Z
Type of Aircraft	Thunderbird MK V		Type of Operation		Private	
Pilot-in-command Licence Type		Microlight Pilot	Age	54	Licence Valid	Yes
Pilot-in-command Flying Experience		Total Flying Hours	195.24		Hours on Type	195.24
Last point of departure		Eagles Creek Airfield - Gauteng Province				
Next point of intended landing		Eagles Creek Airfield – Gauteng Province				
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)						
On grass runway at Eagles Creek Airfield.						
Meteorological Information		Wind direction: Calm, Wind speed: Calm, Temperature: 24°C, Cloud cover: clear skies, Cloud base: clear skies, Visibility: Good.				
Number of people on board	1 + 0	No. of people injured	0	No. of people killed	0	
Synopsis						
<p>The owner/pilot flew the aircraft on a private flight from Eagles Creek Airfield with the intention to fly to the general flying area. After take-off, during climb out, the engine suddenly stopped. The pilot attempted to restart the engine, but he was unsuccessful. The pilot then elected to carry out a forced landing and landed the aircraft on an open field in a grass covered terrain. During the landing sequence, the nose wheel rolled in a tuft of grass and collapsed. The aircraft then flipped over onto its roof and sustained substantial damage. The pilot did not sustain any injury in the accident.</p> <p>The engine was recovered to an engine overhaul facility and examined to determine the cause of engine failure. The evidence found was that the carburettor idle jet was clogged with sludge in the fuel. The fuel system was examined and found to be contaminated.</p>						
Probable Cause		Unsuccessful forced landing after experiencing an engine stoppage during climb out.				
Contributory Factors		Carburettor idle jet was clogged with sludge present in the fuel system. Fuel Contamination				
IARC Date				Release Date		



AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator : Austin Familie Trust
Manufacturer : Trevor Davies Engineering
Model : Thunderbird MK V
Nationality : South African
Registration Marks : ZU-BPC
Place : Open field near Eagle Creek Airfield
Date : 6 January 2012
Time : 08:00Z

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 first refuelled the aircraft at Eagles Creek Airfield during the morning of 6 January 2012, before embarking on the flight. The pilot then carried out a pre-flight inspection on the aircraft to inspect the serviceability of it. According to the pilot, he was satisfied with the serviceability of the aircraft and therefore decided to continue with the flight. He then flew the aircraft from Eagles Creek Airfield on a local private flight in the area.
- 1.1.2 After taking off, during climb out, the aircraft experienced a loss of engine power, followed by it suddenly starting to loose airspeed where after the engine stopped. The pilot attempted to restart the engine but it was unsuccessful. The pilot had no option but to do a forced landing.
- 1.1.3 The pilot selected a suitable open area where he could execute the forced landing. During the landing, the aircraft touched down normally, but the nose gear collapsed and the aircraft flipped over onto its roof. The aircraft sustained substantial damage in the ground impact sequence.
- 1.1.4 The pilot did not sustain any injury in the accident sequence.

1.2 Injuries to Persons

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

1.3 Damage to Aircraft

1.3.1 The aircraft sustained substantial damage in the accident.

1.4 Other Damage

1.4.1 None.

1.5 Personnel Information

Nationality	South African	Gender	Male	Age	54
Licence Number	02705006157	Licence Type	National Pilot License		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	None				
Medical Expiry Date	1 July 2012				
Restrictions	Corrective Lenses				
Previous Accidents	None				

Flying Experience:

Total Hours	195.24
Total Past 90 Days	5.42
Total on Type Past 90 Days	5.42
Total on Type	195.24

1.6 Aircraft Information

Airframe:

Type	Thunderbird MK V	
Serial Number	TDE 64	
Manufacturer	Trevor Davies Engineering	
Date of Manufacture	14 August 1998	
Total Airframe Hours (At time of Accident)	329.54	
Last Annual Inspection (Date & Hours)	318.6	19 July 2011
Hours since Last Annual Inspection	10.94	
Authority to Fly (Issue & Expiry Date)	21 July 2011	18 July 2012
C of R (Issue Date) (Present owner)	21 May 2009 Austin Family Trust	
Operating Categories	Private Authority to Fly	

Engine:

Type	Rotax 618
Serial Number	4380194
Hours since New	329.54
Hours since Overhaul	33.54

Propeller:

Type	De Necker Wood
Serial Number	C 2G4
Hours since New	248.42
Hours since Overhaul	On condition item

- 1.6.1 Aircraft Documentation: The documentation (e.g. certificate of registration, Release Certificate and Authority to Fly etc.) of the aircraft was valid and in compliance with applicable regulation.
- 1.6.2 Maintenance: The aircraft was on an annual inspection maintenance schedule. The annual inspection was carried out within the 12 months calendar time interval or 100 hours whichever comes first. After the annual inspection was completed, the aircraft performance was tested and certified airworthy. The aircraft was then released to service and received by the owner/pilot.
- 1.6.3 Aircraft Maintenance Documentation:
- (i) Logbooks: The entries of maintenance activities that were carried out on the aircraft were appropriately recorded and certified in compliance with applicable regulations. The logbook shows that all the defects entries were rectified accordingly.
 - (ii) Flight Folio: The flight folio did not have any open or deferred defects which still needed to be rectified. The flight folio information was in compliance with applicable regulation. The flight folio also shows that the aircraft was last flown by the pilot on Wednesday, 21 December 2011. The duration of flight was approximately 0.4 hours flight time. The pilot did not experience any defect or malfunction with the performance of the aircraft. After the flight was completed, the aircraft was on the ground standing for 17 days until it was flown again on the day of the accident.
- 1.6.4 The pilot carried out pre-flight inspection prior to the flight. During the pre-flight inspection the pilot did not find any defect or malfunction with the aircraft. The pilot was satisfied that the aircraft was in a serviceable condition.
- 1.6.5 Engine Failure: The pilot reported that he experienced a loss of engine power first. Immediately after the power loss, the engine suddenly stopped in flight. In order to determine what may have caused the loss of engine power and/or engine failure, it was important to review the engine maintenance:

- (i) According to the relevant maintenance logbooks, the engine was a new product fitted on the aircraft when the owner bought it.
- (ii) The manufacturer who was also certified as an AMO was responsible for the aircraft and engine maintenance until it reached a total of 296.0 hours of flight time.
- (iii) The owner then took the aircraft to another aircraft maintenance organisation (AMO) to be responsible for the maintenance of the aircraft. This AMO carried out the maintenance on the aircraft and engine at 307.18 hours on 12 July 2010 and 318.6hours on 19 July 2011. The aircraft and engine was found to be in serviceable condition after the maintenance inspections. The aircraft and engine performance was satisfactory until the day of the accident.

1.6.6 Fuel Status: According to the flight folio, the aircraft was refuelled with 25 litres of 93 unleaded grade of fuel on 6 January 2012. The pilot reported that the identified quantity of fuel was uplifted from a drum. After the refuelling took place, there were 30 litres carried on board the aircraft. The fuel was determined to be sufficient for the intended flight.

1.7 Meteorological Information

1.7.1 The weather information above was submitted by the pilot.

Wind direction	Calm	Wind speed	Calm	Visibility	Good
Temperature	24°C	Cloud cover	Clear	Cloud base	N/A
Dew point	Unknown				

1.8 Aids to Navigation

1.8.1 The aircraft had standard navigation equipment installed. There was no defect or malfunction reported with the navigation equipment. The navigational equipment was in a serviceable condition.

1.9 Communications.

1.9.1 The aircraft was fitted with VHF type radio communication equipment. There was no defect or malfunction reported with the radio communication equipment.

1.10 Aerodrome Information

1.10.1 The owner/pilot operated the aircraft from an unlicensed civilian private airfield. The accident occurred outside the boundaries of the airfield.

Aerodrome Location	Eagle Creek Airfield	
Aerodrome Co-ordinates	S25°54.270 E028°02.100	
Aerodrome Elevation	4855 feet	
Runway Designations	08/26	16/34
Runway Dimensions	1250mx20m	500mx20m
Runway Used	26	
Runway Surface	Grass	
Approach Facilities	None.	

1.11 Flight Recorders

1.11.1 There was no flight recorder (Flight Data Recorder and Cockpit Voice Recorder) installed, neither was it required by regulations.

1.12 Wreckage and Impact Information

1.12.1 The aircraft executed a forced landing in an open grass field. During the landing roll, the nose wheel collapsed resulting in the aircraft impacting the ground. The aircraft skidded on the ground for approximately 5 meters when it hit a tuft of grass and flipped over onto its roof. The aircraft sustained damage to the nose wheel broke, cowlings and tail boom.

1.13 Medical and Pathological Information

1.13.1 The pilot had a valid Class 1 aviation medical certificate with no waivers. The pilot had no medical condition which may have prevented him from flying the aircraft. The pilot and passenger did not sustain any injury in the accident.

1.14 Fire

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

1.15 Survival Aspects

1.15.1 The aircraft sustained substantial damage in the accident. The pilot managed to unfasten the aircraft safety belt and evacuate the aircraft safely. The pilot did not sustain any injury in the accident.

1.16 Tests and Research

1.16.1 The wreckage was recovered to the premises of the aircraft manufacturer. The manufacturer removed the engine from the wreckage for the purpose of conducting an examination to determine the cause of failure. The engine examination findings were the following:

- (i) The carburetors were removed from the engine for inspection.
- (ii) The carburetors bowls were removed to determine if it had any fuel. Thereafter the fuel was checked for contamination. There was still fuel found inside the bowls, fuel starvation to the engine occurred due to the sludge that restricted the flow of fuel.
- (iii) The carburettor idle jets were also removed and examined. The evidence found showed that the idle jets were blocked with sludge which was caused by the contaminated fuel.

1.16.2 Engine Carburetors: According to the Rotax Maintenance Schedule, the carburetors had to be completely serviced at 150 hours and again at 300 hours. It does not appear as though the owner complied with the requirements of the maintenance schedule. The evidence found shows that the carburetors fitted on the aircraft was serviced when the engine was overhauled at 296 hours on 7 May 2009.



Figure 1, shows the carburetors of the aircraft.



Figure 2, shows the idler jets removed from the carburettor.

Note: It is recommended that the idle jets should not be cleaned and reused after it was found blocked by sludge, but replaced with new jets.



Figure 3, shows the piston that seized.

- (iv) The engine cylinders were also examined during the investigation. One of the pistons inside the engine failed. There were scoring marks on the shoulder of the cylinder which was caused by the piston rings.

1.16.3 The fuel was checked during the investigation and evidence was found of small particles of contamination inside the fuel system. The small particles appeared to be some sort of sludge. In order to understand how sludge forms in fuel, the following information is available:

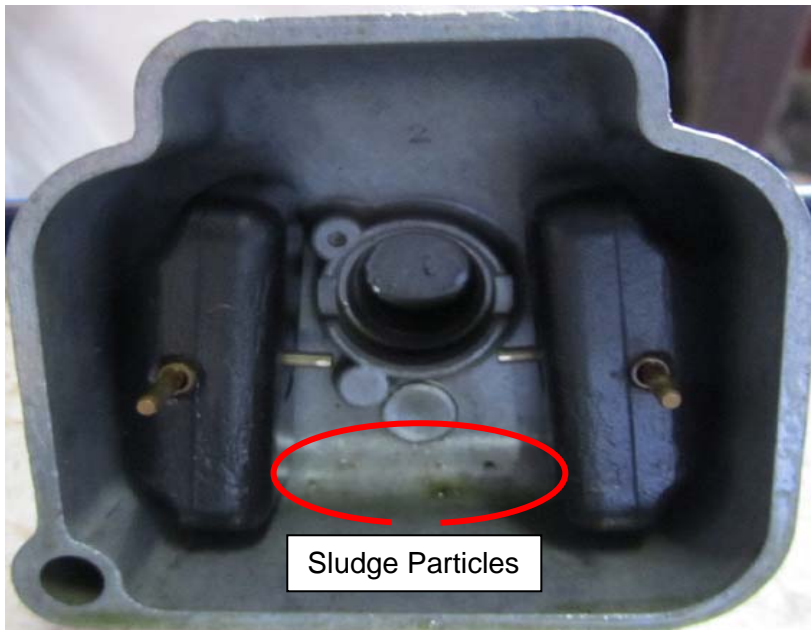


Figure 4, shows carburettor bowl with small particles of sludge inside.

Note: According to website, www.alken-murray.com/WHYTREAT.HTM, SLUDGE--WHAT IS IT?

In your storage tank you have two materials to combat; water and particles of solid chemical compounds, commonly called sludge. Water is due mostly to condensation and leaking manholes, and occasionally from the oil supplier. Regardless, it is always found either on the tank bottom or stratified at different levels throughout the oil.

Modern refining cracking processes produce fuel oils that are subject to sludge formation. The sludge particles are formed principally by blending and mixing fuel oils of different types, either at the refinery or in the consumer's tank. They may also be formed from reactions due to moisture, heat and oxidation, but the amounts from these factors are small.

When the sludge particles are formed, they are quite small and if they remained so, little trouble would occur. Unfortunately, they increase in size as they adhere to each other, becoming so large as to block lines, strainers, pumps and burner nozzles, if drawn into the system.

1.17 Organizational and Management Information

1.17.1 The owner/pilot normally operated the aircraft mainly on a private flight in accordance with CAR Part 24 and 94. There was evidence found showing that the owner/pilot conducted unauthorised maintenance on the aircraft. The owner/pilot did not have an Approved Person (AP) rating which authorised him to do the maintenance. The owner/pilot action was in contravention of applicable regulation.

1.17.2 The last annual inspection carried out on the aircraft was done by an approved aircraft maintenance organisation (AMO). The AMO was authorised to conduct maintenance on the aircraft type. The evidence found shows that the AMO complied with the aircraft manufactures maintenance requirements when maintaining the aircraft. The AMO also complied with applicable regulation ensuring that the aircraft was serviceable and airworthy. There was no anomaly identified with the management and organisation of the AMO.

1.18 Additional Information

1.18.1 None.

1.19 Useful or Effective Investigation Techniques

1.19.1 None.

2. ANALYSIS

- 2.1 The pilot took off from Eagle Creek Airfield with the intention to fly the aircraft on a private flight to the general flying area. The pilot was the sole occupant on board the aircraft at the time.
- 2.2 The pilot performed a pre-flight inspection before the flight and he found that the aircraft was serviceable; hence the decision to continue with the flight. The aircraft was refuelled with a sufficient quantity of fuel for the intended flight. During the engine start and pre-takeoff ground runs, the engine performance was satisfactory. The problem started during climbing when the pilot first experienced loss of engine power and thereafter the engine stopped. Due to engine failure, the pilot was committed to carry out a forced landing.
- 2.3 The aircraft maintenance documentation was reviewed during the investigation to determine if there was any maintenance carried out on the aircraft which may have contributed to the engine failure. Apart from the unauthorised maintenance carried out by the owner/pilot, there was no other anomaly identified with the maintenance of the aircraft. According to the owner/pilot, he tested the aircraft after the unauthorised maintenance being conducted and the aircraft was serviceable.
- 2.4 The engine of the aircraft was removed and examined. The aim was to determine what may have caused the loss of engine power and engine failure. The engine fuel system was checked to determine if the fuel reached the engine. The two carburettors were removed from the engine for this purpose. The bowls were removed from the carburettors and checked if a sufficient quantity of fuel was inside. The evidence found indicates that there was a sufficient quantity of fuel present in the bowls, which indicated that fuel did reach the engine.
- 2.5 The two brass needle jets were then removed from the carburettors and examined. The aim was to determine if the jets throats (small hole) were clear of being clogged. The proof found showed that the jets were indeed clogged with an unidentified substance. The result was that the fuel could not be drawn into the engine through the clogged jets. As such, internal combustion was virtually impossible as the jets could not supply fuel for the combustion to be sustained. Thus, if not enough fuel gets to the engine, the symptom will be poor running and no power available when the throttle is being opened. In this case, there was a loss of engine power and eventually the engine stopped. The evidence of this can be seen by the piston that seized inside the engine.
- 2.6 The fuel that was inside the bowls was examined with the aim to identify the substance that clogged the jets. The evidence found showed that the fuel was contaminated. Though not conclusively determined during the investigation, the contamination may have been sludge that formed. Ordinarily, the sludge will form by blending and mixing fuel oils of different types; either at the refinery or in the consumers tank. The sludge forms due to reactions of moisture, heat and oxidation. Initially the sludge is very small, thus it can be drawn into small spaces or through small holes easily. But over time the sludge grows in size and may cause blockages, the same way like it did with the needle jets being clogged.

2.7 In order to prevent engine failures of this nature, it is important to ensure that the fuel used is free of contamination and filtered if required. The fuel should be checked during each pre-flight inspection to determine if contamination exists. It is important to ensure that the fuel used which is stored in drums is free from contamination prior to refuelling the aircraft. The fuel used should be of good quality and within prescribed usage time intervals. The conclusion is if all the above precautions are adhered to, accidents of this nature where contaminated fuel is being used will be avoided.

3. CONCLUSION

3.1 Findings

3.1.1 The owner of the aircraft was also the pilot flying on the day. He flew the aircraft from Eagle Creek Airfield on a private flight under Visual Flight Rules (VFR) by day.

3.1.2 The pilot performed a pre-flight inspection on the aircraft before takeoff and was satisfied that the aircraft was serviceable.

3.1.3 The pilot experienced a loss of engine power followed by complete engine failure during the flight. However, it could not be determined whether he checked the fuel sample..

3.1.4 Due to engine failure, the pilot was committed to carry out a forced landing.

3.1.5 During the forced landing, the nose landing gear failed—when the aircraft collided with a tuft of grass which caused the aircraft to flip over onto its roof.

3.1.6 The aircraft sustained substantial damage during the ground impact sequence.

3.1.7 During the investigation that followed, it was determined that the aircraft carried sufficient quantity of fuel on board to complete the intended flight.

3.1.8 The aircraft maintenance documentation was reviewed during the investigation and found that apart from the anomaly of the owner/pilot occasionally conducting unauthorised maintenance on the aircraft, there was no indication that the aircraft was not appropriately maintained by the AMO responsible for maintenance.

3.1.9 The maintenance which the owner/pilot conducted was unauthorised and in contravention with applicable regulation and manufactures requirements.

3.1.10 The engine was examined and it was determined that it had failed due to the needle jets inside the carburettors that became blocked and not providing sufficient quantity of fuel for combustion.

3.1.11 The evidence found show that the substance which clogged the needle jets were particles of contamination inside the fuel.

3.1.12 Though not conclusively determined, the particles of contamination found in the fuel had the appearance of being sludge.

3.2 Probable Cause/s 6.13 and 3.4

3.2.1 Unsuccessful forced landing after experiencing a loss of engine power followed by engine failure.

Contributory Factor/s

3.2.2 Engine failed due to interruption in combustion sequence by the fuel not reaching the combustion chamber due to needle jets inside carburettor being clogged by fuel contamination particles.

3.2.4 Nose landing gear failure after touchdown, followed by the aircraft entering a tuft of grass which caused it to flip over onto its roof. Same as 3.1.5

4. SAFETY RECOMMENDATIONS

4.1 It recommended that the Director of Civil Aviation (DCA) through Safety Promotion Department publish relevant information in their Safety Link Magazine to remind the aviation industry about the effects of fuel contamination in the operation of aircraft. The SACAA should seek to have constant reminders annually to the industry of the potential dangers involving fuel contamination.

4.2

5. APPENDICES

5.1 None.

Compiled by:

.....

Date:

For: Director of Civil Aviation

Investigator-in-charge:

Date:

Co-Investigator:

Date: