



## AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

|   |                            |                              |                          |                             |                         |       |
|---|----------------------------|------------------------------|--------------------------|-----------------------------|-------------------------|-------|
|   |                            |                              |                          | Reference:                  | <b>CA18/2/3/7968</b>    |       |
| <b>Aircraft Registration</b>  | ZU-AKE                     | <b>Date of Accident</b>      | 01 June 2005             |                             | <b>Time of Accident</b> | 1300Z |
| <b>Type of Aircraft</b>   | Piper PA 22-150            |                              | <b>Type of Operation</b> | Training                    |                         |       |
| <b>Pilot-in-command Licence Type</b>  | Commercial                 | <b>Age</b>                   | 28                       | <b>Licence Valid</b>        | Yes                     |       |
| <b>Pilot-in-command Flying Experience</b>   | Total Flying Hours         | 1 100                        |                          | Hours on Type               | 1.3                     |       |
| <b>Last point of departure</b>  | Empangeni Aerodrome (FAEM) |                              |                          |                             |                         |       |
| <b>Next point of intended landing</b>   | Empangeni Aerodrome (FAEM) |                              |                          |                             |                         |       |
| <b>Location of the accident site with reference to easily defined geographical points (GPS readings if possible)</b>  |                            |                              |                          |                             |                         |       |
| Sugarcane field north-east of Empangeni. (GPS position S 28° 46' 74.6" E 031° 56' 76.1")  |                            |                              |                          |                             |                         |       |
| <b>Meteorological Information</b>   | Surface wind 180° at 5 kts |                              |                          |                             |                         |       |
| <b>Number of people on board</b>  | 2 + 0                      | <b>No. of people injured</b> | 0                        | <b>No. of people killed</b> | 0                       |       |
| <b>Synopsis</b>   |                            |                              |                          |                             |                         |       |
| <p>The instructor and a student were on a visual flight rule (VFR) training flight from Empangeni Aerodrome with the intention to land back at Empangeni Aerodrome.</p> <p>During the power check and initial climb, the pilot noticed that the engine revolutions per minute (RPM) were 2 300 RPM. After a few minutes and during levelling off at 1 500 ft above ground level (AGL) at a distance of approximately 3 nm from the aerodrome, the pilot heard a loud bang from the engine. Oil started coming out of the engine and smoke entered the cockpit, followed by a complete engine stoppage. The pilot decided to execute a forced landing in a sugarcane field east of Empangeni.</p> <p>On landing, the aircraft impacted an irrigation ditch, bounced, and swung around through 90° before it came to rest on a westerly heading. The aircraft sustained damage to the nose wheel, main landing wheels, propeller, engine mountings and cowling, fuselage and both wings.</p> <p>Both the instructor and the student pilot sustained no injuries from the accident.</p> <p>According to available records, the last annual inspection prior to the accident was certified on 10 May 2005 at 4 239.09 total airframe hours. The aircraft had flown a further 0.5 hours since the last annual inspection. An investigation revealed that at the time of the accident, the aircraft did not have a valid Authority to Fly Certificate</p> |                            |                              |                          |                             |                         |       |
| <b>Probable Cause</b>   |                            |                              |                          |                             |                         |       |
| <p>Unsuccessful forced landing as a result of an engine failure.</p> <p>Contributory factor:<br/>The number 2 cylinder head fractured during flight, which caused a loss of oil pressure resulting in an engine failure.</p>  |                            |                              |                          |                             |                         |       |
| <b>IARC Date</b>  | 28 February 2008           |                              | <b>Release Date</b>      |                             |                         |       |

|                          |
|--------------------------|
| AIRCRAFT ACCIDENT REPORT |
|--------------------------|

**Name of Owner/Operator**    : JH Oosthuizen  
**Manufacturer**                    : Piper Aircraft Corporation  
**Model**                                : PA-22-150  
**Nationality**                        : South African  
**Registration Marks**            : ZU-AKE  
**Place**                                 : Empangeni  
**Date**                                 : 01 June 2005  
**Time**                                 : 1300Z

*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 two 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 instructor and a student were on a visual flight rule (VFR) training flight from Empangeni Aerodrome, with the intention to land back at Empangeni Aerodrome. During the power check and initial climb, the pilot noticed that the engine revolutions per minute (RPM) were 2 300 RPM. After a few minutes and during levelling off at 1 500 ft above ground level (AGL) at a distance of approximately 3 nm from the aerodrome, the pilot heard a loud bang from the engine. Oil started coming out of the engine and smoke entered the cockpit, followed by a complete engine stoppage. The pilot decided to execute a forced landing in a sugar cane field east of Empangeni.

1.1.2 On landing, the aircraft impacted an irrigation ditch, bounced, and swung around through 90° before it came to rest in a westerly heading.

**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 damage to the nose wheel, main landing wheels, propeller, engine mountings and cowling, fuselage and both the wings.



Figure 1: Damage to the aircraft

### 1.4 Other Damage

1.4.1 The damage was limited to the surrounding vegetation.

### 1.5 Personnel Information (Instructor)

|                     |                              |               |            |     |    |
|---------------------|------------------------------|---------------|------------|-----|----|
| Nationality         | South African                | Gender        | Male       | Age | 28 |
| Licence Number      | *****                        | Licence Type  | Commercial |     |    |
| Licence valid       | Yes                          | Type Endorsed | Yes        |     |    |
| Ratings             | Night instrument; instructor |               |            |     |    |
| Medical Expiry Date | 28 May 2006                  |               |            |     |    |
| Restrictions        | None                         |               |            |     |    |
| Previous Accidents  | None                         |               |            |     |    |

Flying Experience:

|                            |       |
|----------------------------|-------|
| Total Hours                | 1 100 |
| Total Past 90 Days         | 150   |
| Total on Type Past 90 Days | 1.5   |
| Total on Type              | 1.5   |

## 1.6 Aircraft Information

### Airframe:

|  |                            |          |
|--|----------------------------|----------|
| Type                                       | Piper PA22-150             |          |
| Serial No.                                 | 22-6033                    |          |
| Manufacturer                               | Piper Aircraft Corporation |          |
| Year of Manufacture                        | 1958                       |          |
| Total Airframe Hours (At time of Accident) | 4 239.09                   |          |
| Last Annual Inspection (Date & Hours)      | 10 May 2005                | 4 238.59 |
| Hours since Last Annual Inspection         | 0.5                        |          |
| Authority to Fly (Issue Date)              | Not Valid (unknown)        |          |
| C of R (Issue Date) (Present owner)        | 01 June 2005               |          |
| Operating Categories                       | NTCA                       |          |

The aircraft was first registered by the Civil Aviation Authority (CDCAA) with registration letters ZS-EBB. In March 1994, the then owner requested from the CDCAA that the aircraft be decertified to LS1/Non-Type Certificated Aircraft (NTCA) category. The request was granted, and the registration letters of the aircraft were changed to ZU-AKE.

### Engine:

|                      |                    |
|----------------------|--------------------|
| Type                 | Lycoming-0-320-B2B |
| Serial No.           | L5558-39           |
| Hours since New      | Unknown            |
| Hours since Overhaul | 85                 |

The manufacturer of the engine was contacted to enquire about the traceability of the engine. According to the manufacturer, the engine was bought new in 1963. Since then, no records relating to the use of the engine could be located.

### Propeller:

|                      |                       |
|----------------------|-----------------------|
| Type                 | Sensenich 74 DM6-0-60 |
| Serial No.           | A58069                |
| Hours since New      | 85.0                  |
| Hours since Overhaul | TBO not reached       |

## 1.7 Meteorological Information

1.7.1 The following weather information was taken from the pilot questionnaire:

|                |         |             |       |            |      |
|----------------|---------|-------------|-------|------------|------|
| Wind direction | 180°    | Wind speed  | 5 kts | Visibility | Good |
| Temperature    | 25°C    | Cloud cover | Nil   | Cloud base | Nil  |
| Dew point      | Unknown |             |       |            |      |

## 1.8 Aids to Navigation

1.8.1 The aircraft was fitted with standard navigation equipment, and none were reported unserviceable prior to the flight.

## **1.9 Communications**

1.9.1 No information was available regarding the communication. The pilot did not make a distress call.

## **1.10 Aerodrome Information**

1.10.1 The accident occurred in a sugarcane field, north-east of Empangeni. (GPS position S 28° 46' 74.6" E 031° 56' 76.1")

## **1.11 Flight Recorders**

1.11.1 The aircraft was not fitted with a Cockpit Voice Recorder (CVR) nor a Flight Data Recorder (FDR), and neither was required by regulations to be fitted to this type of aircraft.

## **1.12 Wreckage and Impact Information**

1.12.1 On landing, the aircraft impacted an irrigation ditch, bounced, and swung around through 90° before it came to rest in a westerly heading.

## **1.13 Medical and Pathological Information**

1.13.1 The occupants on board survived with no injuries.

## **1.14 Fire**

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

## **1.15 Survival Aspects**

1.15.1 Due to low impact forces and because the persons on board were correctly restrained, this accident was considered survivable.

## **1.16 Tests and Research**

1.16.1 The on-site investigation found that the number 2 cylinder head had failed due to a fatigue crack.





**Figure 2:** Fractured no. 2 cylinder head

1.16.2 The fractured cylinder head was taken to the Department of Materials Science and Metallurgical Engineering at the University of Pretoria in order to carry out a metallurgical and failure investigation. The report (**Appendix A**) concluded that:

1.16.2.1 The available evidence suggests that the cylinder head failed as a result of fatigue, caused by the presence of a cyclic tensile stress during service. Although it is difficult to accurately gauge the appropriate age of the fatigue crack in cast components, the smooth appearance of the fracture surface and the amount of grained debris suggest that the crack had been present in the component for a significant period of time prior to final catastrophic failure. The observation that one of the fatigue cracks propagated through virtually the entire wall thickness before final failure suggests that crack propagation occurred under low-stress conditions. This seems to confirm the conclusion that the crack had been present for an extended amount of time before final failure. Early crack detection using non-destructive testing techniques would have been complicated by the location of the crack and the geometry of the component.

## **1.17 Organisational and Management Information**

1.17.1 Although this was a training flight, it was not conducted in terms of the requirements applicable to an approved aviation training organisation (ATO) as required by the Civil Aviation Regulations of 1997, Part 141.

## **1.18 Additional Information**

1.18.1 During the on-site investigation, the following was noticed:

- Not all the aircraft documentation was available on board the aircraft.
- The aircraft did not have a serial number.

1.18.2 The aircraft owner had just bought the aircraft and was in the process of being converted onto the aircraft type.

1.18.3 The aircraft was not yet registered under the new owner's name at the time of the accident and the SACAA was still processing the documents.

1.18.4 The owner of the aircraft, who was also the student during this flight, did not cooperate with the process of the investigation in that he failed (after numerous phone calls) to provide the investigation team with all the required aircraft documentation and also to submit the required questionnaires.

## **1.19 Useful or Effective Investigation Techniques**

1.19.1 None were considered necessary.

## **2. ANALYSIS**

2.1 According to the pilot, he noticed the engine was performing at 2 300 RPM during power check, take-off and climb with full throttle. After levelling off at 1 500 ft AGL, the loud bang was heard and the pilot noticed the engine oil spreading over the windscreen. The pilot elected to execute a forced landing in a sugarcane field east of Empangeni. On landing, the aircraft impacted an irrigation ditch, bounced, and swung around through 90° before it came to rest on a westerly heading.

2.2 The cause of the engine failure was found to be the number 2 cylinder head, which had failed. The failed cylinder head was taken for metallurgical analysis and the results suggested that the cylinder head had failed as a result of fatigue, caused by the presence of a cyclic tensile stress during service. The smooth appearance of the fracture surface and the amount of grained debris suggested that the crack had been present in the component for a significant period of time prior to the final catastrophic failure.

## **3. CONCLUSION**

### **3.1 Findings**

3.1.1 The pilot was a holder of a valid Commercial Pilot Licence and was correctly type rated. His medical was also valid.

3.1.2 Not all the aircraft documentation was available on board the aircraft.

3.1.3 The aircraft did not have a serial number displayed.

- 3.1.4 Although this was a training flight, it was not conducted in terms of the requirements applicable to an approved aviation training organisation (ATO) as required by the Civil Aviation Regulations of 1997, Part 141.
- 3.1.5 The aircraft did not have a valid Authority to Fly Certificate.
- 3.1.6 The owner of the aircraft, who was also the student during this flight, did not cooperate with the process of the investigation.
- 3.1.7 The pilot executed a forced landing due to engine failure.
- 3.1.8 It was found that the number 2 cylinder head had failed/fractured.
- 3.1.9 The history of this engine could not be traced.
- 3.1.10 The aircraft was decertified without any technical data available to support the decertification.

### **3.2 Probable Cause/s**

- 3.2.1 Unsuccessful forced landing as a result of an engine failure.
- 3.2.2 Contributory factor: The number 2 cylinder head fractured during flight, which caused a loss of oil pressure resulting in an engine failure.

## **4. SAFETY RECOMMENDATIONS**

- 4.1 It is recommended that the Commissioner for Civil Aviation should monitor cylinder head failures in order to establish any trend in terms of the revision of maintenance requirements and standards.
- 4.2 It is recommended that the Commissioner for Civil Aviation enhances and reviews the safety oversight requirements and adequacy of requirements associated with owner type conversion training and certification.

## **5. APPENDICES**

- 5.1 Metallurgical examination report.

-END-

Report reviewed and amended by Office of the EM: AIID 19 March 2009