AIRCRAFT INCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/3/2/1226		
Aircraft Registration	**ZU-FRN**	**Date of Incident**	10 November 2018		**Time of Incident**	1015Z	
Type of Aircraft	Yak 52			**Type of Operation**	Private Part 94		
Pilot-in-command Licence Type	Commercial Pilot		**Age**	55	**Licence Valid**	Yes	
Pilot-in-command Flying Experience		Total Flying Hours	2254.3		Hours on Type	199.7	
Last point of Departure	Rand Aerodrome (FAGM)-Gauteng Province						
Next Point of Intended Landing	Rand Aerodrome (FAGM)-Gauteng Province						
Location of the incident site with reference to easily defined geographical points (GPS readings if possible)							
In an open field on a private farm near Heineken factory in Vereeniging, next to R56 Road							
Meteorological Information	Wind direction: 045°; Wind Speed: 10kt; Wind temperature: 18°C; Visibility: CAVOK						
Number of People On-board	2+0	**No. of People Injured**	0	**No. of People Killed**	0		
Synopsis							

A pilot and a passenger were engaged in a private flight when the incident occurred. The aircraft took off from the Rand Aerodrome (FAGM) with an intention to land back at the same aerodrome. During the flight whilst flying overhead Heineken factory in Vereeniging at approximately 7000 feet (ft), the aircraft's engine lost power and went on an idle. The pilot attempted to recover the engine power but was unsuccessful. He then identified an open field on a farm to conduct a forced landing. However, during landing, the aircraft's nose landing gear collapsed and the propeller struck the ground whilst turning at idle, shattering the blades.

The aircraft sustained damages to the nose landing gear, propeller blades and the nose section.

The investigation revealed that there was no evidence of an engine power loss or any other system failure. It also revealed that the aircraft was landed on an uneven terrain, resulting in the nose gear collapsing and the propeller striking the ground before the aircraft came to a stop.

SRP Date	07 October 2019	Publication Date	17 October 2119

ABBREVIATION	DESCRIPTION
°	Degrees
°C	Degrees Celsius
AIID	Incident and Incident Investigations Division
AMO	Aircraft Maintenance Organisation
AMSL	Above Mean Sea Level
AP	Approved Person
CAR	Civil Aviation Regulations
CAVOK	Ceiling and Visibility OK
C of A	Certificate of Airworthiness
C of R	Certificate of Registration
CVR	Cockpit Voice Recorder
E	East
FAGM	Rand Aerodrome
FDR	Flight Data Recorder
ft	Feet
GPS	Global Positioning System Coordinates
hPa	Hectopascal (1 hPa = 100 Pa)
Km/h	Kilometres per Hour
kt	Knots
l	Litres
m	Metres
mmHg	Millimetres of Mercury
MPI	Mandatory Periodic Inspection
NTCA	Non-Type Certified Aircraft
psi	Pressure Per-square Inch
QNH	Query Nautical Height
S	South
SACAA	South African Civil Aviation Authority
TBO	Time Before Overhaul
UTC	Co-ordinated Universal Time
VFR	Visual Flight Rules

Reference Number	**:** CA18/3/2/1226
Name of Owner/Operator	**:** NVT Aircraft CC
Manufacturer	**:** Yakovlev
Model	**:** YAK 52
Nationality	**:** South African
Registration Marks	**:** ZU-FRN
Place	**:** Vereeniging Highway (R56), near a Heineken Factory
Date	**:** 10 November 2018
Time	**:** 1015Z

All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Purpose 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 incidents or incidents and ***not to apportion blame or liability****.*

Investigations process:

The incident was notified to the Incident and Incident Investigations Division (AIID) on 10 November 2018 at about 10:30Z. The investigator/s co-ordinated with all authorities on site by initiating the incident investigation process according to CAR Part 12 and investigation procedures. The AIID of the South African Civil Aviation Authority (SACAA) is leading the investigation as the Republic of South Africa is the State of Occurrence.

Notes:
1. Whenever the following words are mentioned in this Report, they shall mean the following:

- *Incident — this investigated incident*
- *Aircraft— the Yak 52 involved in this incident*
- *Investigation — the investigation into the circumstances of this incident*
- *Pilot — the pilot involved in this incident*
- *Report — this incident report*

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

Disclaimer:

This report is produced without prejudice to the rights of the SACAA, which are reserved.

FACTUAL INFORMATION

1.1. History of Flight

1.1.1 On 11 November 2018 at approximately 1000Z, the pilot and a passenger took off from the Rand Aerodrome (FAGM) on a private flight with an intention to land back at FAGM. The flight was conducted under visual flight rules (VFR). The weather conditions on the day were reported to be fine.

1.1.2 According to the pilot, whilst flying at 7000 feet (ft) above mean sea level (AMSL), the aircraft had an un-commanded engine power loss and went on an idle. He attempted to carry out an engine recovery procedure but was unsuccessful. On realising this, he elected to conduct a forced landing on an open field in a private farm. Upon landing, the nose landing gear collapsed and caused the propeller to strike the ground, shattering the blades. The nose section of the aircraft impacted the ground and the aircraft skidded forward before coming to a stop. Both the pilot and the passenger disembarked the aircraft unassisted after switching off the master switch and securing the aircraft. Both occupants sustained no injuries during the incident, however, the aircraft was damaged.

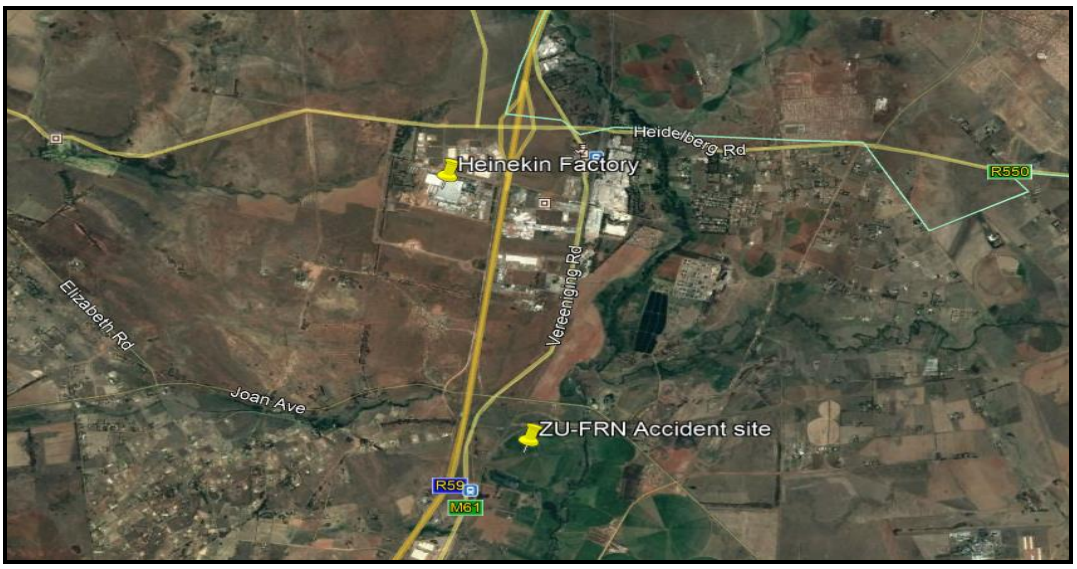

Figure 1: Aerial view of the accident site

1.1.3 The incident occurred near the R59 Road in Vereeniging, Gauteng province. The incident occurred at the following Global Positioning System (GPS) co-ordinates: S 26° 27’ 35.63”, E 028° 4’ 41.57” and at a field elevation of 4862 feet (ft).

1.2 Injuries to Persons

Injuries	Pilot	Crew	Pass.	Other
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
None	1	-	1	-

1.3 Damage to Aircraft

1.3.1 The aircraft sustained substantial damage.

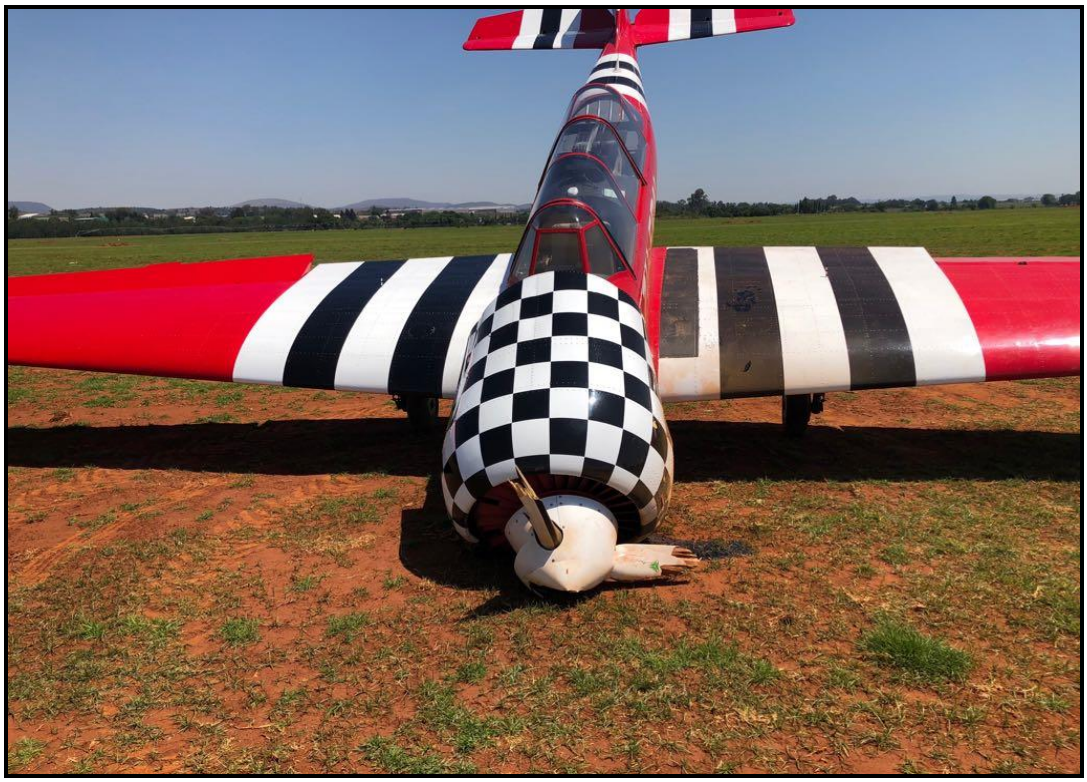

Figure 2: The damaged aircraft.

1.3.2 The front view (Figure 2) of the aircraft shows the nose section bending upwards and to the left-hand side.

1.4 Other Damage

1.4.1 None.

1.5 Personnel Information

Nationality	South African	Gender	Male	Age	55
Licence Number	**********	Licence Type	Commercial Pilot Licence (CPL)		
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Instrument, Night Flight and Aerobatics				
Medical Expiry Date	31 May 2019				
Restrictions	Corrective Lenses				
Previous Incidents	None				

Flying Experience:

Total Hours	2254.3
Total Past 90 Days	20.8
Total on Type Past 90 Days	0.4
Total on Type	199.7

1.6 Aircraft Information

1.6.1 The Yak 52 is an all-metal, two-seat in tandem, single-engine low-wing monoplane, designed by the Yakovlev Design Bureau in Russia as a basic aerobatic training aircraft and manufactured in Romania by Aerostar S.A. The type first flew in 1978 and there were about 1900 built. Production ceased in 2010. The aircraft type never received civil or military type certification. The aircraft is equipped with a variable pitch propeller which can be adjusted from the cockpit with a propeller pitch lever.

Airframe:

Type	Yak 52	
Serial Number	811314	
Manufacturer	Yakovlev	
Date of Manufacture	1981	
Total Airframe Hours (At time of Incident)	892.15	
Last MPI (Date & Hours)	25 June 2018	891.9
Hours since Last MPI	0.25	
ATF (Issue Date)	25 June 2018	
C of R (Issue Date) (Present owner)	19 June 2012	
Operating Categories	NTCA (Part 94)	

Engine:

Type	Vedeneer Russia M14P
Serial Number	K9 331040
Hours since New	1011
Hours since Overhaul	500

Propeller:

Type	MTV-9-B-C
Serial Number	100 347
Hours since New	13
Hours since Overhaul	TBO not yet reached

1.6.2 According to the maintenance records, the aircraft's annual inspection maintenance was carried out on 25 June 2018. From then, the aircraft was never operated until 2 November 2018 for 0.4 flying hours in which 50 litres (l) of AVGAS fuel was uplifted prior to the flight. According to the pilot, who is also the owner of the aircraft, he last flew the aircraft after its maintenance was completed. At the time, he did not experience any anomalies.

1.7 Meteorological Information

1.7.1 The following weather information was obtained from the pilot questionnaire:

Wind direction	045°	Wind speed	10 kts	Visibility	CAVOK
Temperature	18°C	Cloud cover	Nil	Cloud base	N/A
Dew point	Not Known	QNH	Not Known		

1.8 Aids to Navigation

1.8.1 The aircraft was equipped with standard navigation equipment as approved by the Regulator (SACAA) for the aircraft type. No defects that could render the navigation system unserviceable were recorded before the flight.

1.9 Communication

1.9.1 The aircraft was equipped with standard communication equipment as approved by the Regulator for the aircraft type. No defects that could render the communication system unserviceable were recorded before the flight.

1.10 Aerodrome Information

1.10.1 The aircraft incident occurred near the R59 Road in Vereeniging, Gauteng Province. The place where the incident occurred was determined to be at GPS co-ordinates: S 26° 27’ 35.63”, E 028° 4’ 41.57” and at an elevation of 4862 ft.

1.11 Flight Recorders

1.11.1 The aircraft was neither equipped with a flight data recorder (FDR) nor 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 approached the landing area from the north-west direction. Upon landing, the nose gear collapsed and the aircraft turned towards the right-hand side whilst skidding. All three wooden blades of the propeller were shattered during the incident sequence. This indicates that the damage was sustained whilst the propeller was turning.

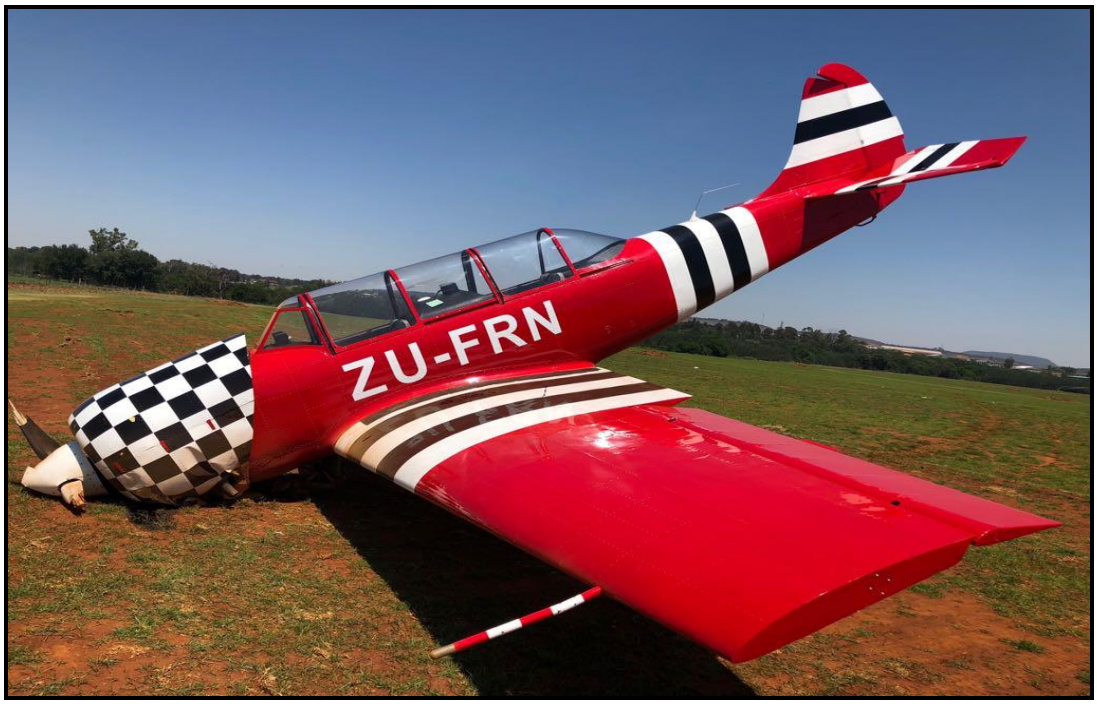

Figure 3: The aircraft at the accident site.

1.12.2 The manifold pressure indicator showed 660 millimetre of mercury (mmHg) reading post incident and was stuck in that position, indicative of an engine being under power.

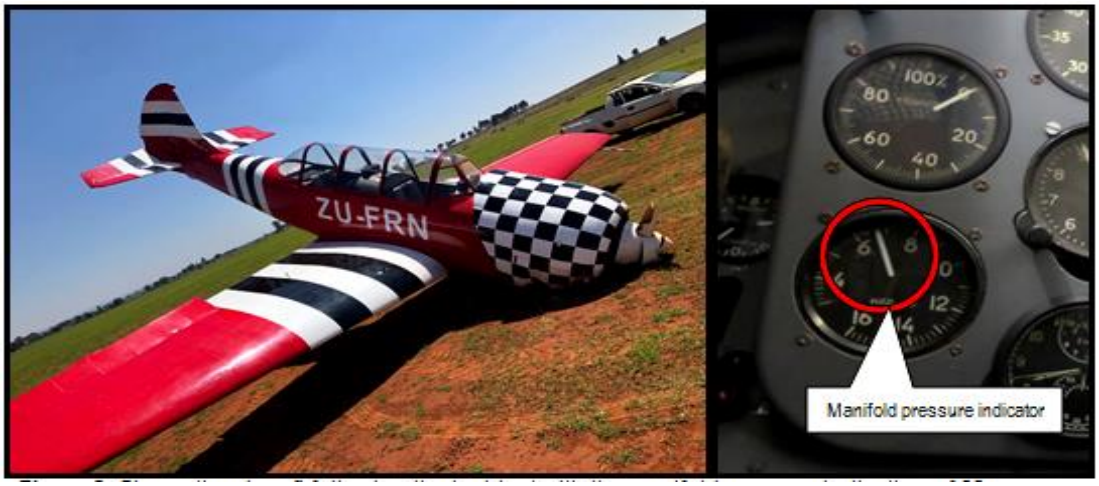

Figure 4: The aircraft after the incident and (inset) the manifold pressure indicator.

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 aircraft incident was considered survivable as there was no damage to the cabin/cockpit area which could have caused injury to the occupants.

1.16 Tests and Research

1.16.1 Following the incident, a post-engine inspection was conducted and no anomalies were found. The aircraft engine had 13 hours of operational after an overhaul service.

1.16.2 The approved personnel (AP) who performed the annual inspection on the aircraft highlighted the following findings:

- All three propeller blades were completely damaged during impact. (This is an indication that the engine was turning at high power settings)
- Indication by the manifold pressure gauge showing 660mmHg (take-off power of the aircraft is 99% at 750mmHg; cruise power is 64% at 600mmHg). Also, it is possible that the high indication of the manifold pressure could be a result of the impact forces
- All engine controls were connected and locked
- Fuel filters and oil filters were found clean and in order
- The carburettor air filter was clean with no signs of debris

Suspected failure units that can cause the reported engine power loss are likely to be:

- Carburettor needle jamming
- Propeller governor failure causing power loss
- Fuel pumps reduction valve failure, creating low fuel pressure before carburettor

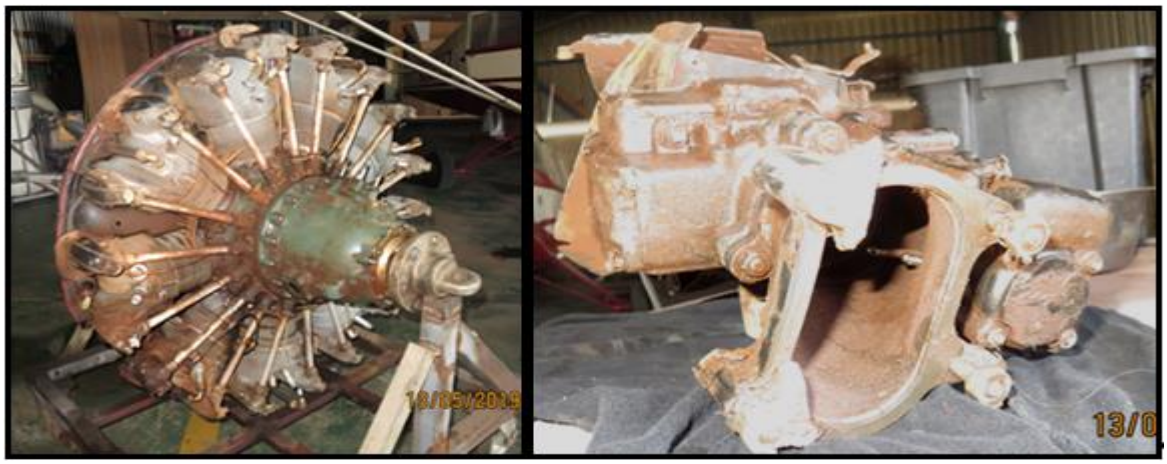

Figure 5: The engine and the carburettor at the maintenance hangar.

1.16.3 Yak 52 emergency procedures:

The emergency procedures in the flight manual accepted by the SACAA were comparable to the ones from the YAK 52 manufacturer's flight manual quoted below. The engine failure checklist read as follows:

ENGINE FAILURE
Establish 172 KPH Glide
Retract Landing Gear
Check Mags, Fuel and Pump
Turn Pump to left and pump fuel pressure to .1 to .2
Attempt restart

5.17. SPECIAL AIRPLANE FEATURES WHEN LANDING WITH DAMAGED ENGINE

5.17.1. In case of a forced landing on a rough or unknown ground, the landing will be performed with the undercarriage retracted.

5.17.4 In case of an emergency landing and engine failure, the pilot must perform the following operations: set the instrumental airspeed to 160 km/h; shut the fire cock [fuel shutoff lever], switch off the magneto, the generator, and the ignition; determine the height of flight and calculate the available gliding distance so as to assess the possibility of landing on the aerodrome.

Another flight manual, published by a UK Yak 52 maintenance organisation in 1995, additionally stated:

Following an in-flight failure of the engine driven fuel pump the primer, set to CARB [left], may be used as an emergency fuel pump to maintain fuel pressure and thus enable the aircraft to be flown to the nearest diversion airfield.

1.16 Organisational and Management Information

1.17.1 The aircraft was privately owned and operated.

1.17.2 The AP who maintained the aircraft held an aircraft maintenance approval certificate issued by the Regulator on 4 October 2018 and expiring on 31 October 2020.

1.17 Additional Information

1.18.1 None.

1.18 Useful or Effective Investigation Techniques

1.19.1 None.

2. ANALYSIS

2.1. General

The following analysis was made with respect to this incident. These shall not be read as apportioning blame or liability to any particular organisation or individual.

2.2. The analysis

2.2.1 The pilot's licence was issued by the Regulator on 27 May 2017. The aircraft was endorsed on it and had an expiry date of 30 June 2019. His medical certificate was issued on 25 May 2018 with an expiry date of 31 May 2019.

2.2.2 According to the flying record, the pilot had flown approximately 0.4 hours on the aircraft type in the past 90 days, including the incident flight. Although this

information was provided during the reporting of the incident, it was not recorded on any of the pilot's logbooks.

2.2.3 The records indicated that the aircraft was maintained by an AP in accordance with the manufacture's recommended procedures. The aircraft was issued with an authority to fly on 25 June 2018, with an expiry date of 24 June 2019.

2.2.4 Although the pilot reported engine power loss, all three propeller blades were shattered during the incident, indicating that the engine was operating at a high-power setting. The fact that the propeller blades were shattered indicated an engine operating at high power setting; this is also supported by the manifold pressure which was found stuck on 660mmHg, a setting indicative of an engine operating just above cruise power. It is, therefore, likely that the engine was operating at a high-power setting during the nose gear collapse.

2.2.5 There was no evidence of any airframe or engine system failure which could indicate a pre-impact failure.

2.2.6 The investigation revealed that there was no evidence on an engine power loss or any other system failure. The investigation also revealed that the aircraft was landed on an uneven terrain, resulting in the nose gear collapsing and the propeller striking the ground before the aircraft came to a stop.

3. CONCLUSION

3.1. General

The following findings, causes and contributing factors were made with respect to this incident. These shall not be read as apportioning blame or liability to any particular organisation or individual.

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

- **Findings —** are statements of all significant conditions, events or circumstances in this Incident. The findings are significant steps in this Incident sequence but they are not always causal or indicate deficiencies.
- **Causes —** are actions, omissions, events, conditions, or a combination thereof, which led to this Incident.
- **Contributing factors —** are actions, omissions, events, conditions, or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the incident or incident occurring, or mitigated the severity of the consequences of the incident or incident. 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 commercial pilot licence (CPL) on 27 May 2017 with an expiry date of 30 June 2019. He was issued a medical certificate on 25 May 2018 which expired on 31 May 2019 with a restriction to wear corrective lenses. The pilot successfully completed his last revalidation on 23 May 2017.

3.2.2 According to the maintenance records, the aircraft was maintained by an AP who held a valid aircraft maintenance approval certificate with the aircraft endorse on it in accordance with manufacture's approved procedure. The last MPI was carried out on 25 June 2018 at 891.9 airframe hours and at the time of the accident it had flown 0.25 hours.

3.2.3 The aircraft was issued with an authority to fly on 25 June 2018 with an expiry date of 24 June 2019. The certificate of registry (CoR) was issued on 19 June 2012.

3.2.4 The AP who conducted maintenance on the aircraft was issued a licence on 4 October 2018 with an expiry date of 31 October 2020.

3.2.5 The aircraft sustained damage on the nose gear, propeller and front of the fuselage.

3.2.6 Although the pilot reported engine power loss, all three propeller blades were shattered during the incident, indicating that the engine was operating at a high-power setting. The fact that the propeller blades were shattered indicated an engine operating at a high-power setting, supported by the manifold pressure which was found stuck at 660mmHg, which is a setting indicative of an engine operating just above cruise power. It is, therefore, the investigators conclusion that the engine was operating at a high-power setting.

3.2.7 There was no evidence of any airframe or engine system failure which could indicate pre-impact failure.

3.2.8 The investigation revealed that there was no evidence on an engine power loss or any other system failure. The investigation also revealed that the aircraft was landed on an uneven terrain, resulting in the nose gear collapsing and the propeller striking the ground before the aircraft came to a stop.

3.2.9 The pilot did not prepare the aircraft for a forced landing as indicated in the emergency procedures.

3.3. Probable Cause/s

3.3.1 The aircraft was landed on an uneven terrain, resulting in the nose gear collapsing and the propeller striking the ground before the aircraft came to a stop.

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.