PRELIMINARY ACCIDENT REPORT

Accident and Incident Investigations Division

Accident
- Preliminary Report -
AIID Ref No: CA18/2/3/9944

Figure 1: The Bell 206B Jet Ranger II helicopter ZS-HUC. (Source: jetphotos.com; photography by Michael Walter)

Description:

The Bell 206B Jet Ranger II helicopter with registration ZS-HUC collided with high-tension electrical cables (the top earth conductor) during a fruit fly baiting operation. The helicopter crashed, and the pilot was fatally injured during the accident.

INTRODUCTION

Reference Number	**:** CA18/2/3/9944
Name of Operator	**:** Heli X Charters (Pty) Ltd
Manufacturer	**:** Bell Helicopter Textron
Model	**:** Bell 206B Jet Ranger II
Nationality	**:** South African
Registration Marks	**:** ZS-HUC
Place	**:** Silverstroom Farm, Wolseley, Western Cape
Date	**:** 19 January 2021
Time	**:** 0550Z

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 informed about a helicopter accident involving a Bell 206B Jet Ranger II, which occurred at Silverstroom farm, Wolseley, Western Cape on 19 January 2021. The occurrence was notified to the AIID investigator on call at 0635Z.

The AIID appointed an investigator-in-charge and co-investigator. Notifications were sent to the State of Registry, and Manufacture and Design, and the National Transportation Safety Board (NTSB). The State of Registry (USA) has assigned a non-travelling accredited representative to this investigation. The AIID will lead the investigation and issue the final report.

The information contained in this preliminary report is derived from the factual information gathered during the on-going investigation into the occurrence. Later, an interim or final report may contain altered information in case new evidence is found during the on-going investigation that requires changes to the information depicted in this report.

The AIID reports are made available to the public at:
http://www.caa.co.za/Pages/Accidents%20and%20Incidents/Aircraft-accident-reports.aspx

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

- *Accident — this investigated accident*
- *Helicopter — the Bell 206B Jet Ranger II 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
AIID	Accident and Incident Investigations Division
AMO	Aircraft Maintenance Organisation
AMSL	Above mean sea level
AOC	Air Operator Certificate
CAR	Civil Aviation Regulations 2011
C of A	Certificate of Airworthiness
C of R	Certificate of Registration
CPL	Commercial Pilot Licence
CRS	Certificate of Release to Service
CVR	Cockpit Voice Recorder
FDR	Flight Data Recorder
FSTD	Flight Simulator Training Device
ft	Foot/feet
G5	Agricultural spraying, seeding, and dusting operations
GPS	Global Positioning System
Km	Kilometre(s)
Kt	Knot
MPI	Mandatory Periodic Inspection
OpSpecs	Operations Specifications
QNH	Query: Nautical height
RWY	Runway
SACAA	South African Civil Aviation Authority
SACATS	South African Civil Aviation Technical Standard
SAPS	South African Police Services
SAWS	South African Weather Services
SOP	Standard Operating Procedures
TBD	To be determined
VFR	Visual Flying Rules
VHF	Very High Frequency
Z	Zulu (Term for Universal Co-ordinated Time - Zero Hours Greenwich)

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1. On Tuesday 19 January 2021, a pilot operating a Bell 206B Jet Ranger II helicopter with registration mark ZS-HUC was conducting a fruit fly baiting operation in Silverstroom Farm in Wolseley, Western Cape province. The flight was conducted in accordance with (IAW) the provisions of Part 137 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.1.2. The pear orchard that was being sprayed was due for harvesting in the next weeks. According to the farm owner, the same pilot was operating the same helicopter the previous day (18 January 2021), and the operation was carried out without incident.

1.1.3. On the day of the accident, the farm owner was 650 metres (m) north of the area of operation. He reported that the pilot started his operation at about 0400Z. He heard the helicopter engine stop briefly, but heard it run again soon after. According to the operator, the pilot had stopped at about 0540Z at a designated loading area located approximately 2 kilometres (km) west of the accident site to load the fruit fly baiting chemical and to refuel.

1.1.4. The farm owner stated that although there was no visual observation of the helicopter, he heard a loud 'popping' sound and the helicopter's engine sound stopped. Soon after, he heard a loud 'crash' sound. He immediately took a fire extinguisher and rushed to the area where he heard the crash sound. He found the helicopter crashed in the pear orchard, but there was no fire.

1.1.5. The farm owner observed that there was some smoke emanating from the wreckage. He also found the pilot fatally injured. He immediately contacted the operator of the helicopter, who in turn, notified the Wolseley South African Police Service (SAPS) and the Accident and Incident Investigations Division about the accident.

1.1.6. The farm owner observed that the earth conductor of the high-tension power cable was missing, which led to the power outage in the neighbouring town (Ceres). The farm owner further reported that according to the orientation, location and distribution of the helicopter wreckage, it seemed as though the pilot who was flying in an easterly direction was attempting to fly across the middle of the electric wires between a section of the electrical pylons when the helicopter collided with the top earth conductor of the high-tension electrical cables.

1.1.7. The helicopter was destroyed during the accident sequence and the pilot was fatally injured. A couple of pear trees were severed during impact, and a portion of a butternut field was damaged by the main rotor blades.

1.1.8. The flight was conducted under visual flight rules (VFR) by day. The helicopter crashed approximately 110m east of the power lines at the following Global Positioning System (GPS) co-ordinates: 33°25'32.80" South, 19°14'037.62" East at an elevation of 932 feet (ft) above mean sea level (AMSL).

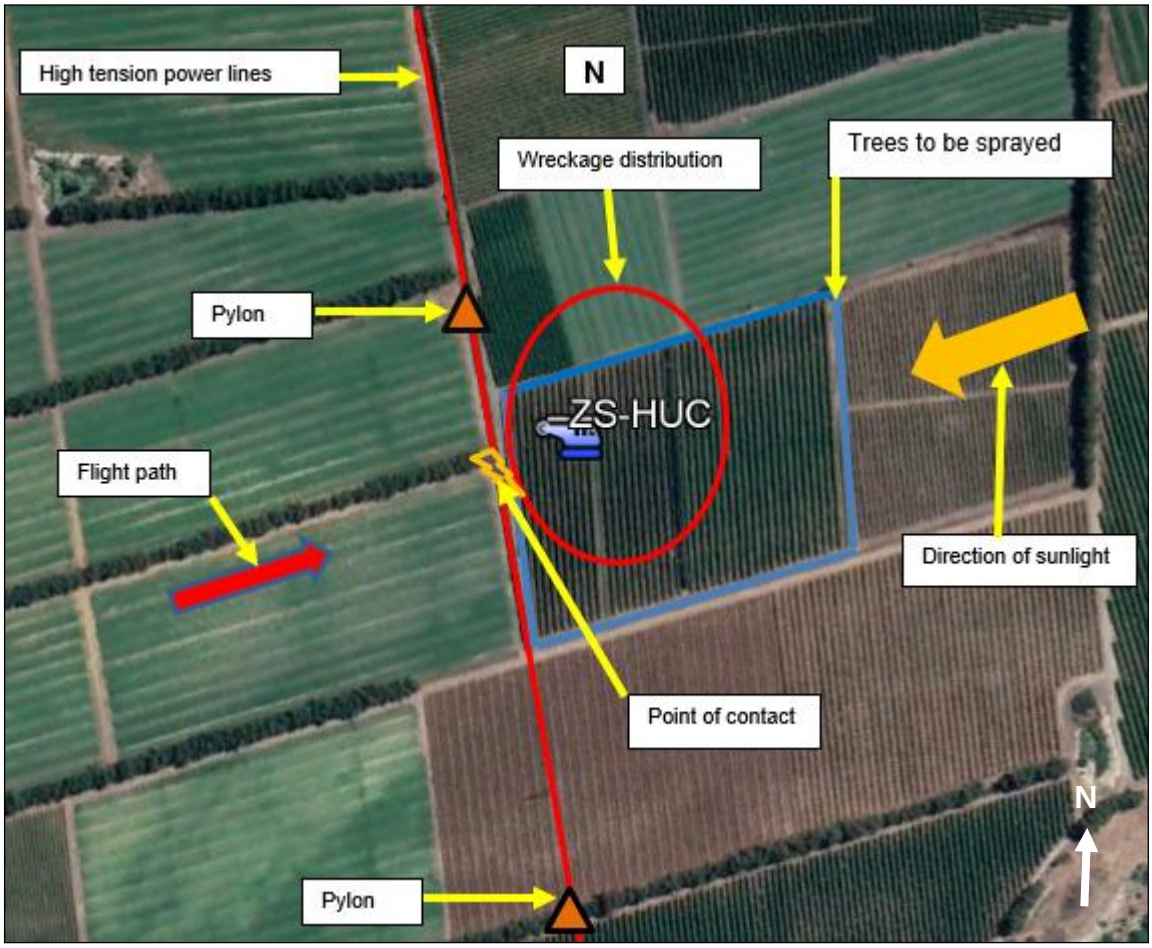

Figure 2: An aerial view of the accident site. (Source: Google Earth)

1.2. Injuries to Persons

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

Note: Other means people on ground.

1.2.1. The pilot was a South African citizen.

1.3. Damage to Helicopter

1.3.1. The helicopter was destroyed during the accident sequence.

Figure 3: The helicopter post-accident.

1.4. Other Damage

1.4.1. The helicopter collided with the earth electrical cable, and later crashed on a butternut field and pear orchard.

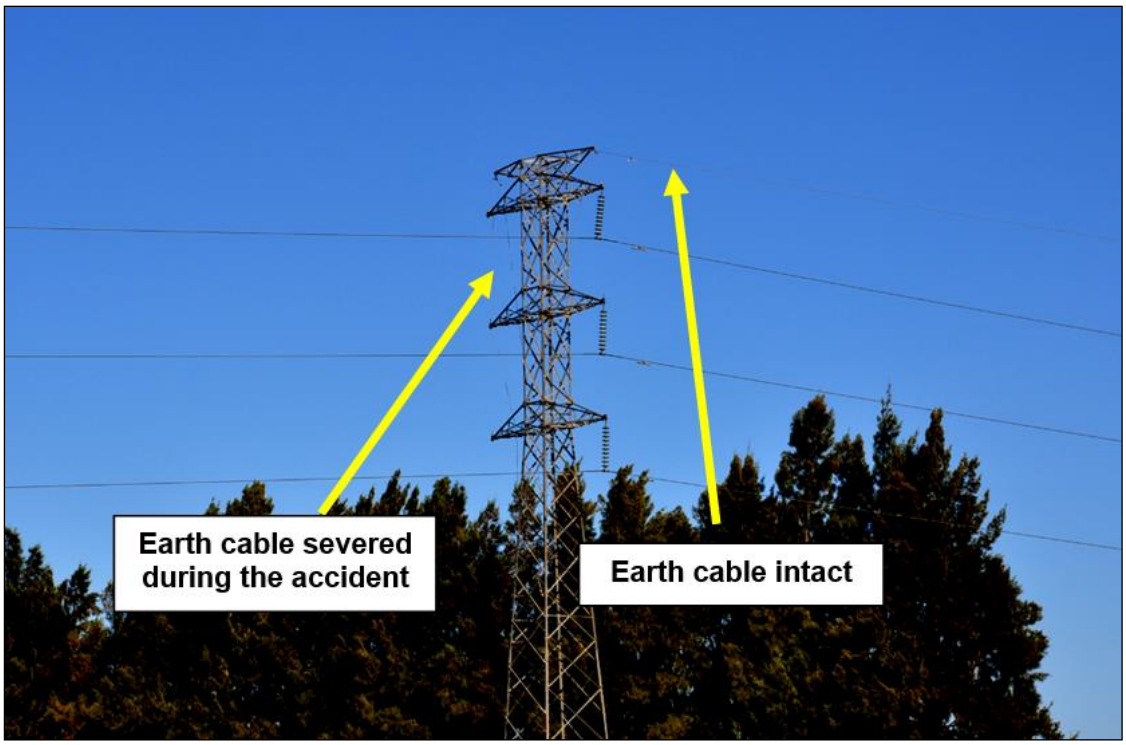

Figure 4: An electrical pylon with the severed earth cable (left) and the intact earth cable (right).

Figure 5: Damage on the butternut field and pear trees.

1.5. Personnel Information

Nationality	South African	Gender	Male	Age	25
Licence Number	0272523226	Licence Type	CPL (H)		
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Night, Agricultural Pilot				
Medical Expiry Date	Class 1, 30 June 2021				
Restrictions	TML (Restriction of the period of validity of the medical certificate (12 months)				
Previous Accidents	None				

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

Flying Experience:

Total Hours	1360.8
Total Past 24 Hours	4.7
Total Past 7 Days	14.5
Total Past 90 Days	124.6
Total on Type Past 90 Days	108.0
Total on Type	486.8

1.5.1. Pilot Experience:

1.5.1.1. The pilot was initially issued a Commercial Pilot Licence (CPL) Helicopter (H) on 27 June 2017. He had a total of 207.4 flying hours, with experience on the Robinson R22 Helicopter (RH22), Robinson R44 Helicopter (RH44) and Flight Simulator Training Device (FSTD).

1.5.1.2. The pilot was issued a Class 1 aviation medical certificate on 30 June 2020 with an expiry date of 30 June 2021.

1.5.1.3. The pilot was also issued a Pest Control Operator certificate in terms of the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947), with a validity date until 30 June 2023.

1.5.1.4. The pilot's initial agricultural rating training was on 18 December 2017. On 4 June 2018, the pilot had conducted a CPL (H) revalidation and successfully completed the skills test. At the time of revalidation, the pilot had a total of 494.3 flying hours, with a total of 210.2 hours completed for agricultural spraying, seeding, and dusting operations (G5) under supervision with 1.6 hours on the Bell 206 helicopter. On 5 June 2018, the pilot conducted the initial G5 operation as pilot-in-command (PIC) without supervision.

1.5.1.5. According the pilot's logbook, on 9 October 2018, the pilot successfully completed the conversion to type Bell/Augusta 206 Jet Ranger II (BH06/B06) helicopter with a grand total of 513.1 flying hours, and with 5.2 hours being on the BH206 helicopter.

1.5.1.6. At the time of the accident, the pilot had a total of 1360.8 hours with 947.6 hours completed for G5 operations, and 486.8 hours on BH206 helicopter type.

1.5.1.7. The pilot had conducted G5 operations a day prior to the accident, as well as twice in the previous month in the same farm.

1.5.2. ***South African Civil Aviation Technical Standard (SACATS) 127.02.12 Maximum Flight Time***

(1) An operator may not allow, nor may a flight crew member exceed, the following maximum flight times:

(a) the flight times specified in Table 1 of subsection 7.1 of this TS;

(b) during the preceding seven days:

(i) for a single-pilot operation: 35 hours;

(ii) for a multi-pilot operation: 40 hours; and

(iii) for mixed single- and multi-pilot operations: 37.5 hours;

(c) during the preceding thirty days:

(i) for a single-pilot operation: 100 hours;

(ii) for a multi-pilot operation: 120 hours; and

(iii) for mixed single- and multi-pilot operations: 110 hours;

(d) 300 during the preceding 90 days; or

(e) 1000 hours during the preceding 365 days.

(2) If a flight crew member expects his or her cumulative flight hours, projected for a particular operation, to exceed the appropriate limit, the flight crew member shall inform the operator accordingly.

(3) Every flight crew member is required to inform the operator of all flying he or she has undertaken if the cumulative amount of such flying and any scheduled duties is likely to exceed the maximum specified in the Regulations.

Maximum Flight Time Determination		
Period	Regulatory Maximum Times for a Single Pilot Operation	Pilot Logbook Flying Hours for (G5 Flying Only)
Previous 7 days	35 hours	14.5
Previous 30 days	100 hours	66.9
Previous 90 Days	300 hours	116.6

1.5.2.1. According to the pilot's logbook flying hours, the pilot did not exceed the regulatory maximum flight times for a single pilot operation.

1.6. Helicopter Information

1.6.1. The Bell 206B Jet Ranger II is a two-bladed, single-engine, five-seater light utility helicopter. The Bell 206B Jet Ranger II is widely used in agriculture crop-spraying operations across Southern Africa.

Airframe:

Manufacturer/Model	Bell 206B Jet Ranger II	
Serial Number	1723	
Year of Manufacturer	1975	
Total Airframe Hours (At Time of Accident)	9029.5	4583.7 Hobbs
Last MPI (Date & Hours)	30 December 2020	9000.2 hours
Hours Since Last MPI	29.3	
C of A (Original Date of Issue)	30 April 2007	
C of A Expiry Date	30 April 2021	
C of R (Issue Date) (Present Owner)	27 October 2010	
Type of Fuel Used in the Helicopter	Jet A1	
Operating Categories	Part 137, Agricultural	
Previous Accidents	None	

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

Engine:

Manufacturer/Model	Rolls Royce 250-C20B	
Serial Number	CAE-822535	
Hours Since New/Hobbs	9043.8	4103.8 Hobbs
Hours Since Overhaul	TBO not reached	

Main Transmission:

Manufacturer/Model	Bell Textron
Serial Number	BKW-10823
Part Number	206-040-002-025
Hours Since New	9029.5
Hours Since Overhaul	3322.9
Overhaul limit	4500

Main Rotor blades:

Manufacturer/Model	Bell Textron	
Serial Number	CS63	CS-202
Part Number	206-010-200-033	206-016-201-133
Hours Since New	921.2	921.2
Retirement life	5000	5000

Tail Rotor Blades:

Manufacturer/Model	Bell Textron	
Serial Number	CS-187	CS-202
Part Number	206-016-261-133	206-011-810-152
Hours Since New	921.2	921.2
Retirement life	2500	2500

Tail Gearbox:

Manufacturer/Model	Bell Textron
Serial Number	ALO-11039
Part Number	206-040-400-9
Hours Since New	9029.5
Hours Since Overhaul	3071.1
Overhaul limit	6000

1.6.2. All applicable Airworthiness Directives (AD) and Service Bulletins (SB) were reviewed and found to have been signed out in the logbooks.

1.6.3. The investigation did not find records of technical defects with the airframe, engine and major components of the helicopter in the logbooks or defect reports.

1.6.4. **IsoLair Spray System**

1.6.4.1. The ZS-HUC helicopter was fitted with an IsoLair spray system 3900-206 for Bell Model 206 helicopters. The system consists of the following components:

- **Tank Assembly:** External mounted fiberglass aerodynamic belly tank. Tank attaches with quick-release pins for fast and easy installation. Hook hole allows for cargo hook usage with tank installed.
- **Pump:** Electric motor driven, flow: 100 gallons per minute (GPM) at 30 pounds per square inch (PSI).
- **Boom Valve/Flow Control:** Boom valve puts negative pressure on boom in 'Off' position, flow control allows in-flight boom pressure adjustments.
- **Cyclic Control:** Allows for pilot's control of pumps, boom valve, emergency dump and flow control.
- **Boom Assembly:** Outboard booms can be rotated to desired nozzle position.

Figure 6: An IsoLair system installed on a similar helicopter as the accident helicopter. (Source: http://www.isolairinc.com/index.php)

1.6.5. **Mass and Balance**

1.6.5.1. No weight and balance report was found at the accident site, however, according to ZS-HUC aircraft's mass and balance report and manufacturer specifications, the helicopter's maximum take-off weight (MTOW) is 3200 pounds (lbs) or 1451.5 kilograms (kg).

1.6.5.2. According to the weight and balance provided by the operator, the helicopter was refuelled to 272lbs (40.6kg) with Jet A1 fuel and loaded with 650lbs (295kg) of pesticide in the spray tank prior to the accident. According to the calculations, the helicopter was operated at approximately 3112.5lbs (1412kg) total weight, which was 87.5lbs (39kg) below the MTOW (see Appendix A). The weight and balance at the time of the accident could not be determined due to the destruction of the IsoLair tank and the fuel tank which had ruptured as a result of the accident.

1.7. Meteorological Information

1.7.1. The weather information in the table below was provided by the South African Weather Service (SAWS) recorded at Worcester weather station on 19 January 2021 at 0600Z. Worcester weather station is the closet weather station located 32 kilometres (km) from the accident site.

Wind Direction	140°	Wind Speed	10kt	Visibility	9999m
Temperature	19.7°C	Cloud Cover	Scattered	Cloud Base	
Dew Point	12.5°C	QNH	1015hPa		

1.7.2. Relative humidity was calculated to be at 63% using the August-Roche-Magnus approximation.

1.7.3. According to the operator's standard operating procedures (SOP) for G5 operations, seeding or spraying should cease when:

- *Wind speed exceeds chemical label (normally 15 km/h)*
- *Humidity below 40%*
- *Temp above 30 degrees Celsius*
- *Visibility is reduced to below 500 meters, or*
- *In rain or any thunderstorm activity in the area*
- *Flight in the presence of possible wind shear or areas where the possibility of wind shear is prohibited.*

1.8. Aids to Navigation

1.8.1. The helicopter was equipped with a TracMap Flight unit. The TracMap Landbase series unit used in the ZS-HUC helicopter on the day of the accident is a GPS-based guidance and mapping system for vehicles and aircraft/helicopters operating in agricultural environments.

1.8.2. The unit has recording capabilities which allow information to be imported and exported to/from a computer using a USB dongle. The unit provides the following parameters for a planned flight: speed and heading of the helicopter, location, size of area to be sprayed, spraying time, amount of product sprayed and flow rate. This devise was not downloaded as it was damaged, and therefore, no data could be recovered.

1.8.3. There were no recorded defects with the navigational equipment prior to the accident flight.

Figure 7: Example of a TracMap unit used in the ZS-HUC helicopter. (Source: https://tracmap.com/)

1.9. Communication

1.9.1. The helicopter was equipped with a very high frequency (VHF) King KX170 transmitter communication system. There were no recorded defects with the communication system prior to the accident.

1.10. Aerodrome Information

1.10.1. The accident did not happen at an aerodrome. The helicopter crashed approximately 110m east of the power lines at the following Global Positioning System (GPS) co-ordinates: 33°25'32.80" South, 19°14'037.62" East at an elevation of 932 ft AMSL.

1.11. Flight Recorders

1.11.1. The helicopter 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 helicopter type.

1.12. Wreckage and Impact Information

1.12.1. The examination of the accident site was conducted on 19 January 2021. The examination revealed that the entire structure of the helicopter sustained impact damage. The helicopter landed on a pear orchard in an inverted attitude and on its left-side with its nose facing west. The main wreckage was located 110m east of the initial point of impact.

1.12.2. Across the helicopter's flight path from the loading area spanned high-tension cables consisting of three electrical conductors and an earth cable at the top that ran from the north-west to the south-east along the perimeter of the pear orchard to where the helicopter wreckage was found. The wreckage distribution revealed that the helicopter collided with the earth cable before crashing. The height of the earth cable was approximately 28m (91ft) above ground.

1.12.3. The wreckage distribution consisted of numerous fragments of the helicopter that were found scattered at a radius of approximately 80m (around the main wreckage), which was indicative of an in-flight break-up of the helicopter after colliding with the earth cable.

Figure 8: Wreckage distribution of main components.

1.12.4. At the time of the accident at 0550Z, it was determined that the sun azimuth angle was just above the high ground (mountains) from the operating area.

1.12.5. Numerous pear trees spanning approximately 2m in one row of the orchard (close to the main wreckage) were damaged. The helicopter had also clipped the top branches of a couple of trees in another row, west of the wreckage (see Figure 5).

1.12.6. The top-left section of the cockpit was missing, and the cockpit and seat were exposed. The top left-side of the cabin had some indication of coming into contact with the main rotor blades. The pilot seat was still secured in its railings although the back rest was detached. The nose section was heavily disturbed at the bottom, indicative of the helicopter being in a nose-down attitude before crashing. The left-side of the helicopter was severely damaged.

1.12.7. The instrument panel was damaged; the components were dislodged and had broken into smaller pieces; the printed circuit assembly (PCA) boards were found scattered near the main wreckage.

1.12.8. The main rotor hub had dislodged from the mast and was located 20m north-west of the main wreckage. Both blades were still attached, however, the dampeners were detached from the rotor blades. The pitch change links had also detached from the main rotor hub. All fractured surfaces associated with the mast assembly appeared to be due to overstress separation.

1.12.9. One of the main rotor blades exhibited deformation along its fractured surface, which occurred halfway through the blade; this blade was also broken towards the tip and a piece was located south-west of the main wreckage. The other main rotor blade had a section missing in the middle, which had broken off; its fractured surface was indicative of instantaneous separation exhibited by its brittle nature.

Figure 9: Damage to the main rotor blades.

1.12.10. The shear lip fracture of the mast was indicative of a sudden stoppage due to overload (shear lip is indicative of rotation at high-speed at the time of separation). The main rotor control tubes were severed and had failed at an extreme point. Continuity was not possible to conduct due to the missing major components (main rotor blades assembly and swash plate assembly) and sustained damage. The main transmission was still attached to the transmission deck although the attaching hardware was heavily disturbed.

Figure 10: Damage to the main rotor mast.

1.12.11. The engine had dislodged and was found south of the main wreckage. The impact mark on the ground indicated that the engine had bounced and landed 3m from the impact point. The inspection of the engine on site indicated that it was powered at the time of impact, showed by the power turbine disk with broken blades. The fuel control unit (FCU) was located near the engine. The engine exhaust duct was located forward of the engine position and was damaged.

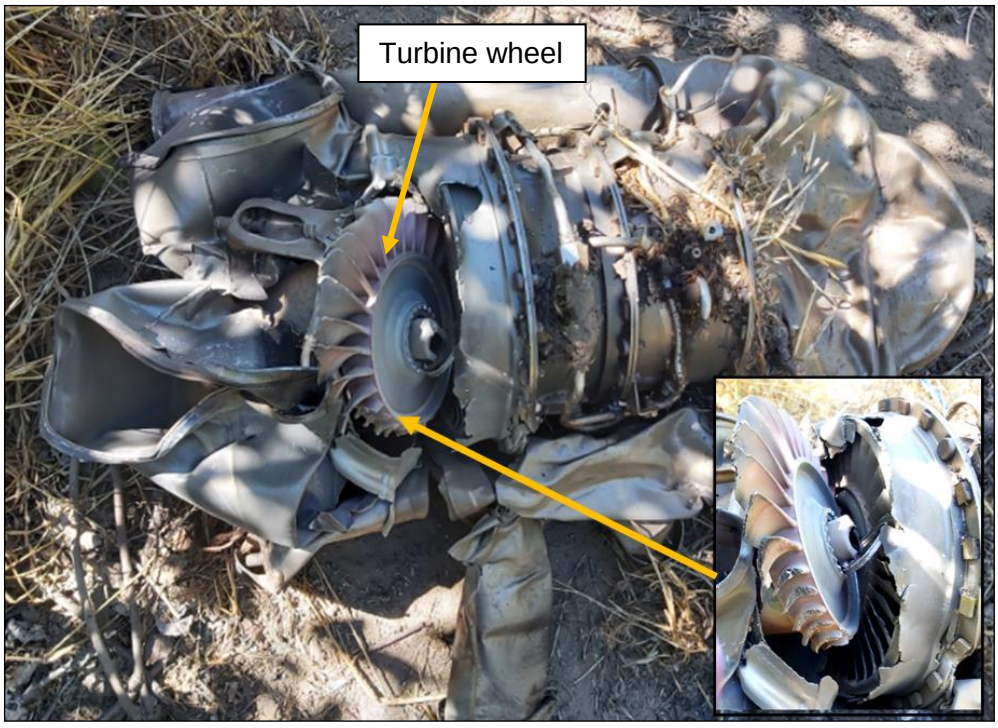

Figure 11: Damaged engine assembly.

1.12.12. Sections of the tail boom were found scattered along the wreckage trail with the middle section located 20m west of the main wreckage. The vertical fin assembly, with the tail gearbox and blades attached, was located 5m north of the main wreckage. The tail boom assembly had impact damage similar to the damage observed on the leading edge of the main rotor blade (Figure 9). The forward section of the tail boom that attaches to the airframe was located 10m west of the main wreckage. The tail drive shaft's middle section was detached from tail boom bearings and was located 10m south-west of the main wreckage.

1.12.13. Continuity of the tail rotor system was checked, and the 90˚ drive was visible when the blades were rotated; the last piece of the main drive shaft rotated in unison. The control tube was moved back and forth, which changed the pitch of the rotor blades.

Figure 12: Tail boom middle section (original position).

Figure 13: Horizontal stabiliser section (original position).

Figure 14: Vertical fin assembly (repositioned).

1.12.14. The IsoLair tank assembly had detached from the helicopter and was found lying open next to the main wreckage. This resulted in the chemical spilling over a large area, east of the main wreckage. The IsoLair boom assembly got detached from the helicopter's high skid gear; half of the boom was located near the high-tension cables while the other half was found near the main rotor blade, 20m north-west of the main wreckage.

1.12.15. A section for the spraying boom mounting assembly had bent 180° with striation marks similar to those observed on the front section of the right skid, which indicated that this section of the boom assembly was in contact with the earth cable during collision. It was found 20m north-west of the main wreckage.

Figure 15: Damaged and scattered IsoLair spray system components.

1.12.16. The helicopter's skid gear had broken off at different positions with some pieces scattered near the main wreckage. The left skid was found mostly still attached to the main wreckage. The right skid forward section was found lying 25m west of the main wreckage, with striation marks observed on the upper surface of the skid, an indication of a wire strike.

Figure 16: Left image: The left skid still attached to the main wreckage. Top-right image: The front section of the right skid showing striations marks. Bottom-right image: The right skid after the accident.

1.12.17. The earth conductor wires showed tension-like failure.

Figure 17: Top-left image: The failed earth conductor. Top-right image: The earth conductor found near the trees. Bottom image: The gouge mark made by the earth conductor after failure.

1.13. Medical and Pathological Information

1.13.1. To be discussed in the final report.

1.14. Fire

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

1.15. Survival Aspects

1.15.1. The accident was considered not survivable due to the flight deck and cabin being destroyed during impact.

1.16. Tests and Research

1.16.1. To be discussed in the final report.

1.17. Organisational and Management Information

1.17.1. The flight was conducted in accordance with (IAW) the provisions of Part 137 of the CAR 2011 as amended.

1.17.2. Although the pilot was employed by the operator, the ZS-HUC helicopter was operated by operator (Lessee). According to the operations manual for operator (Lessee), the pilot also held a position as flight operations manager for operator (Lessee).

1.17.3. The operator was in possession of a Part 127 Air Operator Certificate (AOC) and Operation Specifications (OpSpecs), which was issued on 15 December 2020 by the SACAA with an expiry date of 31 December 2021. The helicopter was duly authorised to operate under the AOC.

1.17.4. According to the Aircraft Lease Agreement (dry), the ZS-HUC helicopter was leased to the operator since 10 August 2018. The conditions of the lease agreement were adhered to by the operator.

1.17.5. The Aircraft Maintenance Organisation (AMO) which carried out the last mandatory periodic inspection (MPI) on the helicopter prior to the accident flight was in possession of an approved AMO certificate issued on 31 March 2020 with an expiry date of 31 March 2021, IAW Part 145 of the CAR 2011 as amended.

1.18. Additional Information

1.18.1. To be discussed in the final report.

1.19. Useful or Effective Investigation Techniques

1.19.1. To be discussed in the final report.

2. FINDINGS

2.1. General

From the available evidence, the following preliminary findings were made with respect to this accident. 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 accident. The findings are significant steps in this accident sequence, but they are not always causal or indicate deficiencies.

2.2. Pilot

2.2.1. The pilot was initially issued a Commercial Pilot Licence (CPL) on 27 June 2017. The pilot's initial agricultural rating training begun on 18 December 2017 to 2 June 2018, when the pilot conducted the initial agricultural (G5) operation as PIC without supervision after completing 210.2 hours of G5 flying under supervision.

2.2.2. The pilot was issued a Class 1 aviation medical certificate with an expiry date of 30 June 2021, with restrictions that the medical certificate period of validity is 12 months (TML).

2.2.3. According to the pilot's logbook, the Bell 206B (B06) helicopter type was endorsed on the pilot's licence on 9 October 2018, with a grand total of 513.1 flying hours and 5.2 dual hours being on the BH206 helicopter.

2.2.4. The pilot was familiar with the area of operation and had flown three times in the same farm prior to the accident flight. The pilot flew 4.7 hours of G5 operations on the same farm the day before the accident flight.

2.2.5. At the time of the accident, the pilot had a total of 1360.8 hours with 947.6 hours completed for G5 operations and 486.8 hours on the BH206 helicopter type, of which 431.86 hours were for agricultural operations.

2.2.6. According to the pilot logbook flying hours, the pilot did not exceed the regulatory maximum flight times for a single pilot operation as stipulated in technical standards Part 127.02.12 of the SA-CATS 2011 as amended. Therefore, it is unlikely that the pilot was fatigued at the time of accident.

2.2.7 The pilot was issued a renewal for registration as a Pest Control Operator in terms of the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947), which had a validity date until 30 June 2023.

2.3. Helicopter Maintenance Information

2.3.1. The last maintenance inspection undertaken on the helicopter prior to the accident flight was a MPI which was carried out on 30 December 2020 at 9000.2 airframe hours. At the time of the accident, the helicopter had flown 29.5 hours since its last MPI.

2.3.2. There were no pre-existing mechanical faults with either the engine, main rotor or tail rotor systems recorded in the flight folio and defect logs that could have contributed to the accident. Additionally, there were no snags recorded in the flight folio and defect logs with either the navigational or communication systems prior to the accident flight.

2.3.3. Following the MPI, the helicopter was issued a Certificate of Release to Service (CRS) on 30 December 2020 stating that the helicopter's next scheduled inspection was to be carried out at 9100.2 airframe hours and 4654.4 Hobbs or on 29 December 2021, whichever occurs first.

2.4. Helicopter Wreckage Information

2.4.1. There were no eyewitnesses when the accident occurred, however, the farm owner who was located 650m north of the area of operation heard a loud 'popping' sound before the helicopter's engine sound stopped. Soon after, he heard another loud 'crash' sound and immediately took his fire extinguisher and rushed to the scene. However, upon arrival, he found that the helicopter had crashed between pear orchards, but there was no fire.

2.4.2. Post-accident on-site investigation revealed that the helicopter collided with the top earth conductor of the high-tension electrical cables before crashing. Damage observed on the wreckage indicated that the helicopter was caught on its right skid by the cable, which was exhibited by the metallic striation marks, indicative of a wire strike on the upper surface of the skid's front section.

2.4.3. A section of the boom mounting assembly which had bent 180° indicated that the electrical cables disturbed the IsoLair spraying assembly, causing it to fail.

2.4.4. The collision of the helicopter with the earth conductor resulted in the tension stress, causing the wires to break. The 'popping' sound heard by the farm owner was probably the sound of the main rotor blades impacting the left-side of the fuselage and severing the engine.

2.4.5. It is possible that at the time of collusion with the earth conductor, the helicopter might have been in a nose-down attitude. This might have prompted the pilot to attempt an evasive manoeuvre which may have resulted in one of the main rotor blades severing the left-front and mid-section of the helicopter, as well as the tail boom section.

2.4.6. The distribution of the wreckage is indicative of an in-flight break-up, which resulted in the helicopter's debris being scattered at a diameter of about 80m around the main wreckage.

2.4.7. According to the provided mass and balance calculation sheet for the ZS-HUC helicopter, the helicopter was operated at approximately 3112.5lbs (1412kg) total weight, which was 87.5lbs (39kg) below the MTOW.

2.4.8. The flight was conducted under VFR by day. The weather conditions at the time of the accident were suitable for a fruit fly baiting operation and did not contribute to the accident.

2.4.9. The helicopter impacted the ground hard following collision with the earth conductor (top high-tension wire). The helicopter was destroyed by impact forces and the pilot was fatally injured. The shear lip failure of the rotor mast was indicative of a sudden stoppage of the main rotor blades which were turning at high speed. The damaged and separation of engine turbine wheel was an indication of a dynamic failure while rotating at nominal speed.

2.5. Operator

2.5.1. The flight was conducted IAW the provisions of Part 137 of the CAR 2011 as amended.

2.5.2. Although the pilot was employed by two different operators, the ZS-HUC helicopter was operated by the Lessee. According to the operations manual of the Lessee, the pilot was also a flight operations manager.

2.5.3. The operator (Lessee) was approved to provide air services and the ZS-HUC helicopter was approved under G5 – agricultural spraying, seeding, and dusting operations.

2.5.4. The AMO which carried out the last MPI on the helicopter prior to the accident flight was in possession of an approved AMO certificated that was issued IAW Part 145 of the CAR 2011 as amended.

3. ON-GOING INVESTIGATION

3.1. The AIID investigation is on-going and the investigator/s will be looking into other aspects of this occurrence which may or may not have safety implications.

4. APPENDICES

4.1. Appendix A – Total Weight Calculation of ZS-HUC prior to the accident

This report is issued by:

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

Appendix A

Total Weight Calculation of ZS-HUC prior to the accident