AIRCRAFT ACCIDENT REPORT

CHL/2022/06/13/F

Nigerian Safety Investigation Bureau

Final Report on the Serious Incident involving De Havilland Twin Otter DHC-6-400 Aircraft with nationality and registration marks 5N-SHE operated by Caverton Helicopters Limited which occurred during landing at Forcados Airstrip, Delta State on 13 June 2022.

This report is produced by the Nigerian Safety Investigation Bureau, (NSIB) formerly the Accident Investigation Bureau, (AIB) Nigeria, Nnamdi Azikiwe International Airport, Abuja.

The report is based on the investigation carried out by Nigerian Safety Investigation Bureau, in accordance with Annex 13 to the Convention on International Civil Aviation, Nigerian Safety Investigation Bureau (Establishment) Act, 2022, and Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 2023.

In accordance with Annex 13 to the Convention on International Civil Aviation, it is not the purpose of aircraft accident/serious incident investigations to apportion blame or liability.

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Safety Recommendations in this report are addressed to the Regulatory Authority of the State (NCAA) as well as other stakeholders, as appropriate. This authority ensures enforcement.

TABLE OF CONTENT

TABLE OF FIGURES

GLOSSARY OF ABBREVIATIONS USED IN THIS REPORT

AIB	Accident Investigation Bureau
AMO	Approved Maintenance Organization
AOC	Air Operator Certificate
CRM	Crew Resource Management
DNFD	Forcados Airstrip
ICAO	International Civil Aviation Organization
LTC	Line Training Captain
NSIB	Nigerian Safety Investigation Bureau
PF	Pilot Flying
PM	Pilot Monitoring
SSCVR	Solid State Cockpit Voice Recorder
SSFDR	Solid State Flight Data Recorder
TP1	Trainee Pilot 1
TP2	Trainee Pilot 2
VMC	Visual Meteorological Conditions

Report number:	CHL/2022/06/13/F
Operator:	Caverton Helicopters Limited
Aircraft type and model:	Twin Otter DHC-6-400
Manufacturer:	DeHavilland Aircraft of Canada Limited
Date of manufacture:	August, 2012
Nationality and registration marks:	5N-SHE
Serial number:	864
Location:	Forcados Airstrip
Date and time:	13 June 2022 at about 14:01 h *All times in this report are local time (UTC +1), unless otherwise stated.*

SYNOPSIS

The then Accident Investigation Bureau (AIB) was notified by Caverton Helicopters Limited of this occurrence via phone call on the 13 June 2022 and investigators were dispatched on 14 June 2022 to Forcados Airstrip.

On 13 June 2022, a De Havilland Twin Otter DHC-6-400 with nationality and registration marks 5N-SHE, operated by Caverton Helicopters Limited, was involved in a runway excursion at Forcados Airstrip (DNFD) during a line training flight.

The flight, which originated from Port Harcourt Military Airport (DNPM), was part of a circuit training exercise under the supervision of a Line Training Captain. During the second circuit at DNFD, varying crosswind conditions were reported. The trainee pilot received repeated advisory inputs on crosswind correction and power management during the approach. Flap extensions were accompanied by low-speed aural warnings, requiring additional thrust adjustments.

The approach was assessed as stable at 500 ft but lateral alignment challenges persisted during the final segment.

The aircraft touched down on Runway 20 and subsequently veered to the left, exiting the runway.

Causal factor

Insufficiently sustained crosswind corrections during the flare and landing roll.

Contributory factor

Limited anticipatory management of crosswind effects throughout the circuit and final approach.

One safety recommendation was made.

1.0 FACTUAL INFORMATION

1.1 History of the flight

On 13 June 2022 at 12:16 h, a De Havilland Twin Otter DHC-6-400, with nationality and registration marks 5N-SHE, operated by Caverton Helicopters Limited, departed Port Harcourt Military Airport (DNPM), Port Harcourt – Rivers State, for Forcados Airstrip (DNFD), Forcados – Delta State. The aircraft was cleared to climb to FL 080. The crew established contact with Forcados Tower and the aircraft landed at 13:03 h.

At Forcados, a Line Training Captain (LTC) briefed two trainee pilots on training activities involving circuits and landing. Both trainees were already captains on the DHC-6-400. The first sortie, a right hand pattern, was conducted between 13:26 h and 13:36 h with Training Pilot 2 as Pilot Flying and the LTC as Pilot Monitoring.

Figure 1: DNPM-DNFD flight and first DNFD sortie

Engine No. 1 (left engine) was shut down after landing. The crew prepared for an additional circuit prior to returning to Port Harcourt, having been informed that six passengers were awaiting pickup.

Four persons were on board for the second training sortie: the three pilots and one maintenance engineer. The aircraft endurance was approximately 2 hours 50 minutes.

At 13:43:21 h, with Trainee Pilot 1 (TP1) as PF and the LTC as PM, radio checks were completed and Engine No. 1 was started. After Start checklist was accomplished and taxi clearance was granted at 13:44 h. Although initially cleared to return to DNPM, the crew informed Tower of their intention to conduct another right-hand circuit and requested revised clearance. Clearance was issued to 1,500 ft on QNH 1011 hPa.

Taxi checks were completed. PF requested a short pause to adjust the seat prior to departure.

At 13:46 h, the Line-Up checklist was completed and the aircraft was cleared for take-off on Runway 20. Initial wind information was 080°/05 kts; shortly thereafter, Tower updated the wind to 220°/08 kts. During the take-off roll, PF was cautioned against applying brake pressure while rudder pedal inputs were being made.

At 13:48 h, Tower instructed the aircraft to report right downwind. The After Take-off checklist was called. The "nosewheel centering" provision of the checklist was not captured on the CVR. After turning crosswind, TP1 observed strong wind conditions and was advised by the PM to climb as necessary to maintain 1,500 ft and to apply right aileron into wind.

At 13:51 h, 5N-SHE reported downwind and informed Tower that it would report established on final for Runway 20.

At 13:53 h, the PF called for the Landing Checklist but was corrected to conduct the Approach Checklist, which was subsequently completed. The PM provided guidance on crosswind correction inputs, advising the PF to apply right aileron and left rudder.

Heading checks were conducted, and runway heading was later set to 020°. The PF was instructed to delay flap extension.

At 13:55:20 h, the aircraft reported final for Runway 20 and was cleared to land. Wind was initially reported calm, then updated to 210°/09 kt.

At 13:55:53 h, the PF requested speed checks and selected Flaps 10. The PM advised on power management as the aircraft's aural "SPEED" annunciation activated multiple times. The PF was instructed to increase power and maintain appropriate crosswind control inputs.

At 13:56:38 h, altitude callouts continued "1,000". The PF requested "prop max," after which the Landing Checklist was commenced. At approximately 700 ft, Flap 20 was selected following speed confirmation. The PF was advised to adjust pitch and trim as required.

At 13:57 h, the aircraft reported short final. Surface wind was transmitted as 230°/05 kts. The aircraft passed 500 ft with the PM assessing the approach as stable. At minimums, the PM called "landing." The PF was advised that the aircraft was left of the runway centreline and was instructed to apply right aileron and left rudder. Additional corrective inputs were suggested as the aircraft descended through 100 ft. The PF was advised to touch down on the right main landing gear first, if possible, and to maintain appropriate pitch attitude.

At 14:00:56 h, the aircraft touched down right of centreline and subsequently veered to the left of the runway and excursed into the grass verge.

At 14:01 h, Air Traffic Control activated the crash alarm. The Fire Service was on standby at the time of the occurrence. All occupants disembarked the aircraft without injury.

The occurrence took place at approximately 14:01 h in daylight under Visual Meteorological Conditions (VMC).

1.2 Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal	Nil	Nil	Nil	Nil
Serious	Nil	Nil	Nil	Nil
Minor	Nil	Nil	Nil	Nil
None	4	Nil	4	Nil
TOTAL	4	Nil	4	Nil

1.3 Damage to aircraft

The aircraft slightly damaged.

1.4 Other damage

A shelter pole used for the Fire Tender was damaged.

1.5 Personnel information

1.5.1 Line Training Captain (Pilot Monitoring)

Nationality:	Philippine
Age:	30 years
Licence type:	Airline Transport Pilot Licence (Aeroplane)
Licence:	Valid till 27 February 2023
Aircraft ratings:	DHC-6-300/400
Medical certificate:	Valid till 27 February 2023
Instrument rating:	Valid till 30 November 2022
Proficiency check:	Valid till 30 June 2022

Total flying time:	10,482:23 h
Total on type:	5,800 h
Last 90 days:	3:34 h
Last 28 days:	3:34 h
Last 24 hours:	3:34 h

1.5.2 Trainee Pilot 1 (TP1/Pilot Flying-PF)

Nationality:	Nigerian
Age:	39 years
Licence type:	Airline Transport Pilot Licence (Aeroplane)
Licence:	Valid till 3 January 2023
Aircraft ratings:	B737-NG, CE-500, DHC-6-300/400
Medical certificate:	Valid till 3 January 2023
Simulator:	Valid till 19 September 2022
Instrument rating:	Valid till 19 March 2023
Proficiency check:	19 September 2022
Total flying time:	3,282 h
Total on type:	2,770 h
Total on type (PIC):	855 h
Last 90 days:	12:21 h
Last 28 days:	0:31 h
Last 24 hours:	0:31 h

1.6 Aircraft information

1.6.1 General information

Type:	Twin Otter DHC-6-400
Manufacturer:	DeHavilland Aircraft of Canada Limited
Date of manufacture:	August 2012
Serial number:	864
Operator:	Caverton Helicopters ltd
Registration number:	5N-SHE
Certificate of Airworthiness:	Valid till 12 May 2023
Certificate of Insurance:	Valid till 30 June 2022
Certificate of Registration:	Issued 14 March 2013
Noise certificate:	Issued 17 April 2013
Airframe time:	6,036:59 h
Cycles since new (CSN):	12,674

1.6.2 Engines

Engine	**Number 1**	**Number 2**
Manufacturer	Pratt & Whitney, Canada	Pratt & Whitney, Canada
Type/Model	PT6A-34	PT6A-34
Serial number	PCE-RB1132	PCE-RB1166
Time Since New	2,073:25 h	2,074:53 h
Cycles since new	4313	4315

Fuel type used: Jet A-1

1.6.3 Propeller

Propeller	**Number 1**	**Number 2**
Propeller model	HC-B3TN-3D	HC-B3TN-3D
Number of blades	3	3
Manufacturer	Hartzell Propeller Inc.	Hartzell Propeller Inc.
Year of overhaul	8 October 2020	27 October 2021
Serial number	BUA33228	BUA21439

1.7 Meteorological information

Weather	**1200UTC**	**1400UTC**
Wind:	150/05 kt	150/05 kt
Visibility:	10 km	10 km
Weather:	Nil	Nil
Cloud:	SCT 390 m	SCT 450 m
Temp/Dew:	33/24 ^{o}C	34/24 ^{o}C
QNH:	1012 hPa	1010 hPa

1.8 Aids to navigation

EQUIPMENT	STATUS
ALDIS LAMP, Binoculars, APAPI	Serviceable
AERODROME BEACON, Windsocks, AIRFIELD LIGHTING	Serviceable
CRASH ALARM BELL, ATC DIGITAL CLOCKS, OPS VEHICLE	Serviceable

1.9 Communications

EQUIPMENT	STATUS
VHF 118.324 MHz mains	Serviceable
VHF 129.1 & 123.4 MHz Monitors	Serviceable
Walkie-Talkie, Phone DCT X INTERCOM AWOS	Serviceable

There was two-way communication between the aircraft and Forcados Tower.

1.10 Aerodrome information

The Forcados Airstrip with location indicator DNFD has a reference point as 05°21'18"N 005°20'56"E with an elevation of 11.0 ft MSL. The airstrip has a single runway with designation 02/20. The runway dimension consists of a length of 799 m and a width of 18 m (2621 ft by 59 ft). There is green vegetation of about 50 ft height on both sides of the runway.

1.11 Flight recorders

Recorders	Flight Data Recorder(FDR)	Cockpit Voice Recorder(CVR)
Model	ARFDR	ARCVR
Part number	980-4710-003	980-6023-002
Serial number	00780	11184
Manufacturer	Honeywell, USA	Honeywell, USA

The aircraft was fitted with a Solid State Cockpit Voice Recorder (SSCVR) and a Solid State Flight Data Recorder (SSFDR).

The recorders were successfully downloaded and analysed.

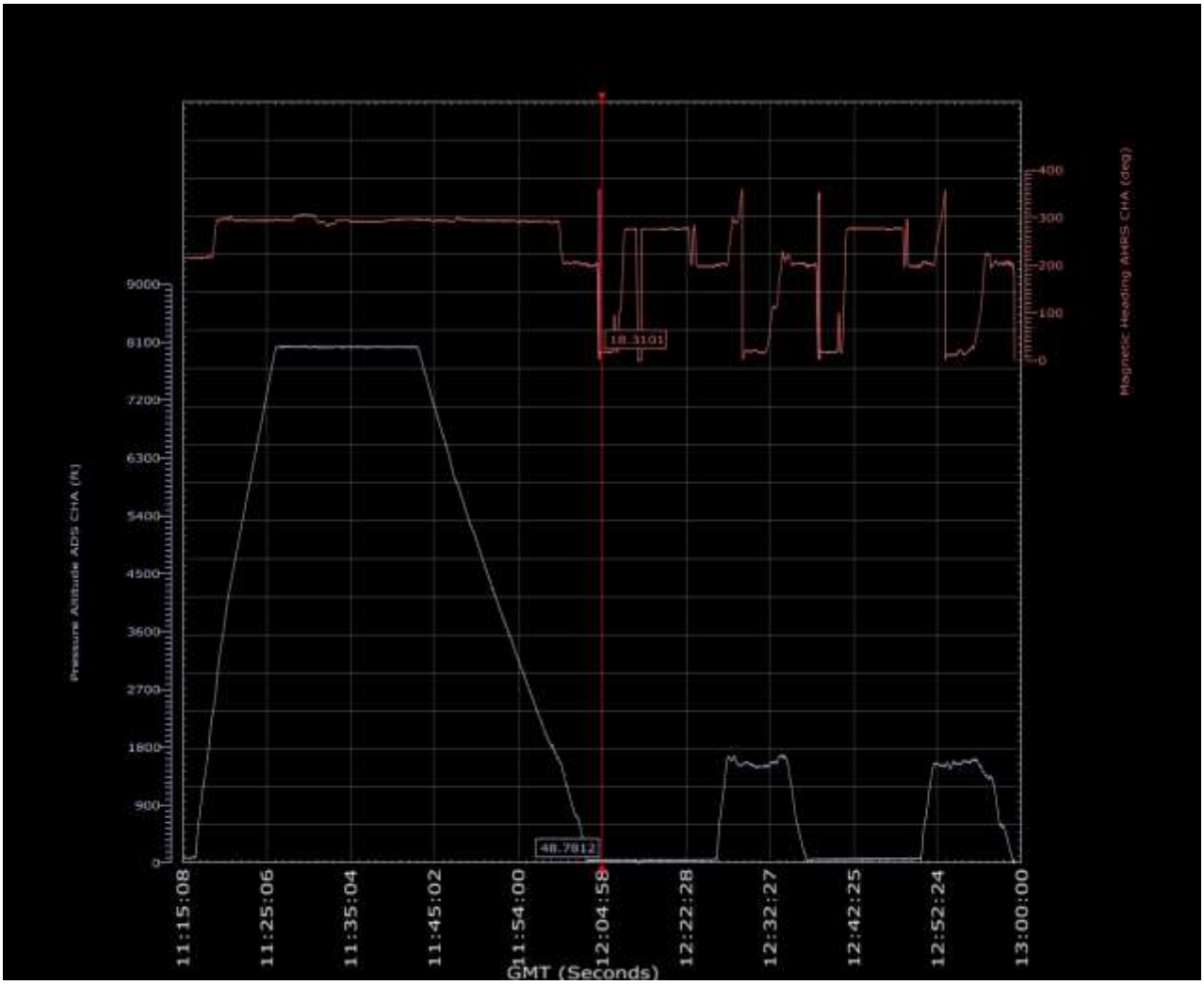

Figure 2: Representative plot for the all three flights

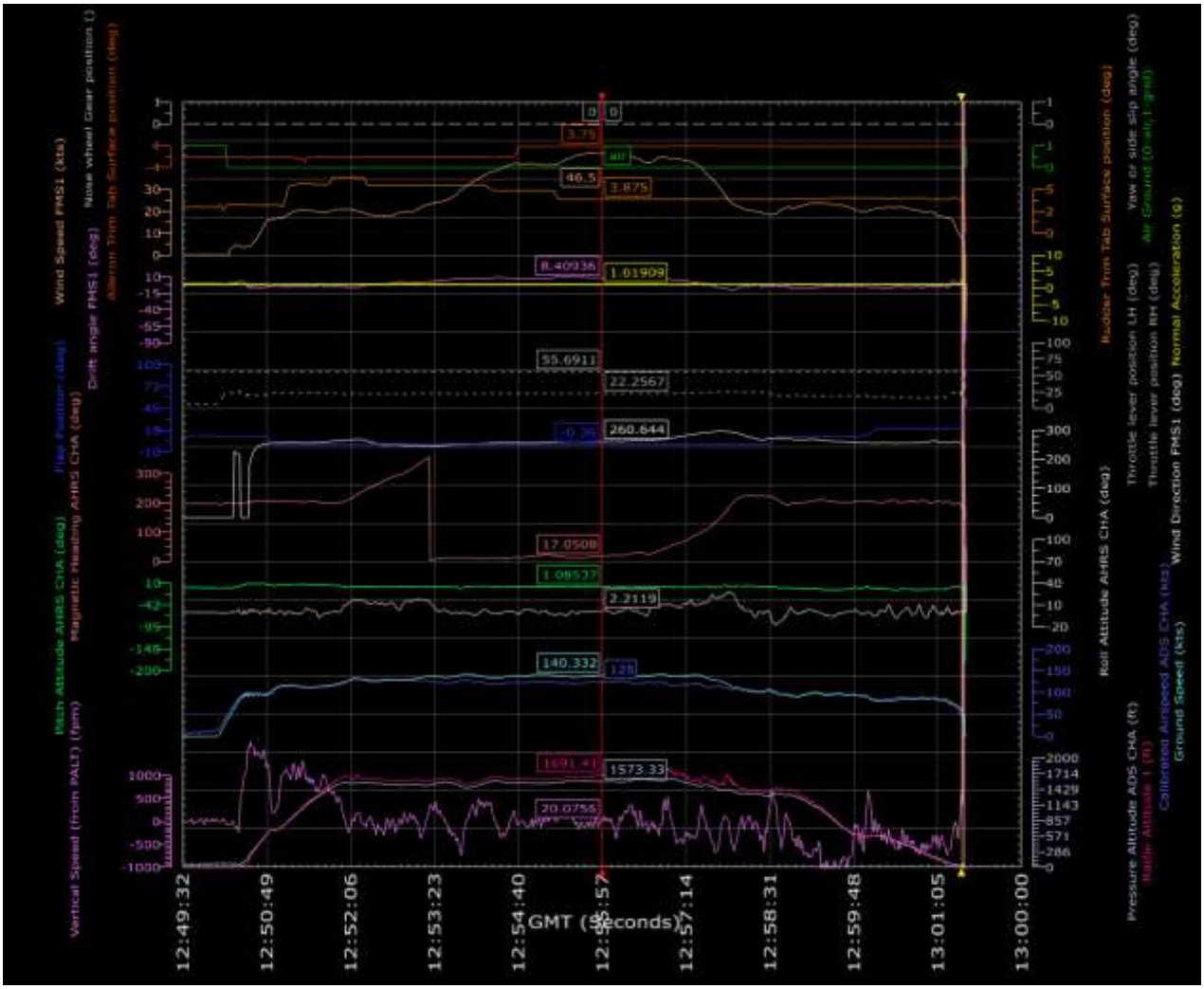

Figure 3: Representative plot for the third sortie

1.11.1 Flight data analysis summary

The reconstructed ground track depicts a right-hand traffic circuit comprising the upwind, crosswind, downwind, base, and final approach legs consistent with operations to Runway 20. The flight data analysis focused on track geometry, approach stability, and directional control during the landing sequence.

Figure 4: Track of the second sortie (right-hand circuit pattern)

During the final approach, the aircraft's ground track was initially aligned within the nominal Runway 20 magnetic heading (about 200°). This degree of alignment is indicative of an acceptable short-final configuration and suggests that the aircraft was laterally established on or near the runway centreline during the early portion of the final approach.

Flight Data Recorder (FDR) information shows that touchdown occurred approximately 61.77 m beyond the Runway 20 threshold and 5.21 m to the right of the runway centreline. Recorded wind conditions were 258.6° at 10.2 kts, corresponding to a right crosswind component of approximately 8.7 kts. The computed landing speeds were 61.9 kts calibrated airspeed (CAS) and 67.0 kts groundspeed.

Analysis of the final seconds prior to and immediately after touchdown revealed increasing variability in the aircraft's ground track. The heading progressively deviated beyond ±20° of the runway heading, followed by sharper divergence exceeding 50°

from the runway axis within a short time interval. These rapid heading excursions indicate significant yaw oscillations during the flare and the initial landing roll.

The pattern of heading changes is consistent with late or reactive crosswind control inputs. Directional stability was not effectively maintained through touchdown and the subsequent rollout phase.

1.12 Wreckage and impact information

The aircraft touched down about 62 m from Runway 20 threshold to the right of the centreline and subsequently veered to the left where it departed the paved surface at a point approximately 238.7 m from the runway threshold. It then travelled an additional 34.05 m across the grass verge before colliding with a shelter pole used for the Fire Tender. The aircraft continued and finally came to a stop after being stuck in mud.

The following damage were observed:

1. The left wing tip (outboard section) was sheared off; the navigation and strobe lights were detached.
2. The left wing flap and aileron were damage and severed from the wing after collision with the shelter pole.

Figure 5: The aircraft stuck in the grass-verge

Figure 6: Damaged left wing of 5N-SHE

Figure 7: The Left wing tip area of the aircraft

Figure 8: The right main wheel stuck in grass-verge

Figure 9: Nose wheel stuck in the grass-verge

Figure 10: Wheel tracks on the grass verge

1.13 Medical and pathological information

No medical or pathological tests were conducted.

1.14 Fire

There was no fire.

1.15 Survival aspect

The occurrence was survivable as there was livable volume of space and the restraint system was intact during the post occurrence inspection.

1.16 Test and research

Nil

1.17 Organizational and management information

1.17.1 Caverton Helicopters Limited

Caverton Helicopters Limited was established in 2002 as a provider of charter, shuttle and maintenance services. It obtained an Air Operator Certificate (AOC), with number CH/AOC/11-14/01 with authorization to conduct passenger and cargo flights, aerial work and charter flight operations. Caverton Helicopters Limited has its principal base of operations at Murtala Muhammad International Airport Ikeja, Lagos. Caverton Helicopters operates a mixed fleet of aircraft comprising Agusta Westland AW139 Helicopters, Bell 407GXP Helicopters, Bell 412 Helicopters, de Havilland DHC-6 Twin Otter, Sikorsky S-76C Helicopters and Airbus H125 (AS350) Helicopter.

1.18 Additional information

Nil.

2.0 ANALYSIS

2.1 General

On 13 June 2022, a De Havilland Canada DHC-6-400 Twin Otter with nationality and registration marks 5N-SHE, operated by Caverton Helicopters Limited, was involved in a runway excursion at Forcados Airstrip (DNFD) during a line training flight.

The aircraft had a valid Certificate of Airworthiness at the time of the occurrence. The flight was conducted for line training purposes involving circuit and landing procedures. This analysis focuses primarily on the conduct of the flight and associated Human Factors elements.

2.2 Conduct of the Flight

This section focuses on operational handling, control inputs, crosswind management, and approach stabilization, based on the recorded sequence of events.

2.2.1 Crosswind Anticipation and Control Application

Throughout the circuit and landing exercise, varying wind information was transmitted by Tower, indicating fluctuating crosswind components. While crosswind corrections were verbally discussed between the Pilot Monitoring (PM) and Pilot Flying (PF/TP1), the timing and magnitude of control inputs suggest that the aerodynamic effects of crosswind were not consistently anticipated and countered at all phases of flight.

Effective crosswind management requires continuous and proactive application of coordinated aileron into wind and opposite rudder to maintain runway alignment and longitudinal axis control. From the downwind leg through final approach, repeated advisory inputs were provided by the PM regarding right aileron and left rudder application. This indicates that corrective inputs were reactive rather than stabilized early and maintained progressively.

The available evidence suggests that while the need for correction was recognized, sustained and anticipatory crosswind control was not consistently achieved, particularly during the transition from approach to flare, and touchdown.

2.2.2 Flap Deployment and Aircraft Energy State

Flap selections (Flaps 10 and subsequently Flaps 20) were made during the approach, accompanied by multiple "SPEED" aural annunciations. The repeated activation of the low-speed warning suggests that the aircraft's energy state was approaching the lower safe margin at certain points.

Flap deployment in crosswind conditions alters lift, drag, and pitch characteristics. It also increases drag significantly, thereby requiring coordinated power adjustments to maintain a stable glide path and target airspeed. The recorded dialogue indicates that power application required prompting and that thrust adjustments were not consistently anticipatory.

The sequence suggests that the aerodynamic consequences of flap extension — particularly increased drag and the associated power requirement — may not have been fully stabilized before further configuration changes were made. As a result, power corrections appear to have been applied in response to deviations rather than in anticipation of them.

2.2.3 Power and Flight Control Coordination

Several exchanges between the PM and PF(TP1) referenced the need to increase power and adjust control inputs. Effective approach management requires coordinated pitch–power coupling; pitch for glide path control and power for energy management, while maintaining directional control through crosswind inputs.

The recorded callouts indicate moments where speed control required intervention and where pitch and trim adjustments were advised by the PM. This suggests that the PF(TP1) may have been managing multiple control demands simultaneously —

airspeed, glide path, and crosswind alignment — leading to increased workload during a critical phase of flight.

In crosswind conditions, the simultaneous requirement to maintain runway centreline (lateral control), stabilized descent (vertical control), and target airspeed (energy control) can significantly increase cognitive and motor demands. The evidence indicates that these elements were not fully harmonized, particularly below 1,000 ft.

2.2.4 Stabilization at 500 ft and Subsequent Deviation

At 500 ft, the PM assessed the approach as "stable." This indicates that, at that point, key stabilization parameters such as descent rate, configuration, and general energy state were considered within acceptable limits.

However, stabilization criteria must be maintained continuously from the Initial Approach to the Touchdown. Subsequent advisory callouts regarding centreline deviation and continued corrective inputs suggest that lateral alignment deteriorated during the final segment of the approach.

Although the aircraft reportedly met stabilization criteria at 500 ft, maintaining runway centreline in crosswind conditions requires continuous, progressive correction as wind gradients and surface effects increase closer to touchdown. The inability to consistently maintain lateral alignment in the final 100 ft indicates that crosswind control inputs were not optimally coordinated and not sustained through the flare.

2.2.5 Transition to Touchdown

The advisory to land on the upwind (right) main gear first was consistent with crosswind landing technique. However, effective execution of this technique requires stable lateral control, appropriate rudder authority to align the longitudinal axis with the runway, and controlled pitch during flare.

The subsequent veer to the left after touchdown is consistent with delayed crosswind correction at the point of weight transfer from wings to wheels.

2.3 Human Factor elements in this investigation

Crew Resource Management elements such as assertiveness and communication were present between the crew. However, training environments can introduce additional cockpit workload due to instructional inputs, performance monitoring, and corrective guidance provided by the instructor. These factors can increase the cognitive demands placed on the pilot flying, particularly during critical phases of flight such as final approach and landing.

The PF had accumulated limited flight time of 31 minutes in the preceding 28 days. Reduced Recency of flight experience can affect pilot proficiency and the ability to anticipate aircraft handling requirements, particularly during manoeuvres requiring precise control inputs such as crosswind landings.

The Line Training Captain provided several corrective instructions to the pilot flying during the final approach and landing.

While instructional inputs are expected during training flights, multiple verbal interventions during the final approach may increase cockpit workload and reduce the pilot's ability to maintain stable aircraft control.

The timing and frequency of these inputs suggest that the pilot flying may have been operating in a reactive control mode, responding to instructor instructions rather than anticipating the aircraft's behaviour.

Such reactive control inputs can lead to delayed or insufficient corrective actions during dynamic phases of flight such as crosswind landings.

3.0 CONCLUSIONS

3.1 Findings

1. The flight crew were qualified and certified to conduct the flight.
2. The pilot flying had limited recent flight experience.
3. The aircraft had a valid Certificate of Airworthiness.
4. The flight was conducted as a training exercise under Visual Meteorological Conditions (VMC).
5. Crosswind corrections were not consistently maintained during the flare and landing roll.
6. The aircraft veered to the left of the Runway centerline during landing roll.
7. The aircraft departed the runway and struck a fixed obstacle located within the runway strip.

3.2 Causal factor

Insufficiently sustained crosswind corrections during the flare and landing roll.

3.3 Contributory factors

Limited anticipatory management of crosswind effects throughout the circuit and final approach.

4.0 SAFETY RECOMMENDATIONS

4.1 Safety Recommendation 2026-002

Caverton Helicopters Limited should incorporate structured crosswind scenarios that require early stabilization of lateral control rather than reactive correction into the simulator and line training sessions.