AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

			Reference:		CA18/2/3/10407		
Aircraft Registration	ZS-XPC & ZS-STD	**Date of Accident**	29 December 2023		**Time of Accident**	0908Z	
Type of Aircraft	Air Tractor AT-502A and Cessna T182T		**Type of Operation**		Agricultural Spraying (Part 137); and Private (Part 91)		
Pilot-in-command Licence Type	Commercial Pilot Licence (CPL) & Private Pilot Licence (PPL)		**Age**	63 & 53	Licence Valid	Yes	
Pilot-in-command Flying Experience		**Total Flying Hours**	14 369.4 & 386.7		**Hours on Type**	3 941.1 & 386.7	
Last Point of Departure	Potchefstroom Aerodrome (FAPS) North West Province						
Next Point of Intended Landing	Potchefstroom Aerodrome (FAPS), North West Province						
Damage to Aircraft	Both aircraft were destroyed						
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)							
Arena Farm, Carletonville District (GPS position: 26°08′21.53″ South 027°26′27.62″ East), elevation 5 106 feet							
Meteorological Information	Surface wind: 034º/12kts: temperature: 22ºC; dew point: 12ºC; Visibility: CAVOK						
Number of People On-board	1+0 & 1+1	**Number of People Injured**	0	**Number of People Killed**	3	**Other (On Ground)**	0

Synopsis

On Friday morning, 29 December 2023 at 0908Z, an Air Tractor AT502-A aircraft registered ZS-XPC with a pilot on-board and a Cessna T182T aircraft registered ZS-STD with two pilots on-board were involved in a midair collision at Arena Farm in the Carletonville District, Gauteng province. The flight was conducted under visual meteorological conditions (VMC) by day. Both aircraft were destroyed during the accident sequence, and all occupants on-board were fatally injured. The ZS-XPC was flying under the provisions of Part 137 and the ZS-STD was flying under the provisions of Part 91 of the Civil Aviation Regulations (CAR) 2011 as amended.

The pilot of ZS-XPC was engaged in a crop-spraying flight and was using a gravel runway on a farm located 6 nautical miles (nm) or 11 kilometres (km) to the west of the maize field which was scheduled to be crop-sprayed. The pilots of ZS-STD were surveying the farm at a higher altitude than that of ZS-XPC. A witness observed the two aircraft flying next to each other. Shortly after, ZS-STD turned right and collided with ZS-XPC. Both pilots lost control of their aircraft, and they crashed on a neighbouring farm. The occupants of both aircraft were fatally injured, and both aircraft were destroyed.

Probable Cause

The ZS-STD encroached the manoeuvring area of ZS-XPC when it turned right (at the same height) and collided with ZS-XPC. The ZS-XPC was also turning right at the time as the pilot was positioning for his next spray run when the collision occurred; both aircraft crashed to the ground.

Contributory Factors

- The Cessna 182 is a high-wing aircraft. During a turn (on either side), the wing structure could limit/restrict or blank out the pilot's view depending on the bank angle. It is believed that this phenomenon contributed to this accident as the pilot of ZS-STD did not see ZS-XPC during the right turn.
- The two pilots on-board ZS-STD failed to keep a proper lookout before executing the right turn.

SRP date	8 October 2024	Publication date	10 October 2024

Occurrence Details

Reference number	**:** CA18/2/3/10407
Occurrence Category	**:** Accident (Category 1)
Type of Operation	**:** Agricultural Spraying (Part 137) and Private (Part 91)
Aircraft Manufacturers	**:** Air Tractor Incorporated and Cessna Aircraft Company
Aircraft Models	**:** AT-502A and T182T
Aircraft Registrations	**:** ZS-XPC and ZS-STD
Nationality	**:** South African
Place	**:** Arena Farm Carletonville District, Gauteng Province
Date and Time	**:** 29 December 2023 at 0908Z
Injuries	**:** Fatal
Damage	**:** Both aircraft were destroyed

Purpose of the Investigation

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011, this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and not 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 a fatal accident involving a Cessna T182T and an Air Tractor AT-502A which occurred at Arena Farm in the Carletonville District, Gauteng province, on 29 December 2023 at 0908Z. The occurrence was classified as an accident according to the CAR 2011 Part 12 and the International Civil Aviation Organisation (ICAO) STD Annex 13. The AIID appointed an investigator-in-charge and a co-investigator to conduct the investigation. The investigators were dispatched on the same day to the accident site for this occurrence. Notifications were sent to the States of Design and Manufacturer in accordance with the CAR 2011 Part 12 and the ICAO Annex 13 Chapter 4. The States appointed non-travelling accredited representatives and advisors.

Notes:

1. *Whenever the following words are mentioned in this report, they shall mean the following:*
   Accident — this investigated of accident
   Aircraft — An Air Tractor AT-502A, and Cessna T182T were involved in this accident
   Investigation — the investigation into the circumstances of this accident
   Pilots — the pilots 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, contrast; or addition of text boxes, arrows, or lines.*

Disclaimer

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Abbreviation	Description
°	Degrees
°C	Degrees Celsius
AMO	Aircraft Maintenance Organisation
CAR	Civil Aviation Regulations
CAVOK	Ceiling and Visibility OK (for VFR flight)
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
ELT	Emergency Locator Transmitter
FAPS	Potchefstroom Aerodrome
FDR	Flight Data Recorder
ft	feet
GPS	Global Positioning System
hPa	Hectopascal
hp	Horsepower
IIC	Investigator-in-charge
kg	kilogram(s)
Kt	Knots
m	metres
METAR	Meteorological Aerodrome Report
MTOW	Maximum Take-off Weight
PIC	Pilot-in-command
PPL	Private Pilot Licence
QNH	Barometric Pressure Adjusted to Sea Level
SACAA	South African Civil Aviation Authority
SAWS	South African Weather Service
TBA	To be advised
TBO	Time Between Overhauls
UTC	Universal Co-ordinated Time
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
Z	Zulu (Term for Universal Co-ordinated Time - Zero Hours Greenwich)

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1 On Friday, 29 December 2023 at 0908Z, an Air Tractor AT-502A aircraft registered ZS-XPC with one occupant on-board and a Cessna T182T aircraft registered ZS-STD with two occupants on-board were involved in a midair collision whilst flying overhead Arena Farm in the Carletonville District, Gauteng province. Visual meteorological conditions (VMC) by day prevailed at the time of the flights. The flights were conducted under the provisions of Part 137 (ZS-XPC) and Part 91 (ZS-STD) of the Civil Aviation Regulations (CAR) 2011 as amended.

1.1.2 The ZS-XPC was engaged in crop-spraying detail on a maize field and ZS-STD was engaged in a private flight. According to available information, the pilots on-board ZS-STD were assessing the condition of the maize crops. After the assessment, they advised the crop-dusting teams, which included two crop-dusting aircraft (ZS-XPC and ZS-CHB) of the fields that needed to be sprayed and what type of aerial applicators are to be used.

1.1.3 The assessment was generally carried out daily during the maize planting season if weather permits (taken into consideration). The farm owner normally uses the helicopter hangared on the farm for this purpose. According to available information, the helicopter had a technical problem on the day and required maintenance. Therefore, the farm owner opted to use the Cessna T182T (ZS-STD) on this occasion. The ZS-STD took off from Potchefstroom Aerodrome (FAPS) where the aircraft was kept in a hangar, with the intention to land back at the same aerodrome.

1.1.4 The pilot of ZS-XPC was operating from a gravel runway on a farm located approximately 6 nautical miles (nm) or 11 kilometres (km) to the west of the maize field which was being sprayed at the time of the accident. The people staying in the area were familiar with the crop-spraying aircraft flying in the area, especially during the maize planting season and in the summer months. An eyewitness reported that ZS-XPC was spraying the maize field to the south of their dwelling (residence) (see Figure 3), and ZS-STD was surveying the farm at a higher height than that of ZS-XPC which was spraying the maize field at the time. A while later, the witness observed the two aircraft flying next to each other; shortly after, ZS-STD turned and collided with ZS-XPC. Both pilots lost control of their aircraft and they crashed on a neighbouring farm. The occupants on-board both aircraft were fatally injured, and both aircraft were destroyed.

1.1.5 The accident occurred during daylight in Arena Farm at Global Positioning System (GPS) co-ordinates determined to be 26°08'21.53" South 027°26'27.62" East, at an elevation of 5 106 feet (ft).

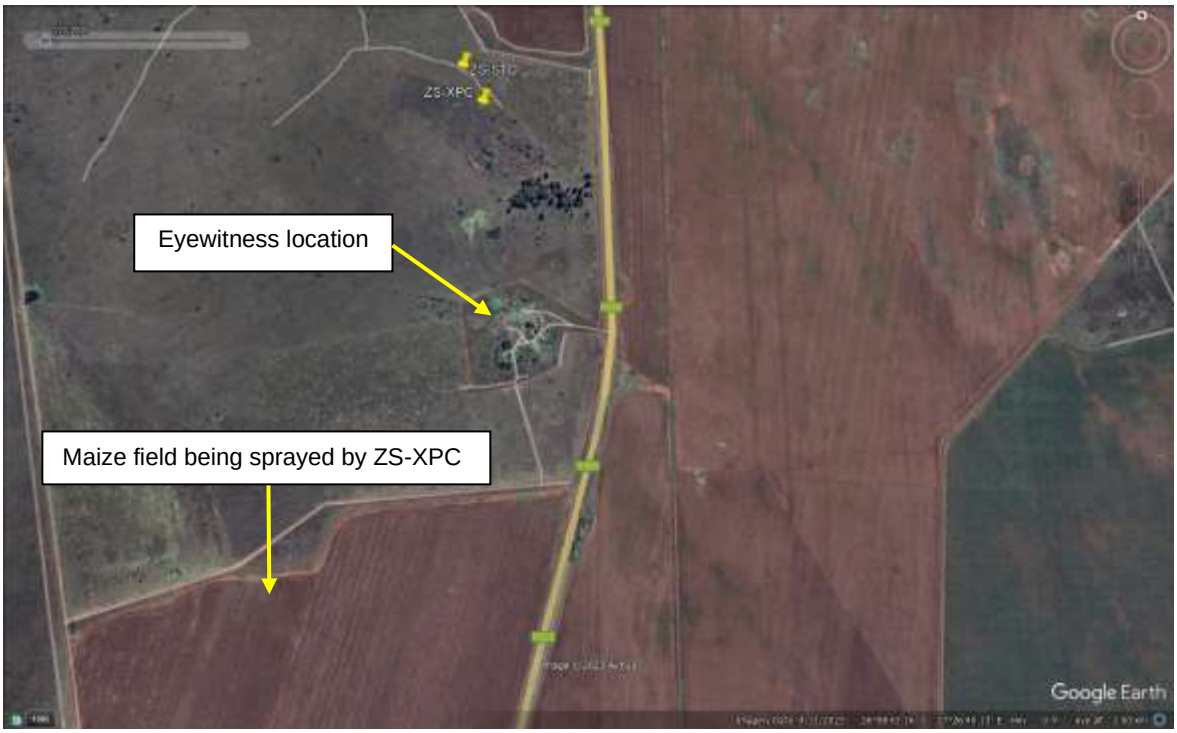

Figure 1: Position of the two main wreckages (yellow pins). (Source: Google Earth)

1.2. Injuries to Persons

1.2.1 ZS-XPC

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

Note: Other means people on the ground.

1.2.2 ZS-STD

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

Note: Other means people on the ground.

1.3. Damage to Aircraft

1.3.1. Both aircraft were destroyed during the midair collision.

1.4. Other Damage

1.4.1. No other damage was caused.

1.5. Personnel Information

1.5.1 Pilot-in-command (PIC) ZS-XPC

Nationality	South African	Gender	Male	Age	63
Licence Type	Commercial Pilot Licence (CPL)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Instrument, Safety Pilot, Tug Pilot, Agricultural Rating				
Medical Expiry Date	31 March 2024 (Class 1)				
Restrictions	VML – Valid only with correction for defective distant, intermediate and near vision				
SANS 10118:2011 Pilot Requirement	Pest Control Operator Certificate				
Previous Accidents	On 27 February 1989 whilst flying a Cessna 188 registered ZS-KRR, there was a loss of engine power during the late part of the take-off; the pilot dumped the chemical load, but the aircraft impacted a fence at the end of the runway which caused the speed to decay further. The aircraft stalled at low altitude, impacted terrain with one wing low, cartwheeled and came to rest in an inverted position. On 7 November 1995 whilst flying an Air Tractor AT-502B registered ZS-NIA, the pilot encountered a strong tailwind on rotation after take-off and dumped the chemical load at full power; the aircraft pitched up 90° and impacted the ground, tail first. On 8 January 2022 whilst flying an Air Tractor AT-502A registered ZS-XPC, the left-wing tip of the aircraft struck a person on his left leg whilst video-recording the aircraft during a crop-spraying detail.				

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

Flying Experience:

Total Hours	14 369.4
Total Past 24 Hours	7.2
Total Past 7 Days	25.4
Total Past 90 Days	134.3

Total on Type Past 90 Days	134.3
Total on Type	3 941.1

1.5.2 The occupants on-board the ZS-STD were pilot 1 (husband) pilot 2 (wife); both had Private Pilot Licences (PPL).

1.5.3 Pilot 1 of ZS-STD:

Nationality	South African	Gender	Male	Age	53
Licence Type	Private Pilot Licence (PPL)				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	None				
Medical Expiry Date	30 June 2024 (Class 2)				
Restrictions	VDL - Valid only with correction for defective near vision HAL – Valid only when hearing aids are worn				
Previous Accident	None				

Flying experience:

Total hours	386.7
Total past 90 days	20.3
Total on type past 90 days	20.3
Total on type	386.7

1.5.4 The aircraft was fitted with dual flight controls.
According to available information, Pilot 1 had a PPL. Pilot 1 received a Class 2 aviation medical certificate on 12 June 2023, valid until 30 June 2024.

Pilot 2 of ZS-STD:

Nationality	South African	Gender	Female	Age	54
Licence Type	Private Pilot Licence (PPL)				
Licence Valid	No	Type Endorsed	Yes		
Ratings	None				
Medical Expiry Date	31 October 2023 (Class 2)				
Restrictions	VDL - Valid only with correction for defective distant vision				
Previous Accident	None				

According to available information, Pilot 2 had a PPL on aircraft and helicopters; and the Cessna 182 was endorsed on her licence.

The pilot 2 was issued a Class 2 aviation medical certificate on 3 October 2022 with an expiry date of 31 October 2023.

Her aviation medical certificate was, therefore, not valid. This was in contravention of the provisions of Part 67.00.9 of the Civil Aviation Regulations 2011 as amended, because the aviation medical certificate was invalid, this rendered the Pilot 2 licence invalid.

Flying experience aeroplane:

Total hours	803.8
Total past 90 days	33.2
Total on type past 90 days	6.6
Total on type	432.2

Total flying experience:

Total flying hours aeroplane	803.8
Total flying hours helicopter	712.6
Grand total	1516.4

1.6. Aircraft Information

1.6.1. Air Tractor AT-502A (Source: www.airtractor.com)

The Air Tractor AT-502A is an agricultural aircraft with an all-metal low-wing monoplane structure and tail dragger configuration. The aircraft is equipped with a chemical hopper tank with a capacity of 1 893 litres (500 US gallons) located between the cockpit and the engine firewall. The aircraft is fitted with a Pratt & Whitney PT6A-140AG turboprop engine, which produces 647 kilowatts (kW) (867 shaft horsepower) paired with a four-blade Hartzell propeller.

Figure 2: The file picture of ZS-XPC aircraft.

Airframe ZS-XPC

Manufacturer/Model	Air Tractor Incorporated / AT-502A (XP)	
Serial Number	502A-3241	
Year of Manufacture	2020	
Total Airframe Hours (at time of accident)	1 863.6	
Last Inspection (Hours & Date)	1 818.0	20 December 2023
Hours Since Last Inspection	45.6	
CRS Issue Date	20 December 2023	
C of A (Issue Date & Expiry Date)	29 September 2020	30 September 2024
C of R (Issue Date) (Present Owner)	7 September 2020	
Type of Fuel Used	Jet A1	
MTOW	4 754kg (10 480lbs)	
Category	Restricted Normal (Aeroplane)	
Previous Accident	On 8 January 2022, the left-wing tip of the aircraft struck a person on his left leg whilst video-recording the aircraft during a crop-spraying detail.	

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

Engine:

Type	Pratt & Whitney PT6A-140AG
Serial number	PCE-VB0081
Hours since new	1 863.6
Hours since overhaul	TBO not reached

Propeller:

Type	Hartzell HC-B4TN-3C
Serial number	CDA5864
Hours since new	1 863.6
Hours since overhaul	TBO not reached

1.6.2. Cessna T182T (Source: https://www.vanbortel.com)

The Cessna T182T aircraft is an all-metal, single-engine piston, high-wing monoplane with a four-person seating capacity, including a crew of one or two. A suitable allowance for luggage is provided.

Figure 3: The file picture of ZS-STD aircraft.

Airframe ZS-STD:

Manufacturer/Model	Cessna Aircraft Company / T182T	
Serial Number	T182-08106	
Year of Manufacture	2001	
Total Airframe Hours (at time of accident)	1 634.6	
Last Inspection (Hours & Date)	1 561.2	9 June 2023
Hours Since Last Inspection	73.4	
CRS Issue Date	9 June 2023	
C of A (Issue Date & Expiry Date)	16 March 2011	31 March 2024
C of R (Issue Date) (Present Owner)	4 April 2018	
Type of Fuel Used	Avgas	
MTOW	1 406kg (3 100lbs)	
Category	Standard Normal (Aeroplane)	
Previous Accident	None	

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

Engine:

Type	Lycoming TIO-540-AK1A
Serial number	L11094-61A
Hours since new	1 634.6
Hours since overhaul	TBO not reached

Propeller:

Type	McCauley B3D36C442
Serial number	011448
Hours since new	1 634.6
Hours since overhaul	TBO not reached

1.7. Meteorological Information

1.7.1. The weather information below was obtained from the Meteorological Aerodrome Report (METAR) that was issued by the South African Weather Service (SAWS), recorded at Ventersdorp on 29 December 2023 at 0900Z. Ventersdorp is located 67 km from the accident site.

Wind Direction	034°	Wind Speed	12kt	Visibility	10 000m
Temperature	22°C	Cloud Cover	None	Cloud Base	None
Dew Point	12°C	QNH	1026 hPa		

1.7.2. The accident investigation team arrived on-site approximately 3 hours after the occurrence; they assessed the weather as good with a light northerly wind.

1.8. Aids to Navigation

1.8.1 Both aircraft were equipped with standard navigational equipment as approved by the Regulator (SACAA). There were no recorded defects with the navigational equipment before the flight.

1.9. Communication

1.9.1 Both aircraft were equipped with a standard communication system as approved by the Regulator. There were no recorded defects with the communication system before the flights.

1.9.2 The two pilots communicated on very high frequency (VHF) 123.30-Megahertz (MHz). This was confirmed by another pilot who was also flying in the area at the time (in an Air Tractor AT-802 with registration ZS-CHB).

1.10. Aerodrome Information

1.10.1 The accident did not occur at or near an aerodrome.

1.11. Flight Recorders

1.11.1 Neither of the aircraft was equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR), nor was it required by the regulation to be fitted on both aircraft.

1.11.2 The ZS-XPC was equipped with an Ag-Nav Platinum model number P771 and serial number 771200025. This unit was recovered and was subjected to an examination with the aim of obtaining the flight track flown by the pilot. The AIID sent the unit for examination to the original equipment manufacturer (OEM) in Canada. See the examination results under test and research section.

1.11.3 The ZS-STD was equipped with a panel-mounted GPS unit. The OEM was contacted to advise if the unit had a non-volatile memory (NVM) that could be downloaded. The response to AIID was that the unit did not have NVM.

1.12. Wreckage and Impact Information

1.12.1 The debris covered the radius of approximately 110 metres (m). The main wreckage of ZS-STD which came to rest in an inverted attitude and faced north-easterly. The entire left wing had separated from the fuselage and was found approximately 40m from the main wreckage. The pilot's (left front) seat was found next to the right wing, and the second seat was still in the cockpit/cabin area. The aircraft was destroyed.

1.12.2 The main wreckage of ZS-XPC also came to rest in an inverted attitude facing south, approximately 100m from the main wreckage of ZS-STD. The empennage of the aircraft was found separated from the main fuselage. The vertical stabiliser and rudder were found separated from the aft fuselage. One of the four propeller blades was severed from the hub assembly, with the three remaining blades sustaining extensive deformation. The deep groove mark on the ground indicated that the propeller was turning under power on impact. The cockpit/cabin area of the aircraft was also severed from the fuselage. The pilot seat and the floor structure it was attached to had ripped off of the fuselage. The pilot seat was found next to the right wing of the main wreckage of ZS-STD. The propeller gear drive, which is part of the engine, had separated from the rest of the engine and was still secured to the propeller hub assembly; the rest of the engine was undamaged and still secured to the fuselage. The spraying equipment, although deformed, had remained attached to the fuselage. The aircraft was equipped with an emergency locator transmitter (ELT); the unit remained intact and was flung off of the fuselage during the impact sequence.

Figure 4: An aerial view of the accident site. (Source: A person on-board another aircraft flying in the vicinity)

Figure 5: The main wreckage of ZS-STD.

Figure 6: The left wing of ZS-STD.

Figure 7: The main wreckage of ZS-XPC.

Figure 8: Deformed propeller blades, with one broken off.

Figure 9: The vertical stabiliser and rudder assembly near the left wing of ZS-STD.

Figure 10: The aft fuselage and empennage with the two horizontal stabilisers still attached.

Figure 11: The pilot's seat and floor structure of ZS-XPC.

1.13. Medical and Pathological Information

1.13.1 The pathology report stated that the cause of death for the pilot of ZS-XPC was multiple blunt force injuries, and the cause of death for both pilots of ZS-STD was also multiple blunt force injuries.

1.14. Fire

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

1.15. Survival Aspects

1.15.1 The accident was considered not survivable due to the damage in the cockpit and cabin area of both aircraft. The occupants on-board the two aircraft were flung out during the accident sequence.

1.16. Tests and Research

ZS-STD components

1.16.1. The ZS-STD aircraft was equipped with a Garmin Aera 795 GPS receiver; it was recovered from the accident site and was sent to the Transportation Safety Board of Canada (TSB) Engineering Laboratory to extract data that might be relevant to the accident. The GPS with serial number 2D0004741 was examined by the TSB. The substantially damaged screen and the outer casing were removed to check the circuitry, which was not damaged. It was determined that it was safe to power on the circuitry. The unit powered up but could not communicate with the laboratory computer. Thereafter, the memory chip (see Figure 13) was removed from the motherboard, cleaned and reballed. The memory chip was then placed on an adapter to be read, but there was no communication between the chip and the computer. Radiographs and computer tomography scan of the chip were completed to examine for internal damage to the chip. There was no damage found. It was likely that there was damage to the memory chip which the scans could not identify. Therefore, it was not possible to extract data from the GPS.

Figure 12: The recovered GPS unit.

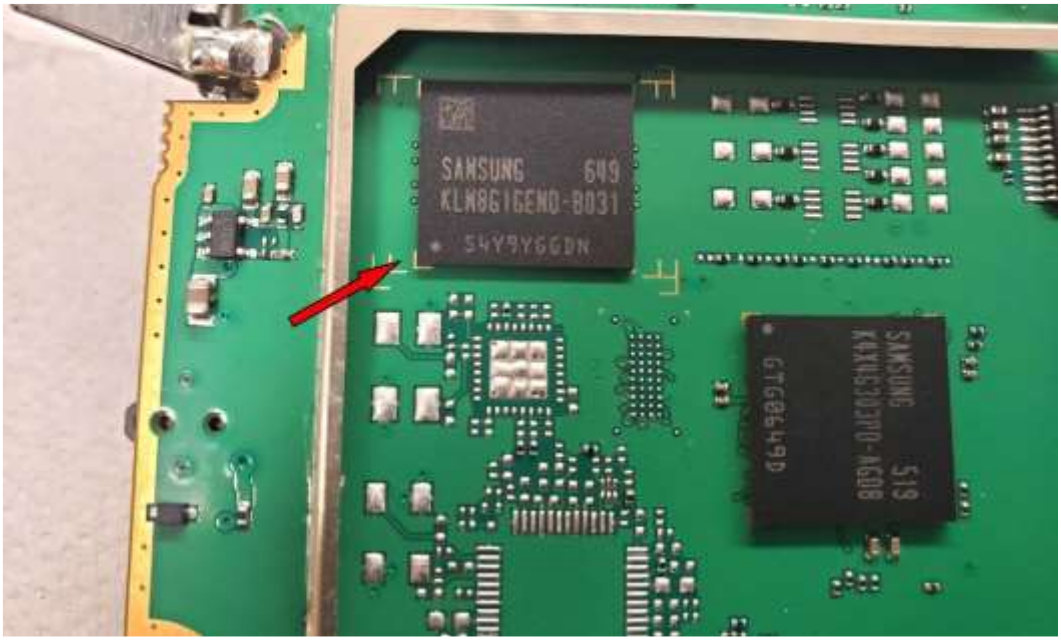

Figure 13: The undamaged memory card. (Source: Honeywell)

1.16.2. The ZS-STD aircraft was equipped with a Honeywell KX155A Navigation/Communication unit (Part number: 069-01032-0101, Serial number: 22916) and KT76C ATC Transponder (Part number: 066-01156-0101, serial number: 12674). These units were both sent to Honeywell in the United States of America where both memory chips were removed and installed to slave components. The last tuned frequencies were confirmed as follows: COMM 123.30 (active), 124.80 (Standby), NAV: 115.20 (active) and 114.55 (standby) [see Figure 14]. The transponder squawk code was 2000.

Figure 14: Radio frequencies displayed during testing. (Source: Honeywell)

ZS-XPC components

1.16.3. The ZS-XPC aircraft was equipped with an Ag-Nav Platinum, model number P771 with serial number 771200025. This unit was recovered from the accident site as it was flung off from the instrument panel during the impact sequence. The unit was shipped to the original equipment manufacturer (OEM) in Canada. Oversight during the download of the data was provided by TSB Canada. The OEM was able to power up the unit and retrieve data.

Figure 15: The Ag-Nav unit had remained intact.

Before spraying the area, the pilot plotted a boundary of the area to be sprayed to see the guidelines to be followed. In this case, it is the area marked as a blue rectangle labelled spray report, see Figure 14.

The data recording starts from where the first spray data begins, there is no yellow line on top of that and the aircraft enters the spray area again from the bottom to the 2nd spray line and the last data that was in the unit was until the "last Ag-Nav position recorded". There are only 6 spray enter and exit lines on the top and eight on the bottom; there is no exit for the first and last lines.

The unit powered off after the crash; it was not able to save the last few seconds of the accident data. The last data recorded was almost at the end of the spray line (flying in a northerly direction), see Figure 15.

The system writes the data records to temporary memory (RAM) for 20 seconds and then writes to the actual hard drive once the 20-second buffer is full. Since it is unknown when the aircraft lost power, the full 20 seconds could have been lost or just a part of the 20 seconds

was recorded. In this case, approximately 10 seconds of data before power loss could not be retrieved.

According to the technician's analysis, the general projection of the aircraft was that it would have made it to the final site within 10 seconds. The ZS-XPC did not deviated from its planned track.

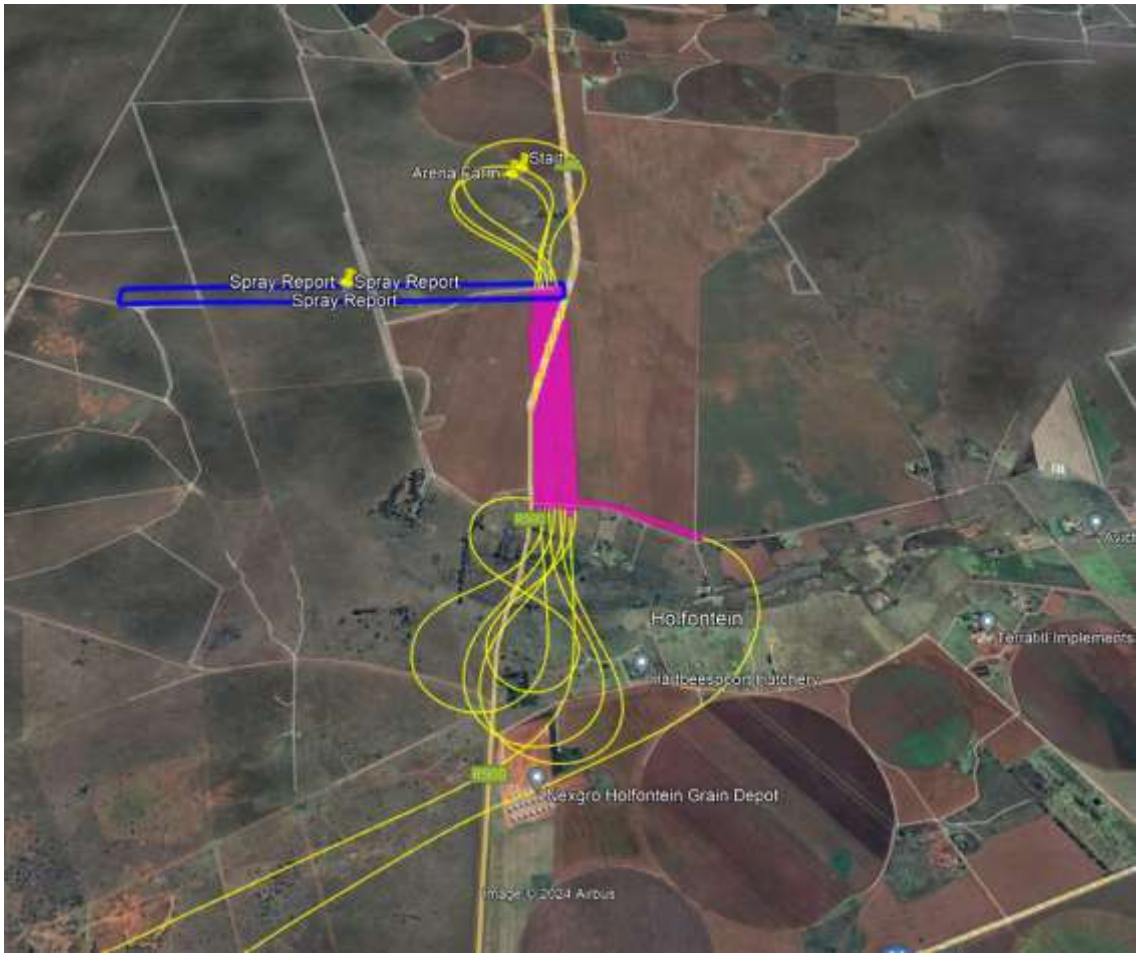

Figure 16: ZS-XPC spray track. (Source: AgNav)

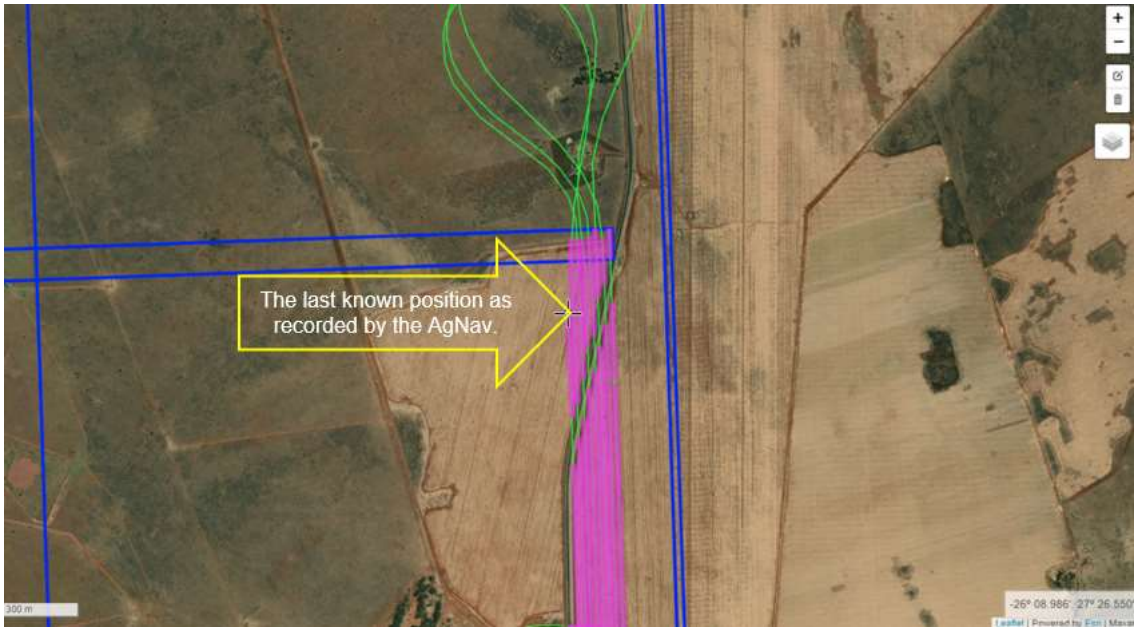

Figure 17: The last known position of the aircraft recorded by the Ag-Nav unit. (Source: AgNav)

1.17. Organisational and Management Information

1.17.1 The ZS-STD aircraft was engaged in a private flight which was conducted under the provisions of Part 91 of the CAR 2011 as amended.

1.17.2 The aircraft maintenance organisation (AMO) that conducted the last mandatory periodic inspection (MPI) had an AMO Certificate that was issued by the Regulator on 27 February 2023 with an expiry date of 29 February 2024.

1.17.2 The ZS-XPC aircraft was engaged in a crop-spraying flight which was conducted under the provisions of Part 137 of the CAR 2011 as amended.

1.18. Additional Information

1.18.1 The ZS-XPC aircraft was equipped with a 406 MHz ELT. The unit, which remained intact and armed, was flung off of the fuselage during the accident sequence. The South African Mission Control Centre (ASMCC) in Cape Town did not receive any coded distress signal (HEX ID: 4B288 AE6CC FFBFF) for this aircraft.

Figure 18: ELT unit as it was found at the accident site.

1.18.2 The ZS-STD was not fitted with an ELT.

1.19. Useful or Effective Investigation Techniques

1.19.1. None.

2. ANALYSIS

2.1. General

From the available evidence, the following analysis was made with respect to this accident. This shall not be read as apportioning blame or liability to any organisation or individual.

2.2. Analysis

2.2.1 The ZS-XPC was spraying a maize field, and the ZS-STD was engaged in a private flight. The pilots on-board the ZS-STD were assessing the condition of the maize crops to advise the crop-dusting teams of the fields that needed to be sprayed and the type of aerial applicators to use.

2.2.2 The ZS-STD pilots both had Private Pilot Licences (PPL). The aircraft was equipped with dual flight controls. Both individuals had the Cessna 182 endorsed on their licences. Pilot 1 received a Class 2 aviation medical certificate on 12 June 2023, valid until 30 June 2024. Pilot 2 received a Class 2 aviation medical certificate on 3 October 2022, valid until 31 October 2023. However, her aviation medical certificate had expired, which was in contravention of Part 67.00.9 of the Civil Aviation Regulations 2011, which rendered her licence invalid if she was the pilot flying. Both pilots were thrown out of the aircraft during the impact sequence. It could not be determined who was flying the aircraft at the time of the accident.

2.2.3 It should be noted that the assessment of crops was generally conducted using the helicopter, for which only Pilot 2 was rated. The morning of 29 December 2023 was no different, however, a technical problem was detected after start-up and, following a discussion with maintenance personnel, it was decided that the helicopter should not be flown. The helicopter was parked on the farm owner's property, which made it convenient for surveying the farm. In this event, this required that the pilots drive from their property to FAPS where ZS-STD was hangared and then fly to the areas/crops they wanted to assess from the air, which resulted in a substantial delay. It was noted from the flight folio of ZS-STD, the helicopter (ZT-RAB), as well as a copy of the pilot's logbook that Pilot 2 continued to fly after her aviation medical certificate had lapsed, rendering her pilot licence invalid. Her last documented flight was on 25 December 2023 on which she was flying the helicopter.

2.2.4 An eyewitness observed two aircraft flying next to each other overhead Arena Farm in Carletonville District. Shortly after, ZS-STD, which was white in colour turned right and collided with ZS-XPC, which was yellow in colour. Both pilots lost control of their aircraft and crashed on a neighbouring farm.

2.2.5 The ZS-XPC aircraft was equipped with an Ag-Nav Platinum model number P771 and serial number 771200025. This unit was recovered and was shipped to the OEM in Canada for examination to obtain the flight track flown by the pilot. The report from the OEM showed that the ZS-XPC did not deviate from its planned spray track, which confirmed that the pilot of ZS-STD turned right without ensuring it was clear to do so and, thus, collided with ZS-XPC.

2.2.6 Regarding communication between the two pilots, it was confirmed that the farm's company frequency was selected by pilots from both aircraft, and the assumption would be that they were communicating with each other. However, the investigation could not determine at what stage of their respective flights did they communicate before the midair collision. It would appear that the two aircraft were not aware of each other's position (or intended flight path) before impact, which suggests that they were not communicating at the time preceding the accident.

2.2.7 Both aircraft were maintained in accordance with the approved maintenance schedule. The on-site wreckage examinations did not identify any aircraft defects or anomalies that might have contributed to or have caused the accident.

2.2.8 Clear weather conditions with a light northerly wind prevailed at the time of the flights; the prevailing weather conditions had no bearing to this accident.

3. CONCLUSION

3.1. General

From the available evidence, the following findings, causes and contributing factors were made with respect to this accident. These shall not be read as apportioning blame or liability to any organisation or individual.

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

- **Findings —** are statements of all significant conditions, events, or circumstances in this accident. The findings are significant steps in this accident sequence, but they are not always causal or indicate deficiencies.
- **Causes —** are actions, omissions, events, conditions, or a combination thereof, which led to this accident.
- **Contributing factors —** are actions, omissions, events, conditions or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the accident occurring, or would have mitigated the severity of the consequences of the accident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil, or criminal liability.

3.2. Findings

<u>The pilots</u>

3.2.1. The ZS-STD Pilot 1 had a Private Pilot Licence (PPL). The licence was initially issued on 11 June 2019 by the Regulator. The licence was reissued on 29 June 2022 with an expiry date of 30 June 2024. The licence had the aircraft type endorsed on it.

3.2.2. The ZS-STD Pilot 1 was issued a Class 2 aviation medical certificate on 12 June 2023 with an expiry date of 30 June 2024. The licence was valid at the time of the accident flight.

3.2.3. Pilot 2 on-board the ZS-STD had a PPL on aeroplanes and helicopters, and was type rated on the Cessna 182T. Pilot 2 was initially issued the licence on 19 March 2018 by the Regulator. The licence was reissued on 8 March 2022 with an expiry date of 28 February 2024.

3.2.4. Pilot 2 was issued a Class 2 aviation medical certificate on 3 October 2022 with an expiry date of 31 October 2023. Her licence was not valid at the time of the accident flight.

3.2.5. The ZS-XPC pilot had a Commercial Pilot Licence (CPL). The licence was initially issued on 21 December 1984 by the Regulator. The licence was reissued on 22 June 2023 with an expiry date 31 July 2024. The licence had the aircraft type endorsed on it.

3.2.6. The ZS-XPC pilot was issued a Class 1 aviation medical certificate on 4 September 2023 with an expiry date of 31 March 2024. The pilot's licence was valid at the time of the accident.

The aircraft (ZS-STD)

3.2.7. The last maintenance inspection that was conducted on the aircraft before the accident flight was certified on 9 June 2023 at 1 561.2 airframe hours by an approved aircraft maintenance organisation (AMO). The aircraft had flown 73.4 hours since the last inspection.

3.2.8 The aircraft was reissued a Certificate of Airworthiness (C of A) on 14 September 2023 with an expiry date of 30 September 2024.

3.2.9 The aircraft was issued a Certificate of Registration (C of R) under the present owner on 15 April 2002.

3.2.10 The aircraft was issued a Certificate of Release to Service (CRS) on 6 June 2023, which was valid until 5 June 2024 or at 1 661.2 airframe hours, whichever comes first.

3.2.11 The aircraft was fitted with dual flight controls. It could not be determined who was flying the aircraft at the time of the accident.

3.2.12 The aircraft was not fitted with an ELT.

3.2.13 According to the eyewitness, ZS-STD was seen flying next to ZS-XPC and made a right turn which resulted in a midair collision with ZS-XPC.

The aircraft (ZS-XPC)

3.2.14 The last maintenance inspection that was conducted on the aircraft prior to the accident flight was certified on 20 December 2023 at 1 818.6 airframe hours by an approved AMO. The aircraft had flown 45.6 hours since the last inspection.

3.2.15 The aircraft was reissued a Certificate of Airworthiness (C of A) on 14 September 2023 with an expiry date of 30 September 2024.

3.2.16 The aircraft was issued a Certificate of Registration (C of R) under the present owner on 7 September 2020.

3.2.17 The aircraft was issued a Certificate of Release to Service (CRS) on 20 December 2023, which was valid until 19 December 2024 or at 1 918.6 airframe hours, whichever comes first.

3.2.18 The aircraft was fitted with an ELT; no distress signal (HEX ID) was received by the relevant authorities in South Africa when the accident occurred.

3.2.19 According to data that was retrieved from the Ag-Nav unit, ZS-XPC did not deviate from its spray flight path.

Environment

3.2.20 Weather conditions indicated good visibility with scattered clouds at the time of the flights. The prevailing wind was light and variable from the north-east.

Communication

3.2.21 It was determined that the active very high frequency (VHF) that was selected by the respective pilots (ZS-STD and ZS-XPC) was the allocated farm's company frequency of 123.30 MHz. This was confirmed by another farm company's pilot who was also flying at the time and heard them communicating on this frequency.

3.3 Probable Cause/s

3.3.1 The ZS-STD aircraft encroached the manoeuvring area of ZS-XPC that was engaged in an agricultural spraying flight. The ZS-STD turned right (at the same height) and collided with ZS-XPC. The ZS-XPC was also turning right at the time as the pilot was positioning for his next spray run when the collision occurred; both aircraft crashed to the ground.

3.4 Contributory Factors

3.4.1 The Cessna 182 is a high-wing aircraft. During a turn (on either side), the wing structure could limit/restrict or blank out the pilot's view depending on the bank angle. It is believed that this phenomenon contributed to this accident as the pilot of ZS-STD did not see ZS-XPC during the right turn.

3.4.2 The two pilots on-board ZS-STD failed to keep a proper lookout before executing the right turn.

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. It is recommended to Ag-Nav that they consider upgrading the software of the unit to allow for shorter data-capturing intervals. The AIID acknowledges that the unit's sole purpose is to assist the pilot in accurate crop-spraying detail. The fact that the unit has a non-volatile memory that captures and stores data every 20 seconds is a bonus when these devices are retrieved for accident investigation purposes. It is, however, recommended that the OEM investigate the possibility of capturing and saving the flight track data every 1 second.

5 APPENDICES

5.1. None.

This report is issued by:
Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa