AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:		CA18/2/3/10051	
Helicopter Registration	**ZU-RDX**	**Date of Accident**		9 October 2021		**Time of Accident**	1150Z
Type of Helicopter	RotorWay Executive 162F			**Type of Operation**		Private (Part 94)	
Pilot-in-command Licence Type	Private Pilot Licence (H)			**Age**	65	**Licence Valid**	Yes
Pilot-in-command Flying Experience		**Total Flying Hours**	2 359			**Hours on Type**	158
Last Point of Departure	Morning Star Aerodrome, Western Cape Province						
Next Point of Intended Landing	Morning Star Aerodrome, Western Cape Province						
Damage to Helicopter	Substantial						

Location of the accident site with reference to easily defined geographical points (GPS readings if possible)

Morning Star Aerodrome at GPS co-ordinates determined to be 33°45'44.37'' South 018°32'54.69'' East, at an elevation of 200 feet (ft)

Meteorological Information	Surface wind: 190° at 11 knots; Visibility: 9999m; Temperature: 21.5°C; Cloud broken at 3 500 feet; QNH: 1021hPa						
Number of People On-board	1 + 1	**Number of People Injured**	0	**Number of People Killed**	0	**Other (On Ground)**	0

Synopsis

On Saturday, 9 October 2021, a pilot accompanied by a passenger on-board a RotorWay Executive 162F helicopter with registration ZU-RDX took off on a private flight from Morning Star Aerodrome in the Western Cape province with the intention to return to the same aerodrome. A flight plan was not filed for this flight. The flight was conducted under visual meteorological conditions (VMC) by day and under the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended.

The pilot reported that the helicopter was towed out of the hangar to the apron in front of the hangar where the pre-flight inspection was conducted. All checks were normal. On departure, whilst the helicopter was transitioning from hover to forward flight, the pilot heard a dull thud from the engine compartment, followed by the helicopter's violent yaw to the left. The pilot lost control of the helicopter and it impacted the ground with the left skid and rolled to the right; in the process, the main rotor blades severed the tail boom. This resulted in the helicopter being substantially damaged. The pilot and the passenger were not injured.

Probable Cause

It is probable that the V-belt was severed during transitioning phase which caused failure of the tail rotor, rendering the helicopter uncontrollable. Subsequently, the pilot lost control of the helicopter and the main rotor blades struck the tail boom.

SRP Date	12 September 2023	Publication Date	22 September 2023

Occurrence Details

Reference Number	**:** CA18/2/3/10051
Occurrence Category	**:** Category 2
Type of Operation	**:** Part 94 (Operation of Non-type Certificated Aircraft)
Name of Operator	**:** Private
Helicopter Registration	**:** ZU-RDX
Helicopter Make and Model	**:** RotorWay Executive 162F
Nationality	**:** South African
Place	**:** Morning Star Aerodrome
Date and Time	**:** 9 October 2021 at 1150Z
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 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) was notified of the occurrence on 9 October 2021 at 1227Z. Investigators were dispatched to the accident site to start the investigation process. The occurrence was classified as an accident according to Part 12 of the CAR 2011 and ICAO STD Annex 13 definitions. Notification was sent to the State of Design and Manufacturer in accordance with Part 12 of the CAR 2011 and ICAO Annex 13 Chapter 4. The state appointed a non-travelling accredited representative and advisor.

Notes:

1. *Whenever the following words are mentioned in this report, they shall mean the following:*
   Accident — this investigated accident
   Helicopter — the RotorWay Executive 162F 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.*

Table of Contents

Abbreviation	Description
°	Degrees
°C	Degrees Celsius
AIID	Accident and Incident Investigations Division
AMSL	Above Mean Sea Level
AP	Approved Person
ATF	Authority to Fly
C of A	Certificate of Airworthiness
C of R	Certificate of Registration
C.G.	Centre of Gravity
CAR	Civil Aviation Regulations 2011
CRS	Certificate of Release to Service
CVR	Cockpit Voice Recorder
EFIS	Electronic Flight Instrument System
FAA	Federal Aviation Authority
FADEC	Full Authority Digital Engine Control
FDR	Flight Data Recorder
FSTD	Flight Simulation Training Device
Ft	Feet
GPS	Global Positioning System Coordinates
hPa	Hectopascal
IGE	In Ground Effect
Km	Kilometre
Kt	Knots
LTE	Loss of Tail rotor Effectiveness
M	Metres
METAR	Meteorological Routine Aerodrome Report
POH	Pilot's Operating Handbook
QNH	Barometric Height Above Mean Sea Level
RPM	Revolutions per Minute
RWY	Runway
SACAA	South African Civil Aviation Authority
SACAR	South African Civil Aviation Regulations
SACATS	South African Civil Aviation Technical Standard
SAWS	South African Weather Service
VFR	Visual Flight Rules
VHF	Very High Frequency
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 9 October 2021, a pilot accompanied by a passenger on-board a RotorWay Executive 162F helicopter with registration ZU-RDX took off on a private flight from Morning Star Aerodrome in the Western Cape province with the intention to land at the same aerodrome. No flight plan was filed for the flight. The flight was conducted under visual meteorological conditions (VMC) by day and under the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.1.2 The pilot, who is the owner of the helicopter, reported that he towed the helicopter out of the hangar to the apron in front of the hangar to conduct the pre-flight inspection. The pre-flight inspection was conducted with the engine cowlings removed; the V-belts were inspected visually and physically for condition, and the tail rotor blades were turned by hand to detect defects on the belts; the idler pulleys were found in good order and none of the tele-temp markers indicated a sign of overheat; and the tail boom and tail rotor were in satisfactory condition. The helicopter's battery was also fully charged.

1.1.3 The helicopter was refuelled with 63 litres of Mogas prior to take-off. No water was detected during fuel purging. The pilot further stated that the engine start-up was normal with the oil pressure and the oil temperature indications rising accordingly. Both fuel pumps had sufficient pressure to keep the metered amount of fuel in the engine. All pre-take-off checks were normal, and the clutch disengaged as required with no defects detected. Prior to lift-off, all engine indications were in the green arc and all switches were appropriately positioned, except that the secondary bearing temperature indicator (bottom right side of the Electronic Flight Instrument System [EFIS] screen) was not displaying.

1.1.4 The pilot reported that whilst hovering in ground effect (IGE) and approximately 2 metres (m) above ground level (AGL), the oil and fuel pressure indications and temperatures remained constant, and the revolutions per minute (RPM) readings were maintained with a manifold air pressure (MAP) indication at 31 inches (Hg) and the maximum available for the day calculated at 33 inches. When the pilot transitioned, the headwind was 8 knots (kt); the helicopter accelerated to approximately 40 knots. After about 50m, an audible and palpable dull thud was heard, and the occupants felt the vibration. This was followed by an un-commanded yaw to the left and a decrease in engine power. The helicopter entered an uncontrolled descent and impacted the ground with the left skid before it rolled to its right side. During impact, the main rotor blades severed the tail boom. The occupants were not injured, and the helicopter sustained substantial damage.

1.1.5 After the accident, the pilot shut off the fuel feed and turned off the master switch. Thereafter, together with the passenger they exited the helicopter through the windshield that they had shattered.

1.1.6 In an interview with the pilot post-accident, he reported that the tail rotor drive and main rotor belts were inspected visually using two inspection hatches located in the lower part of the tail boom and on the main fuselage, just behind the main rotor gearbox. In addition to the visual inspection, the tail rotor was rotated, thus, rotating the belts as well. There was no defect (irregularities or notches, slack, and so forth) noticed. The pilot also reported that he used a tool that is kept in the helicopter to check the aft tail rotor belt tension. He stated that these methods were used as part of the pre-flight check.

1.1.7 According to the pilot, he carried out a pre-flight inspection which included belt-tension checks prior to the accident flight. He stated that the tail rotor drive belt was serviceable at the time and the pre-flight checks were satisfactory; the aircraft operated normally until the sudden uncommanded yaw.

1.1.8 The accident occurred at Global Positioning System (GPS) co-ordinates determined to be 33º45’26.99” South 018º32’54.69” East, at an elevation of 224 feet (ft).

Figure 1: The position of the accident site. (Source: Google Earth)

1.2. Injuries to Persons

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

Note: Other means people on the ground.

1.3. Damage to Helicopter

1.3.1. The helicopter sustained substantial damage.

Figure 2: The helicopter as it came to rest. (Source: Owner)

1.4. Other Damage

1.4.1. None.

1.5. Personnel Information

Nationality	South African	Gender	Male	Age	65
Licence Type	Private Pilot Licence (PPL) Helicopter				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Night				
Medical Class & Expiry Date	Class 2, 31 March 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	2359
Total Past 24 Hours	0.1
Total Past 7 Days	0.1
Total Past 90 Days	0.1
Total on Type Past 90 Days	0.1
Total on Type	158

1.5.1. The pilot renewed his Private Pilot Licence (PPL) Helicopter on 6 October 2020 with an expiry date of 31 August 2022. The pilot had a Class 2 aviation medical certificate that was issued on 4 March 2021 with an expiry date of 31 March 2022.

1.5.2. According to the pilot's logbook, his last flight was conducted on 10 April 2021, six months prior to the accident flight.

1.5.3 The following information is an extract from the South African CAR 2011 Part 91 Subpart 91.02.4 (1):
A pilot shall not act as PIC of an aircraft, or second-in-command (SIC) of an aircraft required to be crewed by more than one pilot, carrying passengers by day, unless such pilot has personally, within the 90 days immediately preceding the flight, carried out either by day or by night at least three take-offs and three landings in the same class or, if a type rating is required, type or variant of aeroplane, and in the case of a helicopter three circuits including three take-offs and three landings in the same type of helicopter as that in which such flight is to be undertaken. The landings required by this sub-regulation may be completed in an FSTD approved for the purpose. In the case of a tail-wheel aeroplane, each landing shall be carried out to a full-stop.

Maintenance Personnel:

1.5.4 The approved person (AP) who carried out the last annual inspection was rated and approved to perform maintenance on the helicopter type. The Approved Person Maintenance Certificate was reissued to the AP on 4 February 2020 with an expiry date of 28 February 2022.

1.6. Helicopter Information

1.6.1. The following information is an extract from Exec 162F Maintenance Manual:

The airframe is constructed of various size tubes consisting of geometric shapes which will allow the airframe to flex at key areas during operation and still maintain a high structural integrity. The tubing is aircraft industry standard 4130 chromemoly. Where tubing requires bending, a mandrel bender is used and tubes are scribed, cut, and coped to a tolerance of .062 inch. The main purpose of the tail boom in all conventional helicopters is to provide a mounting location for the anti-torque system or tail rotor. Its secondary purpose is to mount the vertical and horizontal trim fins which are used to stabilize the aircraft in forward flight, opposing aerodynamic forces from the windscreen and body. The body of the EXEC 162F helicopter consists of several separate panels that when assembled make up a solid egg shape structure. This provides for a very efficient and aerodynamic airflow. Each panel is made using the hand lay-up squeeze method to give the piece the maximum strength to weight ratio. A gel coat is applied to the mold prior to the fiberglass lay-up so that the parts are ready for light sanding and paint. The tail rotor drive of the EXEC 162F utilizes a V-belt design, rather than a drive shaft with gear boxes, to transmit power to the tail rotor. This design provides a simple and effective drive train with low maintenance.

Airframe:

Manufacturer/Model	RotorWay International, Executive 162F	
Serial Number	6911	
Year of Manufacture	2009	
Total Airframe Hours (At Time of Accident)	177	
Last Annual Inspection (Hours & Date)	173	6 November 2020
Hours Since Last Annual Inspection	4.0	
CRS Issue Date	6 November 2020	
ATF (Issue Date & Expiry Date)	2 September 2016	30 September 2021
C of R (Issue Date) (Present Owner)	19 August 2009	
Operating Category	Production Build (Part 94)	
Type of Fuel Used	Mogas	
Previous Accidents	None	

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

Engine:

Manufacturer/Model	RotorWay A24-162F
Serial Number	9016
Hours Since New	177.0
Hours Since Overhaul	TBO not yet reached

Main Rotor Blades:

Number of blades	1	2
Part Number	E20-9000	E20-9000
Serial Number/s	4403(M)	4404(S)
Hours Since New	177.0	177.0
Hours Since Overhaul	TBO not yet reached	TBO not yet reached

Tail Rotor Gearbox:

Part Number	E18-1160 / E18-1150
Serial Number	6584
Hours Since New	173
Hours Since Overhaul	TBO not yet reached

Tail Rotor Blades:

Number of blades	1	2
Part Number	E17-6000	E17-6000
Serial Number/s	6603	6603
Hours Since New	173	173
Hours Since Overhaul	TBO not yet reached	TBO not yet reached

1.6.2 The maintenance history of the helicopter was reviewed to determine if the owner had maintained the aircraft in accordance with the manufacturer's maintenance requirements and applicable regulations and if the helicopter was airworthy at the time of the accident flight.

(i) According to the aircraft logbooks, there was no indication or record of any deferred defects which were not complied with.

(ii) The helicopter was flown for 4.0 hours after the annual inspection which was conducted on 6 November 2020 by an approved person. The applicable regulation requires that the annual inspection be conducted every 12 months or at 100-hour intervals. During the inspection, the main drive belts are checked for condition and cleanliness and the main drive chain or belt is checked for correct tension.

(iii) The three belts were replaced with new ones because they had reached their life span as detailed in the logbook entry dated January 2018. The belts have a life span of 250 hours or 25 millimetres (mm) total stretch limit, whichever comes first.

1.6.3 The investigation found no technical defects with the airframe, engine or installed systems and components recorded in the logbook.

1.6.4 The Authority to Fly (ATF) certificate expired on 30 September 2021. The ATF application had not been filed with the Regulator (SACAA) at the time of the accident.

The following information is an extract from the South African CAR 2011 as amended.
24.02.6 (*1) An authority to fly and a proving flight authority shall be valid until—*
(a) the expiry date

1.6.5 During the interview with the pilot on 10 October 2021, a day after the accident, the pilot stated that their weight (pilot and passenger) was about 86 kilograms (kg) each. The pilot could not produce evidence of the weight and balance calculations on the day of the interview. However, he submitted the calculated weight and balance dated 9 October 2021 on 14 October 2021. According to the submitted weight and balance, the pilot stated his weight as 177 pounds (lb) (80kg) and 185 lb (83.9 kg) for the passenger.

1.6.6 According to the submitted weight and balance calculations, the total calculated take-off weight was 1492 lb (676.75 kg), which was below the maximum take-off weight (MTOW) of 1500 lb (680 kg) by 8 lbs (3.6 kg). Additionally, the calculated centre of gravity (CG) arm was computed to be 95.89 inches (see Appendix A) for the pilot's submitted weight and balance calculations.

1.6.7 Tables 1 and 2 show the variance between the pilot's given weight and balance and the verified weight and balance:

Pilot-given Calculation					
Item	Weight	Arm	Moment	Lateral arm	Lateral moment
	lbs	inch	inch. Lbs	inch	inch. Lbs
Helicopter	1001.00	100.00	100100.00	-	-
Ballast Aft	24.20	163.00	3944.60	-	-
Ballast Front	0.00	26.00	0.00	-	-
Pilot	177.00	71.00	12567.00	-10.25	-1814.25
Passenger	185.00	71.00	13135.00	10.50	1942.5
Zero Fuel	**1387.20**	**431,00**	**129746.60**	**-0.25**	
Fuel Pilot	48.00	100.00	4800.00	-18.25	-876
Fuel Pass	48.00	100.00	4800.00	18.50	888
Take-off Weight	**1483.20**	**631.00**	**139346.60**	**-05**	**140.25**
Fore CG Location		**94**		Lateral CG Location	-0.95

Table 1: Weight and balance table – pilot.

Calculated weight and balance					
Item	Weight	Arm	Moment	Lateral arm	Lateral moment
	lbs	inch	inch. Lbs	inch	inch. Lbs
Helicopter	1004.86	100.00	100486.00	-	-
Ballast Aft	24.20	163.00	3944.60	-	-
Ballast Front	0.00	37.25	0.00	-	-
Pilot	177.00	71.00	12567.00	-10.25	-1943.40
Passenger	185.00	71.00	13135.00	10.50	1990.80
Zero Fuel	**1391.06**	**442.25**	**130132.60**	**0.25**	**47.40**
Fuel Pilot	51.00	100.00	5100.00	-18.25	-930.75
Fuel Pass	51.00	100.00	5100.00	18.50	943.50
Take-off Weight	**1493.06**	**642.25**	**141553.80**	**0.50**	**60.15**
Fore CG		**94.8**		**Lateral CG**	**0.04**

Table 2: Calculated Weight and Balance.

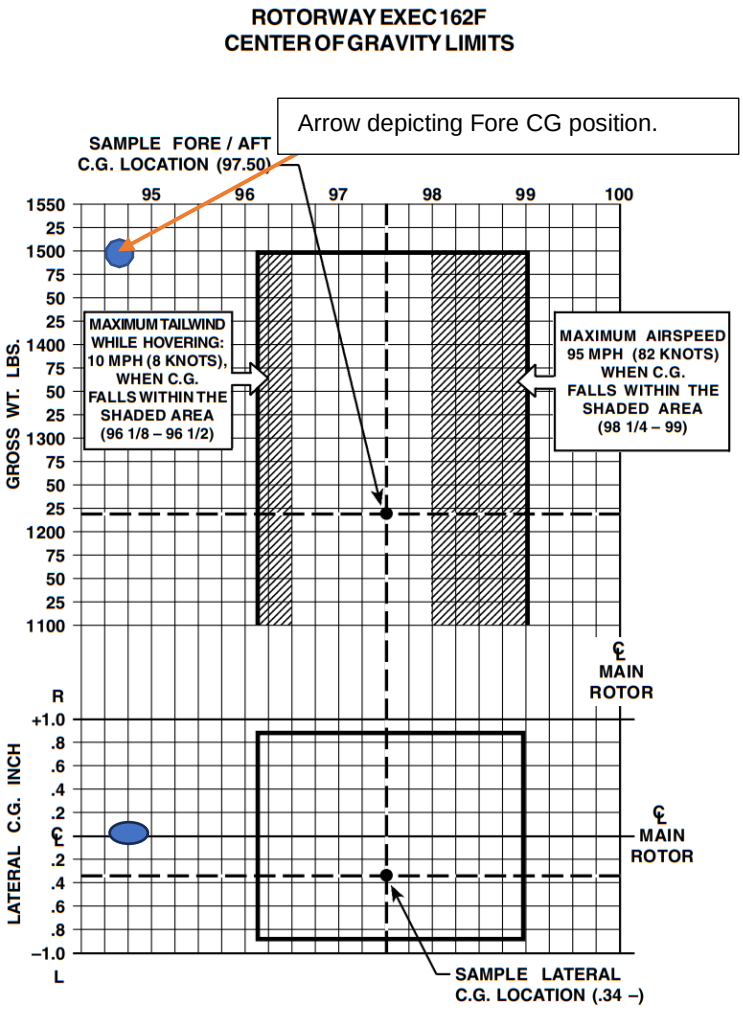

Chart 1: Centre of Gravity chart showing CG out of limits.

1.6.8 Based on the verified calculations (Table 2), the take-off weight on the day of the accident was 1493.06 lb (677.24 kg), which was within the MTOW of 1500 lb (680 kg) by 6.94 lb (3.14 kg). Based on the information above, it was determined that the helicopter was operated within its approved weight limitations of 1500lb.

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 Morning Star Airfield in the Western Cape Province on 9 October 2021 at 1200Z.

Wind Direction	190°	Wind Speed	11kt	Visibility	9999m
Temperature	21.5°C	Cloud Cover	BKN	Cloud Base	3500ft
Dew Point	12°C	QNH	1021hPa		

1.8. Aids to Navigation

1.8.1. The helicopter was equipped with an MGL Avionics Stratomaster enigma standard navigational equipment. There were no recorded defects with the navigational equipment prior to the flight.

1.9. Communication

1.9.1. The helicopter was equipped with a standard communication system as approved by the Regulator (SACAA). There were no recorded defects with the communication system prior to the flight.

1.10. Aerodrome Information

1.10.1. The accident occurred at Morning Star Airfield. The first point of impact was at GPS co-ordinates: 33º45’44.37” South 018º32’54.69” East, at an elevation of 200ft.

Aerodrome Location	Morning Star Airfield, Western Cape Province
Aerodrome Status	Registered
Aerodrome Co-ordinates	33°45'50.0" South,018°33'00.0" East
Aerodrome Altitude	200 feet (AMSL)
Runway Headings	02 / 20
Runway Dimensions	650m X 10m
Heading of Take-off	Runway 20
Runway Surface	Asphalt
Approach Facilities	Nil
Radio Frequency	124.8 MHz

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 permission to recover the helicopter wreckage to the hangar for safe storage was granted on the day of the accident as it was blocking the taxiway at Morning Star Airfield.

1.12.2. Examination of the accident site and helicopter wreckage was conducted on 10 October 2020, one day after the accident:

- The main wreckage was found approximately 67m from the take-off point and the tail boom was located approximately 12m east of the main wreckage.
- The helicopter landed on the soft sand between the main runway and the taxiway; it rested on its right side with the nose facing north-east.

- The structure sustained impact damage from the mid-section towards the tail section; the cabin structure remained intact.

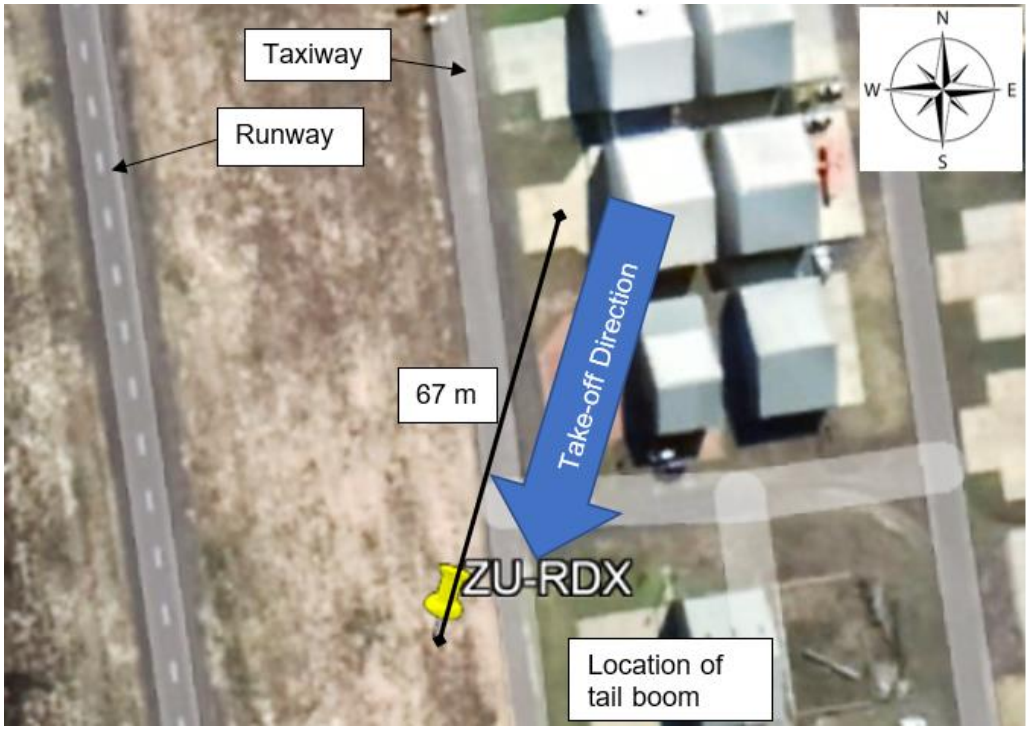

Figure 3: Wreckage location and information. (Source: Google Earth)

1.12.3 Examination of the helicopter's skids and fuselage indicated that the helicopter contacted the ground with its left skid first. This is an indication that the helicopter yawed to the left when the pilot lost control.

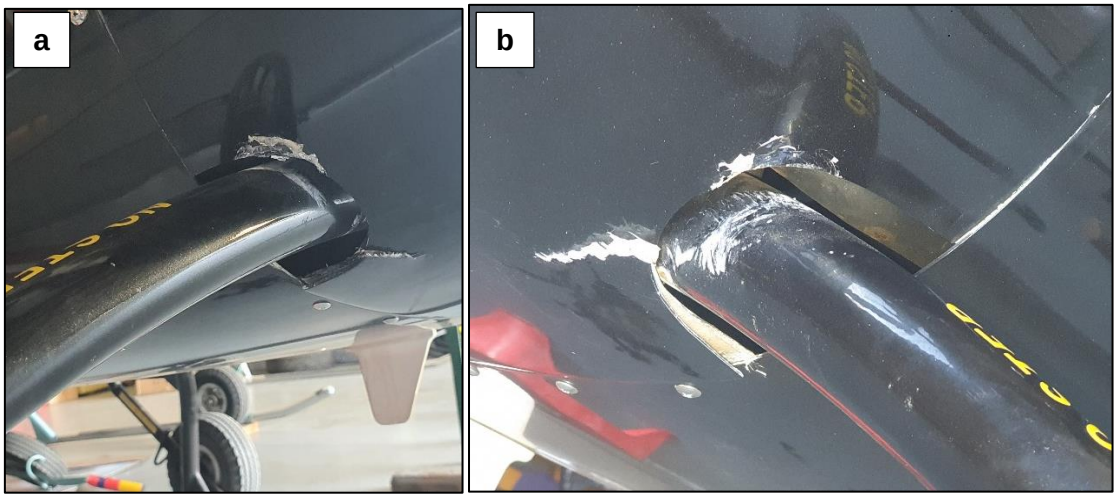

Figure 4: Damage on (a) right-side skid, and (b) left-side skid.

1.12.4 The collective scissor linkage casting was fractured.

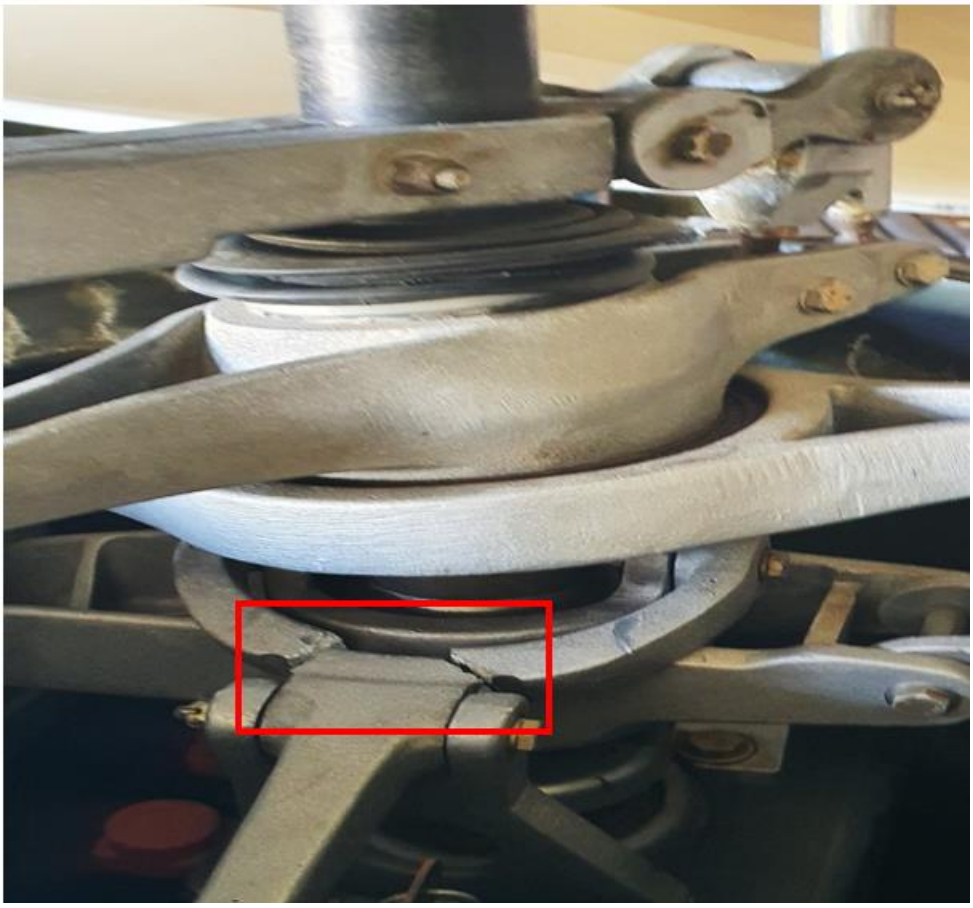

Figure 5: The red block shows the fractured joint component of the main rotor hub's non-rotating swashplate.

1.12.5 Both main rotor blades and the pitch links were still attached; the main rotor hub had a slight bent to the left (when viewed from the rear of the helicopter).

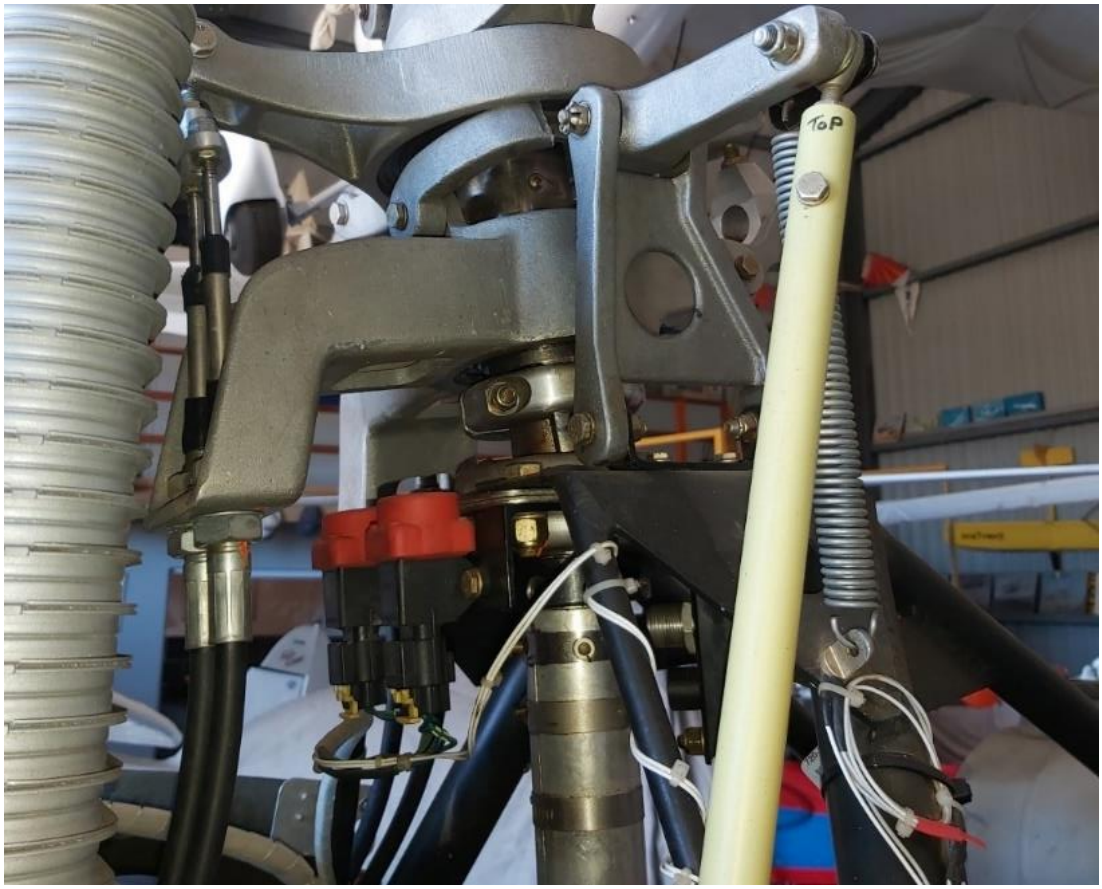

Figure 6: The linkages on the helicopter.

1.12.6 The windshield was found broken from the top of the cabin, which is consistent with the pilot's description of how he had kicked the windshield to exit the helicopter together with the passenger.

Figure 7: Final resting position of the helicopter. (Source: Pilot)

1.12.7 Continuity of the flight controls (collective and cyclic) was established, and the controls moved freely with no obstruction. The engine compartment was free from visible damage, except for the torn drive belt.

1.12.8 One of the blades broke near the root and had deformation signs in the mid-section part of the leading edge (Figure 9a). The other blade showed no distortion near the root section; however, it exhibited similar impact deformation signs on the centre of its trailing edge; this blade also had separated near its tip section of the trailing edge (Figure 9b). The deformations are indicative of metal-to-metal contact at low rotation speed, and the blade's fractures are indicative of slow separation exhibited by its tensile nature. This overload occurred when the helicopter rolled to its right side.

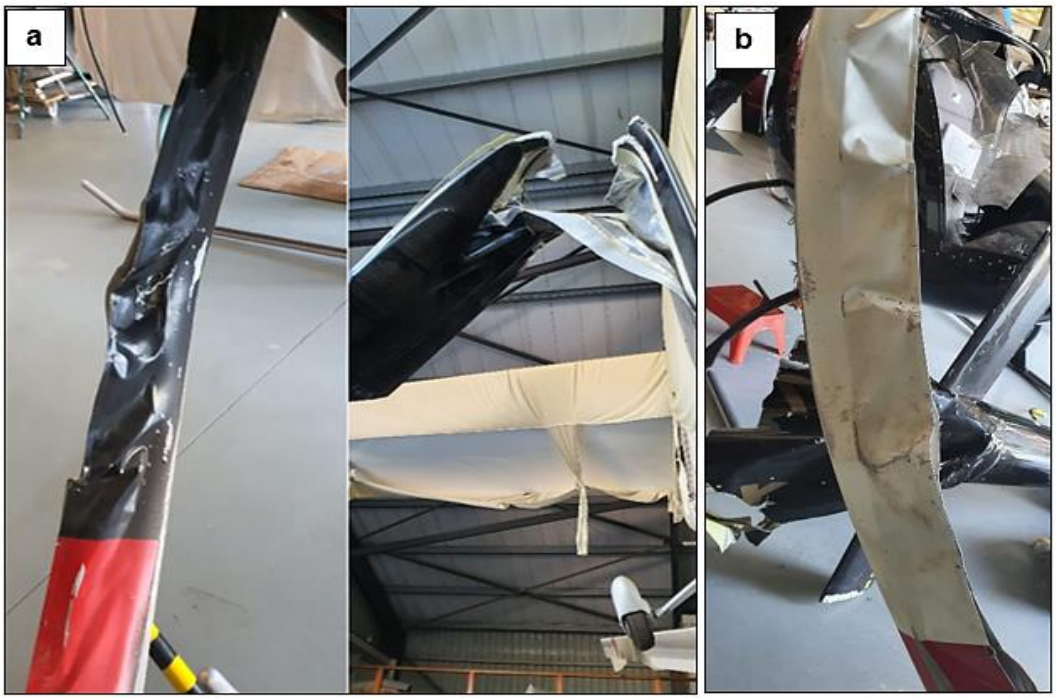

Figure 8: (a). The broken leading edge rotor blade with deformation. (b) The trailing edge deformed blade which separated at the blade tip.

1.12.9 One of the tail rotor blades separated on impact. The tail gearbox/output shaft was found intact. Continuity check between the gearbox and the output shaft was conducted, and the drive was positive.

Figure 9: The tail boom after the accident. (Source: Owner/Pilot)

1.12.10 The drive V-belt was found next to the tail boom, torn and damaged (see Figure 11). The tail boom assembly had impact damage which was consistent with the bent main rotor hub and main rotor deformation.

Figure 10: The V-belt condition at the accident site post-accident.

1.13. Medical and Pathological Information

1.13.1. None.

1.14. Fire

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

1.15. Survival Aspects

1.15.1. The accident was considered survivable as the helicopter's cabin structure was still intact. The occupants were strapped to their respective seats with factory-fitted safety harnesses.

1.16. Tests and Research

1.16.1 After the accident, the engine was started, and it met all the parameters.

1.17. Organisational and Management Information

1.17.1. This was a private flight which was conducted in accordance with the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.17.2. The aircraft maintenance organisation (AMO) which conducted the last annual inspection on the helicopter prior to the accident flight had an approved AMO certificated that was issued by the Regulator on 4 February 2020 with an expiry date of 15 September 2021.

1.18. Additional Information

1.18.1 RotorWay International Exec 162f Pilot's Operating Handbook (POH)

Section 3. Normal Procedures:
D. Tail rotor drive check:
1. Travel of Idler pulley swing arm (not bottoming out in bulkhead)
2. Condition and location of drive belts
3. Tension of drive belts (1-3/8 inch ± 1/8 inch at 10 lbs. using belt tension tool)
4. Condition of the pulleys and bearings
5. Temperature strips on Idler pulleys and drive pulleys:
170° F indicates belt slipping or other problem.
180° F (or higher) belts have been damaged by heat and must be replaced.
IMPORTANT: New belts will tend to stretch and become loose. Belt tension must be monitored and adjusted frequently until stretching has stopped. Check the belt replacement label when adjusting belt tension. Belts must be replaced if more than 1" stretching has occurred since initial tensioning.

NOTE: The belts and pulleys should be kept clean and free of any oil, dirt or other contamination. Use a clean cloth dampened with acetone.

RotorWay International Exec 162f POH

Section 4. Emergency Procedures:

J. Tail rotor failure during hover:

1. Failure is usually indicated by a left yaw which cannot be corrected by applying right pedal.
2. Immediately close the throttle and perform a hovering power off landing.
3. Keep the ship level with the cyclic and increase the collective just before touchdown to cushion landing.

K. Tail rotor failure during forward flight:
1. Failure is usually indicated by a right or left yaw which cannot be corrected by applying pedal.
2. Immediately enter a shallow descent into the wind.
3. CAUTION: If sideslip is excessive and the aircraft tends to spiral, immediately enter an autorotation and plan a power off landing, (full touchdown auto) with throttle off.
*4. Adjust the collective and the throttle to extend the glide **ONLY** if sideslip is not excessive and the aircraft does not tend to spiral.*
5. Select a landing site and perform a run-on landing, touching down at a speed well above translational lift, using throttle to maintain heading.

CAUTION: Attempting a run-on landing with a tail rotor failure requires extreme pilot skill.

According to the Executive 162F pilot operating handbook (POH), the following items should be checked during the pre-flight inspection:
(i) Travel of idler pulley swing arm (not bottoming out in bulkhead)
(ii) The tail rotor drive should be checked for condition and location of drive belts. The tension of the belts should also be checked (1 inch ± inch at 10 lbs using the belt tension tool).
(iii) Condition of the pulleys and bearings
(iv) Temperature strips on the idler pulley and drive pulley:
(a) 170°F (77°C) indicates belt slipping or other problem.
(b) 180°F (82°C) or higher shows that the belt has been damaged by heat and must be replaced.

1.18.2 The emergency procedures in the POH (Section 4, Item K) for tail rotor failure during forward flight are as follows:
(i) Failure is usually indicated by a right or left yaw which cannot be corrected by applying the pedal.
(ii) Immediately enter a shallow descent into the wind.
(iii) Select a landing site and perform a run-on landing, touching down at a speed well above translational lift, and using throttle to maintain heading.

1.18.3 The aircraft manufacturer had published the Mandatory and Advisory Service Bulletins to inform helicopter owners of inspection requirements that had been introduced as a result of the failure of the tail rotor drive belts (see Appendix B: Mandatory and Advisory Service Bulletins A36, A12, A21 and A25).

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The extract below was taken from the Mandatory and Advisory Service Bulletins:
(i) An accident occurred due to loss of tail rotor control. During the teardown inspection, the middle or second tail rotor belt was found in several pieces and the belt cords were wrapped

in the groove of the rear idler pulley.
(ii) The aramid fibre tail rotor belts become tighter as the temperature increases and loosen as the temperature decreases.
(iii) Tail rotor drive belts (Part Numbers E18-1150 and E18-1160) recently failed in two separate instances. Based on the service bulletin both of these belts were Gates brand and type.

The manufacturer published the following recommendations:
(i) There should be immediate inspection of the aircraft to verify proper routing of tail rotor drive belts through the tail boom. The belts should be installed in specific grooves of the pulleys. If belts are routed properly, there is no further action required. Any belt not properly routed into correct idler pulley groove should be replaced immediately.

The standard tail rotor belt tension is 1 3/8" ± 1/8" deflection at 10 pounds of pull whilst the belts are at operating temperature. If the belts are adjusted in cold weather conditions, they may become too tight as the aircraft warms up when it is flown. And, if the belts are checked and adjusted in warm weather conditions and the aircraft is flown in cold weather, the belts may become too loose. Pre- and post-flight inspections are important. The manufacturer recommended the use of their new belt tension tool, which is faster and easier to use than the spring scale and ruler method. Belt tension should be checked before and after each flight, and adjusted when necessary.

1.18.4 The following inspections were conducted by the AP in the presence of the investigator-in-charge (IIC) on 16 January 2022:

- On the day of the accident, the helicopter had 63 litres of Mogas prior to take-off. There was no water detected in the fuel reservoir system. Fuel samples were taken by the AP for analysis and no contamination was found. Due to the position in which the helicopter came to rest after the accident, some fuel leaked through the vents; however, the AP managed to siphon 38 litres from the tanks.
- After the accident, the engine was started, and it met all the parameters.
- The induction air pipes, fuel lines and oil lines were intact.
- All control linkages, cables, pushrods and horn links were found intact, and control to cyclic was working normally.
- The collective scissor linkage casting was found broken with severe impact damage.
- The main shaft was bent about 20 degrees due to impact. Because of the bent main shaft which could not be turned, the main drive belt was lifted and removed to facilitate the engine ground-run test, and it ran normally at all power settings.
- During an on-site inspection, it was noted that the Hobbs meter was reading zero. This was because the internal battery in the Electronic Flight Instrument System (EFIS) was replaced prior to the accident flight and the Hobbs meter was not reset to give the correct reading. However, the flight time indicator was functioning accordingly.
- No defects were detected in the Full Authority Digital Engine Control (FADEC) system and there was no drop in revolutions per minute (RPM) on either of the ignition banks.

1.19. Useful or Effective Investigation Techniques

1.19.1. None.

2. ANALYSIS

2.1. General

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

2.2. Analysis

Pilot

2.2.1. The pilot was initially issued a Private Pilot Licence (PPL) Helicopter on 28 January 2016; it was last renewed on 6 October 2020 with an expiry date of 31 August 2022.

2.2.2. The pilot was issued a Class 2 aviation medical certificate on 4 March 2021 with an expiry date of 31 March 2022. The pilot had a valid licence, and the type rating of the aircraft was endorsed on it. The pilot had no medical problems that could have prevented him from operating the aircraft safely. His training and total hours attested to his flying experience, and he clearly demonstrated his abilities by speedily regaining control during the sudden yaw. He also acted in accordance with the aircraft's flight manual by deciding not to continue with the flight and instead, performed an autorotation. The pilot experienced no anomaly with the helicopter apart from the yaw.

2.2.3. According to the pilot's logbook, his last flight was undertaken on 10 April 2021, six (6) months prior to the accident flight. According to the CAR subpart *91.02.4 (1)* he was in contravention of the regulation and was not supposed to have taken a passenger on the flight with him without conducting three circuits including three take-offs and three landings in the same helicopter type first.

Maintenance Personnel

2.2.4. The approved person (AP) who conducted the last inspection was rated and approved to repair and maintain the helicopter type. According to the AP Certificate, it was reissued on 4 February 2020 with an expiry date of 15 September 2021.

Helicopter

2.2.5. The helicopter's Certificate of Registration (C of A) was issued to the current owner on 19 August 2009.

2.2.6. The helicopter was issued the Authority to Fly (ATF) on 2 September 2016 with an expiry date of 30 September 2021. The ATF certificate had expired nine (9) days before the date of the accident. According to the CAR subpart *24.02.6,* the ATF was past its expiration date at the time of the accident.

2.2.7. The last annual inspection was conducted on 6 November 2020 at 173.0 hours. At the time of the accident, the helicopter had accumulated a total of 177 hours, and had been flown for 4 hours since the said inspection. The investigation found no recorded technical defects with the airframe and engine in the logbook or defect reports.

2.2.8. Based on the verified calculation, the take-off weight on the day of the accident was 1493.06 lb (677.24 kg), which was within the MTOW of 1500 lb (680 kg) by 6.94 lb (3.14 kg). Based on the information above, it was determined that the helicopter was operated within its approved weight limitations of 1500lb.

2.2.9. Post-accident investigation revealed that the helicopter impacted the soft sand with its left side before it entered a dynamic rollover; it came to rest on its right side. The observations made were consistent with the pilot's statement.

2.2.10. It is probable that the V-belt was severed during the transition phase (loud thud heard by the pilot) which caused failure of the helicopter's tail rotor. The pilot stated that the helicopter yawed to the left and he could not stop the yaw when he applied the right pedal. This statement supports the secondary effects of the tail rotor failure during the forward flight.

2.2.11. The helicopter was considered not airworthy as the ATF had expired. The owner/pilot indicated that he had performed a pre-flight inspection. There was no indication of any mechanical systems defect or malfunction prior to the flight. The aircraft started up, lifted and took off as required. During the transitioning phase, a loud thud was heard and, subsequently, the helicopter's tail rotor failed and the helicopter yawed to the left. To correct the yaw, the pilot applied the right rudder. This input proved to be ineffective, an indication of a possible tail rotor failure.

2.2.12. After the accident, it was found that the tail rotor drive belt had failed and caused the loss of control during transitioning phase.

2.2.13. The tail rotor drive belt was recovered from the wreckage. Pictures were taken and used to determine the cause of failure. The investigation found that the tail rotor failure was not an isolated occurrence. The aircraft manufacturer had published Airworthiness Directives and Service Bulletins to inform operators of the potential tail rotor dangers.

2.2.14. One particular Service Bulletin referred to the failure of tail rotor drive belts (part numbers E18-1150 and E18-1160) manufactured by Gates. The investigation into the belts industry revealed that Gates had changed its manufacturing facilities and processes and that users of Gates belts in other applications have also experienced premature belt wear and failure. Based on the findings of the manufacturer's investigation, it was recommended that these belts should not be used as they fail before they reach their time limit of 250 hours.

2.2.15. It was found that the accident aircraft still had the Gates belts installed. The Service Bulletin had, therefore, not been complied with. The result was as stated by the manufacturer: "Loss of tail rotor most likely resulted in significant aircraft damage".

2.2.16. The tail rotor drive belt was found to be within its service lifetime as specified in the maintenance manual. According to the manufacturer, the integrity of the belts also depends on their condition and tension – and these factors have to be checked before each flight. It is recommended that whenever the belts have stretched one inch or more, they should be replaced immediately despite the hours they had been in use. The new belts stretch rapidly, and it is important to prevent them from becoming too loose. A belt that is too loose could be damaged when it hangs over the edge of the pulleys or by the heat created from excessive slippage.

To avoid the above failures, the pilot is required to use the belt tensioning tool during pre-flight inspection. No proof could be found that the pilot did not use the belt tensioning tool. None of these anomalies was observed by the pilot during his pre-flight inspection, however, the aircraft was considered to be serviceable for the flight.

2.2.17. The pilot reported that the helicopter was towed out of the hangar and onto the apron in front of the hangar where the pre-flight inspection was conducted, and all checks were normal. On departure, whilst the helicopter was transitioning from hovering to forward flight, the pilot heard a dull thud from the engine compartment, followed by the helicopter's violent yaw to the left. It is likely that the dull thud was due to the failure of the V-belts when they got severed. The pilot lost control of the helicopter and it impacted the ground with the left skid and rolled to the right. In the process, the main rotor blades severed the tail boom. The helicopter was substantially damaged during the accident sequence, and the pilot and the passenger were not injured.

Weather

2.2.18. The SAWS report revealed that fine weather conditions prevailed at the time of the flight. The weather conditions did not contribute 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

3.2.1. The pilot was qualified but not current in accordance with the existing regulations. The pilot was also medically fit and had a valid Class 2 medical certificate.

3.2.2. The pilot was issued a Class 2 aviation medical certificate on 4 March 2021 with an expiry date of 31 March 2022. The pilot had a valid licence, and the type rating of the aircraft was

endorsed on the licence. The pilot had no medical problems that could have prevented him from operating the aircraft safely. His training and total hours attested to his flying experience, and he clearly demonstrated his abilities by speedily regaining control during the sudden yaw. He also acted in accordance with the aircraft's flight manual by deciding not to continue with the flight. The pilot experienced no anomaly with the helicopter apart from the yaw.

3.2.3. The pilot last flew an aircraft on 10 April 2021, six (6) months prior to the accident flight. On the day of the accident, he had a passenger on-board. According to the CAR subpart 91.02.4 (1): *A pilot shall not act as PIC of a helicopter, carrying passengers by day, unless such pilot has personally, within the 90 days immediately preceding the flight, carried out either by day or by night at least three take-offs and three landings in the same class or, if a type rating is required, in the case of a helicopter three circuits including three take-offs and three landings in the same type of helicopter as that in which such flight is to be undertaken.*

3.2.4. The aircraft was registered as a Non-type Certificated Aircraft (NTCA) and operated in accordance with the requirements of the CAR 2011 Part 24 and Part 94. The aircraft was maintained by an authorised approved person (AP).

3.2.5. The AP who conducted the last annual inspection of the ZU-RDX helicopter was appropriately licensed and qualified to repair and maintain the helicopter type in accordance with the existing regulations.

3.2.6. The helicopter's ATF certificate was not valid at the time of the accident flight. The ATF certificate had expired nine (9) days before the date of the accident.

3.2.7. Based on on-site investigation, the helicopter was structurally intact prior to impact. All control surfaces were accounted for and all damage to the helicopter was attributable to the impact forces.

3.2.8. The fuel that remained in the helicopter's fuel tanks was not contaminated and was of the recommended grade.

3.2.9. Based on the verified calculation, the take-off weight on the day of the accident was 1493.06 lb (677.24 kg), which was within the MTOW of 1500 lb (680 kg) by 6.94 lb (3.14 kg). Based on the information above, it was determined that the helicopter was operated within its approved weight limitations of 1500 lb.

3.2.10. Post-accident investigation revealed that the helicopter impacted the soft sand with its left side before it entered a dynamic rollover; it came to rest on its right side. The observations made were consistent with the pilot's statement.

3.2.11. It is probable that the V-belt was severed during the transitioning phase (loud thud heard by the pilot) which caused the failure of the helicopter's tail rotor. The pilot stated that the helicopter yawed to the left and he could not stop the yaw when he applied the right pedal. This statement supports the secondary effects of the tail rotor failure during the forward flight.

3.2.12. The helicopter was considered not airworthy as the ATF had expired. The owner/pilot indicated that he had performed a pre-flight inspection. There was no indication of any mechanical systems defects prior to the flight. The aircraft started up, lifted and took off as required. During the transitioning phase, a loud thud was heard and, subsequently, the helicopter's tail rotor failed and the helicopter yawed to the left. To correct the yaw, the pilot

applied the right rudder. This input proved to be ineffective, an indication of a possible tail rotor failure.

3.2.13. After the accident, it was found that the tail rotor drive belt had failed and caused the loss of control during transitioning phase.

3.2.14. The tail rotor drive belt was recovered from the wreckage. Pictures were taken and used to determine the cause of failure. The investigation found that the tail rotor failure was not an isolated occurrence. The aircraft manufacturer had published Airworthiness Directives and Service Bulletins to inform operators of the potential tail rotor dangers.

3.2.15. The SAWS report revealed that fine weather conditions prevailed at the time of the flight. The weather conditions did not contribute to this accident.

3.2.16. One particular Service Bulletin referred to the failure of the tail rotor drive belts (part numbers E18-1150 and E18-1160) manufactured by Gates. The investigation into the belts industry revealed that Gates had changed their manufacturing facilities and processes and that users of Gates belts in other applications have also experienced premature belt wear and failure. Based on the findings of the manufacturer's investigation, it was recommended that these belts should not be used as they fail before they reach their time limit of 250 hours.

3.2.17. It was found that the accident aircraft still had the Gates belts installed. The Service Bulletin had, therefore, not been complied with. The result was as stated by the manufacturer: "Loss of tail rotor most likely resulted in significant aircraft damage".

3.2.18. The tail rotor drive belt was found to be within its service lifetime as specified in the maintenance manual. According to the manufacturer, the integrity of the belts also depends on their condition and tension – and these factors have to be checked before each flight. It is recommended that whenever the belts have stretched one inch or more, they should be replaced immediately despite the hours they had been in use. The new belts stretch rapidly, and it is important to prevent them from becoming too loose. A belt that is too loose could be damaged when hanging over the edge of the pulleys or by the heat created from excessive slippage. To avoid the above failures, the pilot is required to use the belt tensioning tool during pre-flight inspections. No proof could be found that the pilot did not use the belt tensioning tool. None of these anomalies was observed by the pilot during his pre-flight inspection, however, the aircraft was considered to be serviceable for the flight.

3.2.19. The pilot reported that the helicopter was towed out of the hangar and onto the apron in front of the hangar where the pre-flight inspection was conducted, and all checks were normal. On departure, whilst the helicopter was transitioning from hover to forward flight, the pilot heard a dull thud from the engine compartment, followed by the helicopter's violent yaw to the left. It is likely that the dull thud was due to the failure of the V-belt when it got severed. The pilot lost control of the helicopter and it impacted the ground with the left skid and rolled to the right. In the process, the main rotor blades severed the tail boom. The helicopter was substantially damaged during the accident sequence, and the pilot and the passenger were not injured.

3.3 **Probable Cause/s**

3.3.1 It is probable that the V-belt was severed during transitioning phase which caused failure of the tail rotor, rendering it uncontrollable. The pilot subsequently lost control of the helicopter and the main rotor blades struck the tail boom.

3.4 Contributory Factor/s

3.4.1 None.

4. SAFETY RECOMMENDATIONS

4.1. General

4.1.1 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.

4.1.2 It is recommended that the aircraft manufacturer provides training to registered owners and operators to appropriately make use of the tail rotor drive belt tension testing equipment and effective visual inspection techniques so that they are equipped with the necessary skills to identify potential problems with the tail rotor transmission system.

5. Appendices

5.1 Appendix A: Weight and balance

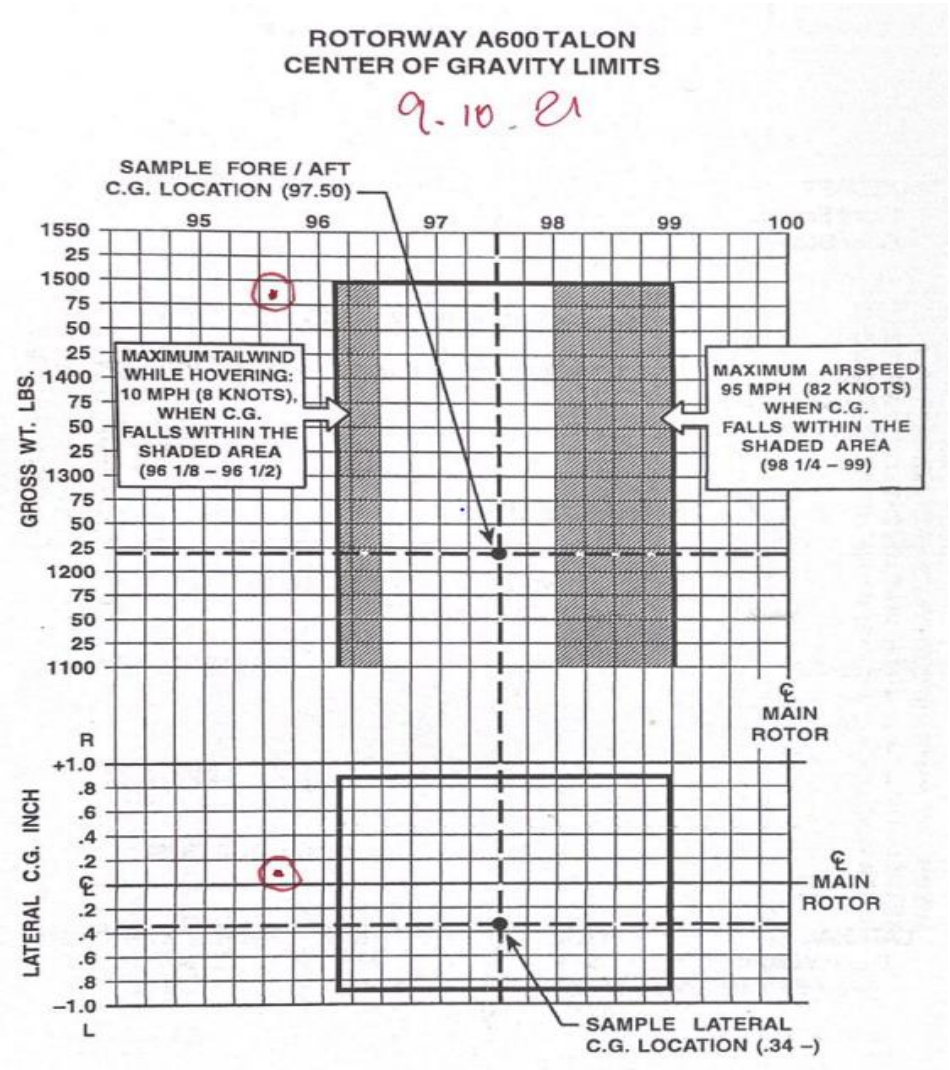
5.2 Appendix B: Advisory Service Bulletins A36, A12, A21 and A25

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

APPENDIX A

The weight and balance and CG provided by the pilot.

Item	Weight	Arm	Moment	Lateral arm	Lateral moment
Aircraft	1001	102,4	102502	-	-
Ballast Aft	24,2	163	3944,6	-	-
Ballast Front	0	26	0	37,5	0
Pilot	177	71	12567	-10,25	-1814,25
Passenger	185	71	13135	10,5	1942,5
Zero Fuel	**1387,2**	**95,3**	**132149**	**0,09**	**128,25**
Fuel Pilot	48	100	4800	-18,25	-876
Fuel Pass	48	100	4800	18,5	888
Take off	**1483,2**	**95,57**	**141749**	**0,09**	**140,25**



Appendix B
Mandatory and Advisory Service Bulletins A36, A12, A21 and A25

ROTORWAY INTERNATIONAL

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April 4, 2002

TO ALL EXEC OWNERS

ADVISORY BULLETIN A-36

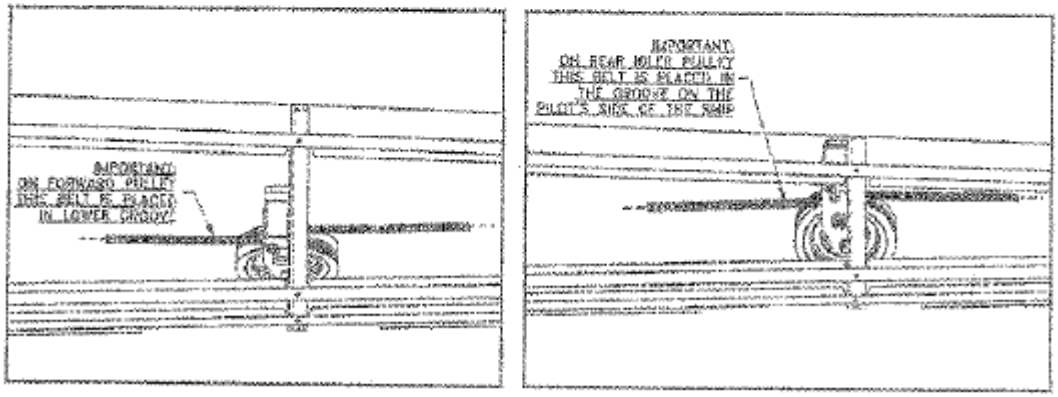
History: Recently an accident occurred due to loss of tail rotor control. During the teardown inspection, the middle or second tail rotor belt was found separated in several pieces and the belt cords were wrapped in the groove of the rear idler pulley. There is a strong opinion that the belts were not routed properly from one pulley to the next pulley, because the cords from the separated belt were wrapped in the pulley groove intended for the rear tail rotor belt.

The tail rotor belts transfer power from the main drive to the tail rotor shaft. As indicated in the construction documents, the belts should be installed in specific grooves of the pulleys. (Refer to the drawings below taken from print E09-2000.)

Action: This bulletin strongly recommends immediate inspection to verify proper routing of tail rotor drive belts through the tail boom. Removal of the tail boom inspection panels will allow for visual determination of belt routing. At the forward idler pulley, the belt coming from the secondary drive unit should be in the lowest groove of the idler pulley, and the second or middle belt should be in upper groove routing rearward. At the second idler pulley location, the second belt should route to the groove on pilot side of the aircraft, and the third belt which routes to the tail rotor shaft should be located in the upper or passenger side pulley groove.

If belts are routed properly there is no further action required.

ANY BELT NOT PROPERLY ROUTED INTO CORRECT IDLER PULLEY GROOVE SHOULD BE REPLACED IMMEDIATELY.



RotorWay INTERNATIONAL

300 South 25th Ave. Phoenix, Arizona 85009 / 602-276-8899
FAX 602-276-7557

September 8, 1992

TO ALL EXEC BUILDERS

EXEC ADVISORY SERVICE BULLETIN A-12

History: Tail rotor drive belts (part numbers E18-1150 and E18-1160) have recently failed during use in two separate instances. Both of these belts were Gates brand. Investigation into the belt industry has revealed that Gates has recently changed their manufacturing facilities and processes; and that users of Gates belts in other applications have experienced premature belt wear and failure.

Since we cannot be sure of the location or process by which the belts are manufactured, we recommend no further use of Gates brand belts on the tail rotor drive system. Loss of your tail rotor will most likely result in significant aircraft damage.

Action: RotorWay International has constructed a fixture for testing different brands of belts. Bando belts, which appear to be of superior construction and are currently being used in the drive train, have tested satisfactory and are now available from RotorWay.

We strongly recommend that all Gates brand belts currently being used in the tail rotor drive be replaced immediately with Bando belts.

Note: Proper installation and maintenance of these belts is critical, and the following installation procedures should be adhered to. The nuts on the tail rotor shaft adjustment rods should be fully loosened so the belts can be installed without being under any tension. **NEVER ROLL ANY BELT INTO PLACE** over the edge of a pulley while under tension - this can damage the cords inside the belt. After installation, tighten the nuts on the adjustment rods to tension the belt. Then check belt tension just forward of the first tail boom bulkhead using a spring scale and ruler. Adjust the belt so that it deflects one inch with 10 pounds of pull.

The belts should be kept free from any dirt, oil, grease, etc. Clean as necessary with a clean cloth, dampened with acetone.

ROTORWAY INTERNATIONAL

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May 12, 1995

TO ALL EXEC, EXEC 90 AND EXEC 162F BUILDERS

TAIL ROTOR BELT ADVISORY BULLETIN A-21

History: As a result of extensive testing of tail rotor belts, RotorWay International has confirmed that when a belt is properly installed and maintained, it will perform as expected for the 250 hour lifetime specified in the Maintenance Manual. In our test fixture, we have been unable to create a deliberate belt failure on properly tensioned belts.

Advisory Bulletin A-20 (dated November 28, 1994) stressed the importance of checking the condition and tension of the belts before every flight. Although this may be time consuming, these pre-flight checks are essential to the continued safe operation of your helicopter.

Action: To simplify the important task of belt inspection, we recommend the use of a "Mandatory Belt Replacement" label to monitor belt stretching, temperature strips to monitor pulley temperatures, and a newly designed tool for checking belt tension. Below are the recommended installation and maintenance procedures to be followed.

1. Belt installation: Fully loosen the nuts on the adjustment rods so that the belts are not under any tension while being installed. NEVER install a belt by rolling it into place over the edge of a pulley while under tension, as this can damage the belt internally.

2. Initial tensioning: Using a spring scale and ruler at the first bulkhead of the tail boom, tension the belts so that a deflection of 1 3/8 inches at 10 pounds of pull is measured. Do not over-tighten the belts. Once the correct initial tension has been attained, apply the belt replacement label to the upper tail rotor slider stringer on the pilot's side. Align the "NEW BELT" mark on the label with the rear edge of the bearing mounting plate. If the bearing mounting plate reaches the "REPLACE" mark during subsequent adjustments, this is an indication that the belt has stretched beyond a safe limit. WHENEVER THE BELTS HAVE STRETCHED ONE INCH OR MORE, THEY MUST BE REPLACED IMMEDIATELY, REGARDLESS OF THE NUMBER OF HOURS THEY HAVE BEEN USED.

(continued)

3. Temperature strips: Install temperature strips on the two tail rotor idler pulleys and the drive pulley on the tail rotor shaft. The heat sensitive "dots" will darken if the indicated temperature is exceeded.

   Examine the temperature strips before and after each flight. If the 170° dot darkens, it is an indication that a belt may be slipping or some other problem may exist. The problem should be identified and corrected before continuing flight. If the 180° (or higher) dot darkens, the belts have been damaged from heat and MUST be replaced.

4. Belt "break-in" period: Upon installing new belts, check and adjust the tension every 15 minutes that the engine is running (idle or operating RPM) until no further adjustment is required. New belts will stretch rapidly during this time, and it is very important to prevent them from becoming too loose. A belt that is too loose could be damaged internally by rolling over the edges of the pulleys; it can also be damaged by the heat created from excessive slipping.

5. Pre- and Post-flight check: RotorWay International recommends the use of our new belt tension tool, which is faster and easier to use than the spring scale and ruler method. Belt tension should be checked before and after each flight and adjusted when necessary.

6. Cleaning: The belts and pulleys should be kept clean and free of any oil, dirt or other contamination. Use acetone and a clean cloth (the rag should be damp but not dripping with acetone).

The belt replacement label (part number E18-1200), temperature strips (part number E08-5200), and belt tension tool (part number E08-5100), along with detailed instructions, are now available from our parts department.

ROTORWAY INTERNATIONAL

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December 21, 1995

TO ALL EXEC, EXEC 90 and EXEC 162F OWNERS

ADVISORY BULLETIN A-25

The following information applies only to aramid fiber tail rotor belts, which have been supplied by RotorWay International since 1/25/94.

History: RotorWay International has observed that the aramid fiber tail rotor belts become tighter as the temperature increases, and loosen as the temperature decreases.

Action: The standard tail rotor belt tension is 1 3/8" ± 1/8" deflection at 10 pounds of pull while the belts are at operating temperature. If the belts are adjusted in cold weather, they may become too tight as the helicopter is flown and warms up. On the other hand, if the belts are checked and adjusted warm indoors, and the helicopter is then taken outside and flown in cold weather, the belts may be too loose.

We recommend that the following procedures be observed during colder weather:

1. The belts should be checked and adjusted in an environment that is approximately the same temperature that the helicopter will be operated in.

2. If the belts are tensioned cold, adjust them to the loose end of the range, so that as they warm up, they will be within limits.

3. Allow the aircraft to run long enough for the coolant and oil temperatures to stabilize, then shut down and immediately check the belt tension again. Adjust as necessary.

4. Remember that if the 170° temperature dot darkens, it indicates that the belts are running hotter than normal. If the 180° (or higher) dot darkens, the belts have been damaged from heat and MUST be replaced.