AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:		CA18/2/3/10165	
Aircraft Registration	**ZS-CSL**	**Date of Accident**	26 May 2022			**Time of Accident**	1445Z
Type of Aircraft	Piper PA-24-250			**Type of Operation**		Private (Part 91)	
Pilot-in-command Licence Type	Commercial Pilot Licence (CPL)			**Age**	34	**Licence Valid**	Yes
Pilot-in-command Flying Experience		**Total Flying Hours**		1466.9		**Hours on Type**	3.9
Last Point of Departure	Newcastle Aerodrome (FANC), KwaZulu-Natal Province						
Next Point of Intended Landing	Krugersdorp Aerodrome (FAKR), Gauteng Province						
Damage to Aircraft	Substantial						

Location of the accident site with reference to easily defined geographical points (GPS readings if possible)

Panorama Airfield perimeter fence at GPS position: 26˚19'31.06" South 028˚4'1.90" East, at an elevation of 5020 feet (ft)

Meteorological Information	Surface wind: 210º/07 kts, Temperature: 19.2ºC; Dew Point: 0.8ºC; Visibility: CAVOK QNH: 850hPa

Number of People On-board	1+2	**Number of People Injured**	3	**Number of People Killed**	0	**Other (On Ground)**	0

Synopsis

On Thursday, 26 May 2022, a pilot and two passengers on-board a Piper Comanche PA-24-250 aircraft with registration ZS-CSL took off on a private flight from Krugersdorp Aerodrome (FAKR) to Newcastle Aerodrome (FANC) in KwaZulu-Natal province, which was the first leg of the flight. On the second leg of the flight, the pilot took off from FANC to FAKR. The flight was conducted under visual flight rules (VFR) by day and under the provisions of Part 91 of the Civil Aviation Regulations (CAR) 2011 as amended.

During the second leg, the pilot stated that whilst overhead the general flying area (GFA) in Johannesburg South, the aircraft's engine ran rough. He then broadcasted blindly on frequency 125.6-Megahertz (MHz) that the engine was running rough. Thereafter, he followed the troubleshooting procedure to resolve the problem, but without success. He then decided to execute a forced landing at Panorama Airfield as it was the closest aerodrome from his position.

When he was overhead Panorama Airfield, he noticed traffic on Runway 20 and decided to carry out the joining procedure for Runway 20 instead of Runway 02 as he had initially intended. When the pilot was established on final approach, he extended the landing gear as he was certain that he was going to make it to Runway 20, but the engine stopped and the aircraft lost height rapidly. When he was approximately 95 metres away from the runway, the main undercarriage got hooked on the barbed wire fence before it impacted the road embankment. The aircraft bounced over the road and spun 180 degrees before it stopped, approximately 20 metres (m) from the first point of impact, facing the opposite direction from which it had approached. The pilot and the passengers sustained serious injuries. The aircraft was substantially damaged during the accident sequence.

The pilot stated that the aircraft had a total of 210 litres of fuel in the main tanks with an endurance of 4 hours. According to the calculations, the trip from FAKR to FANC and back to FAKR would have been 3 hours with a fuel consumption of 49 litres per hour. Therefore, the aircraft should have had 57 litres of fuel remaining in the tanks; this fuel is unaccounted for.

Probable Cause			
Fuel exhaustion and, as a result, the aircraft could not reach the runway at Panorama Airfield.			
SRP Date	14 March 2023	Publication Date	30 March 2023

Occurrence Details

Reference Number	**:** CA18/2/3/10165
Occurrence Category	**:** Category 2
Type of Operation	**:** Private (Part 91)
Name of Operator	**:** Kwartel Eiendomme 4 (PTY) LTD
Aircraft Registration	**:** ZS-CSL
Aircraft Make and Model	**:** Piper PA-24-250
Nationality	**:** South African
Place	**:** Panorama Airfield, Gauteng Province
Date and Time	**:** 26 May 2022 at 1520Z
Injuries	**:** Serious
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 May 2022 at 1545Z. The occurrence was classified as an accident according to the CAR 2011 Part 12 and ICAO STD Annex 13 definitions. Notifications were sent to the State of Design and Manufacturer in accordance with CAR 2011 Part 12 and ICAO Annex 13 Chapter 4. The AIID is leading the investigation as the Republic of South Africa is the State of Occurrence. Investigators 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 PA-24-250 involved 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

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Abbreviation	Description
°	Degrees
°C	Degrees Celsius
ACCID	Accident
AIID	Accident and Incident Investigations Division
AME	Aircraft Maintenance Engineer
AMO	Aircraft Maintenance Organisation
ATC	Air Traffic Control
CAA	Civil Aviation Authority
C of A	Certificate of Airworthiness
CAVOK	Cloud and Visibility OK
CAR	Civil Aviation Regulations
C of R	Certificate of Registration
CVR	Cockpit Voice Recorder
CPL	Commercial Pilot Licence
CRS	Certificate of Release to Service
FDR	Flight Data Recorder
FANC	New Castle Aerodrome
FAKR	Newcastle Aerodrome
ft	Feet
GPS	Global Positioning System
GFA	General Flying Area
kt	Knots
hPa	Hectopascal
m	Metre
METAR	Meteorological Aerodrome Report
MHz	Megahertz
MPI	Mandatory Periodic Inspection
POH	Pilots Operating Handbook
QNH	Altitude Above Mean Sea Level
RWY	Runway
SACAA	South African Civil Aviation Authority
VFR	Visual Flight Rules
VMC	Visual Metrological Conditions
SAWS	South African Weather Service
TBO	Time Between Overhaul
UTC	Co-ordinated Universal Time
Z	Zulu (Term for Universal Co-ordinated Time - Zero Hours Greenwich)

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1. On Monday, 14 March 2022, a pilot refuelled a Piper PA-24-250 aircraft, registered ZS-CSL, with 208 litres (full capacity) of Avgas 100LL as he intended to fly, but he later cancelled the flight due to unfavourable weather conditions. The aircraft was, therefore, taxied to the hangar in Krugersdorp Aerodrome. Later the same day, the operator noticed that fuel was leaking slightly from the right-side tip tank of the aircraft. He then decided to taxi the aircraft from the hangar to the main apron twice as he wanted to determine the source of the leak in order to repair it, and also to recharge the aircraft's battery. He then decided to drain approximately 40 litres of fuel from the auxiliary fuel tanks (tip tanks), leaving about 10 litres in them (tanks). The aircraft was then parked in the hangar. The leak was never repaired.

1.1.2. On Thursday, 26 May 2022, the pilot taxied the aircraft from the hangar to the operator's bulk fuel storage where he topped up the main tanks with a total of 36 litres of Avgas 100LL. The right-side main tank was topped with 20 litres and the left-side main tank was topped with 16 litres, bringing the total in the main tanks to 208 litres (full capacity).

1.1.3. Thereafter, the pilot and the two passengers took off on a private flight from Krugersdorp Aerodrome (FAKR) in Gauteng province to Newcastle Aerodrome (FANC) in KwaZulu-Natal province with the intention to return to FAKR. 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.

1.1.4. The flight from FAKR to FANC was uneventful, and it took 1.2 hours. The pilot stated that prior to departure at FANC, the aircraft had 90 litres of fuel in the left tank and 95 litres of fuel in the right tank; the estimated flight time was approximately 1.4 hours.

1.1.5. The pilot stated that whilst overhead the general flying area (GFA) in Johannesburg South, the aircraft's engine ran rough. Thereafter, the pilot broadcasted blindly on frequency 125.6-Megahertz (MHz) that his aircraft's engine was running rough. He then followed the troubleshooting procedure to resolve the problem by switching between the main left fuel tank and the main right fuel tank, but there was no change in the engine's performance. He then switched fuel to the auxiliary tanks, and the engine operated normally but only for a short while. At this point, the pilot had visual of the Panorama Airfield. Due to the traffic that was taking off from Runway 20, he opted to execute the normal joining procedure by flying overhead the airfield at 2000 feet to reposition for landing on Runway 20 instead of Runway 02 as he had initially intended. During the final approach and when he was certain that he was going to make it for Runway 20, he extended the landing gear.

1.1.6. The aircraft descended fast, and the main undercarriage got caught in the barbed wire fence. The aircraft impacted the road embankment and bounced over to the other side. The aircraft landed (on the other side) facing the opposite direction from which it had approached. The nose landing gear compressed (folded) into the engine compartment and the main landing gear broke off due to impact. The occupants sustained serious injuries, and they were transported to the hospital. The right wing, left wing, propeller blades, underbelly, landing gear and cockpit were substantially damaged. A witness who reported to the scene after the crash stated that he saw a small amount of fuel leaking from both wings but could not estimate the quantity. The aircraft was guarded by two security companies and no interference with the aircraft was reported.

1.1.7. The accident occurred in daylight near Panorama Airfield's perimeter fence at Global Positioning System (GPS) co-ordinates determined to be: S26°19'31.06" E028°4'1.90", at an elevation of 5020 feet (ft).

Figure 1: An aerial view of Panorama Airfield and the accident site. (Source: Google Earth)

1.2. Injuries to Persons

Injuries	Pilot	Crew	Pass.	Total On-board	Other
Fatal	-	-	-	-	-
Serious	1	-	2	3	-
Minor	-	-	-	-	-
None	-	-	-	-	-
Total	1	-	2	3	-

Note: Other means people on the ground.

1.2.1 The pilot and the passengers sustained serious injuries and were taken to the hospital where they were admitted.

1.3. Damage to Aircraft

1.3.1. The aircraft sustained substantial damage to the propeller blades, both wings, underbelly, landing gear and the cockpit.

Figure 2: The aircraft at the scene post-accident.

Figure 3: The perimeter fence that the main undercarriage got caught on.

1.4. Other Damage

1.4.1. The perimeter fence opposite the Panorama Airfield was damaged.

1.5 Personnel Information

1.5.1

Nationality	South African	Gender	Male	Age	34
Licence Type	Commercial Pilot Licence (CPL)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Night, Instructor				
Medical Expiry Date	30 June 2022				
Restrictions	Corrective lens				
Previous Accidents	None				

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

1.5.2 The pilot was initially issued a Commercial Pilot Licence (CPL) on 3 August 2009. He was reissued the licence on 27 June 2021 with an expiry date of 30 June 2022. The pilot converted to the Piper PA-24-250 aircraft type on 25 February 2022 and had flown a total of 1466.9 hours of which 3.9 were on the aircraft type. The pilot was issued a Class 1 aviation medical certificate on 17 June 2021 with an expiry date of 30 June 2022.

Flying Experience:

Total Hours	1466.9
Total Past 24 Hours	0
Total Past 7 Days	0
Total Past 90 Days	7.2
Total on Type Past 90 Days	3.9
Total on Type	3.9

Aircraft Maintenance Engineer (AME) experience:

Nationality	South African	Gender	Male	Age	59
Licence Type	Aircraft Maintenance Engineer				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Group 4				
Restrictions	None				
Previous Accidents	None				

1.5.3 The aircraft maintenance engineer (AME) who released the aircraft to service was initially issued an AME licence on 13 June 1994. The AME was reissued a licence on 10 December 2020 with an expiry date of 4 January 2023. The Teledyne Continental engine series was endorsed on his licence.

1.6 Aircraft Information

1.6.1 Piper Comanche (Source: Piper Comanche PA-24-250 Pilot's Operating Handbook [POH])

The Comanche Model 180 is equipped with a Lycoming 0-360-A series engine rated at 180 HP at 2700 RPM. The engine in the 250 is a Lycoming 0-540-A series, developing 250 HP at 2575 RPM. The engine has compression ratio of 8.5 to 1 and requires 91/96 octane minimum fuel. They are *furnished with a geared starter, 50 ampere 12-volt generator, voltage regulator, shielding, fuel pump, propeller governor, vacuum pump drive, and carburettor air box and filter. The exhaust system on the 180 and 250 is a stainless-steel cross over type. A large muffler and oversize heater shroud are provided on both the 180 and 250 installations to supply heat for cabin and carburetor heater systems. Engine cooling is accomplished without the complication of cowl flaps or exhaust augmenters, and without drag, producing fixed cowl flanges.*

1.6.2 Description of the fuel system:

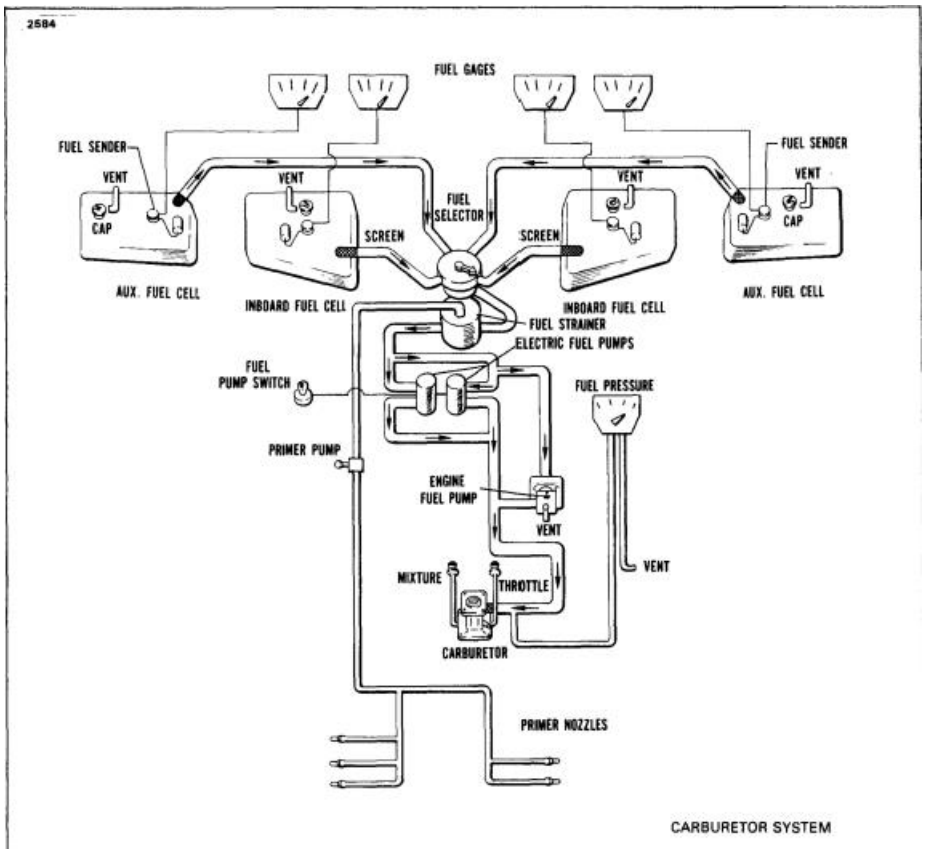

Diagram 1: Schematic diagram of the fuel system.

Two rubber-like fuel cells in the inboard leading-edge sections of the wings provide fuel storage. Available as optional equipment on the PA-24-250 only are two auxiliary fuel cells located on the outboard of the main fuel cells. Auxiliary fuel cells have a 15-gallon capacity. The cells should be kept full of fuel during storage of the airplane to prevent accumulation of moisture and deterioration of cells. For long-term storage without fuel, the cells should be coated with light engine oil to keep the rubber from drying out. The main fuel cells hold a maximum of 30 gallons (113.5 litres). On the 180 [series], to obtain the standard fuel quantity of 50 gallons (189.2 L) total or 25 gallons (94.6 L) per tank, the cells are filled only to the bottom of the filler neck, which extends into the fuel cell about one inch. To obtain the standard plus reserve quantity, the cells are filled to the top of the filler necks. This system provides a reserve fuel capacity for the 180 [series] without the necessity for extra tanks. On the 250 Comanche, 60 gallons (227.1 liters) is the standard fuel capacity, however, if auxiliary fuel cells are installed the fuel capacity is increased to 90 gallons (340.6 L). An electric auxiliary fuel pump is provided for use in the event (two electric auxiliary fuel pumps on PA-24-250) of failure of the standard engine-driven pump. The electric pump is normally turned on for landings and take-offs.

1.6.3 With a total of 208 litres of fuel in the main tanks, the aircraft had an endurance of 4 hours. According to the calculations, the trip from FAKR to FANC and back to FAKR would have been 2.6 hours with a fuel consumption of 53 litres per hour. The aircraft would have needed 138 litres of fuel for a safe return flight. And, with the fuel uplift of 208 litres, it would have meant that the aircraft had enough fuel for the trip. The aircraft should have had 69 litres remaining in the tanks. Seventy (69) litres was not accounted for.

Airframe:

Manufacturer/Model	Piper Aircraft Corporation / PA-24-250	
Serial Number	24-2253	
Year of Manufacture	1973	
Total Airframe Hours (At Time of Accident)	4 892.9	
Last Inspection (Date & Hours)	16 January 2022	4 886.7
Airframe Hours Since Last Inspection	6.2	
CRS Issue Date	7 February 2022	
C of A (Issue Date & Expiry Date)	7 April 2021	30 April 2022
C of R (Issue Date) (Present Owner)	28 May 2018	
Operating Category	Standard Normal Category	
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.

1.6.4 The last maintenance inspection on the aircraft was carried out on 16 January 2022 at 4886.7 hours. The aircraft was issued a Certificate of Release to Service (CRS) on 7 February 2022 with an expiry date of 6 February 2023 or at 4986.7 hours. The maintenance records were reviewed, and it was found that on 24 January 2022, the fuel tanks and the tank bays were inspected for condition, leaks and corrosion. The inspection also included checking the lines, hoses, wires, control cables and pulleys for condition, cleanliness, security, routing and proper functioning. According to the work pack, all fuel lines and systems were checked and signed out during the last maintenance which was conducted on 24 January 2022. On 26 May 2022, the operator reported that there was a fuel leak on the right-side auxiliary tank (the leak was noted on 14 March 2022 and was not repaired), however, there were no defects reported and/or recorded in the flight folio at the time of the accident. During the recovery of the aircraft, the leak was found on the right-side wing auxiliary tank. The right-side coupling was loose as it was not properly tightened according to the AME who was assigned to recover the aircraft. This was not the AME who maintained the aircraft.

1.6.5 The AME who released the aircraft to service was initially issued an AME licence on 13 June 1994. The AME was reissued a licence on 10 December 2020 with an expiry date of 4 January 2023, and the Teledyne Continental engine series was endorsed on it. The aircraft

was issued a Certificate of Registration (C of R) on 28 May 2018.

1.6.6 The aircraft's Certificate of Airworthiness (C of A) was issued on 7 April 2021 with an expiry date of 30 April 2022. There was no updated (renewed) C of A in the aircraft's file or in the Regulator's (SACAA's) records.

1.6.7 At the time of the accident, there was no entry of the accident flight in the flight folio.

1.6.8 The following regulation is an extract from the South African CAR 2011 as amended

Flight folio

91.03.5 (*1) The owner or operator of a South African registered aircraft shall ensure that the aircraft carries a flight folio or any other similar document which meets the requirements of and contains the information as prescribed in Document SA-CATS 91, at all times.*

(2) The flight folio shall be kept up-to-date and maintained in a legible manner by the PIC.

(3) All entries shall be made immediately upon completion of the occurrence to which they refer.

(4) In the case of maintenance being undertaken on the aircraft, the entry shall be certified by the person taking responsibility for the maintenance performed.

(5) The owner or operator shall retain the flight folio for a period of 5 years calculated from the date of the last entry therein.

Fuel record

91.03.6 (*1) The owner of operator shall maintain fuel records to enable the Director to ascertain that, for each flight under his or her control, the requirements of regulation 91.07.12 are complied with.*

(2) The PIC of the aircraft shall enter the fuel and oil records referred to in subregulation (1) in the flight folio.

(3) The owner or operator shall maintain oil records to enable the Director to ascertain that trends for oil consumption are such that an aircraft has sufficient oil to complete each flight.

FLIGHT FOLIO

1. Information to be contained in a flight folio

(1) An owner or operator must retain the following information for each flight in the form of a flight folio –

(a) aircraft registration;
(b) date;
(c) name(s) of flight crew member(s);

(d) duty assignment of flight crew member(s);
(e) place of departure;
(f) place of arrival;
(g) time of departure (off-block time);
(h) time of arrival (on-block time);
(i) hours of flight;
(j) nature of flight;
(k) incidents, observations (if any);
(l) signature of pilot-in-command;
(m) the current maintenance statement giving the aircraft maintenance status of what maintenance, scheduled or out of phase, is next due;
(n) all outstanding deferred defects which affect the operation of the aircraft;
(o) fuel and oil used; and
(p) fuel and oil uplift.

(2) The owner or operator need not keep a flight folio or parts thereof, if the relevant information is available in other documentation.

(3) The owner or operator must ensure that all entries are made concurrently and that they are made in ink or other permanent marking.

Engine:

Manufacturer/Model	Lycoming O-540-E4A5
Serial Number	L-3275-40
Hours Since New	4886.7
Hours Since Overhaul	TBO not yet reached

Propellor:

Manufacturer/Model	Hartzell / HC-C3YR-1RF/F7590
Serial Number	DY7095B
Hours Since New	429.3
Hours Since Overhaul	TBO not yet reached

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) which was recorded on 26 May 2022 at 1500Z at Rand Aerodrome (FAGM), located 85 metres from the accident site.

Wind Direction	210º	Wind Speed	7kts	Visibility	9999m
Temperature	19.2ºC	Cloud Cover	CAVOK	Cloud Base	CAVOK
Dew Point	0.8°C	QNH	850hPa		

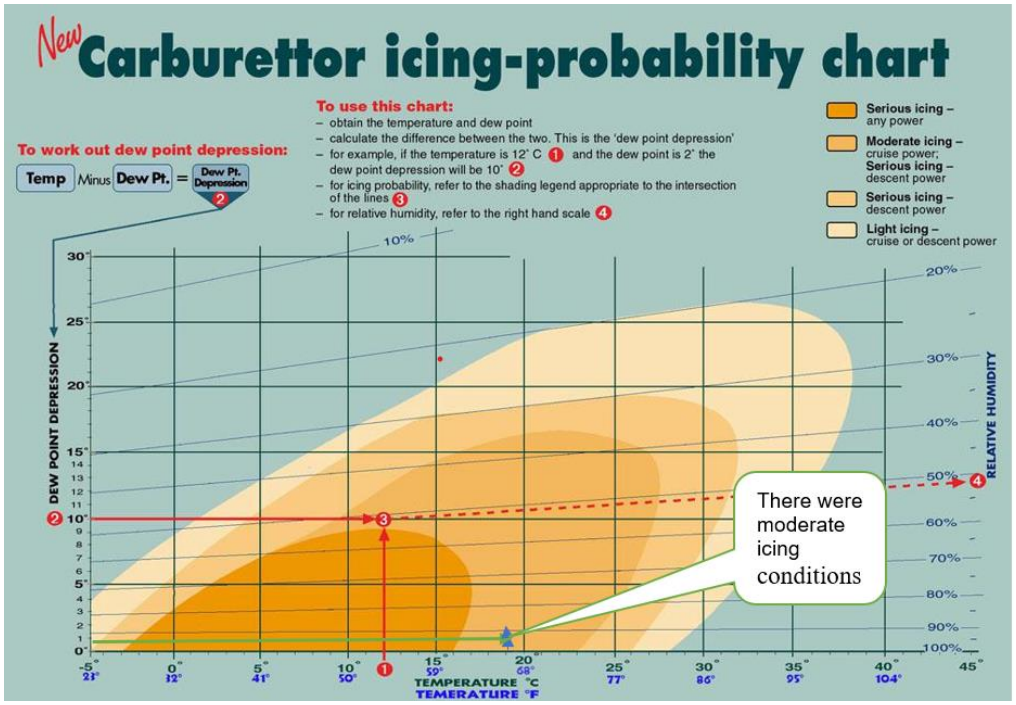

Chart 1: Carburettor icing chart.

1.7.2 According to the carburettor icing chart, there was moderate icing conditions at the time of the accident.

1.8 Aids to Navigation

1.8.1 The aircraft was equipped with standard navigational equipment as approved by the Regulator. There were no recorded defects with the navigation 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

1.10.1 The accident occurred approximately 66m from the threshold of Runway 20 at Panorama Airfield.

Aerodrome Location	Panorama, Gauteng Province		
Aerodrome Status	Unlicensed		
Aerodrome GPS coordinates	26°19'34.31" South 028°04'01.70" East		
Aerodrome Elevation	5050 feet		
Runway Headings	02/20	05/23	12/30
Dimensions of Runway Used	974 x 30m	700 x 20m	600 x 20m
Heading of Runway Used	02		
Surface of Runway Used	Grass		

Approach Facilities	None
Radio Frequency	124.40 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 Once the Accident and Incident Investigations Division (AIID) was notified of the accident, arrangements were made to have the wreckage guarded overnight until the investigators dispatched to the site the following morning.

1.12.2 During approach for an emergency landing at Panorama Airfield, the engine stopped after the landing gear was extended; this was followed by a drastic loss of height before the undercarriage got hooked on the barbed wire fence. The propeller also got entangled in the barbed wire fence. The main landing gear broke off after impacting the road embankment; it was found approximately 26m from the first point of impact with the ground. The fuselage was located approximately 20m from the first point of impact; it came to rest facing the opposite direction from which it had approached. The fuel that was drained from the auxiliary tanks (tip tanks) was approximately 4 litres from both sides.

Figure 4: The first impact with the ground just beyond the barbed wire fence.

Figure 5: The main undercarriage strut and wheel that broke off.

Figure 6: The right wing that impacted the fence post.

Figure 7: The propellor with the barbed wire fence around it.

Figure 8: The right-side main fuel tank with no fuel.

Figure 9: The left main fuel tank with no fuel.

Figure 10: The right auxiliary (tip) fuel tank with no fuel.

Figure 11: The left auxiliary (tip) fuel tank with no fuel.

1.13 Medical and Pathological Information

1.13.1 The pilot and the two passengers were admitted to the hospital after sustaining serious injuries during the accident sequence.

1.14 Fire

1.14.1 There was no evidence of post-impact fire.

1.15 Survival Aspects

1.15.1 The accident was considered survivable. Although there was damage in the cabin and cockpit areas, they both remained intact. The pilot and the passengers were properly restrained with safety harnesses at the time of the accident.

1.16 Tests and Research

1.16.1 When the investigators arrived at the accident site, they did not find fuel in the main tanks of the aircraft. The fuel that was found in the auxiliary tanks added to approximately 4 litres (both tanks combined).

1.16.2 During the recovery of the aircraft, a leak was found on the right-side wing auxiliary tank. The right-side coupling was loose as it was not properly tightened according to the AME who was assigned to recover the aircraft.

1.16.3 The aircraft was recovered to an aircraft maintenance organisation (AMO) facility at FAKR. At the AMO facility, the two main bladder tanks were filled with water to confirm their capacity, and the team filled them with 102 litres, which confirmed that the tanks could carry fuel as prescribed. This also showed that the main tanks were not leaking.

1.16.4 With a total of 208 litres of fuel in the main fuel tanks, the aircraft had an endurance of 4 hours. According to the calculations, the trip from FAKR to FANC and back to FAKR would have been 2.6 hours with a fuel consumption of 53 litres per hour. The aircraft would have needed 138 litres of fuel for a safe return flight. With the fuel uplift of 208 litres, it would mean that the aircraft had enough fuel for the trip. The witness, who is also a pilot, reported that following the accident, he checked the fuel on both wings and found only a small amount inside.

1.16.5 According to the flight folio (pages 14214), the aircraft was refuelled with 155 litres on 25 February 2022. Fuel slip dated 13 March 2022 showed that the aircraft was refuelled to maximum (full tanks) with 168.75 litres. According to the operator, on 26 May 2022 the aircraft was refuelled with 20 litres on the right tank and 16 litres on the left tank, which makes the aircraft to have full capacity (no records are available for this fuel uplift).

Date	**Fuel On-board**	**Usage**	**Trip**
14 March 2022	208 litres	5 litres	Taxi/ Runups
26 May 2022	208 litres	75 litres	FAKR to FANC
26 May 2022	133 litres	64 litres	FANC to FAKR
Unaccounted fuel	69 litres		

1.16.6 Based on the calculations without compensating for wind and climb performance, the aircraft would have had 69 litres of fuel on-board. According to the POH, the aircraft's fuel consumption is 14 gallons per hour.

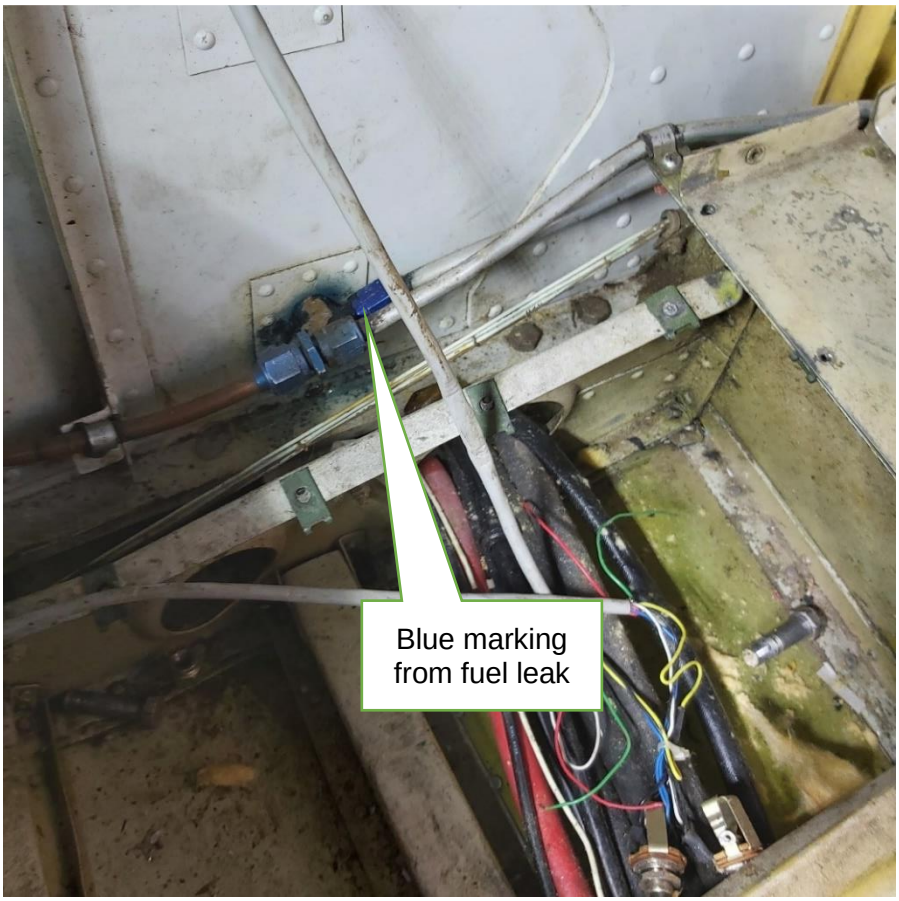

Figure 12: Fuel leak on connections.

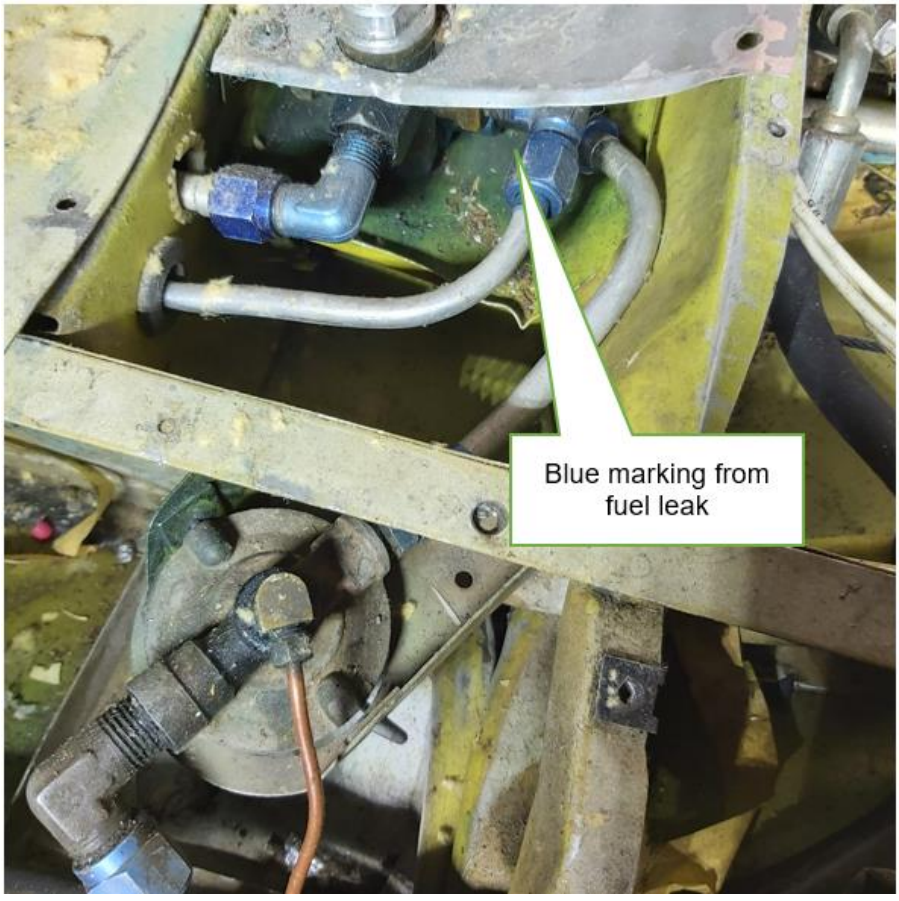

Figure 13: Blue fuel stains on connections.

1.17 Organisational and Management Information

1.17.1 The flight was conducted under the provisions of Part 91 of the CAR 2011 as amended.

1.17.2 The AMO which certified the last maintenance inspection (annual inspection) prior to the accident flight had an AMO certificate that was issued by the Regulator on 31 May 2022 with an expiry date of 31 May 2023.

1.18 Additional Information

1.18.1 The pipeline from the main fuel tanks to the fuel selector valve, including the line from the auxiliary (tip) tanks was inspected for leaks and the only coupling that was found to be loose (hand-tight) was the one from the right-side tip tank. The fuel selector valve was dismantled and inspected, and it was found to have foreign debris.

1.18.2 The following Emergency Landing Gear Procedure is an extract from the POH:

To extend the gear, remove the cover over the emergency disengage control, located between the two front seats, and follow the instruction on the back of this cover, as follows:

1) *Airspeed not over 100 MPH.*
2) *Landing gear switch in centre "off" position.*
3) *Disengage electric motor by pushing motor release arm forward through full travel.*
4) *Pull out emergency extension handle to full length.*
5) *Push handle forward full travel to extend landing gear.*

If it should become necessary to extend the gear manually, at the completion of the flight trouble should be determined with the airplane on jacks. Then return to normal electrical ger operation, re-engaging the electric motor to the landing gear extension torque tube should be done as follows:

1) *Landing gear switch in centre "off" position.*
2) *Pull landing gear emergency extension handle about halfway back, allowing gear to hang partially retracted.*
3) *With landing gear control switch, move end of the electric motor drive shaft into position about halfway back, so that the slot in the drive shaft is near the mating pin on the torque tube.*
4) *Using the extension handle, move the torque tube pin slightly back and forth until it can be engaged with the drive shaft slot, then push the parts together.*
5) *Lock the drive shaft to the torque tube by pulling the motor release arm full back to the normal locked position.*
6) *Safety-wire the release arm in the locked position.*

1.19 Useful or Effective Investigation Techniques

1.19.1 Fuel capacity check was conducted on the two main fuel tanks. The tanks were filled with fluid (water) and were left to stand to confirm the capacity of the tanks as well as to confirm their integrity (no leaks).

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

Pilot

2.2.1. The pilot was initially issued the CPL on 3 August 2009.

2.2.2. The pilot was reissued the CPL on 27 June 2021 with an expiry date of 30 June 2022.

2.2.3. The pilot converted to the Piper PA-24-250 aircraft type on 25 February 2022 and had 3.9 hours on type.

2.2.4. The pilot was issued a Class 1 aviation medical certificate on 17 June 2021 with an expiry date of 30 June 2022.

2.2.5 At the time of the accident, the pilot had not made an entry of the fuel uplift for the flight from FAKR to FANC and back to FAKR in the flight folio before departure as required by Part 91, subpart ***91.03.6 (****1) and (2)* of the Civil Aviation Regulations (CAR) 2011 as amended which state *"that the owner of operator shall maintain fuel records to enable the Director to ascertain that, for each flight under his or her control, the requirements of regulation 91.07.12 are complied with and that the PIC of the aircraft shall enter the fuel and oil records referred to in subregulation (1) in the flight folio."*

Aircraft

2.2.6 The aircraft was issued a C of R on 6 September 2013.

2.2.7 The C of A was issued on 7 April 2021 with an expiry date of 30 April 2022. There was no updated (renewed) C of A in the aircraft's file or on the Regulator's (SACAA's) records.

2.2.8 The last maintenance inspection prior to the accident flight was carried out on 16 January 2022 at 4886.7 hours. The aircraft was issued a CRS on 7 February 2022 with an expiry date

of 6 February 2023 or at 4986.7 hours, whichever comes first. There were no defects recorded in the flight folio at the time of the accident.

2.2.9 The on-site investigation found that the aircraft had a loose coupling on the fuel line from the right-side tip tank pipeline.

2.2.10 With a total of 208 litres of fuel in the main fuel tanks, the aircraft had an endurance of 4 hours. According to the calculations, the trip from FAKR to FANC and back to FAKR would have been 2.6 hours with a fuel consumption of 53 litres per hour. The aircraft would have needed 138 litres of fuel for a safe return flight. With the fuel uplift of 208 litres, it would mean that the aircraft had enough fuel for the trip. The witness, who is also a pilot, reported that following the accident, he checked the fuel on both wings and found only a small amount inside.

2.2.11 The aircraft's main fuel tanks were tested for leaks, and there were none found.

2.2.12 Foreign debris was found in the fuel strainer valve which could have clogged the fuel system, and thus, restricting fuel flow to the engine.

2.2.13 On 14 March 2022, the operator reported that there was a fuel leak on the right-side auxiliary tank, however, this was not recorded in both the flight folio and the logbook, which is non-compliance to ***91.03.6 (****1)(k) which states that all incidents must be recorded in the flight folio.*

Environment

2.2.14 The weather conditions at the time of the flight were as follows: Wind direction: 210° with wind speed of 7 knots; Temperature: 19.2°C; Dew Point: 0.8°C; and Visibility of more than 10 kilometres. Fine weather conditions prevailed at the time of the flight. Although according to the carburettor icing chart there was moderate icing conditions around the time of the accident, the weather was not a contributing factor to this accident.

2.2.15 The witness reported that following the accident, he noticed fuel leak from both wings but could not estimate the quantity. The accident scene was guarded overnight by the security personnel, therefore, there was no interference with the evidence prior to the arrival of the investigators. Moreover, there was no evidence of fuel spillage or fuel smell at the scene of the accident.

2.2.16 The engine ran rough during the flight and subsequently stopped due to fuel exhaustion which was caused by a leak found on the right-side wing auxiliary tank coupling. The coupling was loose as it was not properly tightened after maintenance. The aircraft lost height which led to a rapid forward acceleration and the subsequent crash beyond the perimeter fence of

the airfield. As the aircraft had lost height, the main undercarriage got hooked on the barbed wire fence and spun 180 degrees.

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

Pilot

3.2.1. The pilot was initially issued a CPL on 3 August 2009. The pilot's CPL licence was reissued on 27 June 2021 with an expiry date of 30 June 2022. The pilot converted to the Piper PA-24-250 aircraft type on 25 February 2022 and had 3.9 hours on type.

3.2.2. The pilot was issued a Class 1 aviation medical certificate on 17 June 2021 with an expiry date of 30 June 2022.

3.2.3. The pilot had not made an entry of the fuel uplift in the flight folio at the time of the accident.

Aircraft

3.2.4 The aircraft was issued a C of R on 28 May 2018.

3.2.5 The C of A was issued on 7 April 2021 with an expiry date of 30 April 2022. There was no updated (renewed) C of A in the aircraft's file or in the Regulator's (SACAA's) records.

3.2.6 The last maintenance inspection prior to the accident flight was carried out on 16 January 2022 at 4886.7 hours. The aircraft was issued a CRS on 7 February 2022 with an expiry date of 6 February 2023 or at 4986.7 hours, whichever comes first. There were no defects recorded in the flight folio at the time of the accident.

3.2.7 The aircraft had a loose coupling in the fuel line from the right-side tip tank pipeline.

3.2.8 The aircraft's main fuel tanks were tested for leaks, and no leaks were found.

3.2.9 The fuel strainer valve had foreign debris inside which could have resulted in clogging the fuel system, and thus, restricting fuel flow to the engine.

3.2.10 On 14 March 2022, the operator reported that there was a fuel leak on the right-side auxiliary tank, however, this was not recorded in both the flight folio and the logbook, which is non-compliance to ***91.03.6 (****1)(k) which states that all incidents must be recorded in the flight folio.*

3.2.11 With a total of 208 litres of fuel in the main fuel tanks, the aircraft had an endurance of 4 hours. According to the calculations, the trip from FAKR to FANC and back to FAKR would have been 2.6 hours with a fuel consumption of 53 litres per hour. The aircraft would have needed 138 litres of fuel for a safe return flight. With the fuel uplift of 208 litres, it would mean that the aircraft had enough fuel for the trip. The witness, who is also a pilot, reported that following the accident, he checked the fuel on both wings and found only a small amount inside.

Environment

3.2.12 The weather conditions at the time of the flight were as follows: Wind direction: 210° with wind speed of 7 knots; Temperature: 19.2°C; Dew Point: 0.8°C; and Visibility of more than 10 kilometres. According to the carburettor icing chart, there was moderate icing conditions around the time of the accident. The weather was not a contributing factor to this accident.

3.2.13 The witness reported that following the accident, he noticed fuel leak on both wings but could not estimate the quantity. The accident scene was guarded overnight by the security personnel, therefore, there was no tampering with evidence prior to the arrival of the investigators. Also, there was no evidence of fuel spillage or fuel smell at the scene of the accident.

3.2.14 The engine ran rough during the flight and subsequently stopped due to fuel exhaustion. The aircraft lost height, followed by a rapid forward acceleration and crashed beyond the

perimeter fence of the airfield. As the aircraft had lost height, the main undercarriage got hooked on the fence and spun 180 degrees.

3.3. Probable Cause

3.3.1 Fuel exhaustion and, as a result, the aircraft could not reach the runway at Panorama Airfield.

3.4. Contributory Factor

3.4.1 None.

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 None.

5. APPENDICES

5.1. None.

This report is issued by:

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