

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/3/2/1412						
Classification	Serious Incident	Date	30 April 2023		Time	0923Z	
Type of Operation	Air Transport Operations Carriage: Less Than 20 Passengers (Part 135)						
Location							
Place of Departure	Madikwe East Aerodrome, North West Province		Place of Intended Landing	Madikwe West Aerodrome, North West Province			
Place of Occurrence	Madikwe West Aerodrome, North West Province						
GPS Co-ordinates	Latitude	24°49'13.03" S	Longitude	026°13'52.15" E	Elevation	3 630 feet	
Aircraft Information							
Registration	ZS-LEC						
Make; Model; S/N	Cessna Aircraft Company; 208B (Serial Number: 208B-5519)						
Damage to Aircraft	Substantial			Total Aircraft Hours	1 658.1		
Pilot-in-command							
Licence Type	Commercial Pilot Licence (CPL)		Gender	Male		Age	24
Licence Valid	Yes	Total Hours	1 566.9		Total Hours on Type	144.5	
Total Hours 90 Days	172.5		Total Flying on Type Past 90 Days	144.5			
People On-board	2 + 7	Injuries	0	Fatalities	0	Other (on ground)	0
What Happened							
<p>On Sunday morning, 30 April 2023, two pilots and seven passengers on-board a Cessna 208B aircraft with registration ZS-LEC took off from O.R. Tambo International Aerodrome (FAOR) to Madikwe East Aerodrome (FAMK). The flight was conducted under visual meteorological conditions (VMC) by day and under the provisions of Part 135 of the Civil Aviation Regulations (CAR) 2011 as amended.</p> <p>The flight from FAOR to FAMK was uneventful. After landing, four passengers disembarked from the aircraft and another four passengers boarded the aircraft for a short flight of approximately 10 minutes to Madikwe West Aerodrome. The first officer (FO) who was seated on the right front seat was the pilot flying this sector. After landing at Madikwe West Aerodrome, the pilot-in-command (PIC) took control of the aircraft and taxied to the apron with the intention to park on the paved block (see Figure 1) that was reserved for parking aircraft during embarking and disembarking of passengers.</p> <p>Whilst manoeuvring on the apron area, the pilot applied the left brake to turn the aircraft to the left, but the brake was unresponsive. He then “pumped” the brakes, but this had no effect either, thus,</p>							

he applied reverse thrust (this is executed by changing the pitch of the propeller blades) as the aircraft was approaching an electric fence. Because the pilot was unable to slow down the aircraft, he made the decision to turn the aircraft sharply to the right. But before he could turn, the propeller struck a steel fence post on the side of the apron area. This resulted in damage to the propeller blades and the engine. No people on-board the aircraft were injured.

The serious incident occurred during daylight at Madikwe West Aerodrome at Global Positioning System (GPS) co-ordinates determined to be 24°49'13.03" South 026°13'52.15" East, at an elevation of 3 630 feet (ft).

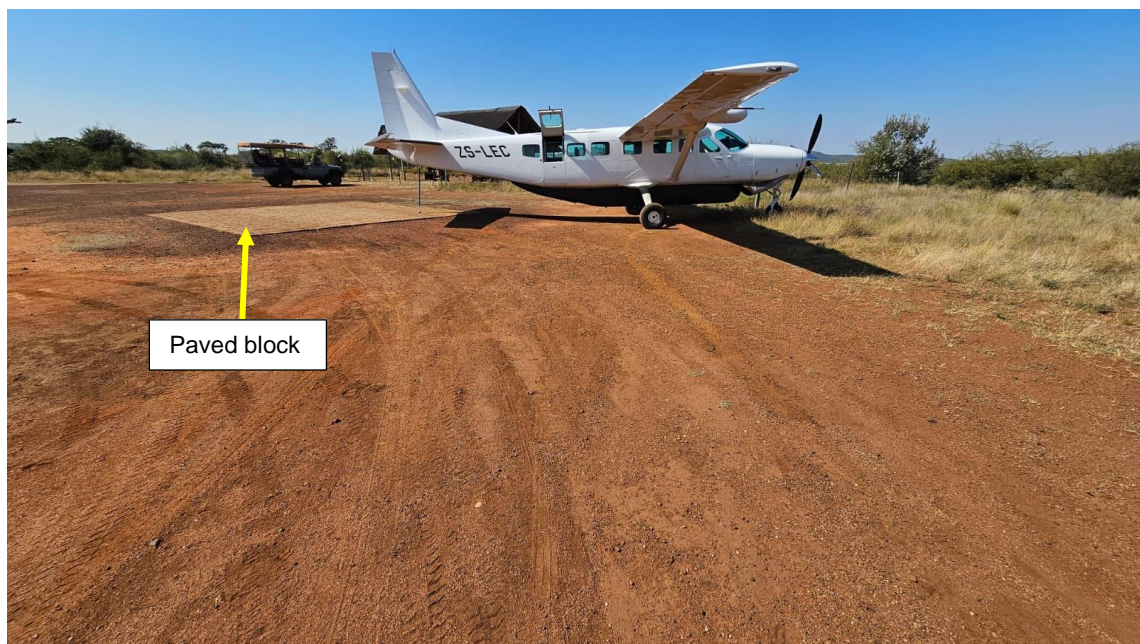


Figure 1: The aircraft as it came to a stop following the serious incident.



Figure 2: The steel fence post impacted by the propeller.



(a)



(b)

Figure 3: Damage to one of the propeller blades (a); and a bent blade tip of one of the propeller blades (b).



Figure 4: The propeller blade strike marks on the fence post.

Findings

1. Personnel Information

- 1.1 The pilot (PIC) had a valid Commercial Pilot Licence (CPL). The pilot's last licence renewal was on 25 June 2022 with an expiry date of 30 June 2023. The pilot had flown a total of 1 566.9 hours of which 144.5 hours were on the aircraft type.
- 1.2 The pilot had a Class 1 aviation medical certificate that was issued on 15 March 2023 with an expiry date of 31 March 2024.
- 1.3 The pilot was properly licensed and medically fit to conduct the flight in accordance with the existing regulations. The aircraft type was endorsed on his licence.
- 1.4 The FO had a valid CPL. The last renewal of the FO's licence was on 13 September 2022, and was valid until 30 September 2023. The FO had flown a total of 368.4 hours of which 81.5 hours were on the aircraft type.

1.5 The FO had a Class 1 aviation medical certificate that was issued on 17 April 2023 with an expiry date of 30 April 2024.

2. Aircraft Information

2.1 The last maintenance inspection that was conducted on the aircraft prior to the serious incident flight was certified on 23 January 2023 at 1 576.9 airframe hours by an aircraft maintenance organisation (AMO). The aircraft was flown a further 81.2 hours since the maintenance inspection.

2.2 The aircraft had a valid Certificate of Airworthiness (C of A) that was issued on 31 July 2019 with an expiry date of 31 July 2023. The aircraft was airworthy when it dispatched for the flight.

2.3 The aircraft's Certificate of Registration (C of R) was issued on 28 July 2022.

2.4 The aircraft was issued a Certificate of Release to Service (CRS) on 7 March 2023 with an expiry date of 6 March 2024 or at 1 771.6 airframe hours, whichever occurs first.

2.5 The aircraft was fitted with a Pratt & Whitney PT6A-140 engine with serial number PCE-VA0568. At the time of the serious incident, the engine had been in operation for 1 658.1 hours (total time since new).

2.6 The aircraft was fitted with a McCauley 4HFR3DC778-I/102BMA-O propeller with serial number 200703. At the time of the serious incident, the propeller had been in operation for 751.0 hours (total time since new).

3. Meteorological Information

3.1 The weather information in the table below was obtained from the pilot questionnaire (form CA 12-03) completed by the PIC.

Wind Direction	045°	Wind Speed	20 kt	Visibility	9999 m
Temperature	26°C	Cloud Cover	Nil	Cloud Base	CAVOK
Dew Point	10°C	QNH	1019hPa		

4. Aerodrome

4.1 According to available information, neither the FAMK nor the Madikwe West Aerodrome was licensed. Operators were to use these aerodromes on their own discretion. The runway orientation at Madikwe West Aerodrome is orientated 08/26; the runway is 1 500m long and 35m wide and has an apron area of 3 136 square (sq) metres (56m x 56m). The runway and the apron area have a gravel surface and a small terminal building which is enclosed by an electric fence to ensure passenger safety. There is no fence around the aerodrome; the animals roam free on the runway and apron area. Rangers are tasked to ensure that the runway is clear of animals before aircraft could land or take-off.



Figure 5: Madikwe Game Reserve has two runways. (Source: www.madikwereserve.org/flights)

4.2 During the investigator's visit to Madikwe West Aerodrome on 22 May 2023 (the day the ZS-LEC engine was prepared for being removed), the following observations were made:

- (i) The runway surface and apron area had a gravel surface which was in a good overall condition.
- (ii) There was no fence around the aerodrome and animals roamed on the runway and apron areas.
- (iii) There were high trees on final approach for Runway 08.

- (iv) Runway 08 had an up slope and Runway 26 had a down slope.
- (v) There was one windsock next to the apron area. A second windsock pole was approximately halfway down the runway but there was no windsock attached to it.
- (vi) There was a small terminal building next to the apron area with an electric fence around it.
- (vii) It was noted that the passengers who boarded a commercial flight that landed at 1147Z did not make use of the terminal building. The passengers walked from the ranger's vehicle that brought them to the aerodrome. The ranger's vehicle was parked at the opposite side of the apron.
- (viii) An area next to the terminal building was demarcated for aircraft that were to be parked overnight. The area had an electric fence around it to prevent animals from causing damage to property.
- (ix) It was evident from the tall grass and vegetation that the overnight parking area was not in use for a considerable time, and the overgrown grass and vegetation posed a fire risk.
- (x) Following the serious incident on 30 April 2023, the ZS-LEC was parked in this overnight parking area as the propeller and engine needed to be removed.
- (xi) It was also noted that there were three paved areas (6.5m x 6.5m) within the apron area of 3 136sq metres (56m x 56m). The paved area in the apron was most probably used for parking aircraft to limit foreign object damage to the propeller during shut down and start up phases.
- (xii) The paved area in front of the terminal building was covered by grass; it was evident that it was not being used often.
- (xiii) The paved area at the threshold of Runway 26 was covered in stones (FOD) and was hazardous to the safe operation of aircraft.
- (xiv) The other paved area was near the "overnight parking area" close to the fence post that was struck by the propeller of ZS-LEC. The pole was positioned 9.8m from the paved area.
- (xv) It was noted that the aircraft (ZS-JAX) that landed at Madikwe West Aerodrome on the day of the incident parked to the north of the paved area, some distance from the "overnight parking area" (see Figure 11) to allow adequate space as there was a vehicle (that was parked in that area at the time) from the maintenance team. The maintenance personnel were working on ZS-LEC aircraft.
- (xvi) The crew of ZS-JAX opted to use Runway 26 for take-off. The crew did not make use of the paved area at the threshold for their power checks, or when applying power for take-off.



Figure 6: Schematic from the operator's parking procedure at Madikwe West Aerodrome.

5. Operator(s)

- 5.1 Due to operational constraints, the operator used a subcontractor (aircraft and crew from another operator) for this flight. The seven passengers were issued tickets by the operator prior to their departure from FAOR to FAMK.
- 5.2 The operator that subcontracted the flight had a valid Air Operating Certificate (AOC) which was issued on 12 May 2022 with an expiry date of 30 June 2023.
- 5.3 The operator that conducted the flight had a valid Air Operating Certificate (AOC) which was issued on 23 March 2023 with an expiry date of 31 January 2024.
- 5.4 Tickets were issued by the crew to the four passengers who boarded the aircraft at FAMK for the flight to Madikwe West Aerodrome.

6. Brake System

Source: Pilot's Operating Handbook (POH), Section 7, Airplane and Systems Description

The airplane has a single-disk, hydraulically actuated brake on each main landing gear wheel. Each brake is connected, by a hydraulic line, to a master cylinder attached to each of the pilot's rudder pedals. The brakes are applied by applying pressure to the top of either the left (pilot's) or right (co-pilot's) set of rudder pedals, which are interconnected. When the airplane is parked, both the main wheel brakes may be set by utilizing the park brake, which is operated by a handle below the right of the pilot's control wheel. To apply the parking brake, set the brakes with the rudder pedals and pull the handle aft. To release the parking brake, push the handle fully in.

A brake fluid reservoir, located just forward of the firewall on the left side of the engine compartment, provides additional brake fluid for the brake master cylinders. The fluid in the reservoir should be checked for proper level prior to each flight.

For maximum brake life, keep the brake system properly maintained. Airplanes are equipped with metallic type brakes and require a special brake burn-in before delivery (or after brake replacement). When conditions permit, hard brake application is beneficial in that the resulting higher brake temperatures tend to maintain proper brake glazing and will prolong the expected brake life. Conversely, the habitual use of light and conservative brake application is detrimental to metallic brakes.

Some of the symptoms of impending brake failure are gradual decrease in braking action after brake application, noisy or dragging brakes, soft or spongy pedals, and excessive travel and weak braking action. If any of these symptoms appear, the brake system needs immediate attention. If, during taxi or landing roll, braking action decreases, let up on the pedals and then re-apply the brakes with heavy pressure. If the brakes become spongy or pedal travel increases, pumping the pedals should build braking pressure. If one brake becomes weak or fails, use the other brake sparingly while using opposite rudder, as required, to offset the good brake.

7. Follow up Inspection.

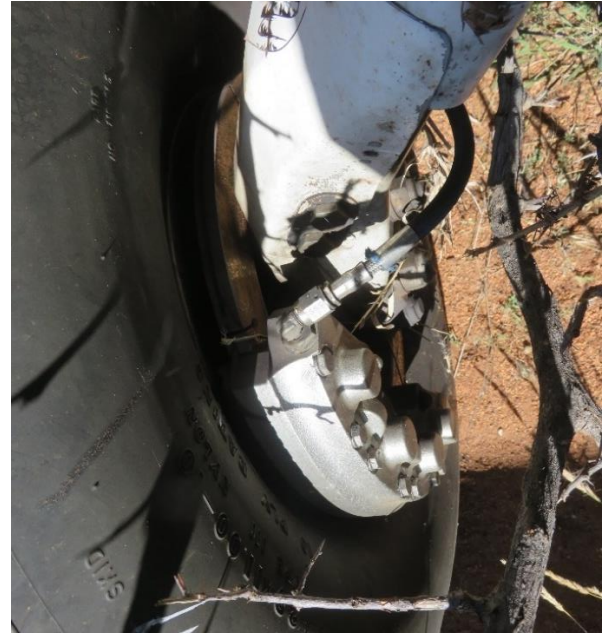
7.1 On Monday, 22 May 2023, a follow-up inspection was conducted at Madikwe West Aerodrome where the aircraft was still parked, following the serious incident on 30 April 2023.

On the day (22 May 2023), an aircraft maintenance team was preparing to remove the engine from the airframe, which was scheduled to undergo a 'sudden stoppage' inspection the next day.

During visual inspection of the aircraft, nothing untoward was observed with the brakes system (i.e., there were no visible leaks, the hydraulic lines to both brake assemblies were not ruptured, there was no mechanical defect with the brake assemblies, and the hydraulic fluid reservoir which is located on the left side of the engine compartment was full).



(a)



(b)

Figure 7: The two-wheel brake assemblies on the left wheel (a); and the right wheel (b).

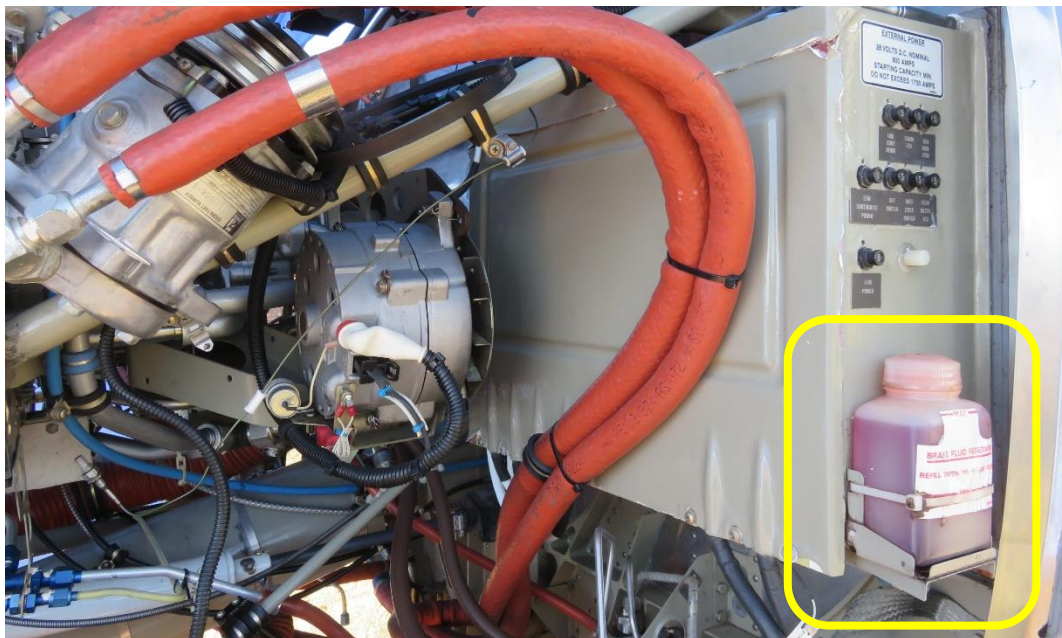


Figure 8: The hydraulic fluid reservoir which is near maximum in the yellow window.

The apron area at Madikwe West Aerodrome had adequate space to park an aircraft the size of a Cessna 208B and larger. Figure 10 depicts a Cessna 208B that landed at the aerodrome to collect passengers (the apron area was more than adequate to accommodate the aircraft).



Figure 9: The terminal building with ZS-LEC parked next to it.



Figure 10: ZS-LEC parked on the left, and the aircraft collecting passengers on the right.

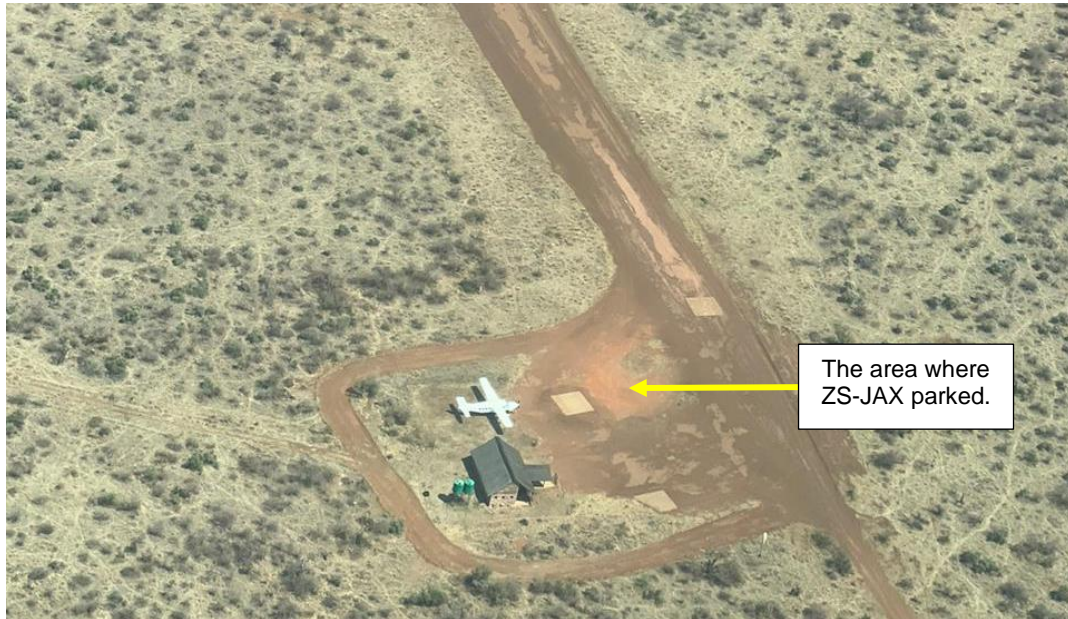


Figure 11: Aerial view of the apron area, with ZS-LEC parked. (Source: Federal Airlines)

The engine was installed on the aircraft on 14 and 15 September 2023 following repairs at an approved engine maintenance facility. The propeller that was removed and accordingly repaired was also installed. As per the maintenance requirements, engine ground runs were performed. On 21 September 2023, the Regulator (SACAA) issued a special flight permit for a flight from Madikwe West Aerodrome to Lanseria International Aerodrome (FALA). The aircraft was flown to FALA the following day, and no technical anomalies were noted.

Probable Cause

While taxiing the aircraft to the parking area, the PIC stated that he had no differential braking and could not turn the aircraft to the left, whereupon an apron excursion followed in which the propeller struck an object on the ground (steel fence post). No defect/malfunction could be found with the aircraft braking system that could support the pilot's statement.

Contributing Factors

1. The overnight parking area that was erected next to the apron building posed a hazard to aircraft manoeuvring in the apron area.
2. None of the steel fence posts used to support the electric fence was painted in a bright colour (yellow or orange, etc.) to increase visibility.
3. There was no information board to indicate the intent use of the overnight parking area or was there any warning to pilots to be cautious when manoeuvring close to that area.

Safety Action
None.
Safety Recommendations
<p>(i) It is recommended that the operator(s) who erected an electric fence (protected overnight parking area) next to the terminal building fence remove it and its supporting poles to prevent a recurrence of the serious incident, which resulted in damage to the aircraft and grounding for nearly five months.</p> <p>It is evident that this “protected overnight parking area” was erected sometime after the aerodrome was operational and, judging by the height of the grass and vegetation within the demarcated area, it seemed that it had not been in use for a lengthy period. The aircraft’s propeller struck one of the electric fence support poles, which was located 9.8m from the corner of the paved area in the apron. The parking procedure as depicted in the Federal Airlines document is not regarded as safe for aircraft operations and needed to be amended. The apron area covers a surface area of 3 136sq metres (56m x 56m), which provided adequate space to operate/park a Cessna 208B or larger aircraft type.</p> <p>(ii) It is recommended that the operator amend its procedure for Madikwe West Aerodrome as the parking method prescribed in the document has the potential to cause a serious incident or accident.</p>
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
<p><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></p>
Disclaimer
<p><i>This report is produced without prejudice to the rights of the AIID, which are reserved.</i></p>

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