SOUTH AFRICAN CIVIL AVIATION AUTHORITY

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

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10181				
Classification	Accident	**Date**	29 June 2022	**Time**	1625Z
Type of Operation	Training (Part 141)				
Location					
Place of Departure	Grand Central Aerodrome (FAGC), Gauteng Province	Place of Intended Landing	Grand Central Aerodrome (FAGC), Gauteng Province		
Place of Occurrence	Runway 17, Grand Central Aerodrome (FAGC), Gauteng Province				
GPS Co-ordinates	Latitude 25° 98' 94" S	Longitude 28° 13' 96" E	Elevation 5 325 ft		
Aircraft Information					
Registration	ZS-MBY				
Make; Model; S/N	Piper PA-34-220T Seneca III (Serial Number: 34-8133020)				
Damage to Aircraft	Substantial	Total Aircraft Hours	3 403.4		
Pilot-in-command					
Licence Type	Airline Transport Pilot Licence (ATPL) Aeroplane (A)	Gender	Male	Age	30
Licence Valid	Yes	Total Hours on Type	83	Total Flying Hours	4 405.1
People On-board	2 + 0	**Injuries**	0	**Fatalities**	0	**Other (on ground)**	0

What Happened

On Wednesday evening, 29 June 2022, a flight instructor (FI) and a student pilot (SP) on-board a Piper PA-34-220T Seneca III aircraft with registration ZS-MBY departed Grand Central Aerodrome (FAGC) in Midrand, Gauteng province, on a type conversion training flight with the intention to land back at the same aerodrome. Fine weather conditions prevailed at the time of the flight. The flight was conducted under visual meteorological conditions (VMC) by night. No flight plan was filed for the flight, which was operated under the provisions of Part 141 of the Civil Aviation Regulations (CAR) 2011 as amended.

According to the FI, a short briefing was conducted with the SP prior to the flight. A pre-flight inspection was carried out in which all indications were found to be operating normally. The FI stated that the checks were completed as per the Pilot's Operating Handbook (POH) as well as the training school's circuits standard operating procedures (SOP). With the SP on the controls, the pair successfully executed three circuits and touch-and-go landings. During the fourth circuit whilst on downwind and on final approach, the same checks were completed.

The SP stated that he remembered calling out "gear down" whilst on the downwind leg and again on base leg. The final approach was stable at about 90 knots (kt). When the aircraft was over the threshold of Runway (RWY) 17 at a height of about 50 to 100 feet (ft) above ground level (AGL), the SP reduced the engine power in preparation for touch down and commenced rounding out and holding off (flaring) the aircraft.

As the aircraft flew over the threshold of RWY 17, the SP waited for the aircraft to touch down on its main landing wheels. But instead, there was a loud grinding noise from the underbelly of the aircraft with sparks on either side of the fuselage as the aircraft slid for about 90 metres (m) before it came to a halt in the middle of the runway. Both pilots reported that they did not hear the landing gear warning horn prior to landing.

The pair carried out the engine shutdown and evacuation procedures before disembarking the aircraft unassisted. As the air traffic control (ATC) service was closed for the day, the FI made a blind radio call to alert other traffic in the vicinity, as well as the aerodrome's Aircraft Rescue and Fire-fighting (ARFF) personnel that their aircraft had stopped in the middle of RWY 17.

The ARFF dispatched to the accident scene. Although there was no smell of fuel and smoke and no indication of fire, the ARFF sprayed foam on and around the aircraft as a precautionary measure. The aircraft sustained substantial damage to the underbelly, both propellers, flaps and both engines. None of the pilots was injured.

Figure 1: The aircraft post-accident. (Source: FAGC ARFF)

Findings

1. Personnel Information

1.1. The FI was reissued an Airline Transport Pilot Licence (ATPL) Aeroplane (A) on 30 May 2022 with an expiry date of 31 May 2023. The FI was reissued an Instructor Grade 2 rating on 18 October 2019 with an expiry date of 31 October 2022. The Piper PA-34 Seneca III aircraft type was endorsed on the FI's licence. A Class 1 medical certificate was issued to the FI on 27 February 2022 with an expiry date of 28 February 2023, with no restrictions. The FI was licensed and qualified for the flight in accordance with the existing regulations.

1.2. The SP was issued a Private Pilot Licence (PPL) Aeroplane (A) on 18 March 2021. At the time of the accident, the SP's PPL had expired on 30 March 2022. An application for the renewal of the pilot's licence was submitted to the South African Civil Aviation Authority (SACAA) on 27 June 2022 and was reissued on 30 June 2022 with an expiry date of 31

March 2023. The SP was not licensed for the flight in accordance with the existing regulations.

The Piper PA-34 Seneca III aircraft type was not endorsed on the SP's licence yet, as this flight was a conversion flight to the aircraft type. A Class 2 medical certificate was issued to the SP on 30 August 2021 with an expiry date of 31 August 2026 with no restrictions.

2. Aircraft Information

2.1. According to the aircraft maintenance engineer (AME) who conducted the post-accident examination of the aircraft, the landing gear toggle switch was found in the down position.

Figure 2: The arrow shows the position of the gear control switch as found post-accident. (Source: FAGC ARFF)

2.2. Before the aircraft was towed to the hangar, an engineering inspection was conducted. No fault was found with the landing gear system or landing gear warning system.

The aircraft was placed on hydraulic jacks and the main landing gears were cycled several times, with both pilots present, and the landing gear warning system operated normally. According to the AME, the three green landing gear lights illuminated, and the landing gear warning horn activated as the gear was retracted with the flaps extended. Based on the fact that the gear and warning system functioned satisfactorily, the AME deduced that gear toggle switch appeared to have been selected to the down/extended position after the accident.

Figure 3: The landing gear in a down and locked position during the test with the three green lights illuminated. (Source: Operator)

2.3. The damage to the underside of the fuselage and the absence of damage (scraping marks) to the landing gear doors and landing gear indicated that the landing gear was fully retracted during the landing phase.

Figure 4: Main landing doors were found intact with no signs of scrape marks on the outside. (Source: FAGC ARFF)

2.4. According to the aircraft's latest Certificate of Release to Service (CRS) and logbooks, the last mandatory periodic inspection (MPI) was certified on 20 April 2022 at 3 390.3 total hours. At the time of the accident, the aircraft had accumulated 3 403.4 hours and had flown a further 13.1 hours since the last MPI.

2.5. The last MPI was carried out by the aircraft maintenance organisation (AMO) with a valid approval certificate. The AME who certified the last MPI was appropriately licensed to carry out maintenance on the aircraft type.

2.6. Aircraft logbooks and maintenance history documents were reviewed. All documents were found to be in order. All applicable Service Instructions (SIs), Service Bulletins (SBs) and Airworthiness Directives (ADs) were complied with.

2.7. The aircraft had a valid Certificate of Airworthiness and was maintained in compliance with the regulations. The aircraft was airworthy when it dispatched for the flight.

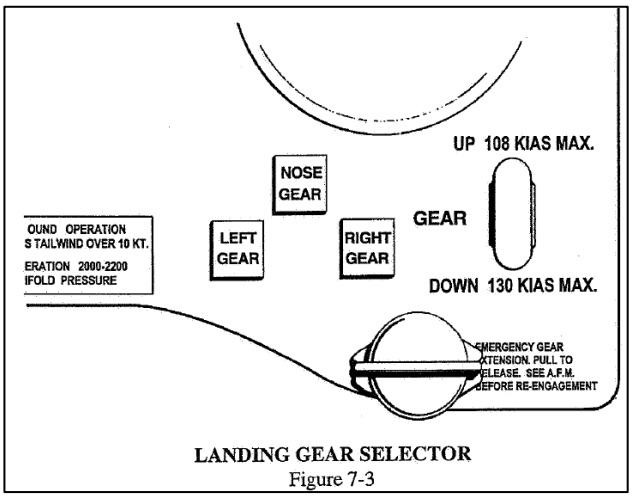
2.8. The aircraft was substantially damaged; however, the occupants did not sustain any injuries during the accident.

3. Landing Gear Information

3.1. Landing gear system overview according to *Section 7 – Description and Operation of the Aircraft and its Systems* from the *Piper 34-220T Seneca III Manual:*

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

Hydraulic pressure for gear operation is furnished by an electrically powered, reversible hydraulic pump. 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 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.



LANDING GEAR SELECTOR
Figure 7-3

The landing gear is designed to extend even in the event of hydraulic failure. When the landing gear is retracted, the main wheels retract inboard in the wings and the nose wheel retracts forward into the nose section. During gear extension, once the nose has started toward the down position, the airstream pushes against it and assists in moving it to the down locked position. After the gears are down and the down lock hooks engage, springs maintain force on each hook to keep it locked until it is released by hydraulic pressure.

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 to the left of 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 serves 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 cycle per minute beeping sound.

The green gear lights are dimmed automatically when the navigation lights are turned on. For this reason, if the navigation lights are turned on in the daytime, it is difficult to see the landing gear lights. If the green lights are not observed after the landing gear selector switch is placed in the "DOWN" position, the first thing to check is the position of the navigation lights switch.

3.2. According to Section 3 – Emergency Procedures from the *Piper 34-220T Seneca III Manual:*

3.15 LANDING GEAR UNSAFE WARNINGS

Red light indicates gear in transit.
Recycle gear if indication continues.
Light will illuminate when gear warning horn sounds at low throttle settings.

3.3. According to Section 4 – Normal Procedures from the *Piper 34-220T Seneca III Manual:*

APPROACH AND LANDING

Gear warning horn .....check
Seat backs .....erect
Belts/harness .....fasten/adjust
Fuel selectors .....ON
Cowl flaps .....as required
Auxiliary fuel pumps .....OFF
Mixture controls .....rich
Prop controls .....FULL FORWARD
Landing gear .....DOWN, 130 KIAS max.
Flaps .....set, 115 KIAS max.
Approach speed .....90 KIAS or above

APPROACH AND LANDING

Sometime during the approach for a landing, the throttle controls should be retarded to check the gear warning horn. Flying the airplane with the horn inoperative is not advisable. Doing so can lead to a gear up landing as it is easy to forget the landing gear, especially when approaching for a single-engine landing, or when other equipment is inoperative, or when attention is drawn to events outside the cabin. The red landing gear unsafe light will illuminate when the landing gear is in transition between the full up position and the down and locked position. Additionally, the light will illuminate when the gear warning horn sounds. The gear

warning horn will sound at low throttle settings (12-15 inches manifold pressure) if the gear is not down and locked.

Prior to entering the traffic pattern, the aircraft should be slowed approximately 120 KIAS, and this speed should be maintained on the downwind leg.

The landing check should be made on the downwind leg.

Select landing gear DOWN and check for the three green lights on the panel and look for the nose wheel in the nose wheel mirror. The landing gear should be lowered at speeds below 130 KIAS and flaps at speeds as follows:
10° 140 KIAS max
25° 122 KIAS max
40° 115 KIAS max

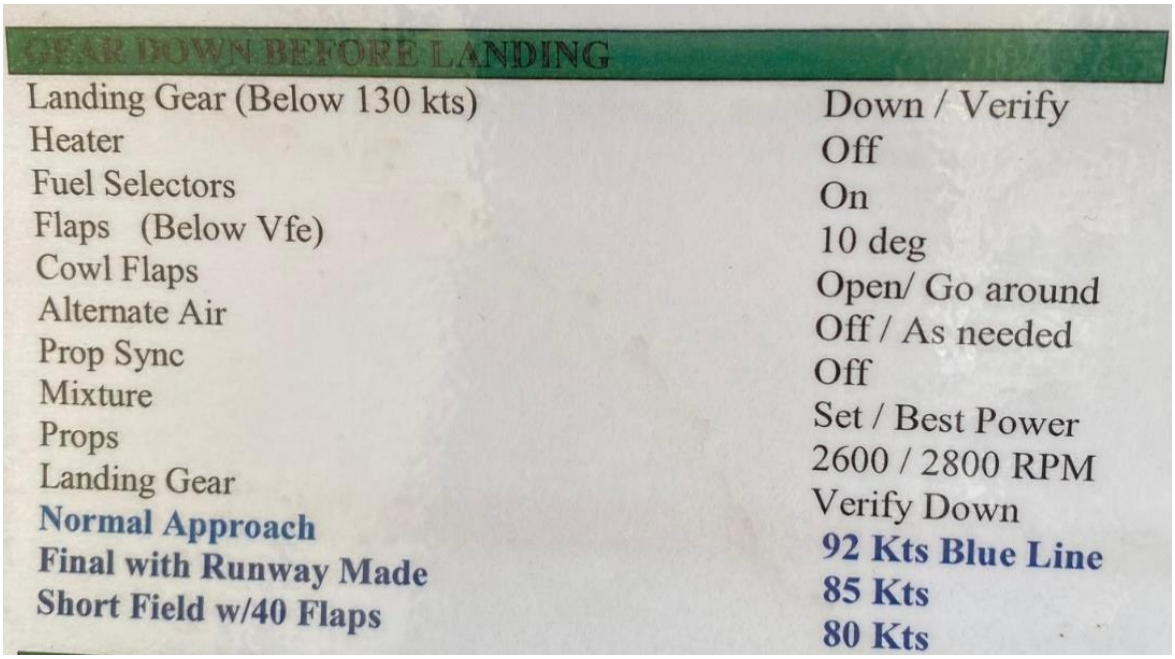
The landing gear position should be checked on the downwind leg and again on final approach by checking the three indicator lights on the instrument panel and looking at the external mirror to check that the nose gear is extended. Remember that when the navigation lights are on, the gear position lights are dimmed and are difficult to see in the daytime.

Flap position for landing will depend on runway length and surface wind. Full flaps will reduce stall speed during final approach and will permit contact with the runway at a slower speed. Good pattern management includes a smooth, gradual reduction of power on final approach, with the power fully off before the wheels touch the runway. This gives the gear warning horn a chance to blow if the gear is not locked down.

3.3.1. For pilots to be alerted that the gear is retracted, the throttle should be placed in a low setting – as for the landing approach, pilots would only be able to hear the warning horn sound at low power settings (manifold pressure of 12-15 inches).

4. Flight Operations Information

4.1. The Approved Training Organisation (ATO) had summarised the Pilot's Operation Handbook (POH) into its pilot's checklist, which contains a section on normal procedures from the Piper 34-220T Seneca III Manual:



GEAR DOWN BEFORE LANDING

Landing Gear (Below 130 kts)	Down / Verify
Heater	Off
Fuel Selectors	On
Flaps (Below Vfe)	10 deg
Cowl Flaps	Open/ Go around
Alternate Air	Off / As needed
Prop Sync	Off
Mixture	Set / Best Power
Props	2600 / 2800 RPM
Landing Gear	Verify Down
Normal Approach	**92 Kts Blue Line**
Final with Runway Made	**85 Kts**
Short Field w/40 Flaps	**80 Kts**

Figure 5: Gear down before landing procedure from the ATO's checklist. (Source: ATO)

4.2. According to the AME, it is possible that the manifold pressure was above 15 inches on approach, which would have resulted in the landing gear warning not activating.

4.3. According to the pilot, completing three circuits successfully may have led to the degradation of his situational awareness. The pilot may have suffered from a confirmation bias after completing three circuits successfully and might not have verified that the landing gear selector was down and locked on final approach as required by the POH and circuit procedures of the training school.

Confirmation bias according to https://skybrary.aero/ is: *Having expectations frequently confirmed reduces the sensitivity of the error detection mechanism. Confirmation bias is a selective process that favours information relevant to the presently held view. In essence, it is a bias towards relevant-appearing information*.

Probable Cause

The landing gear selector was not selected to the down position on final approach, which resulted in the belly landing.

Contributing Factors

1. The action of lowering the landing gear selector was only verbalised and its position not verified before landing.
2. Due to confirmation bias, the three green landing gear lights were not checked on the panel on final approach during the fourth landing.
3. The landing gear warning system did not sound when the landing gear was still retracted, possibly due to manifold pressure being above 15 inches on approach.
4. There was a lack of monitoring to ensure that the landing checklist was correctly carried out as required by the POH and circuit procedures of the school.

Safety Actions

As a result of this occurrence, the aircraft operator had advised that they had taken the following safety actions:

The pre-landing checklist was revised and reintroduced to instructors tasked with training on complex aircraft. Such changes include:

- *Checking the operation of the failsafe systems at top of descent and when joining the circuit at an aerodrome.*
- *Implementation of thorough training and checking the proficiency of all instructors and their knowledge of the aircraft built-in fail-safe systems. This would be incorporated during the instructors' Pilot Proficiency Checks (PPCs) on a biannual basis.*

Safety Message

This incident provides a good example of the importance of checklist vigilance. Checklists are designed to ensure that flight crews properly configure the aircraft for any given phase of flight. Regular routine flying can lead to checklists being conducted mentally without actually actioning them. Vigilance is required to ensure that each checklist is completed correctly and in full.

About this Report

Decisions regarding whether to investigate, and the scope of an investigation are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited scope, fact gathering investigation was conducted to compile this limited report and allow for greater industry awareness of potential safety issues as well as possible safety action/s that the industry might want to consider in preventing a reoccurrence.

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 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****.*

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.

Disclaimer

This report is issued by:

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