

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/3/2/1427						
Classification	Serious Incident	Date	15 August 2023		Time	0945Z	
Type of Operation	Private (Part 94)						
Location							
Place of Departure	Wonderboom Aerodrome (FAWB), Gauteng province		Place of Intended Landing		Wonderboom Aerodrome (FAWB), Gauteng province Pretoria		
Place of Occurrence	On gravel road at Rooiberg area at GPS co-ordinates determined to be 24°46'26" South 027°45'18"						
GPS Co-ordinates	Latitude	24° 46' 26" S	Longitude	027° 45' 18" E	Elevation	3800ft	
Aircraft Information							
Registration	ZU-ADM						
Make; Model; S/N	Aermacchi; Bosbok AM-3C (Serial Number: 2012)						
Damage to Aircraft	Minor			Total Aircraft Hours	3 341.5		
Pilot-in-command							
Licence Type	Airline Transport Pilot Licence (ATPL)		Gender	Male		Age	54
Licence Valid	Yes	Total Hours	11 600		Total Hours on Type	400	
Total Hours 30 Days	5		Total Flying on Type Past 90 Days	5			
People On-board	1+1	Injuries	0	Fatalities	0	Other (on ground)	0
What Happened							
<p>On Tuesday, 15 August 2023 at 0900Z, a pilot and a passenger on-board a Bosbok AM-3 aircraft with registration ZU-ADM took off on a private flight from Wonderboom Aerodrome (FAWB) in Gauteng province with the intention to land back at the same aerodrome. The flight was conducted under visual meteorological conditions (VMC) by day and under the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended. Clear weather conditions prevailed at the time of the flight.</p> <p>The pilot stated that during the return flight to FAWB at 500 feet (ft) above ground level (AGL), the engine ran rough and lost power. As a result, the aircraft lost height rapidly and the pilot had little time to recover. He identified a gravel road ahead of his flight path which appeared to be deserted and glided the aircraft to perform a precautionary landing on it. The aircraft landed safely. The incident occurred 58 nautical miles (nm) from FAWB. Both occupants were not injured.</p> <p>Post-incident examination of the engine by the approved person (AP) revealed that cylinder number 2 had no compression because of the exhaust valve head that separated from the valve stem. The cylinder assembly was replaced with a serviceable one, and the engine ground run was conducted</p>							

which met the set parameters in accordance (IAW) with the operator’s manual. The aircraft was certified airworthy and was flown back to FAWB by the same pilot without incident. According to the AP, the engine had 1 83.7 hours remaining before the next engine overhaul.



Figure 1: File picture of the aircraft. courtesy of. (Source: Warbirds AMO)

According to the aircraft logbook, the AP conducted cold and hot blow inspection on 24 July 2023 at 3 334.0 hours on all the engine cylinders. The recordings were captured as follows:

Cold		Hot	
Cylinder	Reading	Cylinder	Reading
1	73/80	1	73/80
2	80/80	2	78/80
3	66/80	3	74/80
4	78/80	4	76/80
5	58/80	5	60/80
6	74/80	6	74/80

Following the blow-by check on the cylinders, the engine ground run was conducted, and it was found to be serviceable.



Figure 2: The blue circle indicates damage caused by the valve head on the number 2 piston crown.



Figure 3: Cylinder number 2 exhaust valve stem with the head missing. It fractured during operation.



Figure 4: Complete exhaust valve. (Source: <https://www.aircraftspruce.com/catalog/eppages/exhaustValve.php>)

The information below is an extract from the aircraft engine manual:

72-30 - CYLINDER MAINTENANCE

1. General

- A. Complete the inspections identified in Table 1 at the regularly scheduled interval per instructions in this chapter.
- B. Record all findings and any corrective action on a copy of the respective Engine Inspection Checklists in Chapter 05-20 and in the checklists in this chapter as records of inspection.

**Table 1
Regularly Scheduled Cylinder Inspections**

Procedure	Frequency
Visual Cylinder Inspection	After every 100 hours of engine operation
Cylinder Compression Check	After every 100 hours of engine operation
Intercylinder Baffle Inspection	During every visual inspection
Cylinder Borescope Inspection	After every 400 hours of engine operation or as necessary for fault diagnostics
Exhaust Valve and Guide Inspection on TEO-540-A1A engines	After every 1000 hours of engine operation

2. Visual Cylinder Inspection

- (17) The minimum approved engine cylinder pressure reading is 60 psi (414 kPa). Maximum approved leakage is 25% (20 psi (138 kPa) of the 80 psi (552 kPa) regulated pressure).

Findings
<ol style="list-style-type: none"> 1. The pilot was initially issued an Airline Transport Pilot Licence on 3 December 2003. The ATPL was renewed on 24 August 2022 with an expiry date of 31 August 2023. The pilot was issued a Class 1 aviation medical certificate on 3 August 2022 with an expiry date of 31 August 2023. The aircraft type was endorsed on his licence. 2. The aircraft's Certification of Registration (C of R) was issued to the owner on 22 May 2022. 3. The last annual inspection on the aircraft was conducted on 28 August 2022 at 3 292.7 airframe hours (194.3Hobbs) with an expiry date of 28 August 2023 or at 3 392.7 hours (294.3 Hobbs), whichever occurs first. At the time of accident, the aircraft had 3 341.5 hours. The aircraft was flown a further 48.8 hours since the last inspection. 4. The Authority to Fly (ATF) was initially issued on 22 August 2019; it was reissued on 4 August 2023 with an expiry date of 31 August 2024. According to the Service Instruction (No. 1009BE dated 24 April 2020), the time before overhaul (TBO) for this type of engine is 1400 hours. At the time of the incident, 183.7 hours remained before the next overhaul. 5. According to available information, this type of failure was reported for the first time on this particular aircraft type. The weather had no effect to this accident.
Probable Cause(s)
The pilot performed a successful forced landing on the road after the aircraft experienced an in-flight engine power loss as a result of the fractured exhaust valve stem in cylinder number 2.
Contributing Factor(s)
None.
Safety Action(s)
As a safety precaution, the aircraft maintenance organisation (AMO) sent the engine to the workshop for a complete overhaul.
Safety Message and/or Safety Recommendation/s
None.
About this Report
<p><i>The decision to conduct a limited investigation is based on factors including whether the cause is known and the evidence supporting the cause is clear, the level of safety benefit likely to be obtained from an investigation and that will determine the scope of an investigation. For this occurrence, a limited investigation has been conducted, and the Accident and Incident Investigations Division (AIID) has relied on the information submitted by the affected person/s and organisation/s to compile this limited report. The report has been compiled using information supplied in the initial notification, as well as from follow-up desk top enquiries to bring awareness of potential safety issues to the industry in respect of this occurrence, as well as possible safety action/s that the industry might want to consider in preventing a recurrence of a similar occurrence.</i></p> <p><i>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.</i></p>

Purpose

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011 and ICAO Annex 13, 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.

Disclaimer

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**This report is issued by:
Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa**