AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

					Reference:	CA18/2/3/10097	
Aircraft Registration	ZS-NRJ	**Date of Accident**	3 January 2022			**Time of Accident**	0610Z
Type of Aircraft	Jetstream 41			**Type of Operation**		Commercial (Part 121)	
Pilot-in-command Licence Type	Airline Transport Pilot Licence (ATPL)			**Age**	42	**Licence Valid**	Yes
Pilot-in-command Flying Experience		**Total Flying Hours**			6 851.0	**Hours on Type**	2 136.9
First Officer	Commercial Pilot Licence (CPL)			**Age**	34	**Licence Valid**	Yes
Pilot-in-command Flying Experience		**Total Flying Hours**			2 401.6	**Hours on Type**	510

Last Point of Departure	O.R. Tambo International Airport (FAOR), Gauteng Province
Next Point of Intended Landing	Venetia Mine Airfield (FAVM), Limpopo Province
Damage to Aircraft	Substantial

Location of the accident site concerning easily defined geographical points (GPS readings if possible)

On Runway 08 at FAVM and at Global Positioning System (GPS) co-ordinates determined to be 22°26′54.69″ South 029°20′13.68″ East, at an elevation of 2 333 feet (ft)

Meteorological Information	Surface wind: 090° at 03kt; Temperature: 24°C; Dew Point: 21°C; CAVOK; Visibility: 9999m;

Number of People On-board	2+1 + 4	**Number of People Injured**	0	**Number of People Killed**	0	**Other (On Ground)**	0

Synopsis

On Monday morning, 3 January 2022, a Jetstream 41 aircraft with registration ZS-NRJ was on a scheduled commercial flight from O.R. Tambo International Airport (FAOR) in Gauteng province, to Venetia Mine Airfield (FAVM) in Limpopo province. On-board the aircraft were three crew members (two pilots and one cabin crew) and four passengers. A flight plan was filed for this flight and the flight was conducted under instrument flight rules (IFR) by day and under the provisions of Part 121 of the Civil Aviation Regulations (CAR) 2011 as amended.

A safety briefing was conducted by the cabin crew member before departure. After take-off, the aircraft climbed to flight level 210 (FL210). Approximately 15 nautical miles (nm) from FAVM and during descent, the first officer (FO) made a radio call to the FAVM attendant on the very high frequency (VHF) 124.80-Megahertz (MHz) to communicate that they will be landing shortly. Thereafter, the airfield attendant performed a runway inspection and, after completion, informed the crew that the runway was clear. The aerodrome attendant saw the aircraft whilst on final approach and after it touched down on Runway 08. During the landing roll at a ground speed of approximately 43 knots (kt), a large bird (Kori Bustard) got airborne from the right-side of the runway with overgrown grass and flew towards the aircraft. Soon after, one of the right-side engine propeller blades hit the bird.

The aircraft was substantially damaged, however, the occupants on-board the aircraft were unharmed.

Probable Cause			
A bird strike on the propeller blade caused the overload fracture and separation failure of the blade. **Contributory Factor** • Inadequate control of wildlife at the airfield. • Inadequate number of trained personnel to monitor and deter possible wildlife during aircraft operations.			
SRP Date	17 January 2023	Publication Date	6 February 2023

Occurrence Details

Reference Number	**:** CA18/2/3/10097
Occurrence Category	**:** Category 1
Type of Operation	**:** Commercial (Part 121)
Aircraft Registration	**:** ZS-NRJ
Aircraft Make and Model	**:** Jetstream 41
Nationality	**:** South African
Place	**:** On Runway 08 at Venetia Mine Aerodrome (FAVM)
Date and Time	**:** 3 January 2022, 0610Z
Injuries	**:** None
Damage	**:** Substantial

Purpose of the Investigation

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011, this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and not 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 that took place on 3 January 2022 at 0610Z. 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 Registry – South Africa (SA), State of Design and State of Manufacturer (Aircraft Accident Investigation Bureau – [AAIB]) in accordance with the CAR 2011 Part 12 and ICAO Annex 13 Chapter 4. The AAIB appointed a non-travelling accredited representative and advisor. The 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 investigation of the accident
   Aircraft — the Jetstream 41 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 the clarity of the report. Modifications to images used in this report were limited to cropping, magnification, file compression; enhancement of colour, brightness, and contrast; or addition of text boxes, arrows, or lines.*

Disclaimer

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Abbreviation	Description
°	Degrees
°C	Degrees Celsius
AIID	Accident and Incident Investigations Division
AMO	Aircraft Maintenance Organisation
ASL	Air Service Licence
ASLC	Air Services Licence Council
ATC	Air Traffic Control
ATPL	Airline Transport Pilot Licence
Bae	British Aerospace
CAR	Civil Aviation Regulations
C of A	Certificate of Airworthiness
C of R	Certificate of Registration
CRS	Certificate of Release to Service
CVR	Cockpit Voice Recorder
CRMA	Certificate Relating to Maintenance
DoT	Department of Transport
FAOR	O.R. Tambo International Airport
FDR	Flight Data Recorder
ft	Feet
FAVM	De Beers Venetia Diamond Mine Aerodrome
FL	Flight Level
FO	First Officer
GPS	Global Positioning System
IAW	In accordance with
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
KIAS	Indicated Air Speed
kt	Knots
METAR	Meteorological Aerodrome Report
MHz	Megahertz
PF	Pilot Flying
PIC	Pilot-in-command
PM	Pilot Monitoring
nm	Nautical mile(s)
RPM	Revolutions per minute
RWY	Runway
QNH	Pressure set to indicate elevation above mean sea level
SACAA	South African Civil Aviation Authority
SA-CAR	South African Civil Aviation Regulations
SAWS	South African Weather Service
S/N	Serial Number
UTC	Co-ordinated Universal Time
USG	US Gallons
Z	Zulu (Term for Universal Co-ordinated Time - Zero Hours Greenwich)

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1. On Monday morning, 3 January 2022, three crew members and four passengers on-board a Jetstream 41 aircraft with registration ZS-NRJ took off on a scheduled commercial flight from O.R. Tambo International Airport (FAOR) in Gauteng province to Venetia Mine Airfield (FAVM) in Limpopo province. The flight was conducted under instrument flight rules (IFR) by day and under the provisions of Part 121 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.1.2. The crew members comprised two pilots and one flight attendant. The pilot-in-command (PIC) was seated on the left seat, and the first officer (FO) was seated on the right seat. The PIC was the pilot flying (PF) and the FO was the pilot monitoring (PM). The flight attendant conducted the safety briefing before departure. After take-off, the aircraft climbed to flight level 210 (FL210) as per the flight plan. Approximately 15 nautical miles (nm) from FAVM and during descent to FAVM, the FO made a radio call to the FAVM airfield attendant on the very high frequency (VHF) 124.80-Megahertz (MHz) to communicate that they will be landing shortly. Soon after, the airfield attendant performed a runway inspection and, after completing it, contacted the ZS-NRJ crew to inform them that the runway was clear. According to the airfield attendant, the runway inspection is carried out each time an aircraft is scheduled to land or depart in accordance with (IAW) their standard operating procedures (SOP).

1.1.3 The aircraft was later seen by the airfield attendant whilst it was on final approach and on touchdown on Runway 08. During the landing roll, a large bird (Kori Bustard) got airborne from the right-side of the runway with overgrown grass and flew in the direction of the aircraft. At the time "*the graph (FDR recorder) shows that when the bird collided with the right-side (RH) propeller, the airplane was already on the ground. The affected engine was in "reverse mode" with a negative blade angle, with 50-35% reverse torque and approximately 76% (1180RPM) propeller speed. The collision occurred at a speed of approximately 43kts.* As a result, the blade disintegrated and some fragments from the blade penetrated the fuselage (third row of the passenger seat). According to the PIC, the bird strike caused the aircraft to shake, and the number 2 engine indication showed an over-temperature indication. The exhaust gas temperature (EGT) indication was above 750°C, which is abnormal. The crew followed the engine shutdown procedure whilst bringing the aircraft to a stop on the runway. After the aircraft had come to a stop, the PIC checked with the crew member via an intercom if any person was harmed. After checking with the passengers, the cabin crew member reported that no person was injured.

1.1.4 The crew assessed the damage on the aircraft as well as inspected the runway. Thereafter, the crew started up the left engine and taxied the aircraft to the apron—only the left engine was in

operation. Once the engine was shut down, the passengers disembarked from the aircraft. The aircraft sustained substantial damage during the accident.

1.1.5 The accident occurred during daylight on Runway 08 at FAVM at Global Positioning System (GPS) co-ordinates determined to be 22°26′54.69″ South 029°20′13.68″ East, at an elevation of 2 339 feet (ft).

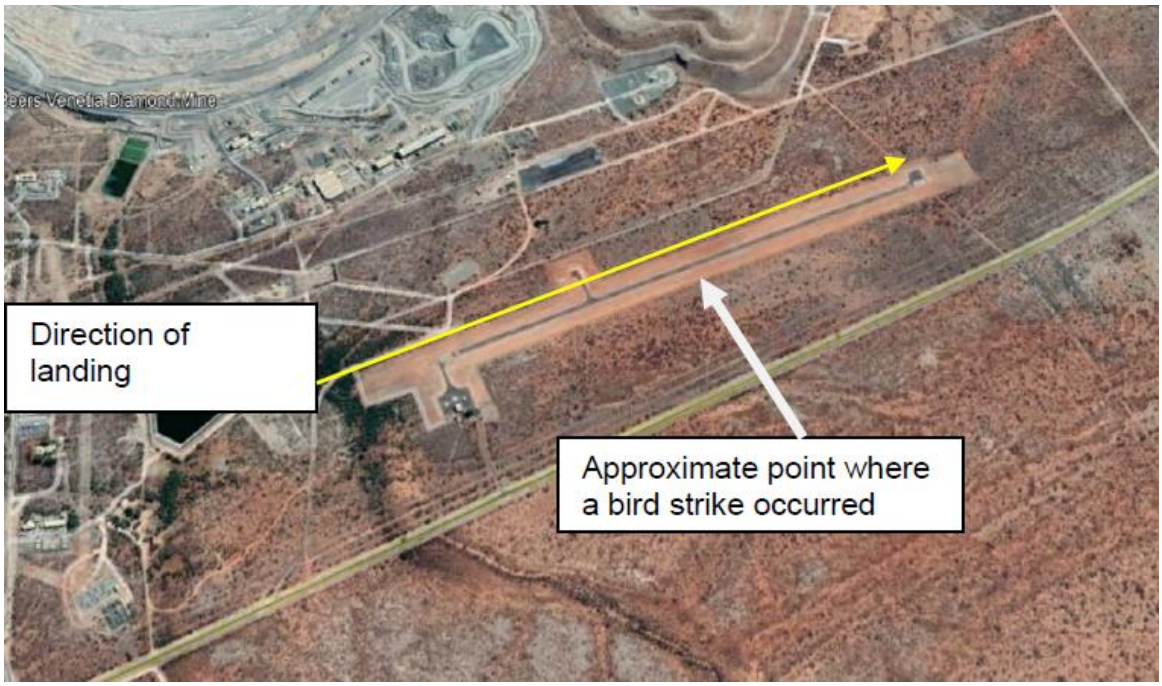


Figure 1: The yellow arrow shows the direction of landing and the white arrow points to the approximate point where the bird strike occurred. (Source: Google Earth)

1.2. Injuries to Persons

Injuries	Pilot	Crew	Pass.	Total On-board	Other
Fatal	-	-	-	-	-
Serious	-	-	-	-	-
Minor	-	-	-	-	-
None	2	1	4	7	-
Total	2	1	4	7	**-**

Note: Other means people on the ground.

1.3. Damage to Aircraft

1.3.1. The aircraft was substantially damaged during the accident sequence.

Figure 2: Damage to the propeller.

1.4. Other Damage

1.4.1 None.

1.5. Personnel Information

Pilot-in-command (PIC)

Nationality	South African	Gender	Male	Age	42
Licence Type	Airline Transport Pilot Licence (ATPL)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Instrument rating, Grade 2 Flight Instructor				
Medical Class	Class 1				
Medical Issue Date	29 October 2021	Medical Expiry Date	31 October 2022		
Restrictions	None				
Previous Accidents	None				

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

Flying Experience:

Total Hours	6 851
Total Past 24 Hours	0
Total Past 7 Days	0
Total Past 90 Days	32.3
Total on Type Past 90 Days	32.3
Total on Type	2 136.9

1.5.1 The PIC was initially issued an Airline Transport Pilot Licence (ATPL) on 1 September 2009 by the South African Civil Aviation Authority (SACAA) IAW Part 61. His last licence revalidation was carried out on 3 March 2021 with an expiry date of 31 May 2022.

1.5.2 The PIC was issued a Class 1 medical certificate on 29 October 2021 with an expiry date of 31 October 2022.

First Officer (FO):

Nationality	South African	Gender	Female	Age	34
Licence Type	Commercial Pilot Licence (CPL)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Instrument rating, Grade 2 Flight Instructor				
Medical Class	Class 1				
Medical Issue Date	11 January 2021	Medical Expiry Date	31 January 2022		
Restrictions	None				
Previous Accidents	None				

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

Flying Experience:

Total Hours	2 401.6
Total Past 24 Hours	1.4
Total Past 7 Days	1.4
Total Past 90 Days	34.2
Total on Type Past 90 Days	34.2
Total on Type	510

1.5.3 The FO was issued a Commercial Pilot Licence (CPL) on 22 July 2014 by the SACAA under Part 61. Her last licence revalidation was on 27 January 2021 with an expiry date of 28 February 2022.

1.5.4 The FO was issued a Class 1 medical certificate in terms of Part 67 of the South African Civil Aviation Regulations on 11 January 2021 with an expiry date of 31 January 2022.

Cabin Crewmember

Nationality	South African	Gender	Female	Age	29
Licence Type	Cabin crew Licence				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Bae 4100 Jetstream				
Medical Class	Class 4				
Medical Issue Date	23 May 2019	Medical Expiry Date	31 May 2024		
Restrictions	None				
Previous Accidents	None				

1.5.5 The cabin crewmember was issued a Cabin crew Licence on 11 May 2021 by the SACAA under Part 61. Her last licence revalidation was on 11 May 2021 with an expiry date of 30 May 2022.

1.5.6 The cabin crewmember was issued a Class 4 medical certificate in terms of Part 67 of the South African Civil Aviation Regulations on 23 May 2019 with an expiry date of 30 May 2024.

1.6. Aircraft Information

1.6.1. The Jetstream 41 is a twin-engine aircraft designed by British Aerospace. The aircraft is powered by Honeywell TPE 331-14GR-805H and TPE 331-14HR turboprop engines, each driving a constant speed 5-blade MT-Propeller model MTV-27-1-NCFR. The engines deliver 1 650 shaft horsepower (hp). The Jetstream 41 has a maximum speed of 295kts (340mph), a service ceiling of 26 000 feet, and a range of 774nm. (Source: aerospace.honeywell.com)

Airframe:

Manufacturer/Model	British Aerospace (BAE) Jetstream 41	
Serial Number	41062	
Year of Manufacture	1995	
Total Airframe Hours (At Time of Accident)	35 782.19	
Last "C" check (Date & Hours)	1 June 2021	35 667.27
Airframe Hours Since Last "C" check	34.85	
C of A (Original Issue Date & Expiry Date)	31 August 2021	31 August 2022
C of R (Issue Date) (Present Owner)	28 May 2008	
Operating Category	Commercial (Part 121)	
Type of Fuel Used	Jet A1	
Previous Accidents	None	

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

1.6.2. According to available information, the aircraft was first registered to the present owner on 28 May 2008. The aircraft's Certificate of Release to Service (CRS) was reissued on 10 March 2021 with an expiry date of 10 March 2022 or at 35 967.25 hours, whichever occurs first.

1.6.3. The last maintenance inspection before the accident flight was a "C" check that was carried out on 1 June 2021 at 35 667.27 airframe hours. The aircraft had accumulated an additional 299.98 airframe hours in operation since the last "C" check inspection.

Right Engine:

Manufacturer/Model	Honeywell TPE 331-14GR-805H
Serial Number	P75080
Part Number	3104800-6
Hours Since New	21 448:43
Hours Since Overhaul	3 453:31

Left Engine:

Manufacturer/Model	Honeywell TPE 331-14HR
Serial Number	16123
Part Number	3104800-6

Hours Since New	31495.45
Hours Since Overhaul	13500.33

Right Propeller:

Manufacturer/Model	MT-Propeller MTV-27-1-NCFR(G)J/CFR-285-82
Serial Number	120739
Part Number	2495J/CFR285-82
Hours Since New	1 922:23
Hours Since Overhaul	615:50

Left Propeller:

Manufacturer/Model	MT-Propeller MTV-27-1-NCFR(G)J/CFRL-285-82
Serial Number	160943
Part Number	2493J/CFR285-82
Hours Since New	1 922:23
Hours Since Overhaul	615:50

1.7. Meteorological Information

1.7.1. The weather information below was obtained from the Meteorological Aerodrome Report (METAR) that was issued by the South African Weather Service (SAWS), recorded at Malale-Esme weather station approximately 53 Nautical Miles (nm) from FAVM on 3 January 2022 at 0610Z.

Wind Direction	090 °	Wind Speed	03 kt	Visibility	9999 m
Temperature	24 °C	Cloud Cover	CAVOK	Cloud Base	CAVOK
Dew Point	21 °C	QNH	-		

1.8. Aids to Navigation

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

1.9. Communication

1.9.1. The aircraft was equipped with standard communication equipment as approved by the Regulator (SACAA). There was no record indicating that the communication equipment was unserviceable prior to the accident.

1.10. Aerodrome Information

1.10.1. FAVM is an unmanned, licensed airfield. It has one runway oriented 08/26.

Aerodrome Location	De Beers Venetia Diamond Mine, Limpopo Province
Aerodrome Status	Licensed
Aerodrome GPS coordinates	S22°26'56.33" South 029°20'06.06" East
Aerodrome Elevation	2 333ft
Runway Headings	08/26
Dimensions of Runway	1 538 x 15 m
Heading of Runway Used	08
The surface of the Runway Used	Asphalt
Approach Facilities	None
Radio Frequency	124.80/130.70 MHz

1.10.2 The copy below is an extract from the CAR 2011 Part 139.02.19 as amended:

139.02.19 ESTABLISHMENT OF ENVIRONMENTAL MANAGEMENT PROGRAMME

1. Bird and wildlife strike control programme

(1) The bird and wildlife strike control programme shall contain the following elements –

(a) assignment of trained personnel accountable for developing and implementing the bird/wildlife strike prevention programme;

(b) a process to report, collect and record data on struck and living birds and wildlife;

(c) risk assessment methodology to analyse the data and assess the bird and wildlife hazard in order to develop mitigation, proactive and reactive measures;

(d) a process of habitat and land management both on the airport and in its vicinity in order to reduce the attractiveness of the area to birds and wildlife; where applicable and relevant, this shall include effective grass management techniques;

(e) a process to expel or remove hazardous birds/wildlife, including by lethal means where appropriate;

(f) a process for liaison with non-airport agencies and local landowners to ensure the airport operator is aware of developments that may contribute to creating additional bird hazards in the infrastructure, vegetation, land use and activities in the airport vicinity and

(g) a programme to have regular meetings with all stakeholders of the airport's bird and wildlife strike prevention committee.

1.10.3 The copy below is an extract from the Venetia Airfield Operations Manual Operating Procedure, Section 3, Revision 4 July 2021. The mine had implemented a bird programme.

3.10.1.4 Bird hazard prevention programme

a) *Types of birds are identified (feathers or bird carcasses are retained, if available, to assist with identification.*

b) *Advice is sought from expert at the Northern Province Environmental Department or the National Aviation Bird and Wildlife Committee.*

c) Various methods will be introduced if necessary including de nesting, monitoring grass length, reducing food source through chemical control, shooting (with the correct permissions), scare techniques eliminating poor run-off and the formation of water pools, etc.

d) Consideration is given to maintaining the environment balance between birds and wildlife to ensure the reduction of one does not increase the other.

e) Liaison with local authorities and company environment conservation specialist regarding refuse dump, sewage farms, development or existence of lakes or adjacent bird sanctuaries, removal of wildlife.

1.11. Flight Recorders

1.11.1. The aircraft was fitted with a flight data recorder (FDR) and a cockpit voice recorder (CVR) as required by Part 121.05.19 of the CAR 2011. The recorders were removed from the aircraft on 4 January 2022, and the FDR was downloaded on 7 January 2022 at an approved aircraft maintenance organisation (AMO) in the presence of investigators.

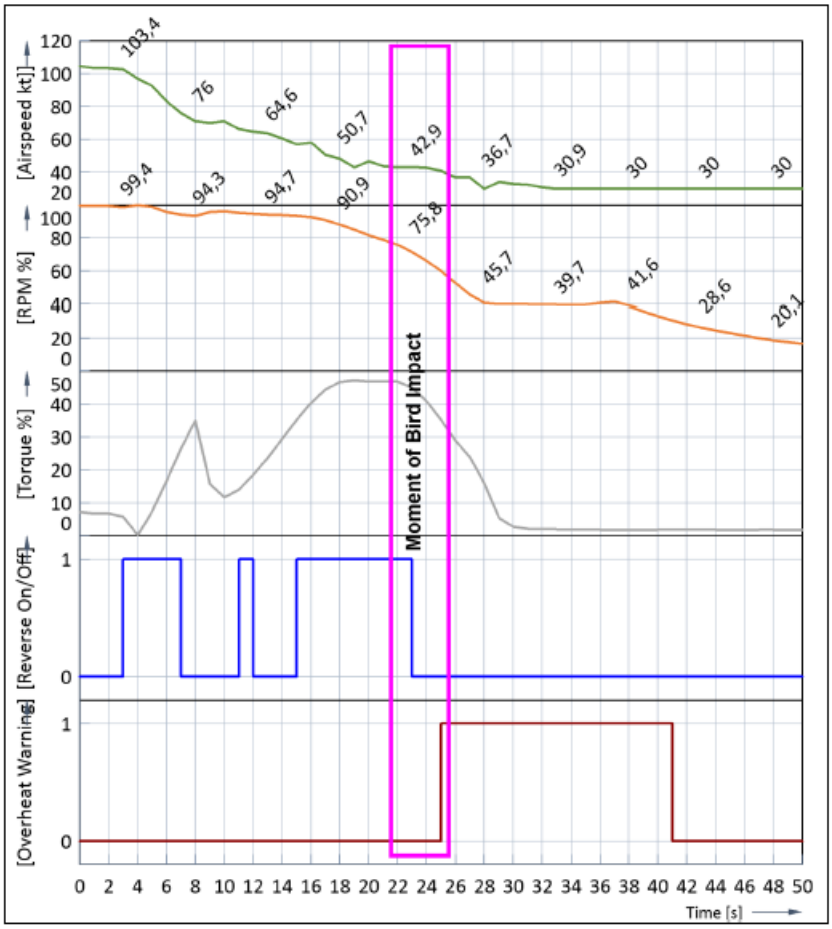
1.11.2. FDR information:

- Manufacturer: L3 Harris
- Type: F1000 SSFDR
- Part Number: S800-200-00
- Serial Number: 01106
- Duration of recording: 25 Hours CVR information:

1.11.3 FDR Summary Result from the Manufacturer (Source: Bundesstelle für Flugunfalluntersuchung (BFU)

- *The actual bird strike case with an approximately 18kg (40lb) bird exceeded the certification envelope of the airplane and propeller by at least factor five and was not able to withstand a force of up to approximately 3.6kg (8lb). The extremely low collision speed with a slow-moving bird in combination with the low propeller speed and reverse blade angle is unusual and the resulting unfavourable impact angle contributed to the extent of damage on the propeller.*

- The analysis of the flight data recorder showed the following parameters versus time:



- *The graph above shows that when the bird collided with the right-side (RH) propeller, the airplane was already on the ground. The affected engine was in "reverse mode" with a negative blade angle, with 50-35% reverse torque and approximately 76% (1180RPM) propeller speed. The collision occurred at a speed of approximately 43kts.*

1.12. Wreckage and Impact Information

1.12.1. During the landing roll phase, a Kori Bustard bird got airborne from the right-side of the runway with overgrown grass and flew in the direction of the aircraft. Thereafter, the bird collided with the right propeller blade of the aircraft. One of the propeller blades was severed near the root, and the blade fragments penetrated the fuselage and caused damage inside the cabin.

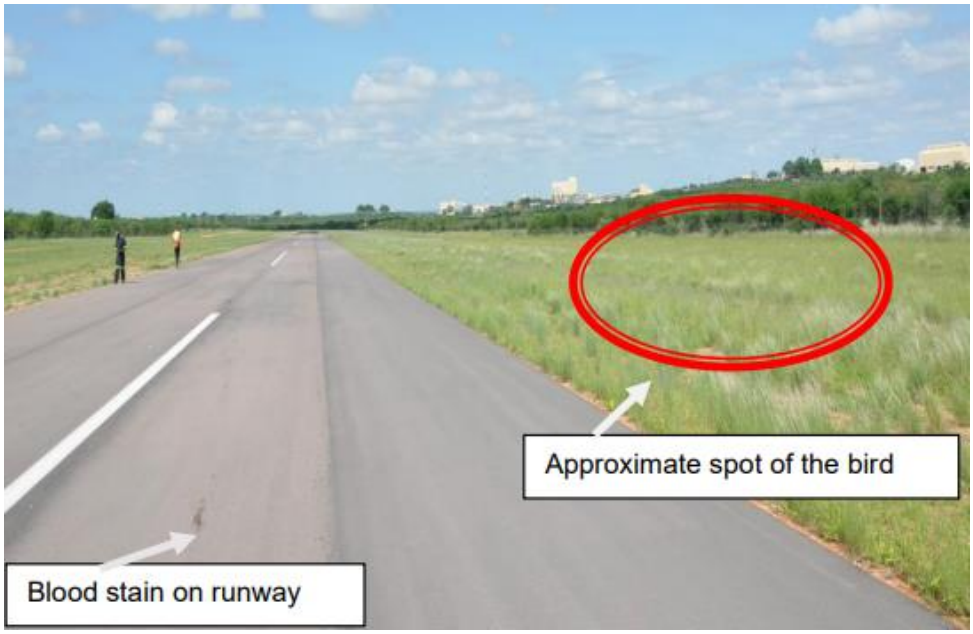


Figure 5: The approximate location where the bird took flight.

Figure 6: Fragments of the propeller blades penetrated the fuselage.

Figure 7: The damaged fuselage.

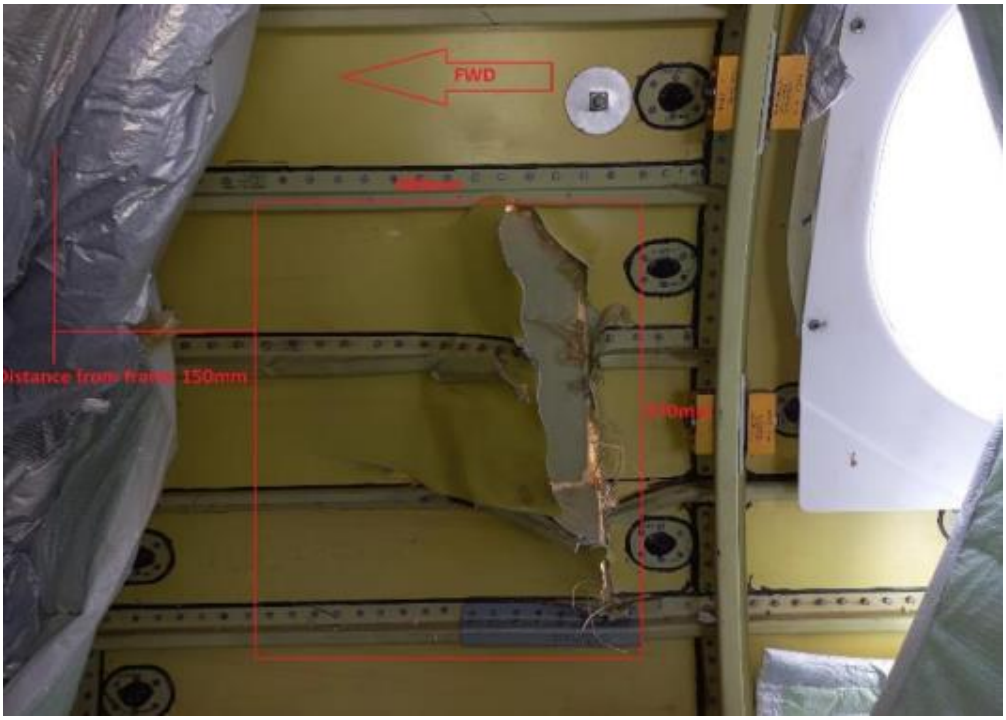


Figure 8: Damage to some of the stringers.

1.12.2. Some fragments of the propeller blade penetrated the fuselage and damaged some of the stringers just below the seat track. Minor damage was noted on the seat track area and extensive damage was on the DADO panel. The front outboard engine mount failed.

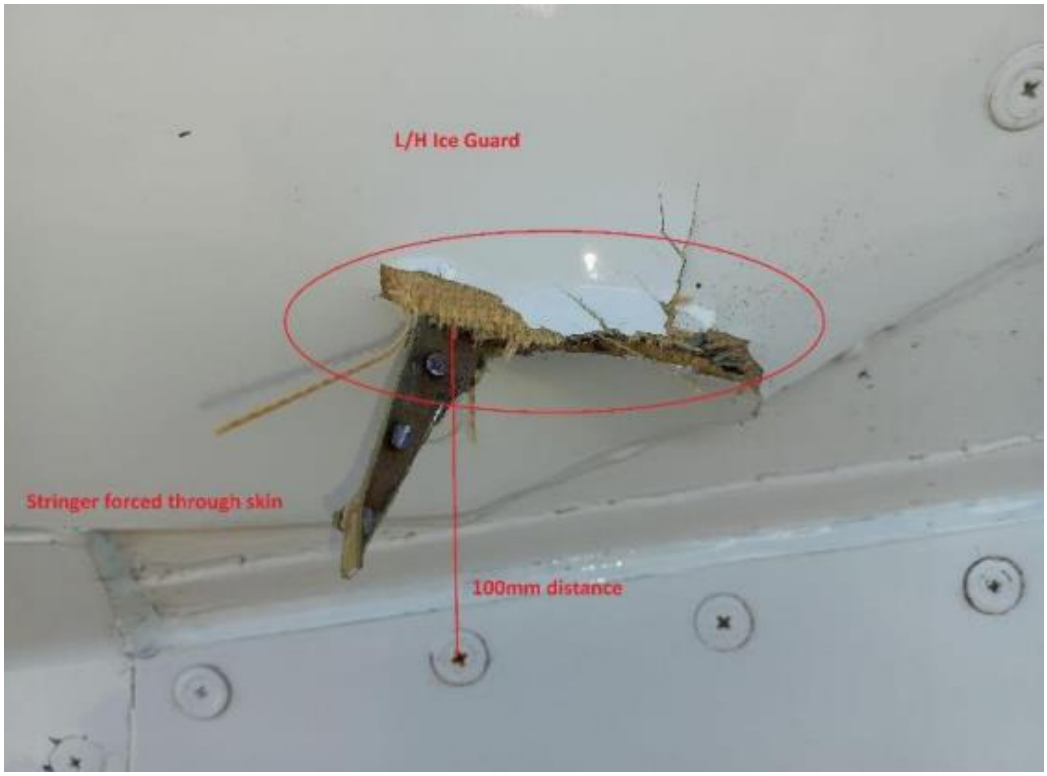


Figure 9: The left-side of the fuselage.

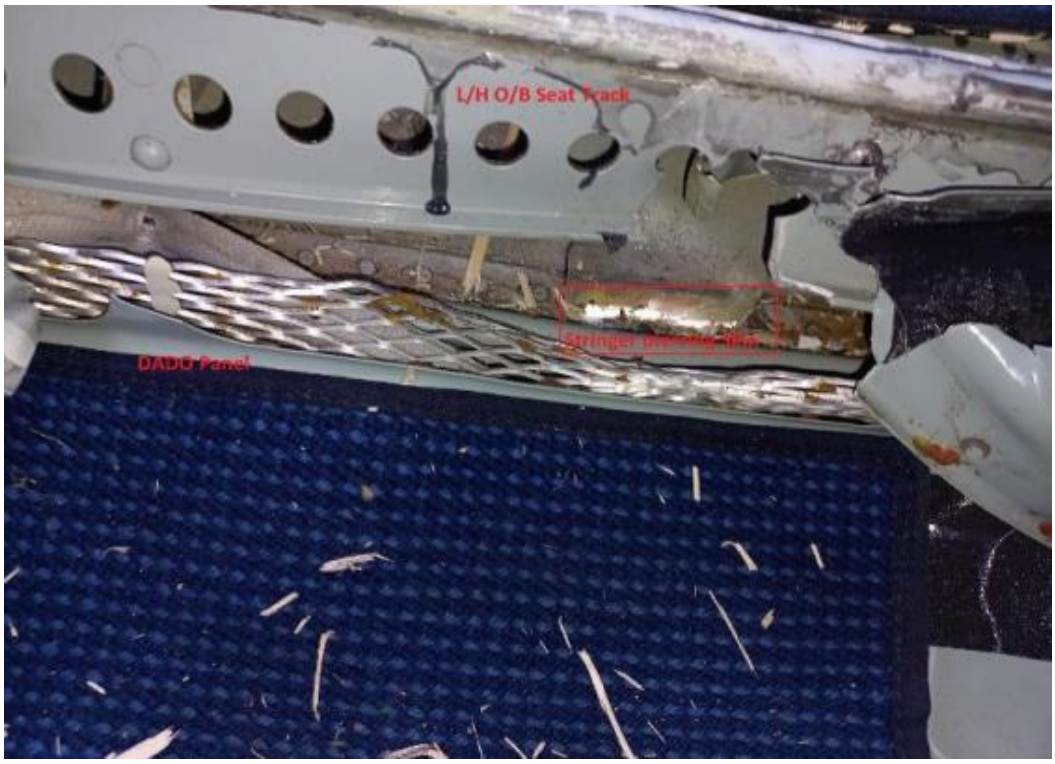


Figure 10: The interior left-side of the fuselage.

Figure 11: Fragments of the propeller blade.

1.12.3. Some components from the engine were damaged during the severe vibration after the bird strike.

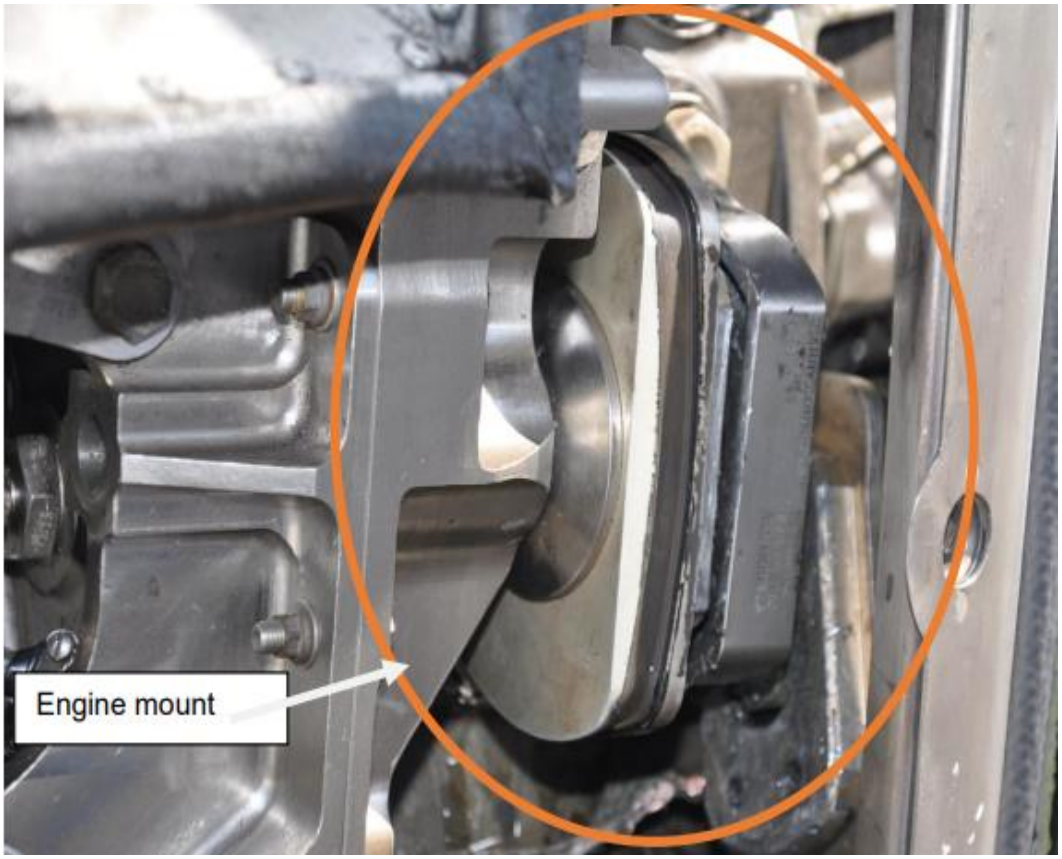


Figure 12: Failed front outboard engine mount.

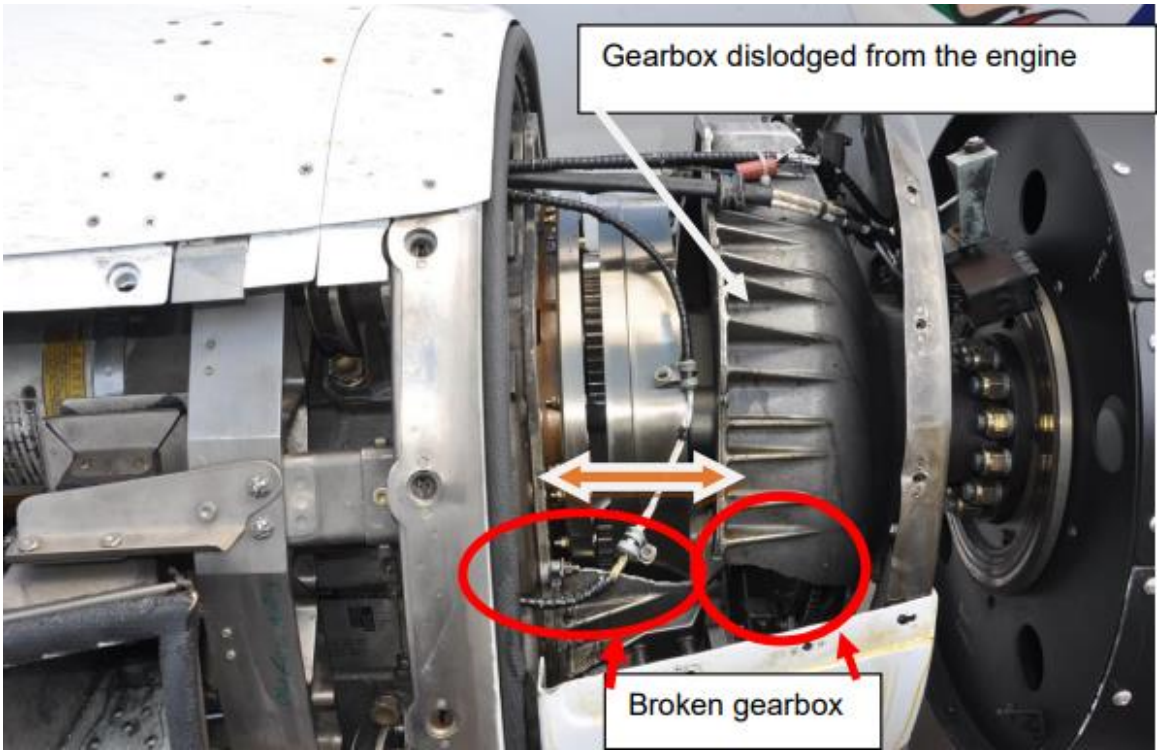


Figure 13: The dislodged and broken propeller gearbox.

Figure 15: The dislodged combustion casing.

1.13. Medical and Pathological Information

1.13.1. None.

1.14. Fire

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

1.15. Survival Aspects

1.15.1. The accident was considered survivable as no person was seated at seat row number 3 during the accident. The cabin crewmember reported that the passenger who was seated in row 3 for weight and balance purposes, vacated the seat during the flight to occupy one of the empty seats at the back of the aircraft.

Figure 16: Damage to the third row of seats.

1.16. Tests and Research

1.16.1. The Kori Bustard (Source: https://africafreak.com/kori-bustard)

1.16.1.1. *The Kori Bustard is Africa's heaviest flying bird; it can weigh up to 19kg. It is a land bird with a long neck and long foot ended by three fingers with light brown or grey plumage. The sides of the crown on the head extend into a black crest. There is a white stripe over each eye. The chin, throat, and neck are creamy white mixed with black bands.*

The underparts of the bird are buff coloured with dark brown vermiculation. The tail has wide bands of greyish brown and white. The primaries, or flight feathers, are also similarly marked. The shoulder area has a checkered black-and-white pattern.

Figure 17: The Kori Bustard.

1.17. Organisational and Management Information

1.17.1. The flight was conducted under the provisions of Part 121 (Air Transport Operations – Carriage on Airplanes of more than 19 Passengers or Cargo) of the CAR 2011 as amended. The operator had a domestic air service licence that was issued by the Air Services Licence Council (ASLC) at the Department of Transport (DoT). The aircraft was issued an Air Operating Certificate (AOC) by the SACAA on 21 April 2021 with an expiry date of 30 April 2022.

1.17.2. The AMO which carried out the last maintenance inspection of the aircraft before the accident flight had an approved AMO certificate that was issued by the Regulator on 30 April 2021 with an expiry date of 30 April 2022.

1.17.3 The airfield was issued a Category 3 certificate in terms of Part 139 of the South African Civil Aviation Regulations on 1 November 2021 with an expiry date of 31 October 2022. The airfield had no findings.

1.17.4 The airfield Operator Manual contained an organogram which reflected five posts that are reporting to the accountable manager of the mine. The posts are Rescue and Fire Department (for the mine), the air traffic service personnel, the airfield manager, the quality assurance manager (for the mine) and the aerodrome safety officer (from the mine). From the organogram, there is no position that reports to the airfield manager (who should be working at the airfield). The Operator Manual mentions the “airfield attendant” who is the “air traffic service personnel”. In this report, the air traffic service personnel is also the airfield attendant (Appendix A).

1.18. Additional Information

1.18.1 None.

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 concerning this accident. This shall not be read as apportioning blame or liability to any organisation or individual.

2.2. Analysis

<u>The Man</u>

2.2.1 The PIC was issued an Airline Transport Pilot Licence (ATPL) on 1 September 2009 under Part 61 of the South African CAR 2011. His last licence revalidation was completed on 3 March 2021 with an expiry date of 31 May 2022.

2.2.2 The PIC was issued a Class 1 medical certificate in terms of Part 67 of the CAR 2011 on 29 October 2021 with an expiry date of 31 October 2022.

2.2.3 The FO was issued a Commercial Pilot Licence (CPL) on 22 July 2014 under Part 61 of the South African Civil Aviation Regulations (SA-CAR). Her last licence revalidation was completed on 27 January 2021 with an expiry date of 28 February 2022.

2.2.4 The FO was issued a Class 1 medical certificate in terms of Part 67 of the South African Civil Aviation Regulations on 11 January 2021 with an expiry date of 31 January 2022.

2.2.5 The cabin crewmember was issued a Cabin Crew Licence on 11 May 2021 by the SACAA under Part 61. Her last licence revalidation was on 11 May 2021 with an expiry date of 30 May 2022.

1.2.6 The cabin crewmember was issued a Class 4 medical certificate in terms of Part 67 of the South African Civil Aviation Regulations on 23 May 2019 with an expiry date of 30 May 2024.

The aircraft

2.2.7 The AMO which carried out the last maintenance inspection (C Check) before the accident flight had an approved AMO certificate that was issued by the Regulator on 30 April 2021 with an expiry date of 30 April 2022.

2.2.8 The last maintenance inspection before the accident flight was a “C” check that was carried out on 1 June 2021 at 35 667.27 airframe hours. The aircraft was issued a Certificate of Release to Service (CRS) on 26 October 2021 with an expiry date of 10 March 2022 or at 35 967.25 hours, whichever occurs first.

2.2.9 The bird which was approximately 18kg (40lb) exceeded the certification envelope of the aircraft and propeller by at least factor five; the aircraft was able to withstand a force of up to approximately 3.6kg (8lb). According to the manufacturer’s report, *the extremely low collision speed with a slow-moving bird in combination with the low propeller speed and reverse blade angle is unusual, and the resulting unfavourable impact angle contributed to the extent of damage on the propeller*.

2.2.10 The bird collided with the right-side propeller whilst the aircraft was already on the ground. The affected engine was in “reverse mode” with a negative blade angle, and with 50-35% reverse torque and approximately 76% (1180RPM) propeller speed. The collision occurred at a speed of approximately 43kts.

The airfield

2.2.11 The airfield was last audited remotely (due to limited contact because of COVID-19) on 2 August 2021. The previous audits were clean audits.

2.2.12 The airfield was issued a Category 3 licence on 1 November 2021 with an expiry date of 31 October 2022.

2.2.13 The airfield is surrounded by a dense forest with wild animals. The only separation between the airfield and the forest is an ill-kept fence in some places.

2.2.14 On the day the investigation team visited the airfield, there was an unmanned open gate through which animals might enter the airfield, which is hazardous.

2.2.15 The airfield is managed by a single person who attends to all the requirements of the crew as well as the tasks required before take-offs and during landings.

2.2.16 The airfield does not have a dedicated fire-fighting team, it relies on the fire-fighting service of the mine.

2.2.17 The airfield attendant who is responsible for carrying out all the tasks in the airfield does not have adequate current competencies.

2.2.18 The carcass next to the runway was not removed and preserved soon after the accident and this was in contravention of Part 139 of the CAR 2011 read together with the South African Civil Aviation Technical Standards (SA-CATS) 139 which states "*a process to report, collect and record data on struck and living birds and wildlife"*. This meant that the operator contravened the Regulator's approved airfield procedures.

3 CONCLUSION

3.1. General

From the available evidence, the following findings, causes, and contributing factors were made concerning this accident. These shall not be read as apportioning blame or liability to any organization 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 —**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

The pilots

3.2.1. The PIC was issued an ATPL on 1 September 2009 under Part 61 of the South African CAR 2011. His last licence revalidation was completed on 3 March 2021 with an expiry date of 31 May 2022.

3.2.2. The PIC was issued a Class 1 medical certificate in terms of Part 67 of the CAR on 29 October 2021 with an expiry date of 31 October 2022.

3.2.3. The FO was issued a Commercial Pilot Licence (CPL) on 22 July 2014 under Part 61 of the South African CAR 2011. Her last licence revalidation was completed on 27 January 2021 with an expiry date of 28 February 2022.

3.2.4. The FO was issued a Class 1 medical certificate in terms of Part 67 of the South African CAR 2011 on 11 January 2021 with an expiry date of 31 January 2022.

3.2.5 The cabin crewmember was issued a Cabin Crew Licence on 11 May 2021 by the SACAA under Part 61. Her last licence revalidation was on 11 May 2021 with an expiry date of 30 May 2022.

3.2.6 The cabin crewmember was issued a Class 4 medical certificate in terms of Part 67 of the South African Civil Aviation Regulations on 23 May 2019 with an expiry date of 30 May 2024.

The aircraft

3.2.7 The AMO which carried out the last maintenance inspection (C Check) before the accident flight had an approved AMO certificate that was issued by the Regulator on 30 April 2021 with an expiry date of 30 April 2022.

3.2.8 The last maintenance inspection before the accident flight was a “C” check that was carried out on 1 June 2021 at 35 667.27 airframe hours. The aircraft was issued a Certificate of Release to Service (CRS) on 26 October 2021 with an expiry date of 10 March 2022 or at 35 967.25 hours, whichever occurs first.

3.2.9 The bird which impacted the propeller blade was approximately 18kg (40lb) and exceeded the certification envelope of the aircraft and propeller by at least factor five; the aircraft was able to withstand a force of approximately 3.6kg (8lb).

3.2.10 The bird collided with the right-side propeller when the aircraft was already on the ground and travelling at approximately 43kts.

The Airfield

3.2.11 The airfield was last audited remotely (due to limited contact because of COVID-19) on 2 August 2021. There were no findings on the previous audits.

3.2.12 The airfield was issued a Category 3 licence on 1 November 2021 with an expiry date of 31 October 2022.

3.2.13 The airfield is surrounded by a dense forest with wild animals. The only separation between the airfield and the forest is an ill-kept fence in some places.

3.2.14 Security gates are sometimes left open and unattended. This is a hazard as animals could enter the runway.

3.2.15 The airfield is run by one person who attends to all the requirements of the crew as well as the tasks required before taking off and during landings. This makes it hard to properly monitor and deter wildlife that may enter the runway during the landing and take-off phases of aircraft under normal operations.

3.2.16 The airfield relies on the fire-fighting service that is contracted to the mine.

3.2.17 The person responsible for tasks in the airfield should have the current competencies to carry out the tasks safely.

3.2.18 Currently, the airfield does not have an adequate number of people to carry out all the tasks during aircraft operations.

3.2.19 The carcass of the bird was not preserved for analysis but was left to rot next to the runway.

The bird strike which was approximately 18kg (40lb) exceeded the certification envelope of the aircraft and propeller by at least factor five; the aircraft is able to withstand a force of up to approximately 3.6kg (8lb). The bird collided with the right-side propeller when the aircraft was already on the ground. The affected engine was in “reverse mode” with a negative blade angle, and with 50-35% reverse torque and approximately 76% (1180RPM) propeller speed. The collision occurred at a speed of approximately 43kt. The extremely low collision speed with a slow-moving bird in combination with the low propeller speed and reverse blade angle is unusual; the resulting unfavourable impact angle contributed to the extent of damage on the propeller.

3.3. Probable Cause

3.3.1 A bird strike on the propeller blade caused the overload fracture and separation failure of the blade.

3.4. Contributory Factors

3.4.1. Inadequate control of wildlife at the airfield.

3.4.2. Inadequate number of trained personnel to monitor and deter possible wildlife during aircraft operations.

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 organizations.

4.2. Safety Recommendation/s

4.2.1. The accident could have been avoided had there been adequate personnel to monitor and deter birds foraging in the grass next to the runway. Thus, it is recommended that there should be an addition of adequately trained staff during aircraft operations to monitor wildlife and aircraft operations.

4.2.2. It is also recommended that a mock runway (a cleared patch covered with grass) be prepared for birds to fly to when chased from the active runway while there are aircraft operations.

5. APPENDICES

5.1. Appendix A – FAVM organogram.

This report is issued by:

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

Appendix A: FAVM Organogram