AIRCRAFT ACCIDENT SHORT REPORT

CA18/3/2/9816: Failure of the propeller due to a pre-exiting crack.

Date and time	**:**15 August 2019, 1310Z
Aircraft registration	**:** ZU-DNI
Aircraft manufacturer and model	**:** Micro Aviation New Zealand Ltd, Bantam B22J
Last point of departure	**:** Saldanha/Vredenburg Aerodrome (FASD), Western Cape
Next point of intended landing	**:** Morning Star Aerodrome, Western Cape
Location of accident site with reference to easily defined geographical points (GPS readings)	**:** S33°15'51.35" E018°13'27.59" at an elevation of 220 ft
Meteorological Information	**:** Surface wind: 135° at 7kts, Temperature: 17°C, CAVOK
Type of operation	**:** Private (Part 94)
Persons on-board	**:**1 + 1
Injuries	**:** None
Damage to aircraft	**:** Substantial

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 (2011), 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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1. SYNOPSIS

1.1 On 15 August 2019, the pilot and the passenger on-board ZU-DNI aircraft took off on a private flight from Saldanha/Vredenburg Aerodrome (FASD) in the Western Cape province to Morning Star Aerodrome in the same province.

1.2 The pilot stated that 20 minutes into the flight, and 10 nautical miles (nm) north of Ysterfontein, the aircraft began to vibrate. When the vibration persisted, the pilot began to search for a landing area. Whilst searching, both occupants heard a loud bang and the vibration intensified. The pilot shut down the engine and glided the aircraft towards a gravel road that he spotted while in the air. However, the pilot noticed a tree on the aircraft's path and pulled up to avoid collision. After clearing the tree, he flared the aircraft for touchdown, but the aircraft subsequently impacted the ground hard. The tyres burst on impact and the left-hand undercarriage bent outwards. The aircraft turned approximately 130° to the left before coming to rest.

1.3 The aircraft was substantially damaged. The occupants reported no injuries.

1.4 The investigation revealed that the propeller failed due to a pre-existing (damage) crack which was left unattended, and which caused vibration whilst the aircraft was in-flight. This led to an unsuccessful forced landing of the aircraft.

2 FACTUAL INFORMATION

2.1 On 15 August 2019, the pilot and the passenger on-board a Bantam B22J aircraft with registration marking ZU-DNI took off on a private flight from Saldanha/Vredenburg Aerodrome (FASD) to Morning Star Aerodrome.

2.2 The pilot stated that 20 minutes into the flight, and 10 nautical miles (nm) north of Ysterfontein, the aircraft began to vibrate. When the vibration persisted, the pilot began searching for a suitable landing area. Meanwhile, both occupants heard a loud bang and, thereafter, the vibration intensified. The pilot shut down the engine and glided the aircraft towards a gravel road that he spotted while airborne. The pilot noticed a tree on the aircraft's path and pulled up to avoid collision. After clearing the tree, he flared the aircraft for touchdown, but the aircraft subsequently impacted the ground hard. The tyres burst on impact and the left-hand undercarriage bent outwards. The aircraft turned approximately 130° to the left before coming to rest.

2.3 The accident occurred during daylight conditions at a geographical position determined to be S33°15'51.35" E018°13'27.59" at an elevation of 220 feet (ft) above mean sea level (AMSL).

Figure 1: The aircraft as it came to rest.

2.4.1 The aircraft's last annual inspection was carried out on 2 February 2019 at 666.0 airframe hours by an approved person (AP). It had a total of 681.0 airframe hours at the time of the accident. The AP stated that the propeller did not show any signs of fatigue on the last annual inspection.

2.4.2 On 28 February 2014, the owner sent the aircraft to the engine and propeller manufacturer to comply with service bulletin JSB 022-1: *correct propeller flange attachment to be completed at the next scheduled maintenance or within the next 50 hours, whichever comes first.* This was the last documented maintenance of the propeller.

2.4.3 The owner stated that the propeller was inspected every two years and the main propeller bolts were inspected every 10-12nm, however, there was no documentation of these inspections.

2.4.4 Post-accident inspection by the engine and propeller manufacturer revealed that one propeller blade was not damaged during the accident sequence, however, the other propeller blade showed signs of damage. As indicated in Figure 2, the manufacturer, after a closer inspection of the blade, concluded that: (i) the first red circle on the propeller tip appears to be blackened, this could be from wood rot; (ii) the second red circle appears to be a nick indicating physical damage; and (iii) the third red circle shows a crack on the leading edge, as if the propeller had struck an object.

Figure 2: Damage on the propeller blade.

2.4.5 *A nick is a sharp, notch-like displacement of a material usually found on leading and/or trailing edges. All nicks are potential crack starters. When cracks are found anywhere in a propeller, are cause for its immediate removal and detailed inspection. Cracks in propellers will grow over time, perhaps very rapidly, and eventually lead to failure. Wood or composite propellers are susceptible to internal damage from small stone strikes that can create delamination or microcracks and permit intrusion of moisture. Moisture will cause expansion of existing cracks and delamination. When moisture freezes within the blade, it causes delamination. When inspecting wood or composite propeller blades, look for cracks or delamination on the blade surface and at blade edges. In wooden propellers, check the glue lines for debonding; look for warp and loss of protective coating (paint or varnish).* Source: Advisory Circular: Aircraft Propeller Maintenance

2.4.6 *Daily Propeller Inspection*

Inspect both blades for:

- *Urethane condition: peeling, tears, pitting or abrasion.*
- *Fibreglass condition: stone chips, trailing edge chips, de-laminations, whitening.*
- *Resin condition: cracks.*

Source: Jabiru Propeller Technical Manual 2014: Paragraph 3.2.4

100 Hourly Propeller Inspection:

- *As all possible circumstances cannot be listed here, the following is provided as guidance only. A critical, trained eye is required, and inspections should include, but not be limited to, the following:*
- *Remove the spinner and carry out a thorough visual inspection checking for cracking, fraying, corrosion and other damage.*

- *Check for loose, missing, corroded or damaged fasteners and hardware.*
- *Check for deposits and radial markings which indicate fretting between moving parts.*
- *Visually check the condition of the propeller, looking for damage to the leading edge protection, glass de-lamination and cracks, splits or crushing of the propeller timber.*
- *Check the tension of the propeller bolts/nuts – Tension if required.*
- *Check spinner and Prop Tracking.*

Source: Jabiru Propeller Technical Manual 2014: Paragraph 5.7.2

Annual Propeller Inspection:

- *Annual inspections include all the items listed for the 100-hourly inspection above plus the additional items below.*
- *As all possible circumstances cannot be listed here, the following is provided as guidance only. A critical, trained eye is required, and inspections should include, but not be limited to, the following:*
- *Remove the propeller from the aircraft.*
- *Carry out the inspections.*
- *Thoroughly check the propeller for cracking, wear or damage – particularly in those areas not visible while the propeller is mounted to the engine. Ensure the propeller does not exceed the wear & damage limits.*
- *Test the fit of the propeller drive bushes.*
- *Check the propeller balance.*

Source: Jabiru Propeller Technical Manual 2014: Paragraph 5.7.3

3 Findings:

3.1 The pilot had been issued a National Pilot licence (NPL) on 15 August 2019 with an expiry date of 14 August 2021. His last competency check flight was on 15 August 2019 on a Rans S9 aircraft (which is in the same category as the accident aircraft). The pilot flew the accident aircraft on the same day (15 August 2019). The pilot had 876.0 total hours and 55.0 hours on type, and the aircraft was endorsed on his licence.

3.2 The pilot's aviation medical certificate was issued on 8 August 2017 with an expiry date of 31 August 2020. The pilot was restricted to wear corrective lenses.

3.3 The aircraft's last annual inspection was carried out on 2 February 2019 at 666.0 airframe hours. It had a total of 681.0 airframe hours at the time of the accident and had flown 15.0 hours since its last inspection.

3.4 The aircraft was issued an Authority to Fly on 13 February 2019 with an expiry date of 1 February 2020.

3.5 The flight was conducted under visual flight rules (VFR) by day.

3.6 The weather at the time of the accident was as follows: wind 135° at 7kts, temperature 17°C, and ceiling and visibility was ok (CAVOK).

3.7 No evidence of maintenance record of the propeller was submitted to the investigators by the owner or the AP during the investigation.

3.8 The manufacturer concluded that the failed propeller blade had pre-existing damage (crack) which occurred sometime during operation. It is, therefore, probable that the propeller had pre-existing impact damage which occurred during operation of the aircraft in the past and was not attended to, or there was no inspection or maintenance carried out on the propeller. The pre-existing damage on the propeller blade had caused vibration during the accident flight and that resulted in a forced landing.

4 PROBABLE CAUSE/CONTRIBUTING FACTOR

4.1 The propeller failed due to pre-existing damage (crack) which was left unattended, causing vibration whilst the aircraft was in-flight. This led to an unsuccessful forced landing of the aircraft.

4.2 Contributory factors

4.2.1 Poor maintenance and pre-flight inspection.

5 REFERENCES USED IN THE REPORT

5.1 Advisory Circular: Aircraft Propeller Maintenance
5.2 Jabiru Propeller Technical Manual 2014

6 SAFETY RECOMMENDATION

6.1 None.