SOUTH AFRICAN CIVIL AVIATION AUTHORITY

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

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10447						
Classification	Accident	**Date**	30 April 2024		**Time**	1625Z	
Type of Operation	Private (Part 91)						
Location							
Place of Departure	Kruger Mpumalanga International Airport (FAKN), Mpumalanga Province	Place of Intended Landing	Wonderboom Airport (FAWB), Gauteng Province				
Place of Occurrence	Wonderboom Airport on Runway 11, Gauteng Province						
GPS Co-ordinates	Latitude	25°39'13.0 S	Longitude	28°13'27" E	Elevation	4078ft	
Aircraft Information							
Registration	ZS-MGW						
Make; Model; S/N	Piper PA-34-200T (Serial Number: 34-7970296)						
Damage to Aircraft	Substantial	Total Aircraft Hours	5729.28				
Pilot-in-command							
Licence Type	Commercial Pilot Licence (CPL) Aeroplane	Gender	Female	Age	24		
Licence Valid	Yes	Total Hours	1591.1	Total Hours on Type	38.8		
Total Hours 30 Days	44.7	Total Flying on Type Past 90 Days	22				
People On-board	1+1	**Injuries**	0	**Fatalities**	0	**Other (on ground)**	0

What Happened

On Tuesday, 30 April 2024, a pilot and a passenger on-board a Piper PA 34 Seneca with registration ZS-MGW were on a private flight from Kruger Mpumalanga International Airport (FAKN) in Mpumalanga province to Wonderboom Airport (FAWB) in Gauteng province. The flight was conducted under visual meteorological conditions (VMC) by day and under the provisions of Part 91 of the Civil Aviation Regulations (CAR) 2011 as amended.

The pilot stated that the flight from FAKN was uneventful. Upon arrival at FAWB, she decided to conduct a few touch-and-go circuits on Runway (RWY) 11 before making a full-stop landing. She completed the first touch-and-go and, during the climb whilst completing the after-take-off checks, she realised that the undercarriage did not retract. To resolve the anomaly, she flew a circuit on the “dead” side (or right-side) circuit to rectify the problem, but she was unsuccessful. When she selected the gear to the up position, a gear unsafe light illuminated. She then checked the engine cowling landing gear mirrors and observed that the nosewheel was still down. She then selected the landing gears down but did not hear or feel any movement. She maintained circuit altitude and commenced with the fault-finding process by pulling and depressing the circuit breaks; she was still not successful. She then replaced the left main gear light bulb, but there was still no change. A pilot on-board another aircraft at the holding point of Runway 11 who was listening when ZS-MGW broadcasted her situation to the air traffic control (ATC) officer informed ZS-MGW that the landing gears were down but

could not confirm if they were locked into position. The ZS-MGW pilot decided to conduct a precautionary landing. She lowered the landing gears and removed the lock on the emergency gear extension to release pressure and use gravity to bring the undercarriage down. The Pilot's Operating Handbook (POH) states that once the emergency extension has been pulled out, it should remain in that position to avoid pressure from being reapplied which would stop the manual extension. When the aircraft touched down, the landing gears collapsed. The aircraft skidded on its belly before it stopped on Runway 11. No person was injured; the aircraft sustained substantial damage to the underbelly and the propeller blades.

A post-accident inspection conducted by the aircraft maintenance organisation (AMO) revealed the following:

"The emergency gear lever was activated and then reset or pushed back to its stowed position before the gears were down and locked. The emergency procedure states that the lever must be left in the out position (pulled out). The lever pushed back is not the correct procedure for the emergency gear extension. Excessive brush wear on the undercarriage motor can occur when there is excessive resistance in the hydraulic system which could be caused by numerous factors."

"The reason the motor failed was because the brushes were worn, they do not make contact with the armature and the motor stops turning. As seen in the pictures there are traces of oil on the inside of the motor which soften the brushes and cause them to wear excessively. The electric motor is mounted on top of the hydraulic pump which has an oil seal that I suspect has started leaking hydraulic oil towards the electric motor. I would say it is wear and tear, but was accelerated by the fact that hydraulic oil leaked into the motor."

Figures 1 and 2: Oil deposits found inside the motor caused the brushes to soften and, thus, preventing proper contact. (Source: AMO)

Figure 3: Foam applied to the runway after the aircraft had stopped. (Source: Operator)

Figure 4: Damaged propeller blades and the scarred underbelly. (Source: Operator)

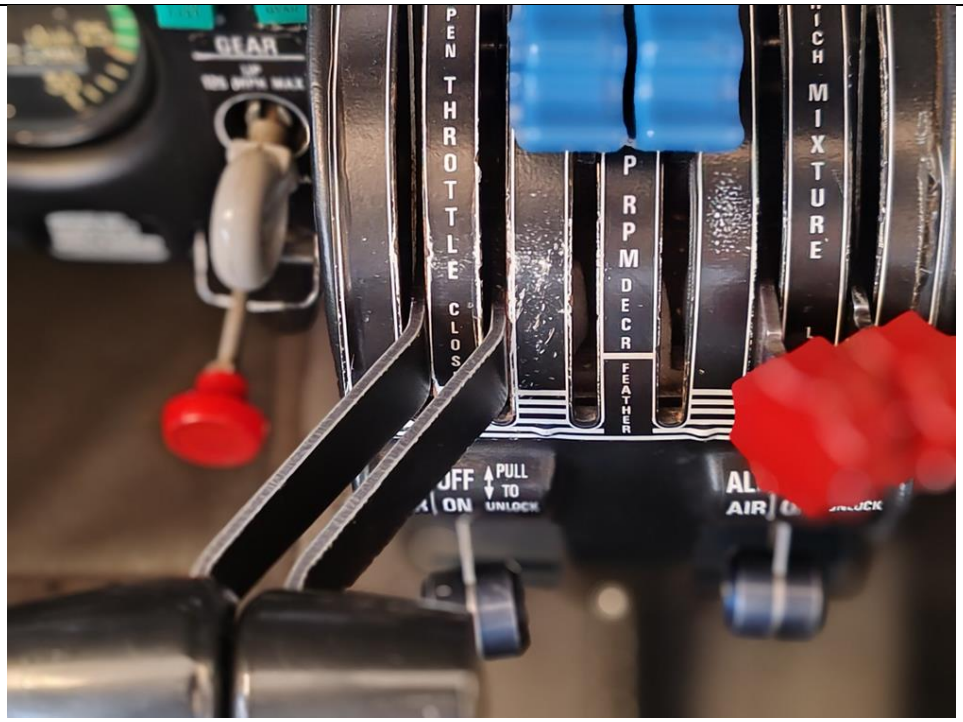

Figure 5: Control levers position after the accident. (Source: Operator)

MANUAL EXTENSION OF LANDING GEAR

Check following before extending gear manually:
Circuit breakers.....check
Master switch .....ON
Alternators .....check
Navigation lights.....OFF
(daytime)

To extend, reposition clip downward clear of knob and proceed as follows:
Airspeed.....reduce (85 KIAS max.)
Gear selector .....GEAR DOWN
LOCKED position
Emerg. gear extend knob .....pull
Indicator lights.....3 green
Leave emergency gear extension knob out.

Figure 6: Undercarriage emergency procedure – manual extension. (Source: Piper PA-34-200T POH)

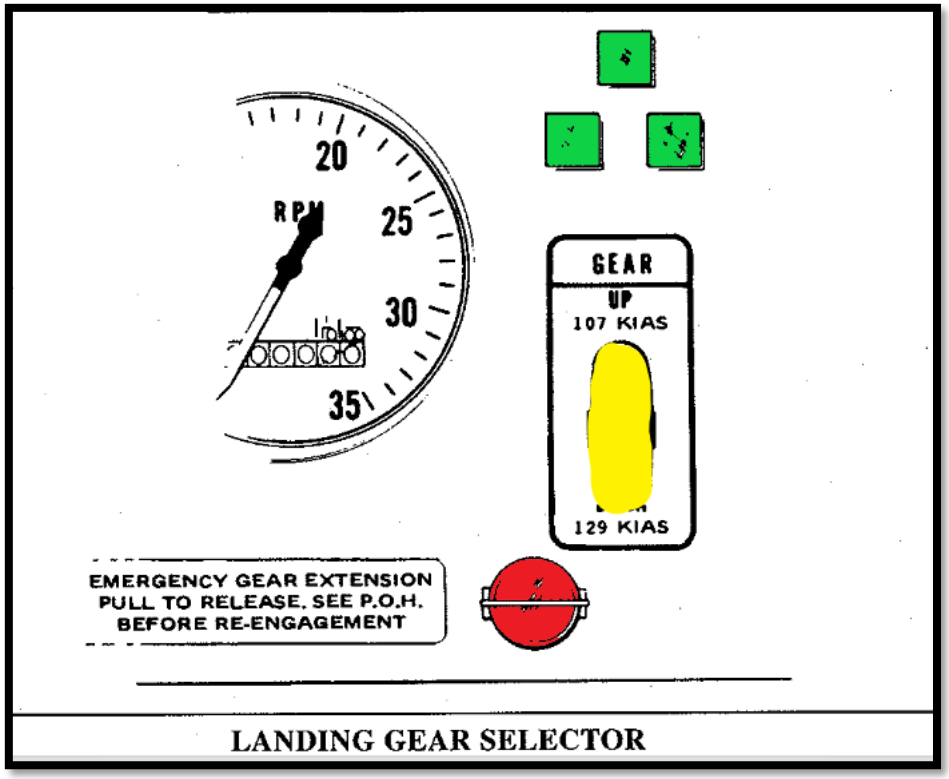

Figure 7: Emergency gear extension with the guard in place to prevent inadvertent operation. (Source: Piper PA-34-200T POH)

7.9 LANDING GEAR

The Seneca II is equipped with hydraulically operated, fully retractable, tricycle landing gear.

Hydraulic pressure for gear operation is furnished by an electrically powered, reversible hydraulic pump (refer to Figures 7-5 and 7-7). The pump is activated by a two-position gear selector switch located to the left of the control quadrant on the instrument panel (Figure 7-3). The gear selector switch, which has a wheel-shaped knob, must be pulled out before it is moved to the "UP" or "DOWN" position. When hydraulic pressure is exerted in one direction, the gear is retracted; when it is exerted in the other direction, the gear is extended. Gear extension or retraction normally takes six to seven seconds.

CAUTION

If the landing gear is in transit, and the hydraulic pump is running, it is NOT advisable to move the gear selector switch to the opposite position before the gear has reached its full travel limit, because a sudden reversal may damage the electric pump.

The landing gear is designed to extend even in the event of hydraulic failure. Since the gear is held in the retracted position by hydraulic pressure, should the hydraulic system fail for any reason, gravity will allow the gear to extend. When the landing gear is retracted, the main wheels retract inboard into the wings and the nose wheel retracts forward into the nose section. Aerodynamic loads and springs assist in gear

Figure 8: Landing gear extension description – Part 1. (Source: Piper PA-34-200T POH)

extension and in locking the gear in the down position. During gear extension, once the nose gear has started toward the down position, the airstream pushes against it and assists in moving it to the downlocked position. After the gears are down and the downlock hooks engage, springs maintain force on each hook to keep it locked until it is released by hydraulic pressure.

To extend and lock the gears in the event of hydraulic failure, it is necessary only to relieve the hydraulic pressure. Emergency gear extension must not be attempted at airspeeds in excess of 84 KIAS. An emergency gear extension knob, located directly beneath the gear selector switch is provided for this purpose. Pulling this knob releases the hydraulic pressure holding the gear in the up position and allows the gear to fall free. During normal operation, this knob is covered by a guard to prevent inadvertent extension of the gear. Before pulling the emergency gear extension knob, place the landing gear selector switch in the "DOWN" position to prevent the pump from trying to raise the gear. If the emergency gear knob has been pulled out to lower the gear by gravity, due to a gear system malfunction, leave the control in its extended position until the airplane has been put on jacks to check the proper function of the landing gears hydraulic and electrical systems. See Aircraft Service Manual for proper landing gear system check out procedures. If the airplane is being used for training purposes or a pilot check out mission, and the emergency gear extension has been pulled out, it may be pushed in again when desired if there has not been any apparent malfunction of the landing gear system.

When the gear is fully extended or fully retracted and the gear selector is in the corresponding position, electrical limit switches stop the flow of current to the motor of the hydraulic pump. The three green lights directly above the landing gear selector switch illuminate to indicate that each of the three landing gears is down and locked. A convex mirror on the left engine nacelle both series as a taxiing aid and allows the pilot to visually confirm the condition of the nose gear. If the gear is in neither the full up nor the full down position, a red warning light on the instrument panel illuminates. Should the throttle be placed in a low setting - as for a landing approach - while the gear is retracted, a warning horn sounds to alert the pilot that the gear is retracted. The gear warning horn emits a 90 cycles per minute beeping sound.

Figure 8: Landing gear extension description - Part 2. (Source: Piper PA-34-200T POH)

Findings

1. Personnel Information

1.1 The pilot had a Commercial Pilot Licence (CPL) that was initially issued on 22 October 2020. It was renewed on 22 September 2023 with an expiry date of 30 September 2024. The pilot had flown a total of 1591.1 hours of which 38.8 hours were on the aircraft type. The aircraft type was endorsed in the pilot's licence.

1.2 The pilot was issued a Class 1 aviation medical certificate on 18 September 2023 with an expiry date of 30 September 2024 with no restrictions.

2. Aircraft Information

2.1 The aircraft was issued a Certificate of Release to Service (CRS) on 20 February 2024 with an expiry date of 19 February 2025 or at 5847 Tachometer hours, whichever occurs first. The accident occurred at 5729.28 Tachometer hours, which meant that the aircraft accrued 32.28 hours since the last inspection.

2.2 The aircraft had a valid Certificate of Airworthiness (C of A) that was initially issued by the Regulator on 23 March 1991. The latest C of A was issued on 26 January 2024 with an expiry date of 31 March 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 6 June 2021.

2.4 The aircraft maintenance organisation (AMO) had a valid AMO Certificate that was issued on 31 October 2023 with an expiry date of 30 November 2024. The aircraft maintenance engineer (AME) had a valid AME Certificate that was issued on 15 June 2021 with an expiry date of 6 June 2025. The AME had an airframe rating on the aircraft type.

2.5 The 100-hour brush inspection on the landing gear motor was conducted on 14 February 2023. The next inspection was due at 63 hours.

2.6 At the AMO, the investigating team inspected the undercarriage lock mechanism and found that it operated as expected, with damage observed on the nosewheel doors. The aircraft was placed on jacks and the AMO demonstrated how the manual extension function: *The landing gears are secured in the up position by hydraulic pressure. In an emergency, the pilot must select gear down first at 85 knots or lower speed and then pull the manual extension to maximum (this position must be maintained because pushing it back will reapply the hydraulic pressure and lock it in transition). It will be difficult for the landing gears to lock; therefore, pilots are encouraged to rock the aircraft from side to side until the landing gears are down and locked and the three green lights illuminate.*

2.7 The electrical motor failed due to a hydraulic leak which softened the brushes; this resulted in imperfect contact.

2.8 The pilot did not follow the emergency landing gear extension procedure correctly as prescribed in the POH.

Probable Cause(s)

The hydraulic motor failed during normal landing gear extension and the pilot did not pull the emergency extension to maximum; this caused the landing gears to collapse.

Contributing Factor(s)

The emergency lever was activated and then reset (or pushed back) before the gear was down and locked. Pushing the lever back after being extended is an incorrect procedure.

Safety Action(s)

None.

Safety Message and/or Safety Recommendation/s

Safety Message: When faced with minor emergencies, pilots should always refer to the in-flight emergency manual to make sure that they follow the correct procedure.

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 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.

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 to apportion blame or liability.

Disclaimer

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