



AVIATION OCCURRENCE REPORT

LOSS OF DIRECTIONAL CONTROL FOLLOWING TAIL ROTOR STRIKE DURING AUTOROTATIVE LANDING

**OKOTOKS FLIGHT CENTRE INC.
HUGHES 269C (HELICOPTER) C-FQCN
OKOTOKS AIR PARK, OKOTOKS, ALBERTA
27 JUNE 1994**

REPORT NUMBER A94W0108

MANDATE OF THE TSB

The Canadian Transportation Accident Investigation and Safety Board Act provides the legal framework governing the TSB's activities. Basically, the TSB has a mandate to advance safety in the marine, pipeline, rail, and aviation modes of transportation by:

- conducting independent investigations and, if necessary, public inquiries into transportation occurrences in order to make findings as to their causes and contributing factors;
- reporting publicly on its investigations and public inquiries and on the related findings;
- identifying safety deficiencies as evidenced by transportation occurrences;
- making recommendations designed to eliminate or reduce any such safety deficiencies; and
- conducting special studies and special investigations on transportation safety matters.

It is not the function of the Board to assign fault or determine civil or criminal liability. However, the Board must not refrain from fully reporting on the causes and contributing factors merely because fault or liability might be inferred from the Board's findings.

INDEPENDENCE

To enable the public to have confidence in the transportation accident investigation process, it is essential that the investigating agency be, and be seen to be, independent and free from any conflicts of interest when it investigates accidents, identifies safety deficiencies, and makes safety recommendations. Independence is a key feature of the TSB. The Board reports to Parliament through the President of the Queen's Privy Council for Canada and is separate from other government agencies and departments. Its independence enables it to be fully objective in arriving at its conclusions and recommendations.



The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Aviation Occurrence Report

Loss of Directional Control Following Tail Rotor Strike During Autorotative Landing

Okotoks Flight Centre Inc.
Hughes 269C (Helicopter) C-FQCN
Okotoks Air Park, Okotoks, Alberta
27 June 1994

Report Number A94W0108

Synopsis

An instructor and a student in a Hughes 269C helicopter were on a training flight carrying out full-on practice autorotations to touchdown when, during the flare, the helicopter's tail rotor blades struck the ground about 300 feet short of the intended landing area. The helicopter then climbed rapidly to about 50 feet above ground level, where it started rotating in the opposite direction of the main rotor blades. It then pitched nose down and crashed into the ground. The instructor and student sustained minor injuries. The helicopter was substantially damaged.

The Board determined that the student pilot misjudged the altitude and distance from the intended landing area during the practice autorotation, and the instructor did not take the necessary corrective action in time to avoid the tail rotor strike and subsequent loss of control of the helicopter.

Ce rapport est également disponible en français.

Table of Contents

	Page
1.0 Factual Information	1
1.1 History of the Flight	1
1.2 Injuries to Persons	1
1.3 Damage to Aircraft	1
1.4 Other Damage	1
1.5 Personnel Information	2
1.5.1 The Instructor	2
1.5.2 The Student	2
1.6 Aircraft Information	2
1.6.1 General	2
1.6.2 Additional Information	3
1.7 Meteorological Information	3
1.8 Aerodrome Information	3
1.9 Wreckage and Impact Information	3
1.10 Survival Aspects	3
1.11 Complacency and Vigilance	3
1.12 Instructor Technique	4
2.0 Analysis	5
2.1 Introduction	5
2.2 Actions of Instructor and Student	5
3.0 Conclusions	7
3.1 Findings	7
3.2 Causes	7
4.0 Safety Action	9
5.0 Appendices	

Appendix A - Glossary 11

1.0 Factual Information

1.1 History of the Flight

The instructor and student were in a Hughes 269C helicopter on a local training flight at the Okotoks Air Park near Okotoks, Alberta. They were preparing for the student's upcoming Transport Canada (TC)¹ flight test for issue of a commercial rotary wing licence. During the over one-hour-long flight, the student had successfully completed five full-on autorotations to touchdown.

During a 180-degree-turning autorotation, the student's approach was short of the intended landing area. The instructor expected the student to continue the autorotation although there was no verbal communication to that effect. The student initiated the flare and did not level the helicopter prior to touchdown. The instructor tried to push the cyclic forward to level the helicopter but the tail rotor blades struck the ground while the helicopter was still in a flared attitude. The helicopter then climbed rapidly to about 50 feet above ground level (agl), and rotated to the right. The instructor tried to recover, but the helicopter pitched nose down, crashed into the ground, and came

helicopter was substantially damaged.

The accident occurred at latitude 50°44'N and longitude 113°56'W, at 1345 mountain daylight time (MDT)² during the hours of daylight, at a ground elevation of 3,601 feet above sea level (asl)³.

1.2 Injuries to Persons

	Crew	Passengers	Others	Total
Fatal	-	-	-	-
Serious	-	-	-	-
Minor/None	<u>2</u>	<u>-</u>	<u>-</u>	<u>2</u>
Total	2	-	-	2

1.3 Damage to Aircraft

The helicopter was substantially damaged.

1.4 Other Damage

Pieces of wreckage and debris were scattered for several hundred feet over the ramp and taxiway, in front of the hangar and parked aircraft. None of these aircraft was damaged.

-
- 1 See Glossary for all abbreviations and acronyms.
 - 2 All times are MDT (Coordinated Universal Time [UTC] minus six hours) unless otherwise stated.
 - 3 Units are consistent with official manuals, documents, reports, and instructions used by or issued to the crew.

to a stop. The instructor and the student sustained minor injuries and were sprayed with avgas from a punctured fuel tank, but were able to exit the helicopter on their own. The

1.5 Personnel Information

	Instructor	Student
Age	57	59
Pilot Licence	CPL	CPL
Medical Expiry Date	01 Nov. 1994	01 Jul. 94
Total Flying Time	18,000 hr	8,000 hr
Total on Type	4,000 hr	36 hr

Total Last 90 Days	100 hr	36 hr
Total on Type		
Last 90 Days	95 hr	36 hr
Hours on Duty		
Prior to		
Occurrence	06 hr	06 hr
Hours off Duty		
Prior to		
Work Period	36 hr	N/A

1.5.1 The Instructor

The instructor has several years of instructing experience at the Okotoks Flight Centre. He has about 18,000 hours total time, with over 14,000 hours on helicopters, and about 8,000 hours instructing. Most of his over 4,000 hours on the Hughes 269C helicopter were spent as an instructor. The instructor could not offer an explanation as to why the helicopter touched down so far short of the intended landing area.

1.5.2 The Student

The student held a commercial fixed-wing licence and had a reported 8,000 hours of bush flying on single-engine fixed-wing aircraft on wheels, skis, and floats in northern British Columbia. Desiring a rotary wing endorsement, he enrolled in a helicopter training school at Abbotsford, British Columbia, to complete a 60-flying-hour conversion course. This flight training commenced in January 1994; after over 75 flight-hours of training, the flight training was terminated by mutual agreement. The student was advised that he would probably require additional flight instruction to meet the required standard.

On 17 May 1994, the student, wanting to complete the conversion course, started flight training on a Hughes 269C helicopter at the Okotoks Flight Centre. After the student had completed over 30 hours of flight training with him, the instructor felt that the student was ready for a TC flight test. The instructor recommended the student and booked a TC Air Carrier Inspector to perform the check ride

on the following Thursday, three days later. The occurrence flight was to be the last training flight prior to the flight test. The student could not offer an explanation as to why the helicopter touched down so far short of the intended landing area.

1.6 Aircraft Information

1.6.1 General

Manufacturer	Hughes Helicopters
Type	269C
Year of Manufacture	1981
Serial Number	211029
Certificate of	
Airworthiness	
(Flight Permit)	Valid
Total Airframe Time	5,595.2 hr
Engine Type	Avco Lycoming
(number of)	HIO-360-D1A (1)
Propeller/Rotor Type	
(number of)	Schweizer (1)
Maximum Allowable	
Take-off Weight	2,050 lb
Recommended Fuel	
Type(s)	100/130 or 100 LL Avgas
Fuel Type Used	100 LL

1.6.2 Additional Information

The helicopter was certified, equipped, and maintained in accordance with existing regulations and approved procedures. The helicopter's weight was within limits, and the centre of gravity (C of G) was within the normal range. The helicopter was equipped with fully functional dual flight controls.

The emergency locator transmitter (ELT) on board was a Narco ELT 10. This unit became detached from its mounting bracket on the doorframe during the egress. It was found switched to the OFF position, but was functionally tested and found to be serviceable.

The Hughes 269C, and most other light helicopters, descend rapidly during autorotations.

1.7 Meteorological Information

The weather was not a factor in the occurrence. The wind was light and variable. The temperature was 20 degrees Celsius.

1.8 Aerodrome Information

The Okotoks Air Park, at an elevation of 3,601 feet asl, was suitable for the intended training. There is a single runway oriented on 160/340°M (degrees magnetic). A taxiway, oriented on 070/250°M, connects the runway to the refuelling and parking area in front of the hangar. Depending on the wind direction, the taxiway is normally used for helicopter training and autorotations.

1.9 Wreckage and Impact Information

The helicopter, travelling on a magnetic heading of 060 degrees in a nose-high flare, descended until the tail rotor blades struck a paved access road about 50 feet from the edge of the ramp/taxiway, and 300 feet short of the intended landing area on the taxiway. Although this area and its immediate vicinity is clear of obstacles, the surface is not suitable for run-on landings across the access road to the ramp.

The tail rotor blades were destroyed by the impact. The tail rotor drive shaft was twisted and uncoupled from the transmission. After impact, the helicopter travelled a further 84 feet onto the ramp, where it came to a stop. Pieces of the tail rotor and tail boom were found 180 feet farther along the wreckage trail.

1.10 Survival Aspects

The cockpit retained its original size and shape, and the occupants were able to exit the wreckage on their own. Both pilots had been sprayed with avgas. Several witnesses, with fire extinguishers and first aid kits, were on the scene within seconds to administer first aid. The instructor and the student were taken to separate hospitals for observation. The student was examined and released later that day; the instructor was not released until the following day.

1.11 Complacency and Vigilance

Complacency is a state of reduced conscious attention or awareness caused by a sense of security and self confidence. Characteristics of complacency include over-confidence and boredom, both of which can significantly degrade effective performance.

Vigilance is the maintenance of the appropriate level of conscious attention for the assigned task. Lapses in attention may occur after a person has been at a monitoring task for a period of time.

It cannot be determined whether complacency and/or lack of vigilance contributed to this accident, although the facts revealed are consistent with both or either of such factors.

1.12 Instructor Technique

An instructor must assess the benefits of allowing the student to make mistakes, then waiting a suitable time to see whether the student recognizes the mistake and is correcting for it, versus taking control and taking the necessary corrective action. Often this assessment must take place within seconds, with only a fine line separating the options.

During a full-on autorotation to

touchdown, the helicopter's inherent high rate of descent and proximity to the ground require the instructor to be vigilant as there may be little time to take the necessary corrective action. When the approach path is misjudged or less than optimal, the instructor should not delay taking the appropriate corrective action, such as either initiating a power recovery or taking control and continuing flight to touchdown at a suitable point.

2.0 *Analysis*

2.1 *Introduction*

During the investigation, neither the instructor nor the student could offer an explanation as to why the helicopter's tail rotor struck the ground so far short of the intended landing area.

Adequate corrective action was not taken during the descent. The analysis will concentrate on the instructor's and the student's actions.

2.2 *Actions of Instructor and Student*

Although the student had initially experienced some difficulty converting to rotary-wing flying, the instructor had flown more than 30 hours with him, and was satisfied that his performance met the required standards for a TC endorsement.

The facts revealed on investigation are consistent with complacency and/or lack of vigilance throughout the final autorotation. Although the instructor was aware that the student had misjudged his altitude and distance and had allowed the helicopter to descend below the optimum approach path for the intended landing area, the instructor allowed the student to continue the autorotation to touchdown. The instructor did not take the appropriate corrective action in time to prevent the tail rotor from striking the access road, likely because the student had successfully performed the five previous full-on autorotations. The damage to the tail rotor blades and drive shaft resulted in a loss of

directional control of the helicopter when a recovery was attempted, and the helicopter crashed.

3.0 *Conclusions*

3.1 *Findings*

1. The student misjudged the altitude and distance from the intended landing area, initiated a steep flare, and did not level the helicopter prior to touchdown.
2. The instructor allowed the student to continue the autorotation to touchdown and did not take the necessary corrective action in time to prevent a tail rotor strike.
3. The tail rotor strike resulted in damage to the tail rotor blades and drive shaft, and loss of directional control.
4. The helicopter was certified, equipped, and maintained in accordance with existing regulations and approved procedures.
5. The instructor and student were certified and qualified for the flight in accordance with existing regulations.

3.2 *Causes*

The student pilot misjudged the altitude and distance from the intended landing area during the practice autorotation, and the instructor did not take the necessary corrective action in time to avoid the tail rotor strike and subsequent loss of control of the helicopter.

4.0 *Safety Action*

The Board has no aviation safety recommendations to issue at this time.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson John W. Stants, and members Zita Brunet and Hugh MacNeil, authorized the release of this report on 12 April 1995.

Appendix A - Glossary

agl	above ground level
asl	above sea level
C of G	centre of gravity
CPL	commercial pilot licence
ELT	emergency locator transmitter
hr	hour(s)
lb	pound(s)
LL	low lead
MDT	mountain daylight time
N	north
N/A	not available
TC	Transport Canada
TSB	Transportation Safety Board
UTC	Coordinated Universal Time
W	west
°	degree(s)
°M	degrees of the magnetic compass
'	minute(s)

TSB OFFICES

HEAD OFFICE

HULL, QUEBEC*

Place du Centre
4th Floor
200 Promenade du Portage
Hull, Quebec
K1A 1K8
Phone (819) 994-3741
Facsimile (819) 997-2239

ENGINEERING

Engineering Laboratory
1901 Research Road
Gloucester, Ontario
K1A 1K8
Phone (613) 998-8230
24 Hours (613) 998-3425
Facsimile (613) 998-5572

REGIONAL OFFICES

ST. JOHN'S, NEWFOUNDLAND

Marine
Centre Baine Johnston
10 Place Fort William
1st Floor
St. John's, Newfoundland
A1C 1K4
Phone (709) 772-4008
Facsimile (709) 772-5806

GREATER HALIFAX, NOVA SCOTIA*

Marine
Metropolitain Place
11th Floor
99 Wyse Road
Dartmouth, Nova Scotia
B3A 4S5
Phone (902) 426-2348
24 Hours (902) 426-8043
Facsimile (902) 426-5143

MONCTON, NEW BRUNSWICK

Pipeline, Rail and Air
310 Baig Boulevard
Moncton, New Brunswick
E1E 1C8
Phone (506) 851-7141
24 Hours (506) 851-7381
Facsimile (506) 851-7467

GREATER MONTREAL, QUEBEC*

Pipeline, Rail and Air
185 Dorval Avenue
Suite 403
Dorval, Quebec
H9S 5J9
Phone (514) 633-3246
24 Hours (514) 633-3246
Facsimile (514) 633-2944

GREATER QUÉBEC, QUEBEC*

Marine, Pipeline and Rail
1091 Chemin St. Louis
Room 100
Sillery, Quebec
G1S 1E2
Phone (418) 648-3576
24 Hours (418) 648-3576
Facsimile (418) 648-3656

GREATER TORONTO, ONTARIO

Marine, Pipeline, Rail and Air
23 East Wilmot Street
Richmond Hill, Ontario
L4B 1A3
Phone (905) 771-7676
24 Hours (905) 771-7676
Facsimile (905) 771-7709

PETROLIA, ONTARIO

Pipeline and Rail
4495 Petrolia Street
P.O. Box 1599
Petrolia, Ontario
N0N 1R0
Phone (519) 882-3703
Facsimile (519) 882-3705

WINNIPEG, MANITOBA

Pipeline, Rail and Air
335 - 550 Century Street
Winnipeg, Manitoba
R3H 0Y1
Phone (204) 983-5991
24 Hours (204) 983-5548
Facsimile (204) 983-8026

EDMONTON, ALBERTA

Pipeline, Rail and Air
17803 - 106 A Avenue
Edmonton, Alberta
T5S 1V8
Phone (403) 495-3865
24 Hours (403) 495-3999
Facsimile (403) 495-2079

CALGARY, ALBERTA

Pipeline and Rail
Sam Livingstone Building
510 - 12th Avenue SW
Room 210, P.O. Box 222
Calgary, Alberta
T2R 0X5
Phone (403) 299-3911
24 Hours (403) 299-3912
Facsimile (403) 299-3913

GREATER VANCOUVER, BRITISH COLUMBIA

Marine, Pipeline, Rail and Air
4 - 3071 Number Five Road
Richmond, British Columbia
V6X 2T4
Phone (604) 666-5826
24 Hours (604) 666-5826
Facsimile (604) 666-7230

*Services available in both official languages