AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:		CA18/2/3/10062	
Aircraft Registration	**ZS-PMT**	**Date of Accident**		30 October 2021		**Time of Accident**	0800Z
Type of Aircraft	Cessna 182P			**Type of Operation**		Private (Part 91)	
Pilot-in-command Licence Type	Private Pilot Licence (PPL)			**Age**	32	**Licence Valid**	Yes
Pilot-in-command Flying Experience		**Total Flying Hours**		125.6		**Hours on Type**	52.8
Last Point of Departure	Lanseria International Airport (FALA), Gauteng Province						
Next Point of Intended Landing	Rand Airport (FAGM), Gauteng Province						
Damage to Aircraft	Destroyed						
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)							
Approximately 1.2 nautical miles (nm) west of FAGM at the following GPS co-ordinates: S 26º 14' 44.8" E 28º 07' 04.7", at an elevation of 5 139ft							
Meteorological Information	Surface wind 260º, 11 knots; Temperature: 20ºC; Dew point: 09ºC; CAVOK; QNH: 1021hPa						
Number of People On-board	1+1	**Number of People Injured**	2	**Number of People Killed**	0	**Other (On Ground)**	0

Synopsis

On Saturday, 30 October 2021 at 0600Z, a pilot and a passenger on-board a Cessna 182P aircraft with registration ZS-PMT were on a flight from Lanseria International Airport (FALA) in Gauteng province to Rand Airport (FAGM) in the same province. 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.

The aircraft was refuelled to capacity (322 litres [L]) and, after departure, the pilot decided to fly to Blue Valley Mountain private airstrip in Hekpoort, Krugersdorp, for a full stop landing before proceeding to FAGM. However, he later decided to abort the full stop landing and instead, opted to execute a missed approach due to wet grass on the runway. The pilot then routed to FAGM, flying between 6500 feet (ft) and 7000ft altitude levels. Whilst still some distance away from Romeo Delta (RD), which is an entry point to FAGM airspace, he felt the engine become sluggish. This was followed by a drop in manifold air pressure (MAP) and engine power loss. The pilot contacted FAGM air traffic control (ATC) and advised them of his situation and position. The ATC cleared the aircraft for a long straight-in approach for Runway 11. Meanwhile, the aircraft was losing speed and altitude. The pilot deduced that he would not reach the runway and decided to execute a forced landing on an open field approximately 1.2 nautical miles (nm) west of FAGM. During the forced landing, the aircraft impacted some tree branches before it came to a halt near the riverbank. A post-impact fire started soon after. The pilot and the passenger sustained injuries, including first- and third-degree burns. The aircraft was destroyed during the accident sequence.

Post-accident visual examination of the engine revealed that a castellated nut and bolt that join the carburettor throttle control lever and throttle were missing. This resulted in the separation of the throttle control lever and throttle, as well as unregistered inputs from the cockpit.

Probable Cause			
The throttle cable separated from the throttle lever control in-flight because of the missing cotter pin on the castellated nut, which caused the engine to run at idle. The pilot was unable to maintain the aircraft's height and, thus, led him to execute an unsuccessful landing which was followed by a post-impact fire that destroyed the aircraft. **Contributory Factor** • Inadequate pre-flight inspection. • A missing cotter pin on the castellated nut was not identified during maintenance.			
SRP Date	14 February 2023	Publication Date	16 February 2023

Occurrence Details

Reference Number	**:** CA18/2/3/10062
Occurrence Category	**:** Category 1
Type of Operation	**:** Private (Part 91)
Name of Operator	**:** Mike Zulu Victor (PTY) Ltd
Aircraft Make and Model	**:** Cessna Aircraft Corporation, Cessna 182P
Nationality	**:** South African
Place	**:** Thulisa Park, Alberton, Gauteng Province
Date and Time	**:** 30 October 2021; 0800Z
Injuries	**:** 2
Damage	**:** Destroyed

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 accident that occurred on 30 October 2021 at 0800Z. 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 Design/Manufacturer in accordance with CAR 2011 Part 12 and ICAO Annex 13 Chapter 4. The National Transport Safety Board (NTSB) appointed a non-travelling accredited representative and advisor. 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 Cessna 182P 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
AD	Airworthiness Directive
AIID	Accident and Incident Investigations Division
AME	Aircraft Maintenance Engineer
AMO	Approved Maintenance Organisation
ATC	Air Traffic Control
ATO	Approved Training Organisation
C of A	Certificate of Airworthiness
C of R	Certificate of Registration
CRS	Certificate of Release to Service
CVR	Cockpit Voice Recorder
FAGM	Rand Airport
FALA	Lanseria International Airport
FDR	Flight Data Recorder
ft	Feet
GFA	General Flying Area
hPa	Hectopascal
kt	Knots
M	Metres
MAP	Manifold Air Pressure
METAR	Meteorological Aerodrome Report
MPI	Maintenance Periodic Inspection
PPL	Private Pilot Licence
RCF	Radio Communication Failure
RD	Romeo Delta
RPM	Revolutions per Minute
RWY	Runway
SACAA	South African Civil Aviation Authority
SAWS	South African Weather Service
SB	Service Bulletin
SID	Supplementary Inspection Documents
QNH	Altitude Above Mean Sea Level
VFR	Visual Flight Rules
Z	Zulu (Term for Universal Co-ordinated Time - Zero Hours Greenwich)

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1 On 2 August 2021, the South African Civil Aviation Authority (SACAA) granted a special permit to the owner of the Cessna 182P aircraft with registration ZS-PMT to ferry it from its previous owner in Vereeniging Aerodrome (FAVV) to Lanseria International Airport (FALA), both located in Gauteng province. The ferry flight to FALA progressed as expected and the aircraft landed safely, apart from the radio communication failure (RCF) that was experienced by the pilot during the flight. For the next two months, a mandatory periodic inspection (MPI) and other repairs and restoration tasks, which were a requirement for the new Certificate of Airworthiness (CoA) and Certificate of Registration (C of R) to be issued were carried out. On 25 October 2021, SACAA granted the ZS-PMT aircraft a C of A with an expiry date of 31 October 2022. The C of R was also granted to the new owner.

1.1.2 On Saturday morning of 30 October 2021, the pilot and the passenger had planned to relocate the aircraft to its new hangar at Rand Airport (FAGM) after they had undertaken a scenic flight in the Magaliesburg area. The pilot stated that he had also planned to make a full stop landing at Blue Mountain Valley private airstrip in Hekpoort, Krugersdorp, before proceeding to FAGM. Before departure at FALA, the aircraft was topped up with 174 litres (L) of Avgas 100LL, which came to a total of 322L. The pilot did not file a flight plan for this flight, which 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.

1.1.3 The aircraft took off from FALA at 0830Z to the general flying area (GFA) in Magaliesburg and, later, routed to Blue Mountain Valley private airstrip, which is within the GFA, with the intention to make a full stop landing to stock up on some refreshments. On arrival at Blue Mountain Valley private airstrip, the pilot commenced with the joining procedures, followed by the normal circuit. Whilst on final approach for landing on the grass runway, he aborted the landing because of the wet grass.

- The pilot decided to route to FAGM, flying between 6500ft and 7000ft altitude levels. He then communicated on JHB special rules west and south to advise other traffic of his position and intentions. At this time, the aircraft was headed for Romeo Delta (RD), a reporting beacon for aircraft inbound to FAGM. The pilot stated that whilst at some distance from RD, he noticed a decrease in the engine manifold air pressure (MAP) indication and that the engine felt like it was not at full power. Thereafter, the aircraft started to lose speed and altitude; he then opted to lower the nose to maintain the speed whilst carrying out fault-finding checks. The pilot checked if the:
  - Carb heat was turned on (suspecting carb icing)

- Fuel selector was on both tanks (unchanged from take-off at FALA)
- Mixture was pushed to full rich
- Ignition switch was selected to both
- Primer was in and locked

1.1.4 During the post-accident investigation, the pilot stated that "*the throttle control lever appeared to be inoperative – it felt as though there was no feedback/response on the throttle control cable regardless of the throttle position, the RPM remained constant, and the MAP remained low".*

1.1.5 After completing the checks with no change or improvement in the engine performance, the pilot decided to advise FAGM air traffic control (ATC) of their situation. The aircraft had not flown past RD at the time, but FAGM ATC instructed the pilot to route to Runway (RWY) 11 which would be a straight-in approach from his position (west to east). The pilot stated that it was clear that he will not make it to RWY 11, and he decided to scan his surroundings for an open field which he located approximately 1.2 nautical miles (nm) west of FAGM on which to perform a forced landing. (*In a post-accident interview, the pilot stated that he did not consider landing on one of the roads as he was mindful of the power cables in the area).* Upon reaching the open field, he cut off the fuel mixture and fuel, applied full flaps and opened his door slightly (for ease after landing). The aircraft collided with trees during the landing sequence. This was followed by a post-impact fire that ensued soon after impact. The aircraft was engulfed in flames and the pilot freed himself and disembarked from the burning aircraft. He said he found his passenger walking away with serious burn wounds to his upper body and face. The pilot suffered minor burns and impact injuries. They were both taken to the hospital by ambulance where the passenger was put in an induced coma.

Figure 1: The green line is the aircraft's flight path from Silver Ball to the accident site. The red line, which is 1.2nm, is the distance from the threshold of Runway 11 at FAGM.

1.1.6 The accident occurred during daylight in visual meteorological conditions and at Global Positioning System (GPS) co-ordinates determined to be S 26º 14' 44.8" E 28º 07' 04.7", at an elevation of 5 139ft.

1.2. Injuries to Persons

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

Note: Other means people on the ground.

1.3. Damage to Aircraft

1.3.1. The aircraft was destroyed by post-impact fire.

Figure 2: ZS-PMT engulfed in flames immediately after coming to a stop. (Source: Facebook)

1.4. Other Damage

1.4.1. None.

1.5. Personnel Information

Nationality	South African	Gender	Male	Age	32
Licence Type	Private Pilot Licence (PPL)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	None				
Medical Expiry Date	31 August 2024				
Restrictions	None				
Previous Accidents	The pilot was involved in an accident whilst flying a Cessna 182P with registration ZS-MZV on 28 June 2021.				

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

Flying Experience:

Total Hours	125.6
Total Past 24 Hours	1.5
Total Past 7 Days	1.5
Total Past 90 Days	10.1
Total on Type Past 90 Days	10.1
Total on Type	52.8

1.5.1. According to the pilot's logbook, he started to fly on 8 September 2019 as a student pilot on the Cirrus SR20 aircraft. On 24 November 2020, he flew a 40-hour dual check with a flight instructor. On 22 March 2021, he undertook his Private Pilot Licence (PPL) skills test, which he passed. During his training period, he flew a total of 71.8 hours, of which 56.7 hours were dual flights and 15.1 were solo flights.

1.5.2. On 3 April 2021, the pilot commenced his conversion training to a Cessna 182P model with an approved training organisation (ATO). The conversion consisted of three flights with a flight instructor at a total flight time of 4.5 hours. The pilot subsequently flew 23 flights on different Cessna 182P aircraft at a total flight time of 38.2 hours. At the time of the accident, the pilot had accumulated 52.8 hours in total on the Cessna 182 aircraft type. The pilot was issued a PPL on 26 March 2021 with an expiry date of 31 March 2022.

1.5.3. The aircraft maintenance engineer (AME) who maintained the aircraft was first issued an AME licence on 14 February 1980; his current AME licence was reissued on 8 September 2020 with an expiry date of 16 September 2022. The accident aircraft type was endorsed on the AME's licence.

1.6. Aircraft Information

Airframe:

Manufacturer/Model	Cessna Aircraft Company	
Serial Number	182-62650	
Year of Manufacturer	1977	
Total Airframe Hours (At Time of Accident)	3 092.5	
Last MPI (Date & Hours)	15 September 2021	3 091
Hours Since Last MPI	1.5	
C of A (Issue Date)	25 October 2021	
C of A Expiry Date	31 October 2022	
C of R (Issue Date) (Present Owner)	28 July 2021	
Type of Fuel Used in the Aircraft	Avgas 100LL	
Operating Categories	Private (Part 91)	
Previous Accidents	None	

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

Engine:

Manufacturer/Model	Continental
Serial Number	451909-72R
Hours Since New	3091
Hours Since Overhaul	TBA

Propeller:

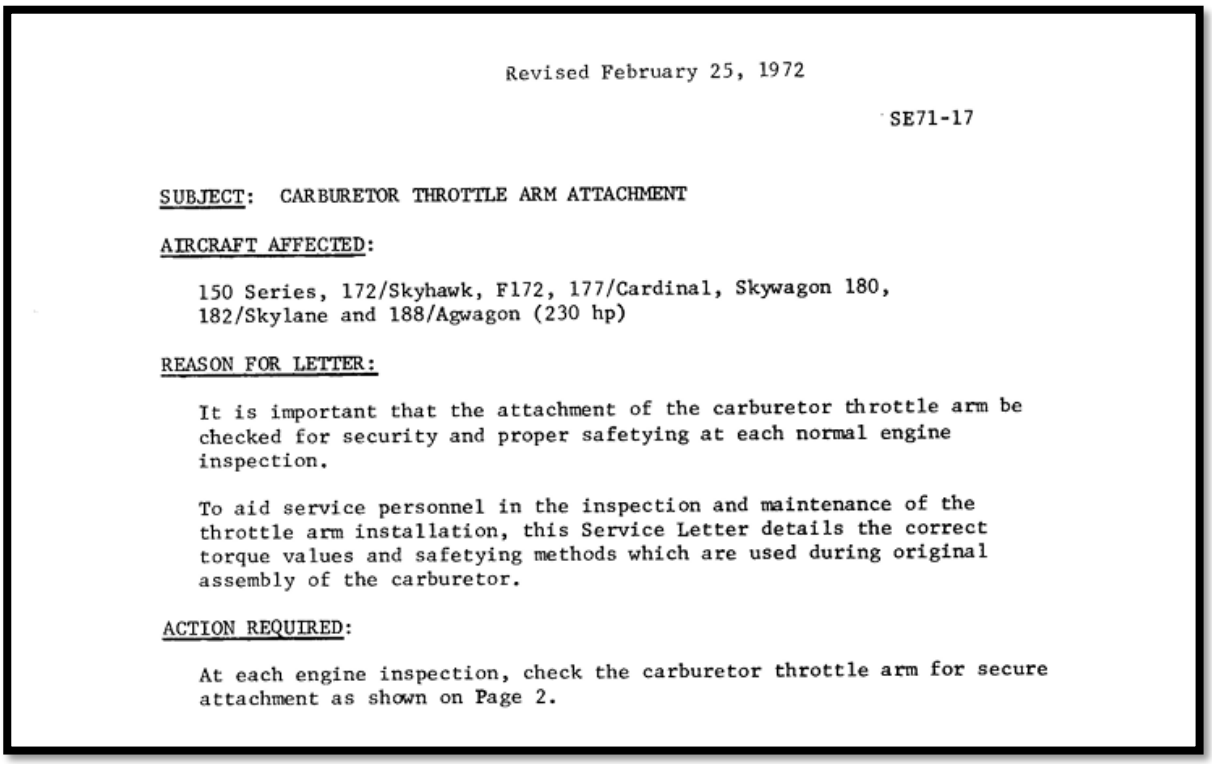
Manufacturer/Model	McCauley Propellers
Serial Number	738395
Hours Since New	3091.0
Hours Since Overhaul	TBA

1.6.1 The aircraft was ferried to the aircraft maintenance organisation (AMO) in FALA on 2 August 2021. On 4 August 2021, maintenance and repair work was started on the aircraft. The defect that was recorded was a radio failure. Apart from that, the aircraft was regarded as not airworthy, hence, the special permit from FAVV to FALA. The AME was qualified to carry out maintenance on the aircraft type and he followed the maintenance schedule for aircraft with 5700kg or less, as well as run-up sheet, maintenance periodic inspection (MPI) checklist and aircraft systems checks.

1.6.2 During maintenance, the manufacturer's checklist document No D2006-4-13 REV 4 dated 01 March 2004 was followed to check and monitor the engine run-up parameters recorded before and after inspections, and they were found to be acceptable.

1.6.3 The status report (Annexure C) indicated that the carburettor was installed on 11 February 2016 and was due for an overhaul on 8 February 2026. The last MPI was completed on 15 September 2021, and the aircraft was granted a Certificate of Airworthiness (C of A) on 25 October 2021 with an expiry date of 31 October 2022.

1.6.4 All service bulletins (SB), airworthiness directives (AD) and supplementary inspection documents (SID) were all complied with. The carburettor was last overhauled on 11 February 2016 with the next overhaul due on 8 February 2026.



Revised February 25, 1972

SE71-17

SUBJECT: CARBURETOR THROTTLE ARM ATTACHMENT

AIRCRAFT AFFECTED:

150 Series, 172/Skyhawk, F172, 177/Cardinal, Skywagon 180, 182/Skylane and 188/Agwagon (230 hp)

REASON FOR LETTER:

It is important that the attachment of the carburetor throttle arm be checked for security and proper safetying at each normal engine inspection.

To aid service personnel in the inspection and maintenance of the throttle arm installation, this Service Letter details the correct torque values and safetying methods which are used during original assembly of the carburetor.

ACTION REQUIRED:

At each engine inspection, check the carburetor throttle arm for secure attachment as shown on Page 2.

Figure 3: Service letter SE71-17.

1.6.5 The AMO used the service manual to check the carburettor throttle control lever (item no 33); the manual stated that it should be checked every 50 hours (see Figure 3).

1.7. Meteorological Information

1.7.1 The weather report was received from the South African Weather Service (SAWS) dated 18 November 2021. The weather report extract from SAWS stated: "*Note the missing METAR FAGM at 0800Z; Inferring from previous time steps reports, there is no indication of sudden changes to significant weather over FAGM that might have been omitted by the absence of 0800Z METAR*".

0700Z

Wind Direction	260º	Wind Speed	11kt	Visibility	9 999m
Temperature	20ºC	Cloud Cover	Nil	Cloud Base	N/A
Dew Point	09ºC	QNH	1021hPa		

0900Z

Wind Direction	260º	Wind Speed	17kt	Visibility	9 999m
Temperature	20ºC	Cloud Cover	Nil	Cloud Base	N/A
Dew Point	07ºC	QNH	1021hPa		

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 navigational equipment was unserviceable prior to the accident flight.

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 flight.

1.10. Aerodrome Information

1.10.1 The aircraft did not reach the intended aerodrome (FAGM); it crashed 1.2 nautical miles (nm) west of FAGM.

Aerodrome Location	Gauteng Province	
Aerodrome Status	Licensed	
Aerodrome Co-ordinates	S26°14'31.12" E028°09'04.88"	
Aerodrome Elevation	5 438 feet (ft)	
Runway Headings	11/29	17/35
Runway Dimensions	1 579m x 15m	1 197m x 15m
Runway Used	Runway 11	
Runway Surface	Tar	
Approach Facilities	RAV (VOR)	
Radio Frequency	118.7-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 was on long final approach for RWY 11 as advised by the FAGM ATC. Post-accident, the pilot stated that he had made certain preparations to slow down the aircraft to reduce the extent of damage. The area chosen by the pilot was sloping downwards and was not suitable for a forced landing (Figure 4 shows the elevation profile). Moreover, the area had large rocks. The first point of contact was the left-side tyre on the rock surface, followed

by broken tree branches on the right-hand side of the pilot. The right-side wing further impacted a tree stump and the aircraft swung 90° to the left and came to a halt facing the river edge.

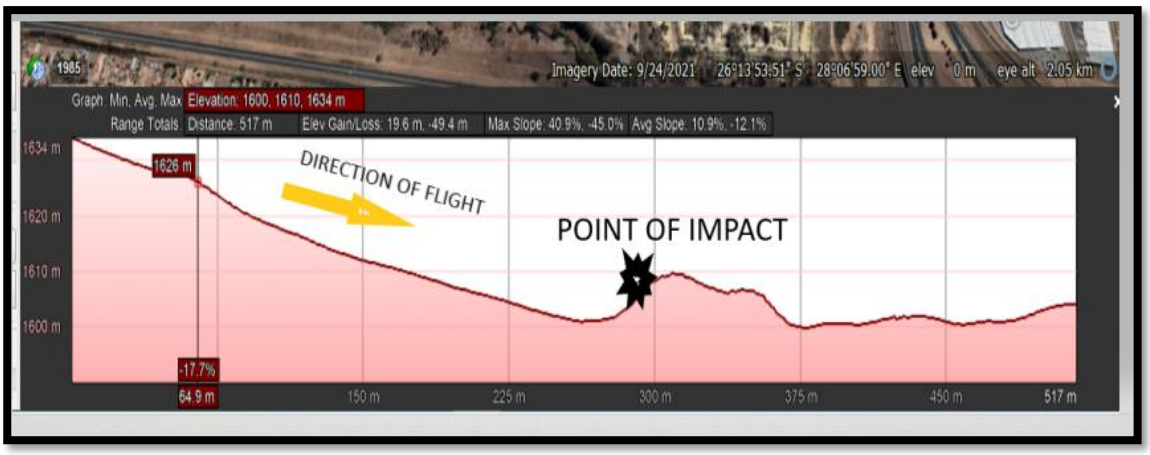


Figure 4: Profile elevation of the forced landing area. (Source: Google Earth)

1.12.2 As evidenced on the accident site, the tail section did not catch fire. Both the elevators and the rudder were inspected and found to be operating normally. The flight control cables were still attached and intact although they were severely burnt. Cables continuity for the elevator, rudder and ailerons were checked and verified. All control surface movements were evidenced by the cables moving forward and backwards. The left-side aileron was not checked due to the damage it had sustained.

1.12.3 The engine was still attached to the cradle. The extension leads were scorched. Both propeller blades suffered impact damage and were still attached to the flange. Both blade tips were showing signs of damage consistent with low revolutions per minute (RPM) on impact. The engine turned satisfactorily when it was rotated by hand. It was noted that the throttle cable had detached from the attachment point where it connects to the lever (see Figure 7). The position of the lever indicated an engine in idle position as found at the accident site.

Figure 5: The aircraft burned beyond recognition. (Source: University of Pretoria)

Figure 6: The engine and propeller blades post-accident. (Source: University of Pretoria)

1.12.4 The fire consumed most of the aircraft except for the engine, both outboard wings and the tail section of the empennage. The aircraft came to a stop facing south.

Figure 7: The separated caburettor throttle control lever and (inset) throttle control cable. (Source: University of Pretoria)

1.13 Medical and Pathological Information

1.13.1 The pilot was discharged from the hospital later on the same day of the accident. The passenger was treated in the hospital for burn wounds; he had since made a full recovery.

1.14 Fire

1.14.1 The aircraft burst into flames on impact with the ground and the occupants did not have enough time to extinguish the flames with the on-board portable Halon fire-extinguisher fitted in the aircraft. The aircraft was consumed by intense flames. Only the outboard wings and the tail section of the empennage remained after the fire had burned out. By the time the firefighters arrived at the accident scene, the fire had already died down and a request was made to the firefighters to spray more water to dissipate heat and to allow the relevant personnel to inspect the wreckage.

1.15 Survival Aspects

1.15.1 The accident was considered survivable but severe due to the impact forces and the post-impact fire that engulfed the aircraft. The cabin area was still intact after impact and both occupants managed to escape before the fire intensified. The door handles still functioned adequately after impact. The occupants suffered impact injuries and burn wounds.

1.16. Tests and Research

1.16.1. During the recovery stage, one of the technicians found that the carburettor throttle control lever had separated from the throttle control cable. The search for the attaching bolt and castellated nut proved unfruitful. The remaining eye end of the throttle cable was sent for testing analysis in a laboratory to determine the mode of failure.

The summary and findings of the report that was compiled by the Laboratory for Microscopy & Microanalysis of the University of Pretoria are as follows:

1.16.2. Throttle Cable Assembly (Part no 565-549-031; no serial) The visual inspection revealed extensive post-impact fire damages to the throttle cable assembly (Photo 2).

Figure 8: Throttle cable as found at the accident site. (Source: University of Pretoria)

Figure 9: A complete throttle cable. (Source: University of Pretoria)

1.16.3. *The bending damage corresponded with the support bracket- and fire-wall positions when fitted. The inner area of the throttle cable ball-eye end revealed extensive build-up of foreign material*.

Figure 10: Ball-eye end and affected cable. (Source: University of Pretoria)

1.16.4. At higher magnifications the foreign material particulate morphologies conformed to high temperature generated metallic residue and remnants of burnt-out oil and/or fuel. The EDS MAP analysis revealed the foreign particles compositions to conform to Iron-oxides (Fe, O)

originating from steel-based material/s – the high Oxygen Wt.% suggest exposure to high temperature; remnants of a fuel/oil fuelled fire (P, S, Cl); soil based elements (Ca, Si) possibly originating from the accident site and other trace elements originating from various base materials (Al, Mg, Cr) typically found in aircraft construction (EDS Results 1 and 2).

1.16.5. The investigation revealed no clear pre-impact fractures or other discrepancies within the throttle control cable and carburettor assemblies that would result in the separation of the two parts in-flight.

Figure 11: Simulated attachment bolt. (Source: University of Pretoria)

1.16.6. A new attachment bolt was fitted to the assembly to simulate an assembled unit for reference purposes (Figure 10). The noted close tolerances (Figure 11, red dashed circles) between the bolt outer surface and both the carburettor control arm and the throttle cable ball-eye end, support the notion that the level of foreign particles ingestion at these areas as noted would be highly unlikely with the bolt/nut/washers/cotter-pin fitted in position. It may therefore be concluded that the bolt/nut/washers/cotter-pin assembly was not in the depicted position at the time of the initiation of, and during, the post-impact fire

1.17. Organisational and Management Information

1.17.1. The AMO which carried out the last maintenance inspection on this aircraft was issued an AMO approval certificate on 21 February 2021 with an expiry date of 28 February 2022. The aircraft type was duly authorised to be maintained under the AMO.

1.17.2. The aircraft was maintained in accordance with Part 43 of the Civil Aviation Regulations (CAR) 2011 as amended, as well as the Cessna aircraft maintenance manuals.

1.17.3. On 2 August 2021, the new owner of the aircraft was granted a special flight permit to ferry the aircraft to the base of the current AMO in FALA due to the lapsed C of A on 31 May 2020.

1.17.4. After the MPI was completed on 15 September 2021, the aircraft was granted the C of A on 25 October 2021 with an expiry date of 31 October 2022.

1.18. Additional Information

1.18.1. Regulations governing maintenance release to service and dual inspection

Carrying out of maintenance

43.02.3 *Any person who carries out maintenance on an aircraft or aircraft component shall—*

(a) have available adequate accommodation and facilities for the necessary disassembly, proper inspection and re-assembly of the aircraft or aircraft component.

(b) use methods, techniques and practices which are—

(i) prescribed in the current manufacturer's maintenance manual or in any instructions for safe operation and continued airworthiness.

(ii) in accordance with the approved maintenance programme for the aircraft.

(iii) in accordance with Document SA-CATS 43; or

(iv) approved by the Director.

(c) use the tools, equipment, and test apparatus necessary to ensure that the maintenance is carried out in accordance with the appropriate manufacturer's requirements or standard practices approved by the Director.

(d) on completion of the maintenance, ensure that the condition of the aircraft or aircraft component is satisfactory for release to service and is at least equal to its original or properly modified condition about—

(i)aerodynamic function.
(ii)structural strength.
(iii)resistance to vibration and deterioration; and
(iv)other qualities affecting airworthiness.

Duplicate inspections of flight and engine controls

43.04.8 *(1) No person shall certify a control system component after the initial assembly, subsequent disturbance or adjustment of any part of such control system, unless—*

(a) a duplicate safety inspection of the control system has been carried out; and

(b) the duplicate safety inspection is recorded and certified in the appropriate logbook or other maintenance record approved by the Director.

(2) A duplicate safety inspection authorised in terms of sub-regulation (1), shall consist of—

(a) an inspection by a person referred to in regulation 43.04.1 to certify the release to service of the control system after maintenance; and

(b) a second inspection carried out by another person who is a person referred to in sub-regulation (1) for an aircraft with a MCM more than 5700 kg, as prescribed in Document SA-CATS 43: or

(c) a second inspection carried out by another person who is a person referred to in sub-regulation (1) for helicopters with a MCM more than 3 175 kg, as prescribed in Document SA-CATS 43: or

(d) a second inspection carried out by another person who is a person referred to in sub-regulation (1) for an aircraft with a MCM below 5 700 kg and helicopters with a MCM below 3 175 kg, as prescribed in Document SA-CATS 43.

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

Pilot

2.2.1 The pilot was in possession of a Private Pilot Licence (PPL) that was issued on 26 March 2021 with an expiry date of 31 March 2022. He had a valid Class 2 medical certificate that was issued on 24 August 2019 with an expiry date of 31 August 2024 with no restrictions. The Cessna 182P type was endorsed on his licence.

2.2.2 The aircraft's last maintenance periodic inspection (MPI) was carried out by a certified AMO. The Certificate of Release to Service (CRS) was issued on 15 September 2021 at 3091.7 airframe hours, and the next inspection would have been at 50-hour at 3139.7 hours.

Mission

2.2.3 The pilot had planned to ferry the aircraft to Rand Aerodrome (FAGM) where it would be based. Their planned route was via Magaliesburg GFA with a full stop landing at Blue

Mountain Valley private airstrip. On final approach at Blue Mountain Valley private airstrip, the pilot aborted the landing due to wet grass on the runway and decided to route directly to FAGM. Whilst cruising between 6500ft and 7000ft above ground level and not far from FAGM, the manifold pressure dropped, and the engine power reduced. The pilot stated that the throttle appeared to be inoperative (*it felt as though there was no tension on the throttle cable regardless of the throttle position).*

2.2.4 The pilot advised FAGM tower of his situation, and he was cleared for landing on Runway 11. During approach, the aircraft's speed was reducing and, to maintain it, the pilot adopted a nose-down attitude which led to the loss of height. The pilot advised FAGM tower that they were performing a forced landing on an open area about 1.2nm from the threshold of Runway 11. During the forced landing, the aircraft impacted tree branches before it came to a stop facing south. A post-impact fire ensued soon after impact. The pilot managed to free himself, he then rushed to the side of the passenger, but found that the passenger had already freed himself. The pilot suffered third degree burns and the passenger sustained first degree burns. The pair was sent to the hospital for medical attention.

Machine

2.2.5 Prior to the accident flight, the aircraft was flown to FALA on a special permit to carry out mandatory periodic inspection (MPI) which would allow the aircraft to be evaluated and granted a C of A. Maintenance carried out on the aircraft included complying with the manufacturer's checklist D2006-4-13 REV 4 dated 01/03/2004. The MPI work pack provided to the investigators included running the engine and making sure that all parameters were met, checking the airframe and that all aerodynamic surfaces moved freely, as well as checking the propeller's integrity and confirming the absence of corrosion throughout the airframe. When completing maintenance work in the engine bay, the AMO was supposed to have followed the service letter (single engine) SE71-17 which was dated 25 February 1972. The service letter states that, "*It is important that the attachment of the carburettor throttle lever be checked for security and proper safe tying at each normal engine inspection*." The throttle cable was separated from the throttle lever during flight because it was not properly secured, and that was the reason the pilot felt there was no tension in the throttle cable.

2.2.6 Furthermore, post-accident investigation revealed that the engine could still be turned by hand and that during recovery of the aircraft, it was discovered that the throttle cable had separated from the throttle lever control in the carburettor. The missing bolt and nut were not recovered at the accident site. The carburettor and the throttle cable were sent for testing at the Laboratory for Microscopy & Microanalysis of the University of Pretoria. Their report conclusively indicated that:

- *The inner area of the throttle cable ball-eye end revealed extensive build-up of foreign*

matter

- *The foreign matter particulate morphologies conformed to high temperature generated metallic residue and remnants of burnt-out oil and/or fuel.*

2.2.7 During maintenance and where it concerns the throttle cable and the throttle lever control, the AMO did not follow the service letter SE71-17 (Figure 3) and the CAR 2011 43.02.3 (d) which states that, "*on completion of the maintenance, ensure that the condition of the aircraft or aircraft component is satisfactory for release to service and is at least equal to its original or properly modified condition with regard to— aerodynamic function; structural strength; resistance to vibration and deterioration and other qualities affecting airworthiness."*

2.2.8 In the work pack that was studied by the investigating team, the dual inspection was stamped as complete, but it was not. It is not clear how two inspectors were not able to notice the missing bolt and split pin. The CAR 43.04.8 (1*)* states, *"No person shall certify a control system component after the initial assembly, subsequent disturbance, or adjustment of any part of such control system, unless—*
(a) a duplicate safety inspection of the control system has been carried out; and
(b) the duplicate safety inspection is recorded and certified in the appropriate logbook or other maintenance record approved by the Director."

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 pilot was issued a PPL on 26 March 2021 with an expiry date of 31 March 2022. He was also issued a Class 2 medical certificate on 25 May 2019 with an expiry date of 31 August 2024.

3.2.2. Before the MPI was carried out, the accident aircraft was based in Vereeniging Aerodrome (FAVV) and had last been flown in 2018 (no exact date is available as the flight folio was burnt by post-impact fire). On 2 August 2021, the new owner was granted a special flight permit to ferry the aircraft to the base of the current AMO in FALA.

3.2.3. After complying with the requirements of the SACAA CAR 2011 Part 43, the aircraft was issued a C of A on 25 October 2021 with an expiry date of 31 October 2022. The aircraft was registered to the new owner and a C of R was issued on 28 July 2021.

3.2.4. The SAWS report indicated that there was no weather report for 0800Z, but the weather given between 0700Z and 0900Z only differed with only the increase of wind speed; however, it did not contribute to this accident.

3.2.5. The aircraft impacted tree branches before it crashed, and a post-impact fire ensued soon after. The pilot and the passenger managed to free themselves from their seats and disembarked from the aircraft. They sustained burn wounds. The post-impact fire consumed most of the aircraft.

3.2.6. The pilot was discharged from hospital on the same day whilst the passenger was placed on a medically induced coma to facilitate his recovery.

3.2.7. The firefighting service personnel were called to the accident site, but they arrived after the fire had died down. A request was made to the firefighters to pour water onto the wreckage to dissipate any residual heat and to allow relevant personnel to inspect the wreckage.

3.2.8. During recovery, the engine was tested by turning the propeller by hand and it complied, confirming that it was operating normally, and that it had not stopped operating prior to the accident.

3.2.9. The status report indicated that the carburettor was due for overhaul on 8 February 2026.

3.2.10. It was found that the throttle cable had separated from the throttle lever and only the eye end of the cable was found; it was then sent for testing and analysis. The bolt, castellated nut and the split pin were not recovered.

3.2.11. Continuity on flight control surfaces was checked and there were positive movements of the associated cables and control surfaces.

3.2.12. Testing found that both the throttle cable eye and the throttle lever on the carburettor had extensive build-up of foreign matter which comprised metallic residue and remnants of burnt-out oil and/or fuel.

3.2.13. During the last MPI, the work pack indicated the work carried out and the dual inspection as having been completed and stamped, confirming that the carburettor throttle cable attachment was in order, but the accident proved that it was not properly maintained.

3.3. Probable Cause/s

3.3.1 The throttle cable separated from the throttle lever control in-flight because of the missing cotter pin on the castellated nut, which caused the engine to run at idle. The pilot was unable to maintain the aircraft's height and, thus, led him to execute an unsuccessful landing which was followed by a post-impact fire that destroyed the aircraft.

3.4. Contributory Factor

3.4.1 Missing cotter pin on the castellated nut was not identified during maintenance.

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. Annexure A - Cessna 182P Inspection check sheet page 2-21 – Engine Compartment.
5.2. Annexure B – Cessna 182P Engine parts replacement time page 2-26
5.3. Annexure C – Cessna 182P Status report

This report is issued by:

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

ANNEXURE A

	SPECIAL INSPECTION ITEM	EACH 200 HOURS	EACH 100 HOURS	EACH 50 HOURS
20. Cabin heat valves, doors and controls				
21. Starter, solenoid and electrical connections				
22. Starter brushes, brush leads, commutator				
23. Alternator and electrical connections				
24. Alternator brushes, brush leads, commutator or slip ring				7
25. Voltage regulator mounting and electrical leads				
26. Magnetos (External) and electrical connections				
27. Magneto timing				3
28. Carburetor and drain plug (Refer to Service Letter (SE73-13.)				
29. Firewall				
30. Engine cowl flaps and controls				
31. Engine cowling				
32. Cowl flap hinges and hinge pins (Refer to Service Letter SE71-27.)				
33. Carburetor throttle arm attachment (Refer to Service Letter SE71-17.)				
34. Alternator support bracket for security (Refer to Service Letter SE71-42.)				
FUEL SYSTEM				
1. Fuel strainer, drain valve and control, fuel cell vents, caps and placards				
2. Fuel strainer screen and bowl				
3. Drain fuel and check cell interior, attachment and outlet screens				5
4. Fuel cells and sump drains				
5. Fuel selector valve and placards (Refer to Service Letter SE74-1.)				
6. Engine primer				
7. Fuel quantity indicators and transmitters				
8. Perform a fuel quantity indicating system operational test. Refer to Section 15 for detailed accomplishment instructions.				16
LANDING GEAR				
1. Brake fluid, lines and hose, linings, discs, brake assemblies and master cylinders				
2. Main gear wheels				
3. Wheel bearings				9
4. Main gear springs				

WELL CO AMO 119 INSP 1 AIR SERVICES

ANNEXURE B

COMPONENT	REPLACEMENT TIME	OVERHAUL
Engine Compartment Flexible Fluid-Carrying Rubber Hoses (Cessna-Installed) Except Drain Hoses (Drain hoses are replaced on condition)	5 years or engine overhaul, whichever occurs first (Note 1)	NO
Engine Air Filter	500 hours or 36 months, whichever occurs first (Note 9)	NO
Engine Mixture, Throttle, and Propeller Controls	At engine TBO	NO
Oxygen Bottle – Lightweight Steel (ICC-3HT, DOT-3HT)	Every 24 years or 4380 cycles, whichever occurs first	NO
Oxygen Bottle – Composite (DOT-E8162)	Every 15 years	NO
Engine-Driven Dry Vacuum Pump Drive Coupling (Not lubricated with engine oil)	6 Years or at vacuum pump replacement, whichever occurs first	NO
Engine-Driven Dry Vacuum Pump (Not lubricated with engine oil)	500 hours (Note 10)	NO
Standby Dry Vacuum Pump	500 hours or 10 Years, whichever occurs first (Note 10)	NO

3. Supplier-Established Replacement Time Limits

A. The following component time limits have been established by specific suppliers and are reproduced as follows:

Table 2: Supplier-Established Replacement Time Limits

COMPONENT	REPLACEMENT TIME	OVERHAUL
ELT Battery	(Note 3)	NO
Vacuum Manifold	(Note 4)	NO
Magnetos	(Note 5)	YES
Engine	(Note 6)	YES
Engine Flexible Hoses (TCM-Installed)	(Note 2)	NO
Auxiliary Electric Fuel Pump	(Note 7)	YES
Propeller	(Note 8)	YES

ANNEXURE C

	30-05-2019	1 Year	-16 m	29-05-2020
C of Reg				
	28-07-2021	Once off		
Radio Station License				
	31-03-2021	1 Year	6 m	31-03-2022
ENGINE				
MAGNETO 500 HR Inspection				
	3091,7	500 Hours	500 h	3591,7
MAGNETO 500 HR Inspection				
	19-08-2021	4 Years	46 m	18-08-2025
MAGNETO Overhaul				
	3091,7	1500 Hours	1500 h	4591,7
ALTERNATOR 500 HR Inspection				
	3091,7	500 Hours	500 h	3591,7
ALTERNATOR Overhaul				
	1639,3	1500 Hours	48 h	3139,3
STARTER 500 HR Inspection				
	3091,7	500 Hours	500 h	3591,7
STARTER Overhaul				
	1639,3	1500 Hours	48 h	3139,3
CSU Hours Inspection				
	3088	1500 Hours	1496 h	4588
CSU Date Inspection				
	23-02-2016	7 Years	16 m	21-02-2023
ENGINE Overhaul				
	1639,3	1500 Hours	48 h	3139,3
ENGINE HOSES Replacement				
	13-10-2021	10 Years	120 m	11-10-2031
ENGINE AIR FILTER Replacement				
	3091,7	500 Hours	500 h	3591,7
ENGINE AIR FILTER Replacement				
	15-09-2021	3 Years	35 m	14-09-2024
ENGINE, PROPELLER CONTROL AND LINKAGE Replacement				
	1639,3	1500 Hours	48 h	3139,3
CARBURETOR Overhaul				
	11-02-2016	10 Years	52 m	08-02-2026

Description /Part	Installed	Frequency	To Go	When Due
AILERON AND ELEVATOR TRIM TAB				
AUTOPILOT RIGGING Hours Inspection	N/A	600 Hours	h	
AUTOPILOT RIGGING Date Inspection	N/A	1 Year	m	
ELEVATOR TRIM TAB ACTUATORS Hours Inspection	3091,7	600 Hours	600 h	3691,7
ELEVATOR TRIM TAB ACTUATORS Date Inspection	15-09-2021	1 Year	11 m	15-09-2022
FUEL SYSTEM & INSTRUMENT SYSTEM				
FUEL BLADERS Inspection	3091,7	1000 Hours	1000 h	4091,7
VACUUM SYSTEM AIR FILTER Replacement	3091,7	500 Hours	500 h	3591,7
VACUUM SYSTEM RELIEF VALVE Replacement	3091,7	100 Hours	100 h	3191,7