



LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/3/2/1457						
Classification	Serious Incident		Date	25 October 2024		Time	0830Z
Type of Operation	Private (Part 94)						
Location							
Place of Departure	Springs Aerodrome (FASI), Gauteng Province		Place of Intended Landing	Brits Aerodrome (FABS), North West Province			
Place of Occurrence	North of N12 Highway in Benoni, Gauteng Province						
GPS Co-ordinates	Latitude	26° 9'12.64"S	Longitude	28°26'56.89"E	Elevation	5230 ft	
Aircraft Information							
Registration	ZU-BSA						
Make; Model; S/N	Shadow Lite CC; Jabiru SK (Serial Number: 167)						
Damage to Aircraft	Substantial			Total Aircraft Hours	2029.1		
Pilot-in-command							
Licence Type	Private Pilot Licence (PPL) Aeroplane		Gender	Female		Age	37
Licence Valid	Yes	Total Hours	564.6		Total Hours on Type	525.5	
Total Hours 30 Days	5.9		Total Flying on Type Past 90 Days	25			
People On-board	1+0	Injuries	0	Fatalities	0	Other (on ground)	0
What Happened							
<p>On Friday morning, 25 October 2024, a pilot on-board a Jabiru SK aircraft with registration ZU-BSA was on a private flight from Springs Aerodrome (FASI) in Gauteng province to Brits Aerodrome (FABS) in North West province when the serious incident occurred. Visual meteorological conditions (VMC) by day prevailed at the time of the flight which was conducted under the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended.</p> <p>The pilot reported that she felt the aircraft's engine vibrate about 25 minutes into the flight. She then broadcasted a Mayday call on Traffic Information Broadcast by Aircraft (TIBA) frequency 124.8-Megahertz (MHz) and proceeded to conduct a precautionary landing on an open field next to the N12 highway near Daveyton in the East Rand, Gauteng province. During landing, the right main gear impacted a rock which damaged the wheel. After bringing the aircraft to a stop, the pilot switched off the master switch and disembarked from the aircraft unassisted and uninjured. The aircraft sustained damage to the wheel.</p>							



Figure 1: The aircraft after landing on an open field.

ENGINE FAILURE DURING FLIGHT		
1	Airspeed	Best Glide Angle 57 KIAS ¹
2	Carburetor Heat	ON
3	Fuel Shutoff Valve	ON
4	Fuel Pump	ON
5	Ignition Switches	ON

Note¹ *A slightly higher speed may give better distance over the ground if gliding into wind; a slightly lower speed if gliding downwind*

Figure 2: The engine failure in-flight procedure.

The aircraft owner appointed an approved person (AP) who was rated on the engine to conduct an engine teardown. The summary of the report was as follows.

Jabiru Aircraft ZU-BSA Engine Serial No. 22A

On 11 November 2024, the above engine was handed to our workshop for tearing down and inspection to determine the reason for engine stoppage.

Findings:

- *Cylinder No.4 Piston Completely shattered.*
- *Connecting Rod on Cylinder No. 4 completely deformed, bent and twisted (see Figure 4).*
- *Cylinder Head of Cylinder No. 4 also badly pitted from the failed Piston. Both the inlet and Exhaust Valves are still fully in tacked (see Figure 3).*



Figure 3: Damage in the top of the cylinder and the valves. **Figure 4:** Deformed piston connecting rod. (Source: Owner)



Figure 5: Piston pin un/damaged circlip. (Source: Owner)



Figure 6: Piston assembly debris in the oil sump. (Source: Owner)

- *Damage to the Cylinder in Figure 4 is from the failed piston.*
- *A Hand full of Aluminium particles was found in the Sump that is clearly parts of the shattered piston.*
- *A loose full Circlip that holds the Piston Pin in position is also visible between the debris in the Oil Sump (See Figure 5).*

Conclusion:

It is very clear that a complete Piston failure caused this destruction of Cylinder No. 4. and was not caused from a Valve failure as both Valves are still intact.

The loose Piston Pin undamaged Circlip found in the Oil Sump could have maybe led to a Piston Pin moving out of position causing the Pin to hook onto the Engine Block and broke the Piston to pieces. This also resulted to the complete deformation of the Connecting Rod. A second possibility is a cracked Piston that just failed, causing all this damage.

3.12.1 Cylinder subassemblies (refer to section 4.4)	
Items reusable upon inspection	Mandatory replacement items
Rockers	Exhaust valves
Rocker shafts	Inlet valves
Cylinder head / barrel (includes valve guides and seats)	Valve collets
Pushrod tubes	Inner and outer valve springs
Pushrods	Top and bottom spring washers
	Rocker bushes
	All O-rings
	All circlips
	Pistons, gudgeon pins and piston rings
	All capscrews and washers

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ISSUE	1	2	3	4	5	6	7	8	Dated: 1/2/2021	Issued By: DM	Page: 28 of 210

Figure 7: Mandatory replacements at overhaul every 1000 hours. (Source: JEM0004-8)

1.8.3 Abrupt Engine Stoppage

- An abrupt engine stoppage may be caused by a number of different failures within the engine but essentially any hard, harsh stoppage of the engine is considered to fall into this category. A piston failure is a typical example.
- Abrupt engine stoppages are treated the same as high power propeller strike.

Figure 8: A note in the manual regarding abrupt engine stoppage. (Source: JEM0004-8)

Findings

1. Personnel Information

- 1.1 The pilot had a Private Pilot Licence (PPL) that was initially issued on 20 March 2020. The PPL was renewed on 23 May 2023 with an expiry date of 31 May 2025. The pilot had flown a total of 78.7 hours on this aircraft type.
- 1.2 The pilot was issued a Class 2 aviation medical certificate on 29 January 2024 with an expiry date of 31 January 2029 with no restrictions.

2. Aircraft Information

- 2.1 The last annual inspection of the aircraft was conducted and certified on 22 October 2024 at 2028.5 airframe hours. The serious incident occurred at 0.5 airframe hours after the annual inspection. The aircraft was issued a Certificate of Release to Service (CRS) with an expiry date of 21 October 2025 or at 2128.5 airframe hours, whichever occurs first. According to the aircraft maintenance engineer (AME), the engine had 1348.8 total hours. At 562.4 hours, the aircraft's engine failed; it was shock-loaded, and a complete overhaul was performed. The aircraft had completed 786.8 hours since the overhaul. The engine overhaul interval is 1000 hours.
- 2.2 The aircraft had a valid Authority-to-fly (ATF) Certificate that was issued by the Regulator on 28 August 2024 with an expiry date of 31 October 2025. The aircraft was airworthy when it was dispatched for the flight.
- 2.3 The aircraft's Certificate of Registration (C of R) was issued to the present owner on 13 January 2010.
- 2.4 The aircraft maintenance organisation (AMO) which maintained the aircraft had a valid AMO Certificate that was issued on 31 August 2024 with an expiry date of 31 August 2025. The approved person (AP) had a valid AP Certificate with an expiry date of 22 January 2025. The AP was rated on the airframe and engine of this aircraft type.
- 2.5 The prevailing weather conditions did not contribute to the serious incident; the wind was 280° at 10 knots at the time of the flight.
- 2.6 The report concluded that a complete piston failure caused the destruction of cylinder No. 4; it was not caused by a valve failure as both valves were still intact. The Jabiru Manual support this conclusion in Figure 8; it states: "*an abrupt engine stoppage may be caused by a number of different failures within the engine but essentially any hard, harsh stoppage of the engine is considered to fall into this category. A piston failure is a typical example.*"

Probable Cause(s)
In-flight engine failure caused by the failure of the No. 4 piston and its connecting rod; the cause of this failure cannot be determined conclusively. The engine failure resulted in the successful precautionary landing.
Contributing Factor(s)
Piston failure.
Safety Action(s)
None.
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
<i>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.</i>
Disclaimer
<i>This report is produced without prejudice to the rights of the AIID, which are reserved.</i>

This report is issued by:

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