SOUTH AFRICAN CIVIL AVIATION AUTHORITY

Section/division **Accident and Incident Investigations Division** Form Number: CA 12-57

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10448						
Classification	Accident	**Date**	5 May 2024		**Time**	0910Z	
Type of Operation	Private (Part 91)						
Location							
Place of Departure	Landfontein Private Airstrip near Smithfield, Free State Province	Place of Intended Landing	Welkom Airfield (FAWM), Free State Province				
Place of Occurrence	On Runway 01 at New Tempe Aerodrome (FATP), Free State Province						
GPS Co-ordinates	Latitude	29°02'30.8"S	Longitude	26°16'32.85" E	Elevation	4 542 ft	
Aircraft Information							
Registration	ZS-NVM						
Make; Model; S/N	Cessna Aircraft Corporation; T210L (Serial Number: 210-61372)						
Damage to Aircraft	Substantial	Total Aircraft Hours	4243				
Pilot-in-command							
Licence Type	Commercial Pilot Licence (CPL)	Gender	Male	Age	40		
Licence Valid	Yes	Total Hours	1 927	Total Hours on Type	938.8		
Total Hours 30 Days	6.8	Total Flying on Type Past 90 Days	30.4				
People On-board	1+3	**Injuries**	0	**Fatalities**	0	**Other (on the ground)**	0

What Happened

On 5 May 2024, a pilot and three passengers on-board a Cessna T210L aircraft with registration ZS-NVM took off on a private flight from Landfontein private airstrip near Smithfield in the Free State to Welkom Aerodrome (FAWM), also in the same province. Visual meteorological conditions (VMC) by day prevailed at the time of the flight which was conducted under the provisions of Part 91 of the Civil Aviation Regulations (CAR) 2011 as amended.

The pilot stated that he conducted a pre-flight inspection and found no anomalies. He took off from Landfontein private airstrip at approximately 0815Z. All the landing gears retracted normally during the climb; the flight to FAWM progressed as expected. He stated that upon reaching FAWM, he selected the landing gear lever to ‘down’ position; however, he heard a ‘click’ which was an anomaly. This drew his attention to the landing gear hydraulic pump which was still in operation. The gear-down indicator light did not illuminate as expected. The pilot attempted to extend the landing gears using the redundancy system, but there was no movement of the gears or pressure on the handpump.

Thereafter, the pilot decided to divert to New Tempe Aerodrome (FATP) which is also in the Free State province where the aircraft maintenance organisation (AMO) is based. Upon arrival at FATP, he contacted the aircraft maintenance engineer (AME) via a mobile phone to assist him in troubleshooting the landing gears. The pilot and the AME conducted several manoeuvres to extend the landing gears, but they were not successful. The AME reassessed the pilot's reported challenge and concluded that the hydraulic fluid in the system might be insufficient, hence, there was no pressure build-up after multiple strokes on the hand pump. The pair decided to add one litre of engine oil that was on-board the aircraft into the system to get the landing gears to function. After adding the engine oil, the nose landing gear of the aircraft extended and locked into position, but the main landing gears remained retracted. The pilot and the engineer decided to conduct a wheels-up landing with the emergency services personnel on standby.

The pilot burnt fuel at FATP general flying area (GFA) in preparation for a wheels-up landing. He also secured the cabin and briefed the passengers about his intentions. At 0910Z, the pilot positioned the aircraft for a long final approach for Runway 01. The aircraft touched down on Runway 01 with its underbelly with full flaps and extended nose landing gear. The landing speed was 65 knots (kts). The aircraft skidded for approximately 400 metres (m) before it veered off to the left of the runway and onto the grass surface where it came to a stop. The aircraft was substantially damaged; however, the pilot and the passengers were unharmed. The occupants disembarked unassisted.

During the accident sequence, the main landing gear doors, bottom aft fuselage, left horizontal stabiliser and the left elevator were damaged.

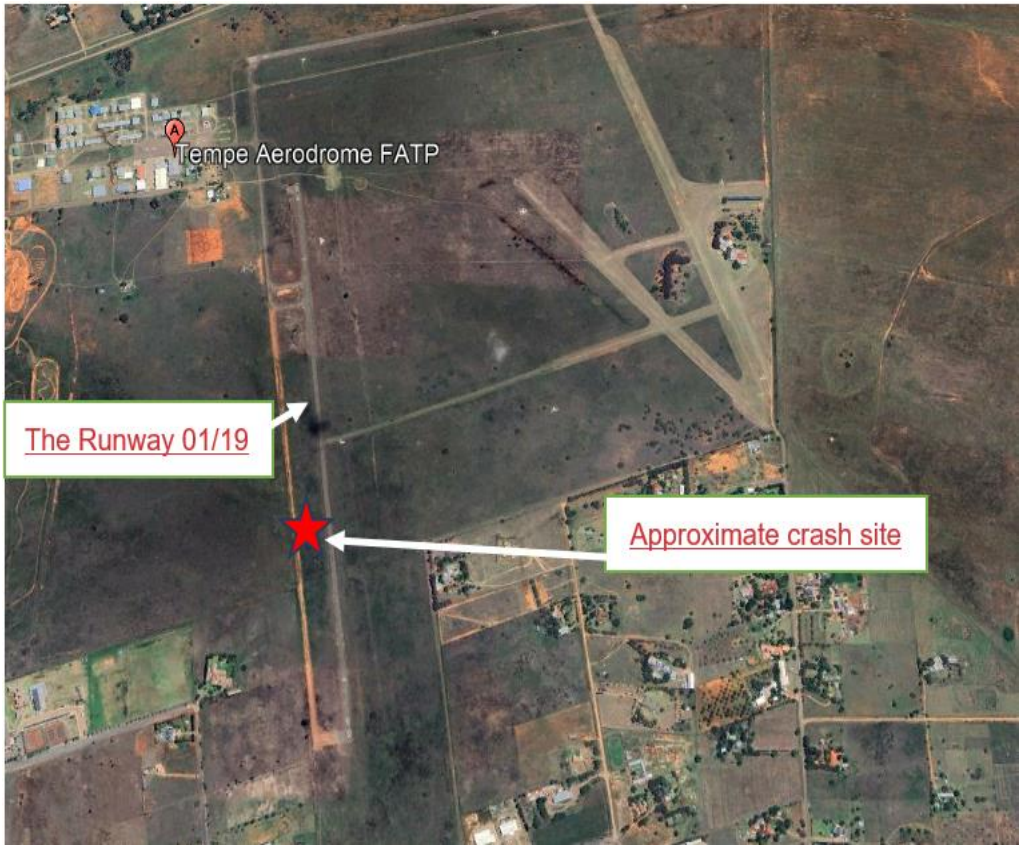

Figure 1: Aerial view of FATP and the approximate area where the aircraft came to a stop. (Source: Google Earth)

Figure 2: The aircraft as it came to rest after the accident with the nose gear extended. (Source: Pilot)

Description of the Landing Gear Systems Operation (Source: Cessna 210L Pilot's Operating Handbook)

The landing gear is raised and lowered by hydraulic actuators, one for each leg, with hydraulic pressure being generated by an electrically powered and controlled pump assembly with an integral reservoir. The pump motor is activated by a pressure switch in the pump delivery line; this switch should close, to start the pump, when the pressure in this line falls to about 1,000 psi and open, to stop the pump, when the pressure rises above 1,500 psi.

The electrical power to the system is supplied through two circuit breakers, one for the indication and control circuits (5 Amp) and the other for the pump motor (30 Amp). Whenever the Battery Master Switch is ON and these two circuit breakers are made, the pump unit operates automatically, controlled by the pressure switch and the landing gear position selector; if either circuit breaker is open the pump unit will not operate.

The landing gear position selector, in the cockpit, is a hydraulic changeover valve and selecting landing gear UP or DOWN connects the pressure delivery line from the pump unit to the appropriate side of each of the three landing gear actuators and the two main landing gear down lock actuators; the nose down lock is incorporated into its retraction actuator. The gear is held in the retracted position by residual hydraulic pressure when the gear is selected UP. Whichever position the gear is selected to, the pump will start to drive the gear towards that position whenever the hydraulic pressure drops below 1,000 psi.

The landing gear indication system on aircraft of this build standard consists of a single green light to indicate that all landing gears are locked down and an amber light to indicate all gears fully up. These lights illuminate when the appropriate microswitches on all three legs are made. When the gear is in transit or at least one leg is not at a limit position, there is no indication light. There is also a warning horn which should sound if the landing gear is not fully locked down and the throttle is retarded beyond a pre-determined low-power position. The quantity of hydraulic fluid level should be checked at 25-hour intervals. To facilitate checking and filling the system, a dipstick and filler are located on the right side of the hydraulic pump behind a snap-out cover panel on the right side of the pedestal. The top end (cap end) of the dipstick employs an over-centre locking device and serves as the cap for the filler. When the fluid level is at or below the line marked ADD on the dipstick, hydraulic fluid (MIL-H-5606) should be added to the system.

Landing Gear Malfunction Procedure (Source: Cessna 210L Pilot's Operating Handbook)

In analyzing a landing gear malfunction, first check that the master switch is turned on and the LDG GEAR and HYD PUMP circuit breakers are in; reset if necessary. Also, check both landing gear position indicator lights for operation by utilizing the press to test the features of the light

units. Rotate the lights while they are depressed to check for open dimming shutters. A burned cut bulb can be replaced in flight by using the bulb from the remaining gear position indicator light.

Extension Malfunction

Normal landing gear extension time is approximately 8 seconds. If the landing gear will not extend normally, perform the general checks of circuit breakers and master switch and repeat the normal extension procedures at a reduced speed of 100 miles per hour (MPH). if efforts to extend and lock the gear through the normal landing gear system fail, the gear can be manually extended (as long as hydraulic system fluid has not been completely lost) by use of the emergency hand pump. The pump is located between the front seats.

Technical Report Post-occurrence (Source: Operator)

After recovering the aircraft at our [aircraft maintenance organisation (AMO)] facility, the hydraulic system was inspected, and found that the hydraulic reservoir was almost empty. We flushed the hydraulic system to clean the incorrect oil residue that was added to the reservoir during the flight. Further inspection revealed that the left main landing gear door actuator gland retaining ring broke free from the actuator assembly, allowing the cylinder rod to become adrift from the actuator. Due to the damage sustained following the wheels-up landing, it cannot be determined with certainty if this occurred before landing or because of the aircraft weight coming to rest on the left main landing gear door. Our suspicion is the latter, as the retaining ring and all other components were still hanging from the gland assembly after recovery. We suspect that they would have been lost if this occurred in flight. The actuator was re-assembled to test the undercarriage system. After filling the hydraulic reservoir to the correct level, the aircraft was placed on jacks, and the system function was tested and found to be operating satisfactorily. The emergency system was also tested at this time and found to be functioning normally and no hydraulic fluid (MIL-H-5606) could be found leaking from the system.

Hydraulic System (Cont)

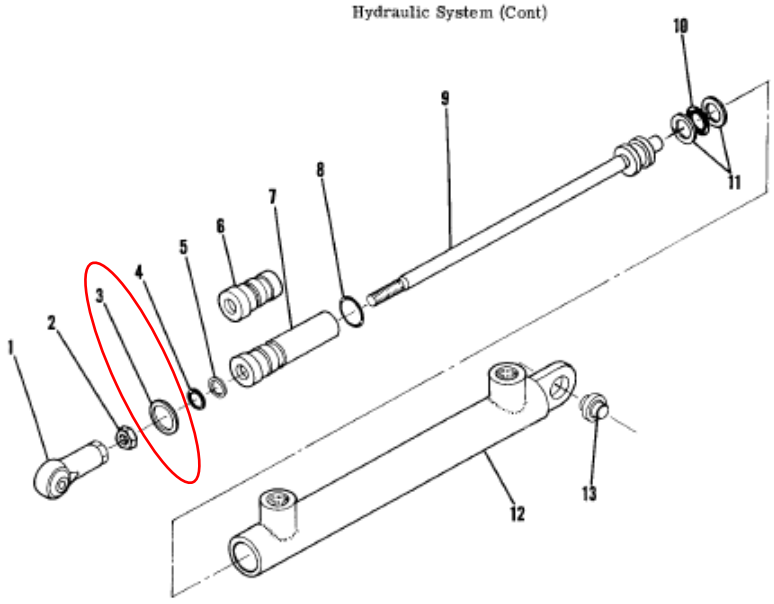

Figure 128. Main Gear Doors & Nose Gear Doors Actuator Assembly

FIGURE AND INDEX NO.	PART NUMBER	DESCRIPTION 1 2 3 4 5 6 7	UNITS PER ASSY	USABLE ON CODE
128 -	1281028-1	MAIN GEAR DOOR ACTUATOR ASSEMBLY	1	
	1281028-2	NOSE GEAR DOOR ACTUATOR ASSEMBLY	1	
- 1	S1819-3	ROD END	1	
- 2	AN316-4R	NUT	1	
- 3	MS16625-1065	RING-RETAINING	1	
- 4	S1628-011	RING-BACK UP	1	
- 5	MS28775-011	O RING	1	
- 6	1281022-1	GLAND-MAIN GEAR ACTUATOR USED ON 1281028-1 ONLY	1	
- 7	1281022-2	GLAND-NOSE GEAR ACTUATOR USED ON 1281028-2 ONLY	1	
- 8	MS28775-014	O RING	1	
- 9	1281031-1	PISTON & ROD-MAIN GEAR ACTUATOR USED ON 1281028-1 ONLY	1	
	1281031-2	PISTON & ROD-NOSE GEAR ACTUATOR USED ON 1281028-2 ONLY	1	
-10	MS28775-111	O RING	1	
-11	S1628-111	RING-BACK UP	2	
-12	1281010-1	CYLINDER-MAIN GEAR ACTUATOR USED ON 1281028-1 ONLY	1	
	1283010-1	CYLINDER-NOSE GEAR ACTUATOR USED ON 1281028-2 ONLY	1	
-13	S2009-3	BEARING	1	

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Figure 3: The failed retaining ring. (Source: Cessna T210 K, L Parts Catalogue)

Findings

Pilot

The pilot was initially issued a Commercial Pilot Licence (CPL) on 29 July 2014. His last validation was conducted on 16 June 2023 with an expiry date of 30 June 2024. The aircraft type was endorsed on the pilot's licence. A Class 1 medical certificate was issued to the pilot on 12 July 2023 with an expiry date of 31 July 2024.

Engineer

The aircraft maintenance engineer who certified the last mandatory periodic inspection (MPI) was appropriately certificated to conduct maintenance on the aircraft.

Aircraft

The aircraft's Certificate of Registration (C of R) was issued to the current owner on 20 December 2018. The Certificate of Airworthiness (C of A) was initially issued on 6 December 1996. The latest C of A was reissued on 25 February 2024 with an expiry date of 28 February 2025.

The last MPI was certified on 25 February 2024 at 4 218.46 total airframe hours. At the time of the accident, the aircraft had accumulated 4 243 airframe hours, which meant that the aircraft had accrued 24.54 hours since the last MPI. The hydraulic fluid level is checked every 25 hours during MPI.

The aircraft was issued a Certificate of Release to Service (CRS) on 25 February 2024 at 4 218.46 airframe hours with an expiry date of 28 February 2025 or at 4 343 airframe hours, whichever occurs first. There were no defects recorded in the flight folio before the accident.

The aircraft maintenance organisation (AMO) which certified the last maintenance inspection before the accident flight had an AMO Certificate that was issued by the Regulator (SACAA) on 9 September 2023 with an expiry date of 30 September 2024.

The Pilot's Operating Handbook does not specify whether the hydraulic fluid level should be checked during pre-flight inspection.

The left main landing gear door actuator gland retaining ring separated from the actuator and the hydraulic fluid escaped through the actuator. This rendered the landing gear system inoperative due to a lack of hydraulic fluid in the system to control the opening of the landing gear doors as well as lock them into position.

Probable Cause
The landing gear system failed to extend due to a lack of hydraulic fluid in the system; this resulted in a gear-up landing.
Contributing Factors
Poor fitment of the locking or retaining pin which resulted in its separation 24.54 hours after the last maintenance.
Safety Action(s)
None.
Safety Message and Recommendation
Safety message: In the interest of safety, AMOs must put systems in place to ensure that the maintenance is conducted in accordance with the manufacturers' prescripts and regulations to prevent injury or damage to property.
About this Report
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 desktop inquiries to bring awareness of potential safety issues to the industry in respect of this occurrence, as well as safety action/s that the industry might want to consider in preventing a recurrence of a similar occurrence. *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
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 apportion blame or liability.
Disclaimer
This report is produced without prejudice to the rights of the AIID, which are reserved.

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