AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:		**CA18/2/3/10033**	
Aircraft Registration	**ZS-KFG**	**Date of Accident**	26 August 2021			**Time of Accident**	0900Z
Type of Aircraft	Piper Seneca II (PA-34-200T)			**Type of Operation**		Training (Part 141)	
Pilot-in-command Licence Type	Commercial Pilot Licence (CPL)			**Age**	26	**Licence Valid**	Yes
Pilot-in-command Flying Experience		**Total Flying Hours**		1 255.4		**Hours on Type**	78.8
Last Point of Departure	Springs Aerodrome (FASI), Gauteng Province						
Next Point of Intended Landing	Springs Aerodrome (FASI), Gauteng Province						
Damage to Aircraft	Substantial						
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)							
Runway (RWY) 21 at FASI at Global Position System (GPS) co-ordinates determined to be 26˚14'51.86" South 028˚23'51.57" East, at elevation 5 340 feet (ft)							
Meteorological Information	Wind 320˚ at 11kt, Temperature 19˚C, Dew point 06˚, Visibility 9999m						
Number of People On-board	1+1	**Number of People Injured**	0	**Number of People Killed**	0	**Other (On Ground)**	0

Synopsis

On 26 August 2021, a student pilot and an instructor on-board a Piper Seneca II (PA-34-200T) aircraft with registration ZS-KFG took off on a multi-engine type conversion training from Springs Aerodrome (FASI) to the general flying area (GFA) Hotel Golf Victor (HGV), which falls under the Johannesburg Special Rules South very high frequency omni-directional range (VOR) beacon. The duo intended to return to FASI after training. The flight was conducted under the provisions of Part 141 of the Civil Aviation Regulations (CAR) 2011 as amended. Clear weather conditions prevailed at the time of the flight.

The student pilot stated that all was normal during the final approach for landing on Runway (RWY) 21. He stated that the landing gear down and locked indication lights on the instrument panel had illuminated and the gears were cross-checked on the side mirror. The aircraft touched down a few metres beyond the runway threshold; however, approximately 3 seconds later during the landing roll, the nose gear collapsed. Both propellers struck the runway and the aircraft skidded on its nose section for approximately 282 metres (m) from the first propeller strike. Neither the student pilot nor the instructor applied the toe brakes to try stop the aircraft from skidding. The aircraft was substantially damaged. The student pilot and the instructor were not injured.

Probable Cause

The aircraft landed whilst the main landing gears were not in the down and locked position, which resulted in the failure of the nose gear down lock link assembly. This led to the nose gear collapse during the landing roll.

Contributory Factors

- Landing with unsafe gear.
- Inadequate maintenance due to service manual instructions not carried out.
- Hard landings not recorded.

SRP Date	14 March 2023	Publication Date	30 March 2023

Occurrence Details

Reference Number	**:** CA18/2/3/10033
Occurrence Category	**:** Category 1
Type of Operation	**:** Part 141
Name of Operator	**:** Mach 1 Aviation
Aircraft Registration	**:** ZS-KFG
Aircraft Make and Model	**:** Piper PA-34 200T Seneca II
Nationality	**:** South African
Registration	**:** ZS-KFG
Place	**:** Springs Aerodrome (FASI)
Date and Time	**:** 26 August 2021 at 0900Z
Injuries	**:** None
Damage	**:** Substantial

Purpose of the Investigation

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.

Investigation Process

The Accident and Incident Investigations Division (AIID) of the South African Civil Aviation Authority (SACAA) was notified of the occurrence on 26 August 2021 at 1119Z. The occurrence was classified as an accident according to the CAR 2011 Part 12 and ICAO STD Annex 13 definitions. Notification was sent to the State of Registry/Operator/Design/Manufacturer in accordance with CAR 2011 Part 12 and ICAO Annex 13 Chapter 4. The State of Manufacturer did not appoint an accredited representative and advisor. The investigator was not dispatched to the accident site for this occurrence.

Notes:

1. *Whenever the following words are mentioned in this report, they shall mean the following:*
   Accident — this investigated accident
   Aircraft — the Piper Seneca II PA-34-200Tinvolved in this accident
   Investigation — the investigation into the circumstances of this accident
   Pilot — the pilot involved in this accident
   Report — this accident report

2. *Photos and figures used in this report were taken from different sources and may have been adjusted from the original for the sole purpose of improving clarity of the report. Modifications to images used in this report were limited to cropping, magnification, file compression; or enhancement of colour, brightness, contrast; or addition of text boxes, arrows, or lines.*

Disclaimer

Table of Contents

Abbreviation	Description
°	Degrees
°C	Degrees Celsius
AD	Airworthiness Directive
AIID	Accident and Incident Investigations Division
AME	Aircraft Maintenance Engineer
AMO	Aircraft Maintenance Organisation
ATO	Approved Training Organisation
C of A	Certificate of Airworthiness
C of R	Certificate of Registration
CPL	Commercial Pilot Licence
CRS	Certificate of Release to Service
CVR	Cockpit Voice Recorder
FAA	Federal Aviation Administration
FAOR	O.R. Tambo International Airport
FASI	Springs Aerodrome
FDR	Flight Data Recorder
ft	Feet
GFA	General Flying Area
GPS	Global Positioning System
hPa	Hectopascal
HGV	Hotel Golf Victor
KIAS	Knots Indicated Airspeed
KM	Kilometre
kt	Knots
m	Metres
METAR	Meteorological Aerodrome Report
MHz	Megahertz
MPI	Mandatory Periodic Inspection
NLG	Nose Landing Gear
nm	Nautical Mile
NOSIG	No Significant
NTSB	National Transportation Safety Board
PIC	Pilot-in-command
PPL	Private Pilot Licence
QNH	Query Nautical Height
RWY	Runway
RPM	Revolutions per Minute
SACAA	South African Civil Aviation Authority
SAWS	South African Weather Service
SB	Service Bulletin
TBO	Time Between Overhauls
VHF	Very High Frequency
VOR	Very High Frequency Omni-Directional Range
QNH	Altitude Above Mean Sea Level
Z	Zulu (Term for Universal Co-ordinated Time - Zero Hours Greenwich)

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1. On 26 August 2021, a student pilot and an instructor on-board a Piper Seneca II PA-34-200T aircraft with registration ZS-KFG took off on a multi-engine type conversion training from Springs Aerodrome (FASI) to the general flying area (GFA) Hotel Golf Victor (HGV), which falls under the Johannesburg Special Rules South very high frequency omni-directional range (VOR) beacon. The duo intended to return to FASI. The flight was conducted under the provisions of Part 141 of the Civil Aviation Regulations (CAR) 2011 as amended. Clear weather conditions prevailed at the time of the flight.

1.1.2. The instructor stated that after take-off from Runway (RWY) 21, they routed to HGV. The instructor broadcasted their intentions on the very high frequency (VHF) radio 125.6 Megahertz (MHz). They then conducted simulated landing exercises in the GFA. Upon completion of the exercises, they routed north, making their way back to FASI. The instructor stated that whilst inbound at FASI there was another aircraft in the circuit. They then carried out an unmanned joining procedure on right downwind which included landing gear cycling. The three-landing gear green lights had illuminated on the instrument panel, indicating that the landing gears were in the down and locked position. There were no warning lights on the instrument panel. The student pilot cross-checked the gears if they were in the down position using the side mirror. The approach for RWY 21 was stable with the airspeed in the blueline arc (or 90 knots) and the flap setting of 25°. The instructor further stated that there was a slight 10 knots crosswind from the right.

1.1.3. The student pilot was the pilot flying. He stated that after touchdown a few metres (m) beyond the threshold, the nose gear collapsed and both propellers struck the runway surface which caused the aircraft to skid on its nose section for approximately 282m from the first propeller strike. The student pilot and the instructor did not apply the toe brakes to stop the aircraft from skidding.

1.1.4. The aircraft was substantially damaged during the accident sequence. The student pilot and the instructor were not injured.

1.1.5. During recovery of the aircraft, the main landing gears were not in the “locked” position (not engaged). Therefore, the aircraft was placed on jacks and inspected. It was confirmed that the main landing gears down locks were not engaged, evidenced by the oleo strut which was swinging sideways. The emergency gear extension was then engaged and the landing gears were pumped to the down and locked position. As a precaution, the main landing gear drag braces were secured by attaching steel rods/locking wire and the aircraft was pushed to the

hangar. There was no trace of hydraulic leak on the hydraulic system and on the tarmac post-accident.

1.1.6. The accident occurred on RWY 21 at FASI at Global Positioning System (GPS) co-ordinates determined to be 26˚14'51.86" South 028˚23'51.57" East, at an elevation of 5 340 feet (ft).

Figure 1: Overlay of the aerodrome and location of the accident. (Source: Google Earth)

1.2. Injuries to Persons

Injuries	Pilot	Crew	Pass.	Total On-board	Other
Fatal	-	-	-	-	-
Serious	-	-	-	-	-
Minor	-	-	-	-	-
None	2	-	-	2	-
Total	**2**	**-**	**-**	**2**	**-**

Note: Other means people on the ground.

1.3. Damage to Aircraft

1.3.1. The aircraft was substantially damaged.

Figure 2: The damaged nose section.

1.4. Other Damage

1.4.1. None.

1.5. Personnel Information

1.5.1 Instructor

Nationality	Libyan	Gender	Male	Age	26
Licence Type	Commercial Pilot Licence (A)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Instrument and flight instructor Grade 2				
Medical Expiry Date	31 December 2021				
Restrictions	None				
Previous Accidents	None				

Note: Previous accidents refer to past accidents the pilot was involved in, when relevant to this accident.

Flying Experience:

Total Hours	1 255.4
Total Past 24 Hours	3.3
Total Past 7 Days	9.5
Total Past 90 Days	87.5
Total on Type Past 90 Days	59.7
Total on Type	78.8

1.5.2 The instructor was issued a Commercial Pilot Licence (CPL) on 29 March 2021 with an expiry date of 30 March 2022. The conversion on type was done on 22 November 2016 and a total

of 14.2 hours were flown, according to the entry in the logbook. The initial instructor training was carried out on 23 November 2017; it was renewed on 29 March 2021 with an expiry date of 31 March 2024. The instructor had a Grade 2 instructor licence. The instructor was also issued a Class 1 medical certificate on 3 December 2020 with an expiry date of 31 December 2021 with no medical waiver.

1.5.3 Student Pilot

Nationality	Indian	Gender	Male	Age	24
Licence Type	Private Pilot Licence (A)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Night rating				
Medical Expiry Date	13 July 2026				
Restrictions	None				
Previous Accidents	None				

Flying Experience

Total Hours	203
Total Past 24 Hours	1.8
Total Past 7 Days	13.3
Total Past 90 Days	21
Total on Type Past 90 Days	3.5
Total on Type	3.5

1.5.4 The student pilot was issued a Private Pilot Licence (PPL) on 7 September 2020 with an expiry date of 30 August 2021. The student pilot was in the process of acquiring a type conversion and had accumulated 3.5 hours. The student pilot was issued a Class 2 medical certificate on 13 July 2021 with an expiry date of 13 July 2026 with no medical waiver.

1.5.5 The student pilot had a dispensation letter (extension on the licence) issued by the Regulator (SACAA) on 14 July 2021 for a period of 30 days (1 September 2021 to 30 September 2021).

1.5.6 Aircraft Maintenance Engineer (AME)

Nationality	South African	Gender	Male	Age	46
Licence Type	Category A&C (airframe and engine)				
Licence Valid	Yes	Type Endorsed	Yes		
Issue and Expiry date	8 February 2021		10 April 2023		

1.5.7 The aircraft maintenance engineer (AME) was issued an AME licence on 8 February 2021 with an expiry date of 10 April 2023. The aircraft type (PA34 series) was endorsed on his licence.

1.6. Aircraft Information

1.6.1. *The Piper PA-34-200T 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. The pump is activated by a two-position gear selector switch located to the left of the control quadrant on the instrument panel. 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 extracted; when it is exerted in the other direction, the gear is extended. Gear extension or retraction normally takes six to seven seconds. When the gear is fully extended or fully retracted and the gear selector is in the corresponding position, electrical limit switch stops 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 down position, a red warning light on the instrument panel illuminates. Should the throttle be placed in a low setting as for 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.*

Airframe:

Manufacturer/Model	Piper Aircraft Corporation	
Serial Number	34-7870276	
Year of Manufacture	1978	
Total Airframe Hours (At Time of Accident)	5 167.2	
Last Inspection (Date & Hours)	20 August 2021	5 157.7
Airframe Hours Since Last Inspection	9.5	
CRS Issue Date	20 August 2021	
C of A (Last Issue Date & Expiry Date)	15 July 2021	31 July 2022
C of R (Issue Date) (Present Owner)	20 July 2019	
Operating Category	Part 141	
Type of Fuel Used	Avgas 100LL	
Previous Accidents	None	

Note: Previous accidents refer to past accidents the aircraft was involved in, when relevant to this accident.

Engine 1:

Manufacturer/Model	Continental/T510-360-KB113 CEB
Serial Number	811268-R
Part Number	LTSIO-360-KB CEB
Hours Since New	1 105.2
Hours Since Overhaul	TBO not reached

Engine 2:

Manufacturer/Model	Continental/L510-360-KB-CEB
Serial Number	812003-R
Part Number	LTSIO-360-KB CEB
Hours Since New	1 105.2
Hours Since Overhaul	TBO not reached

Propeller 1:

Manufacturer/Model	Hartzell
Serial Number	AN4523
Part Number	BHC-C2YF-2KLUF
Hours Since New	5 157.7
Hours Since Overhaul	544.8

Propeller 2:

Manufacturer/Model	Hartzell
Serial Number	ANH4103
Part Number	BHC-C2YF-2KLUF
Hours Since New	5 157.7
Hours Since Overhaul	531.3

1.6.2 According to the scheduled maintenance page of the airframe logbook, there were new items (pressure plate and back plate, main gear tyres, linings, nose wheel bearings and vacuum inlet filters) which were fitted during the mandatory periodic inspection (MPI). These items were not recorded in the material part list that forms part of the work pack.

1.6.3 According to the airframe logbook and flight folio, there were no recorded hard landings and no evidence relating to this information.

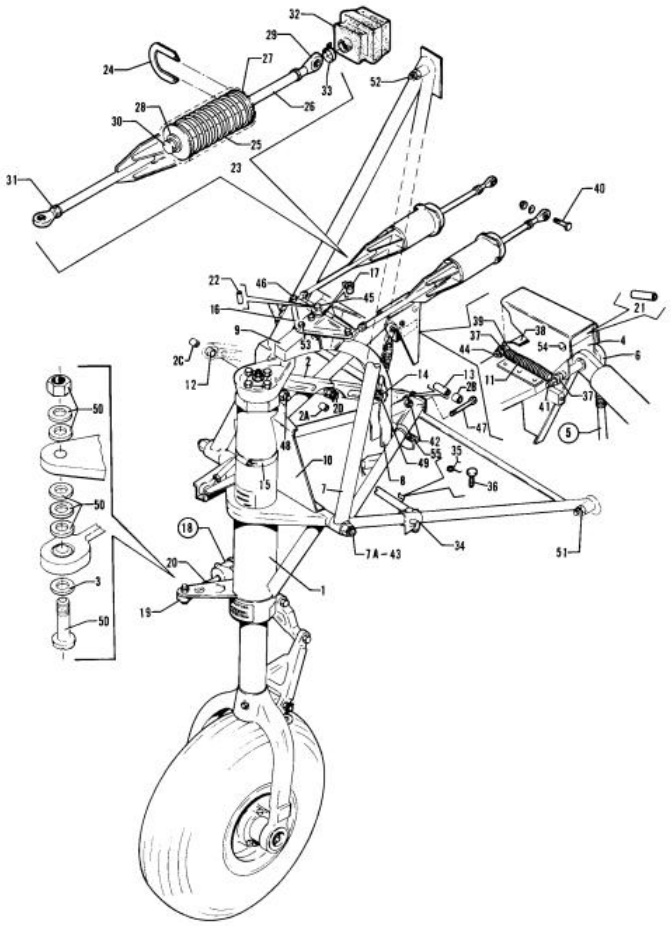

Figure 42. Nose Gear Installation

REVISED: MAY 1983

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PA-34-200T

Illustration 1: Nose gear installation schematics. (Source: Illustrated Parts Catalogue)

1.7. Meteorological Information

1.7.1. The weather information below was obtained from the Meteorological Aerodrome Report (METAR) that was issued by the South African Weather Service (SAWS) recorded on 26 August 2021 at 0900Z at O.R. Tambo International Airport (FAOR), located 11 nautical miles (nm) from the accident site.

METAR: FAOR 260900Z 32011KT 290V300 CAVOK 19/06 Q1026 NOSIG

Wind Direction	320°	Wind Speed	11kts	Visibility	9999m
Temperature	19°C	Cloud Cover	Nil	Cloud Base	Nil
Dew Point	06°C	QNH	1026hPa		

1.8. Aids to Navigation

1.8.1. The aircraft was equipped with standard navigational equipment as approved by the Regulator (SACAA). There were no records indicating that the navigation system was unserviceable prior to the accident.

1.9. Communication

1.9.1. The aircraft was equipped with a standard communication system as approved by the Regulator. There were no recorded defects with the communication system prior to the accident.

1.10. Aerodrome Information

Aerodrome Location	Springs, Gauteng Province
Aerodrome Status	Unlicensed
Aerodrome GPS co-ordinates	26˚14’51.86” South 028˚23’51.57” East
Aerodrome Elevation	5 340 ft
Runway Headings	03/21
Dimensions of Runway Used	1 600m x 18m
Heading of Runway Used	21
Surface of Runway Used	Asphalt
Approach Facilities	End of runway light
Radio Frequency	122.4 MHz

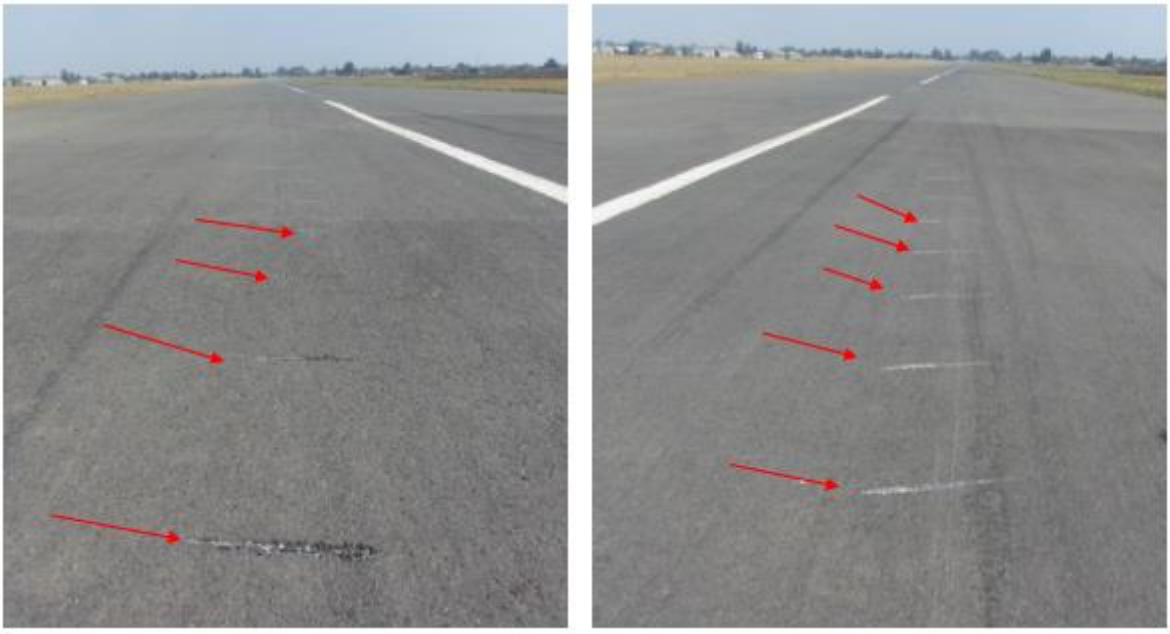
1.11. Flight Recorders

1.11.1. The aircraft was not equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR), nor was it required by regulation to be fitted to the aircraft type.

1.12. Wreckage and Impact Information

1.12.1. The aircraft touched down just after the threshold of Runway 21 at FASI. During the landing roll, the nose wheel collapsed which caused all four blades of the propellers to contact the ground and, as a result, curled (folded) inward.

1.12.2. As evidenced by the propeller marks on the asphalt runway surface, the first impact marks of both propeller tips were approximately 255m from the runway threshold. Both propeller tip marks continued for approximately 20m. Towards the end of the propeller tip marks on the runway, the nose cone contacted the runway surface and the aircraft skidded on its nose cone and propeller tips for a further 282m before it came to a halt just after the second taxiway intersection. The distance from the threshold to the end of the nose cone scraping marks was 557m.



Figures 3 and 4: Arrows showing the left- and right-side propeller tip marks on the asphalt runway.

Figure 5: Left- and right-side propeller assemblies.

Figure 6: The propeller tip with scrape marks.

Figure 7: Final resting position of the aircraft. (Source: ATO)

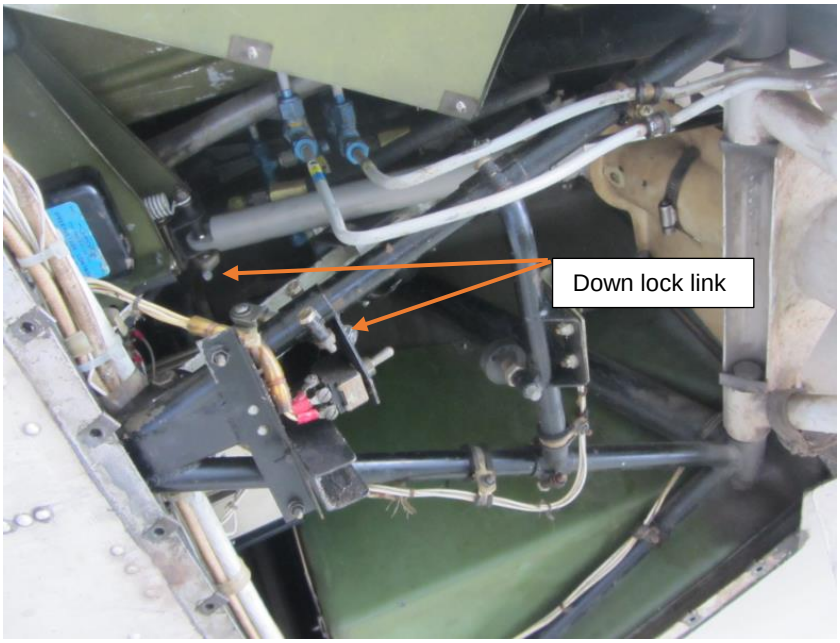


Figure 8: Location of the down lock link.

1.13. Medical and Pathological Information

1.13.1. None.

1.14. Fire

1.14.1. There was no evidence of a pre- or post-impact fire.

1.15. Survival Aspects

1.15.1. The accident was considered survivable because the fuselage and the cockpit structures were still intact. Both occupants had made use of the aircraft's safety harnesses.

1.16. Tests and Research

1.16.1 The aircraft maintenance organisation (AMO) engineers recovered the aircraft to the Aviation Training Organisation's (ATO's) hangar. During recovery, it was discovered that the main landing gears were unstable when the aircraft was moved. This was an indication that they were not in the "locked" position. The aircraft was then placed on jacks, thereafter, the emergency extension was selected using the hand pump, and the down locks were engaged. The landing gears were immobilised by attaching a steel rod on the extension/retraction links.

1.16.2. The University of Pretoria conducted an analysis on the down lock link assembly. Based on the University of Pretoria's Failure Analysis Report (FA-0012-02-22) for the fractured Down Lock Link Assembly for the ZS-KFG aircraft, the following was found:

1.16.2.1 *Down Lock Link Assembly Failure Analysis Results*

The visual inspection revealed a fracture within the threaded section of the down lock link rod end shown by the yellow arrows in Figure 9 (Schematic left and Image right). The location of the fracture is shown by the blue arrow in Figure 10.

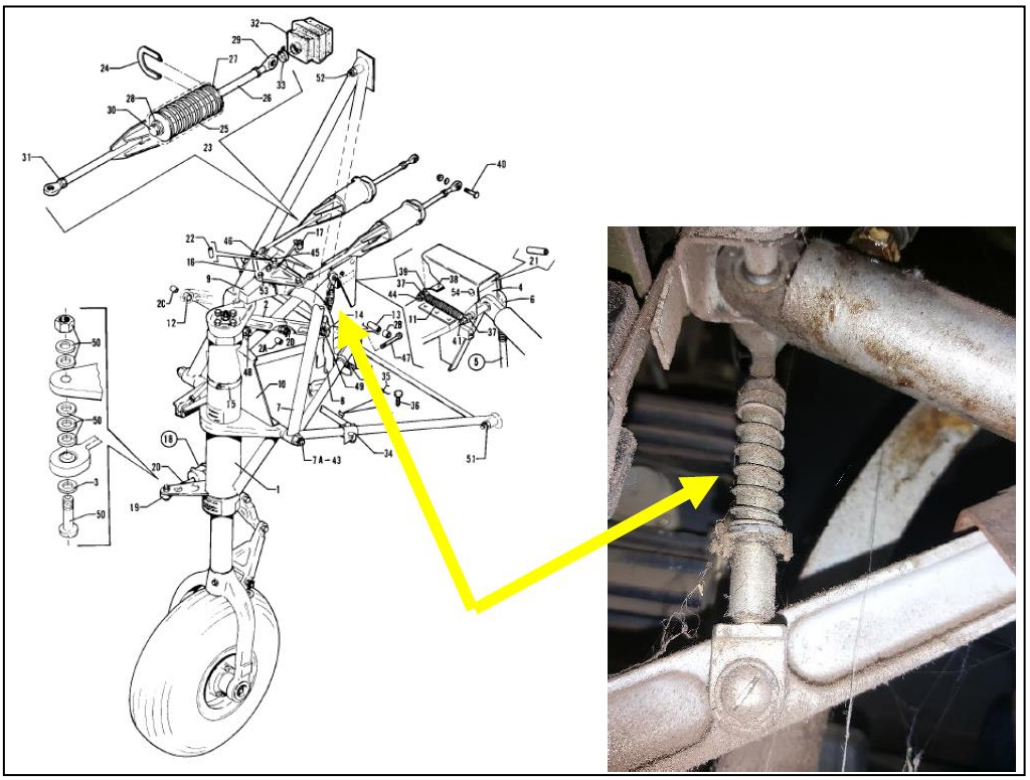


Figure 9: Nose Gear assembly, fitment of Down Lock Link ASSY showed.
(Picture taken from a serviceable aircraft)

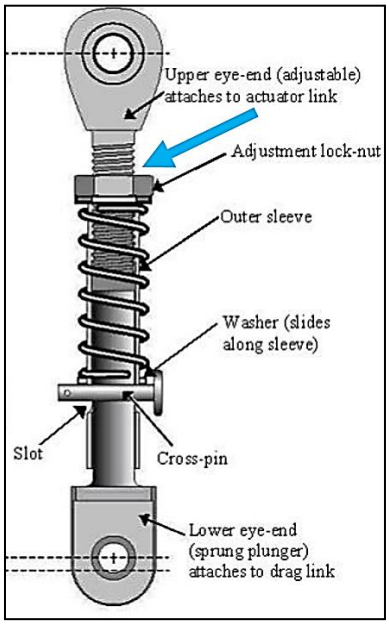


Figure 10: Schematic of a Down Lock Link assembly (blue arrow indicating location of failure at the threaded area). (Source: Metallurgy report)

1.16.2.2 At lower magnifications using the Stereomicroscope, the corresponding fracture surface morphologies revealed no clear indications of pre-existing corrosion-, fatigue- or metal inclusion induced fracture initiation/s (Figure 11).

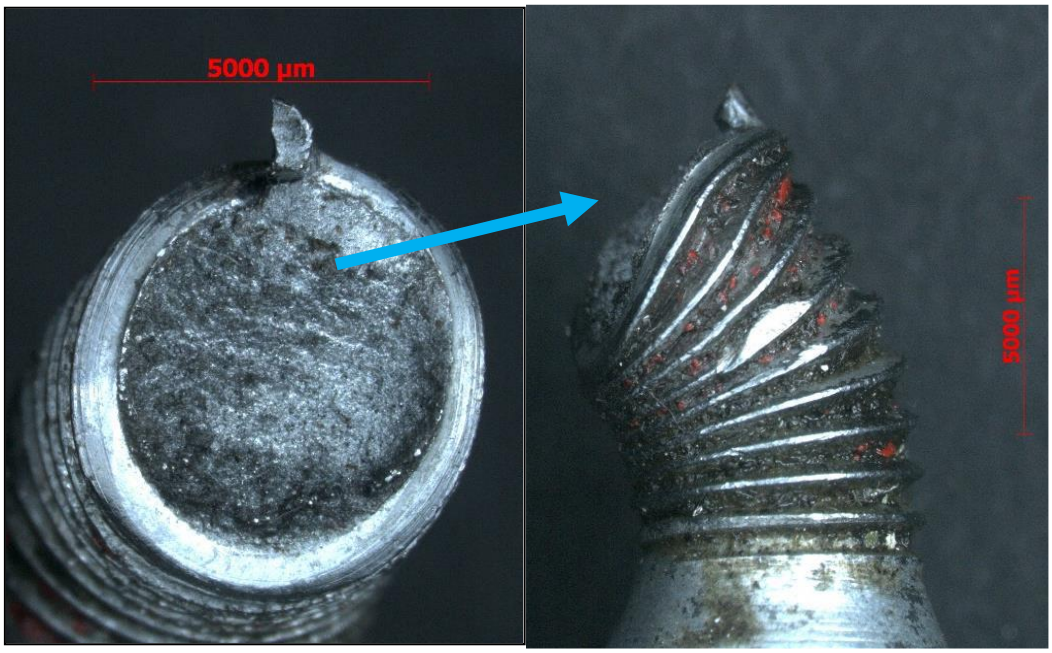


Figure 11: Fracture surface morphology and side view of the threaded section of the failed upper-eye rod end observed under the Stereomicroscope. (Source: University of Pretoria Failure Analysis Report)

1.16.2.3 The threaded section just adjacent to the locknut revealed extensive bending damages which resulted in secondary fracture formation within the thread root areas (Figure 12). This is indicative of a single overload (compression) bending event caused by the unlocking of the upper draglink during operation allowing for the noted compression load applied to the Down Lock Link ASSY.

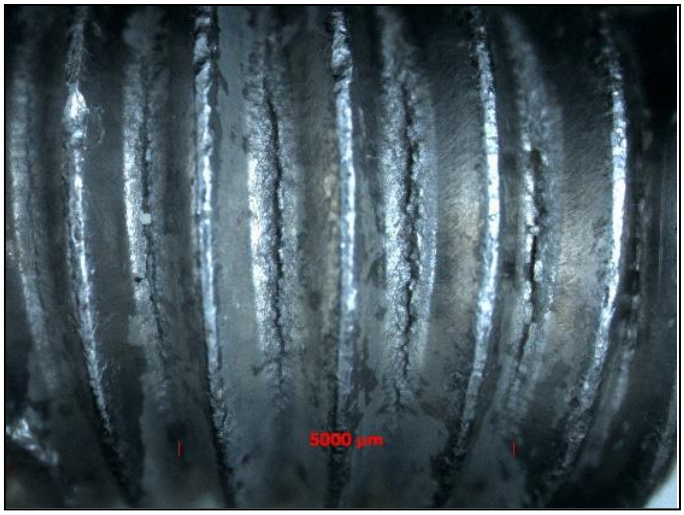


Figure 12: Bending damages on the threaded section, secondary fracture initiations of the failed upper-eye rod end observed under the Stereomicroscope. (Source: University of Pretoria Failure Analysis Report)

*1.16.2.4 At higher magnifications, the corresponding fracture surfaces revealed no indication/s of pre-existing fracture initiation/s (Figure 13 **(a** and **b**) while the surfaces correspond with a typical micro-void coalescence morphology with indications of ductile shear.*

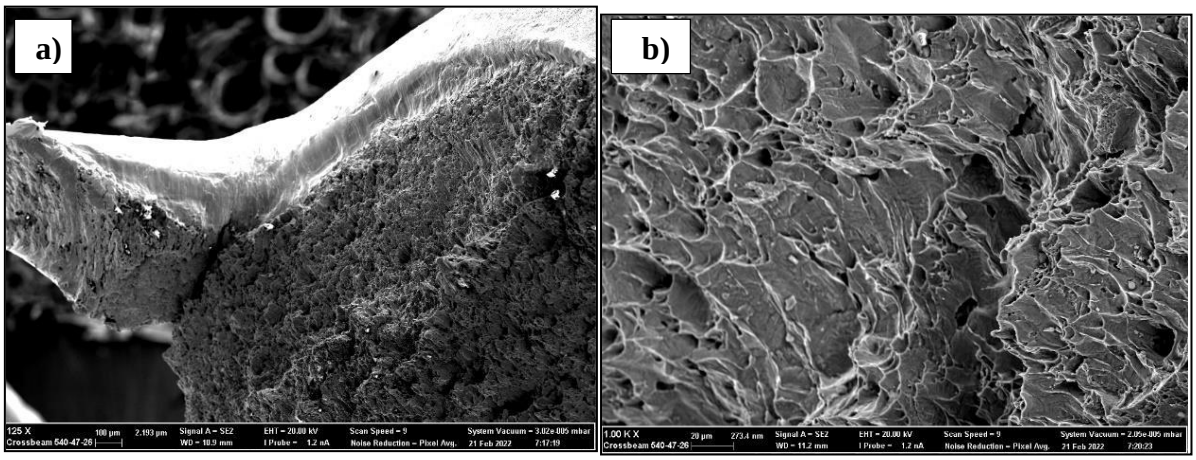


Figure 13: a) Fracture surface morphology (85-125X, 20kV, SE, FEGSEM). **b)** Fracture surface morphology (1000-1500X, 20kV, SE, FEGSEM) (Source: UP Microscopy Laboratory)

1.16.3 The down lock link inside diameter of the upper eye end, pin slot and lower eye end were measured.

- Upper rod end was measured to be 0.189 inches.
- Pin slot was measured to be 0.191 inches.
- Lower eye end was measured to be 0.190 inches.

1.16.4 According to the service bulletin (SB), the measurement limits are as follows.

Service Wear Limits

	Part Description	ID Wear Limits	
		Min.	Max.
1.	Drag Link Upper Bushing	0.562	0.564
2.	Drag Link Center Bushing	0.375	0.377
3.	Drag Link Lower Bushing	0.438	0.442
4.	Trunnion Pivot Bushings	0.500	0.503
5.	Steering Arm Center Pivot Bushings	0.375	0.377

	Part Description	ID Wear Limits	
		Min.	Max.
6.	Steering Arm Center Pivot Sleeve	0.250	0.253
7.	Down Lock Link Bushing	0.251	0.253
8.	Actuator Mount Bracket	0.250	0.252
9.	Down Lock Link Rod End	0.190	0.192

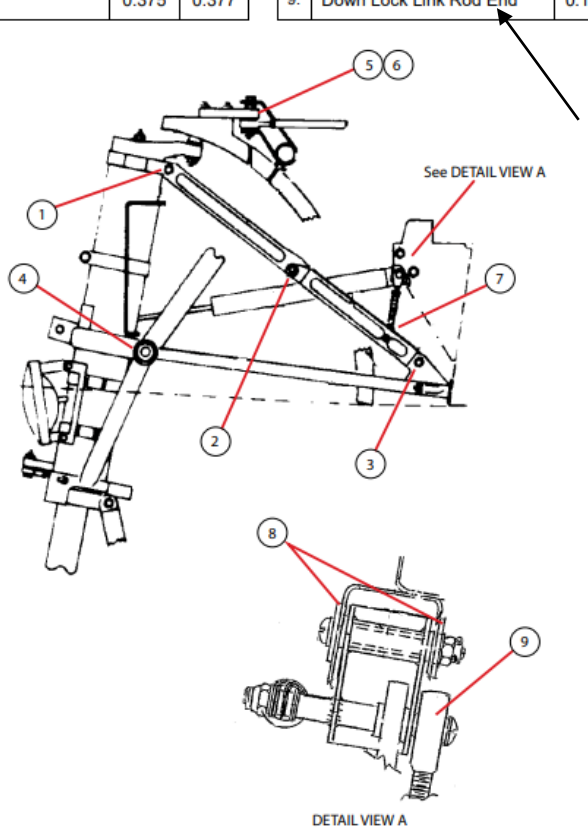


Figure 2
Service Wear Limit Locations

Illustration 2: Nose gear schematics (Source: SB 1123C)

1.17. Organisational and Management Information

1.17.1. This was a training flight conducted under the provisions of Part 141 of the CAR 2011 as amended.

1.17.2. The ATO was issued an ATO certificate on 17 June 2020 with an expiry date of 30 June 2025.

1.17.3. The AMO which carried out the last MPI was in possession of an AMO certificate that was issued on 5 August 2021 with an expiry date of 31 July 2022.

1.18. Additional Information

1.18.1. Approach and landing (Source Piper Seneca Pilot's Operating Handbook [POH])

Gear warning horn	*Check*
Airspeed	*98 KIAS on downwind leg*
Seat backs	*erect*
Seat belts and harness	*fastened/adjust*
Fuel selectors	*ON*
Cowl flaps	*as required*
Auxiliary fuel pumps	*OFF*
Mixture controls	*set*
Propellers	*2250 RPM*
Landing gear	*Down, 127 KIAS max*
Flaps	*set as required*
Airspeed	*97 KIAS on base leg, 87 KIAS on final*

On close final

Power	*reduced*
Prop. Controls	*full FORWARD*
After landing	

Clear of runway

Flaps	*retract*
Cowl flaps	*fully OPEN*
Alternate air	*OFF*

1.18.2 Description of the landing gear system:

The PA34-200T airplane is equipped with a retractable tricycle air-oil strut type landing gear, hydraulically powered reversible pump. A selector switch in the instrument panel to the left of the control quadrant is used to select UP or Down position. Gear positions are indicated by green lights directly above the selector switch when the gear is down and locked, and a red light at the top of the instrument panel when the gear is unsafe. Activation of all three down lock switches shut the hydraulic pump off. As the instrument lights are turned on the green lights will dim. As manifold pressure drops below 14 inches of mercury, and if the landing gear has not been extended, a throttle switch located in the quadrant will actuate a warning horn indicating to the pilot the landing gear is still up. The warning horn will continue to operate until the landing gear is down and locked, at which time three green lights on the instrument panel will energize. The nose and main gear require no assist springs. Once the gears are down and down lock hooks engage, a spring maintains pressure on each hook in the locked position until released by hydraulic pressure.

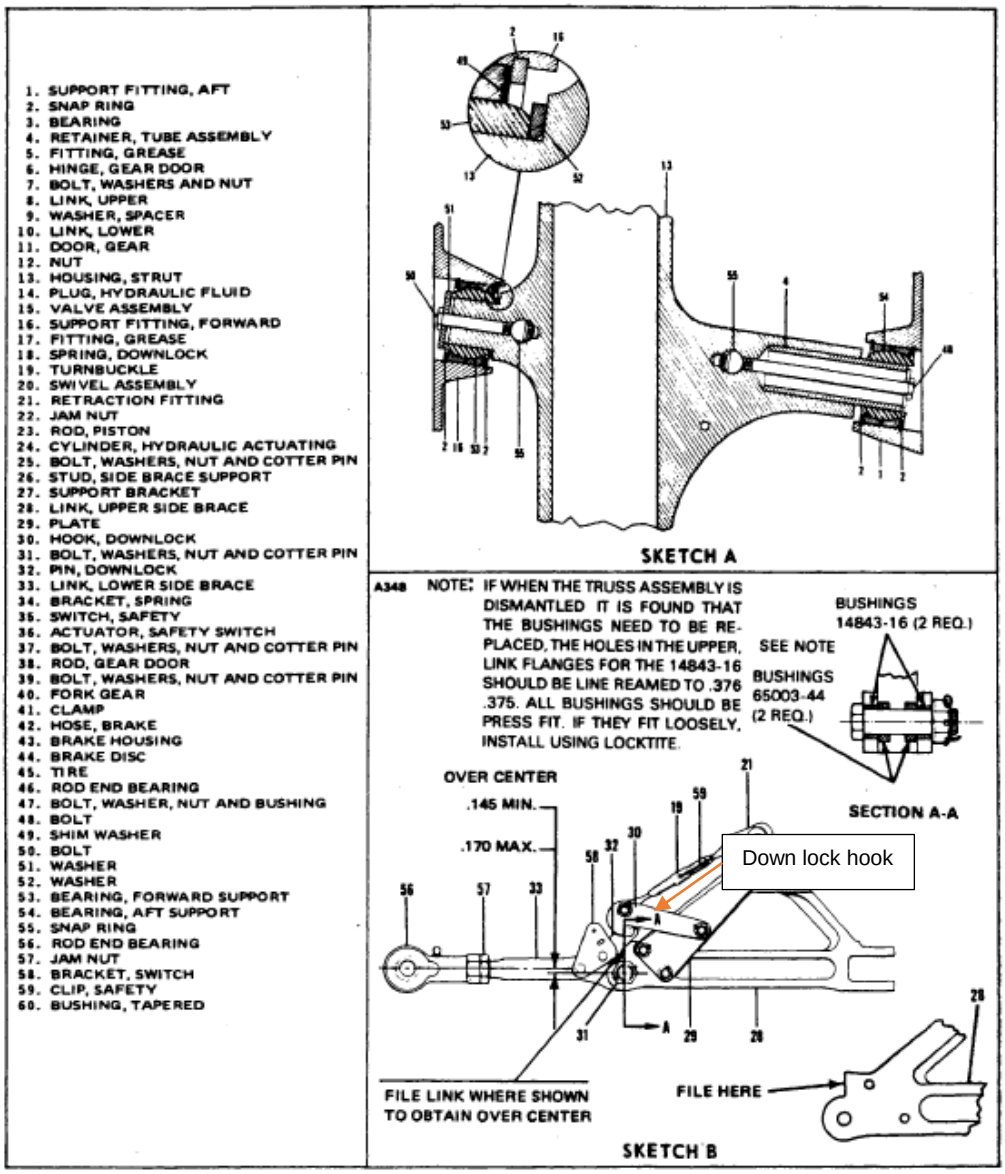


Diagram 2: Main gear installation.

1.19. Useful or Effective Investigation Techniques

1.19.1. None.

2. ANALYSIS

2.1. General

From the available evidence, the following analysis was made with respect to this accident. This shall not be read as apportioning blame or liability to any organisation or individual.

2.2. Analysis

2.2.1. Man

The instructor was issued a CPL on 29 March 2021 with an expiry date of 30 March 2022.

The conversion on type was carried out on 22 November 2016. According to the logbook

entry, a total of 14.2 hours were flown on the aircraft. The initial instructor training was conducted on 23 November 2017; it was renewed on 29 March 2021 with an expiry date of 31 March 2024. The instructor had a Grade 2 instructor licence. He was issued a Class 1 medical certificate on 3 December 2020 with an expiry date of 31 December 2021 with no medical waiver.

The student pilot was issued a PPL on 7 September 2020 with an expiry date of 30 August 2021. The student pilot was in the process of acquiring a type conversion and had accumulated 3.5 hours. The student pilot was issued a Class 2 medical certificate on 13 July 2021 with an expiry date of 13 July 2026 with no medical waiver.

The student pilot stated that during final approach, all was normal and that the instrument panel had three greens (indicating that the landing gear was down and locked). The student pilot also cross-checked on the side mirror that the landing gears were down. The aircraft touched down a few metres from the threshold, and approximately 3 seconds later, the nose gear collapsed.

The AME was issued an AME licence on 8 February 2021 with an expiry date of 10 April 2023. The aircraft type (PA34 series) was endorsed on his licence.

2.2.2 Machine

The MPI was carried out on 20 August 2021 at 5 157.7 airframe hours (1 095.8 Hobbs meter reading). The Certificate of Release to Service (CRS) was issued by the AMO on the same day with an expiry date of 20 August 2022 or at 5257.7 airframe hours (1 195.8 Hobbs meter reading), whichever comes first. During the MPI, there were defective items that required to be changed. The defects were outlined on the defect sheet. The rectification of the defects as presented on the material part list did not correlate with items on the defect sheet. There were some items which were in the material part list that were not snagged on the defect sheet. Moreover, the inspection that was carried out to ensure that the rigging for the nose gear was within limits was not conducted according to the maintenance manual, and the service bulletin (SB) 1123C was not complied with. The measurement values were not recorded and this was not in line with CAR Part 43.03.1 (1d)

The AMO did not comply with the requirements of the SB 1123C and this was found to be unsatisfactory. The values for the rigging of the nose gear as required by inspection instruction number G39 were not found. It is not known if at the time of the MPI the nose gear rigging was within limits. Damage sustained by the nose gear after the nose landing gear collapse made it difficult for the investigator to verify the rigging. The inspection instruction also called for lubrication of the nose gear hardware. The nose gear hardware was lubricated

in accordance with the service manual instruction. During the recovery of the aircraft, the landing gears were unstable. The down lock hooks were not engaged, which indicated that the gear was unsafe. It is likely that the aircraft touched down while the landing gears were in transit. There was no trace of hydraulic leak on the hydraulic systems (pipes and cylinders) as well as on the tarmac. The damage sustained by the nose landing gear down lock link assembly was attributed to the gears that were unsafe during landing. The nose landing gear does not bear any load; thus the fracture was instantaneous.

2.2.3 Environment

The weather was considered not a factor to this accident.

2.2.4 Investigation

The down lock link assembly was examined by an external entity to determine the failure mode. The examination revealed that the fracture was due to an exceedingly high compression load. The load was most probably imposed when the upper drag link went off centre during operation, causing the drag link to fold in an upward direction. The threaded section revealed extensive bending load damage which formed secondary fracture within the root area. There was no pre-existing corrosion, fatigue or metal inclusion induced fracture initiations. The following contributing factors were outlined: (i) incorrect rigging or failure of the Down Lock Link assembly and/or upper drag link not in the over-centre condition prior to the load being applied on the NLG during operation, (ii) landing while gear is in transit and, (iii) failure to use the hand pump for emergency extension. During the recovery of the aircraft, the engineers discovered that the landing gear down lock was not engaged. It is likely that the aircraft touched down with the unsafe gear which was not in the down and locked position.

3. CONCLUSION

3.1. General

From the available evidence, the following findings, causes and contributing factors were made with respect to this accident. These shall not be read as apportioning blame or liability to any organisation or individual.

To serve the objective of this investigation, the following sections are included in the conclusion heading:

- **Findings —** are statements of all significant conditions, events, or circumstances in this accident. The findings are significant steps in this accident sequence, but they are not always causal or indicate deficiencies.

- **Causes —** are actions, omissions, events, conditions, or a combination thereof, which led to this accident.
- **Contributing factors —** are actions, omissions, events, conditions or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the accident occurring, or would have mitigated the severity of the consequences of the accident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil, or criminal liability.

3.2. Findings

3.2.1. The instructor was issued a CPL on 29 March 2021 with an expiry date of 30 March 2022. The instructor was issued a valid Class 1 medical certificate on 3 December 2020 with an expiry date of 31 December 2021, with no medical waiver. The instructor had a Grade 2 instructor rating that was issued on 29 March 2021 with an expiry date of 31 March 2024.

3.2.2. The student pilot was issued a PPL on 7 September 2020 with an expiry date of 31 August 2021. The student pilot was issued a Class 2 medical certificate on 13 July 2021 with an expiry date of 13 July 2026 with no medical waiver. The student pilot had a dispensation letter for the licence and ratings, issued by the Regulator on 14 July 2021 for the period 1 September 2021 to 30 September 2021.

3.2.3. The AME was issued an AME licence on 8 February 2021 with an expiry date of 10 April 2023. The aircraft type (PA34 series) was endorsed on his licence.

3.2.4. The ATO was issued an ATO certificate on 17 June 2020 with an expiry date of 30 June 2025.

3.2.5. The AMO which certified and released the aircraft was issued an AMO certificate on 5 August 2021 with an expiry date of 31 July 2022.

3.2.6. The last MPI was carried out on 20 August 2021 and the Certificate of Release to Service was issued by the AMO on 20 August 2021 at 5 157.7 (1 095.8 Hobbs meter reading) airframe hours with an expiry date of 20 August 2022 or at 5 257.7 (1 195.8 Hobbs meter reading) airframe hours, whichever comes first. The compliance of the SB 1123C was not adhered to by the AMO and this was in contravention of the CAR Part 43.03.1 (1d). The important values regarding rigging of the nose gear were not recorded on the work pack which made it difficult for the investigation to conclude the findings with certainty. The AME who signed out the last MPI was properly licensed and his AME licence was valid.

3.2.7. The aircraft was initially issued the Certificate of Airworthiness (C of A) on 11 July 1999; the reissued C of A had an expiry date of 31 July 2022.

3.2.8. The aircraft was issued a Certificate of Registration (C of R) under the current owner on 30 July 2019.

3.2.9. The weather was not a factor at the time of the accident.

3.2.10. This was the student pilot's training flight towards conversion to a multi-engine rating. The flight was conducted under the provisions of Part 141 of the CAR 2011 as amended.

3.2.11. The aircraft sustained substantial damage during the accident sequence; however, no injuries were reported.

3.2.12. It was found that the failure of the down lock link assembly was a result of fracture on the threaded section of the upper eye end due to extremely high compression load. The nose gear collapse was due to the landing gear not engaged in the down and locked position.

3.2.13. It was found that during the last MPI, the SB 1123C was not complied with and that the instruction G39 which requires rigging of the nose gear to be checked was also not complied with as the values were not recorded to ensure that the nose gear was within limits.

3.2.14. There were no hard landing records documented by the ATO.

3.2.15 During recovery, all landing gears were not in the down and locked position, which suggested that the landing gears were extended late. This led to the locking mechanism failure to engage and, thus, the subsequent nose landing gear failure.

3.2.16 All damage caused to the aircraft was attributed to the accident.

3.3. Probable Cause/s

3.3.1 The aircraft landed whilst the main landing gears were not in the down and locked position, which resulted in the failure of the nose gear down lock link assembly. This led to the nose gear collapse during the landing roll.

3.4. Contributory Factor/s

3.4.1. Landing with unsafe gear
3.4.2. Inadequate maintenance due to service manual instructions not carried out.
3.4.3. Hard landings not recorded by the ATO.

4. SAFETY RECOMMENDATIONS

4.1. General

The safety recommendations listed in this report are proposed according to paragraph 6.8 of Annex 13 to the Convention on International Civil Aviation and are based on the conclusions listed in heading 3 of this report. The AIID expects that all safety issues identified by the investigation are addressed by the receiving States and organisations.

4.2. Safety Recommendation/s

4.2.1. It is recommended that the AMO follow the service manual instructions as laid out by the manufacturer during inspections to ensure that maintenance of aircraft are done safely and efficiently.

4.2.2. **Safety message:** To prevent these types of accidents, pilots are reminded to always be vigilant during the critical stages of the flight such as take-offs and landings to ensure that nothing distracts them from completing the check list and, if necessary, to execute a go-around timeously.

5. APPENDICES

5.1. Annexure A: General Maintenance Rules CAR Part 43.03.1.

This report is issued by:

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

Annexure A

Maintenance records

43.03.1 *(1) Any person who carries out maintenance on an aircraft or aircraft component shall record, on completion of the maintenance—*

details of the maintenance including, where applicable, the type of inspection and any approved data used;

(a) or a mandatory periodic, progressive or scheduled inspection, whether a detailed inspection or routine inspection of the particular components or areas of the aircraft was carried out;

(b) The serial numbers, if any, of components removed or fitted;

(c) details of measurements or test results obtained, including the results of any ground or air tests;

(d) or an air speed indicator or altimeter system pilot static test and inspection, the date on which, and maximum altitude to which the altimeter has been tested;

(e) the date of completion of such maintenance;

(f) the references to the documents used to carry out the maintenance and their revision status;

(g) the name of the person completing such maintenance, if other than the person certifying the release to service;

(h) the location and, if applicable, the name of the facility where such maintenance was carried out; and

(i) where such maintenance has been carried out as a consequence of the failure of any equipment, or damage caused by forced landing or accident, the reasons for carrying out the maintenance.