

AVIATION OCCURRENCE REPORT

LOSS OF ENGINE POWER

**CANADIAN HELICOPTERS LIMITED
AEROSPATIALE AS 350B, A-STAR C-GAHG
GOLDEN, BRITISH COLUMBIA 30 mi N
18 MARCH 1994**

REPORT NUMBER A94P0047



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.

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(Helicopter) C-GAHG
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Synopsis

The pilot of the Aérospatiale AS 350B helicopter and four passengers were on a flight from Golden, British Columbia, to a lodge. En route, the aircraft experienced a partial loss of engine power. The pilot attempted an emergency landing in a clearing; however, on final approach, the main rotor blades of the helicopter struck a tree. The helicopter struck the snow-covered ground heavily and was substantially damaged. The pilot and two of the four passengers were seriously injured.

The Board determined that there was a partial loss of engine power; the cause of the loss of engine power was not established.

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	1
1.6 Aircraft Information	2
1.6.1 General	2
1.6.2 Aircraft Loading	2
1.6.3 Engine Power/rpm Compensation	2
1.7 Meteorological Information	2
1.8 Flight in Snow	2
1.9 Aids to Navigation	3
1.10 Communications - Flight Following	3
1.11 Wreckage and Impact Information	3
1.11.1 General	3
1.11.2 Ice or Snow Contamination	3
1.12 Medical Information	4
1.13 Fire	4
1.14 Survival Aspects	4
1.15 Wreckage Examination and Tests	4
2.0 Analysis	5
2.1 Evidence of an Engine Power Loss	5
2.2 Loss of Engine Power	5
2.3 Flight in Snow	5
3.0 Conclusions	7
3.1 Findings	7
3.2 Causes	7
4.0 Safety Action	9
5.0 Appendices	
Appendix A - List of Supporting Reports	11
Appendix B - Glossary	13

1.0 Factual Information

1.1 History of the Flight

The pilot of the Aerospatiale AS 350B helicopter and four passengers departed at 1110 Pacific standard time (PST) from a staging area, 12 miles north of Golden, British Columbia, on a visual flight rules (VFR) flight, to a recreation lodge located 35 miles northeast of Golden. This was the second flight to the lodge that morning, and the helicopter was refuelled shortly before departure.

Thirty miles north of Golden, while proceeding at 70 knots up the Blaeberry River valley, at 300 feet above ground level (agl), the pilot noticed the main rotor rpm (Nr) begin to decay. With the intent of making an emergency landing and in order to maintain Nr, the pilot lowered the collective control and entered a steep, descending left turn toward a small clearing. At the edge of the clearing the main rotor blades contacted a tree. The helicopter continued its descent and struck the snow-covered ground heavily. The engine was still running following impact and was shut down by the pilot.

The helicopter was substantially damaged. The pilot and two of the four passengers were seriously injured.

The accident occurred at 1130 PST during daylight hours at an elevation of 4,200 feet above sea level (asl).

1.2 Injuries to Persons

	Crew	Passengers	Others	Total
Fatal	-	-	-	-
Serious	1	2	-	3
Minor/None	-	2	-	2
Total	1	4	-	5

1.3 Damage to Aircraft

The aircraft was substantially damaged by impact with the tree and the ground.

1.4 Other Damage

There was no other damage as a result of this occurrence.

1.5 Personnel Information

	Pilot-in-Command
Age	31
Pilot Licence	Commercial
Medical Expiry Date	01 July 1995
Total Flying Time	4,684 hr
Total on Type	476 hr
Total Last 90 Days	46 hr
Total on Type Last 90 Days	46 hr
Hours on Duty Prior to Occurrence	5 hr
Hours off Duty Prior to Work Period	13 hr

The pilot was certified, trained, and qualified for the flight in accordance with existing regulations. He was familiar with the flight route.

1.6 Aircraft Information

1.6.1 General

	Particulars
Manufacturer	Aerospatiale
Type	AS 350B
Year of Manufacture	1979
Serial Number	1047
Certificate of Airworthiness (Flight Permit)	valid
Total Airframe Time	7,986 hr
Engine Type (number of)	TurboMecca Arriel 1B (1)
Propeller/Rotor Type (number of)	Aerospatiale (3)
Maximum Allowable Take-off Weight	4,300 lb
Recommended Fuel Type(s)	Jet A/B
Fuel Type Used	Jet B

The aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures. All modifications and required maintenance had been complied with. The helicopter had flown 87.7 hours since the last Phase 32, 100-hour inspection.

The engine had a total time of 1,199.4 hours since overhaul.

1.6.2 Aircraft Loading

The fuel load on departure was 440 pounds. In addition to the four passengers, whose total weight was 620 pounds, 200 pounds of cargo and skis were carried. The skis were stowed in an external ski basket mounted on the right skid gear; the cargo was placed in the baggage compartment and in the left rear area of the passenger compartment. The cargo had been secured with suitable tie-downs. The engine was running while the helicopter was being loaded.

The helicopter's maximum allowable gross weight is 4,300 pounds. On take-off, the gross weight was about 3,915 pounds, and the centre of gravity was within the prescribed limits.

1.6.3 Engine Power/*rpm Compensation*

The engine is designed to automatically increase power to compensate for a loss of Nr. In the event of a main rotor strike and a significant reduction in Nr, the engine will compensate automatically with a power increase that is likely to cause deformation in the flexible drive shaft couplings and possibly the transmission support structure.

1.7 Meteorological Information

Witnesses indicated that, at the time of departure, the visibility was about one-quarter to one-half mile in heavy wet snow. Fifteen minutes later, as the flight progressed up the valley, the snowfall lessened and the visibility improved slightly. The outside air temperature (OAT) at the accident site was minus one degree Celsius, and the wind was

light. Visual meteorological conditions (VMC) were reported at the lodge.

1.8 Flight in Snow

The aircraft flight manual states that, "...flight under falling snow is prohibited [when] visibility lower than 800 metres...".

Airworthiness Directive No. 93-067-066(B), released by Direction General de L'Aviation Civile states, in part, the following:

In order to avoid risks of engine flameout when flying in falling snow, the following measures are rendered mandatory:

Flight in falling snow:

-flight when visibility is between 800 and 1500 metres (0.43 to 0.81 NM): the total flying time in falling snow is limited to 10 minutes. This time limit includes the time required to leave all snowy conditions, irrespective of the visibility.

-flight when visibility is less than 800 metres (0.43 NM): flight in falling snow is prohibited.

Conversations with pilots and operators of this helicopter type and with a representative of the aircraft manufacturer indicate that, if falling snow presents a problem, it will result in a complete loss of engine power (flame-out), not a partial and prolonged decrease in power.

1.9 Aids to Navigation

The aircraft was equipped with an automatic direction finder (ADF) and a Loran C.

1.10 Communications - Flight Following

The aircraft was in radio contact with the operator's staging area using frequency modulation (FM) radios and FM repeater stations. Prior to the accident, the pilot established FM radio communication with the lodge through an FM repeater station and advised the lodge of his estimated time of arrival. The lodge was

radio-telephone equipped for communication with the helicopter operations base at the Golden Airport.

1.11 *Wreckage and Impact Information*

1.11.1 *General*

Following the main rotor tree strike, the helicopter yawed left and struck the ground heavily in a slight pitch down, level roll attitude. The helicopter had minimal ground speed at impact, and, except for the tail boom which separated from the fuselage, the aircraft remained largely intact. At rest, the heading of the helicopter was 050° magnetic.

The spar of the first rotor blade to strike the tree failed in overload; the spars of the other two blades did not fail although the blades were substantially damaged.

The transmission deck, which supports the transmission, was intact and had not been deformed. The forward left transmission support strut was bent in a fashion consistent with the vertical forces associated with impact.

Examination of the forward and aft flexible coupling on the engine-to-transmission drive shaft did not reveal any distortion.

1.11.2 *Ice or Snow Contamination*

The pilot and one passenger inspected the aircraft immediately following the accident and reported that there was no evidence of ice or snow accumulation on the aircraft. Wreckage examination conducted at the site within 24 hours of the occurrence established that there was no snow accumulation in the engine intake area or elsewhere on the airframe or rotor blades.

1.12 *Medical Information*

There was no evidence of any physiological or psychological factors which could have adversely affected the pilot's performance or

judgement, nor was there any evidence to suggest that the pilot was fatigued or under pressure by the helicopter operator or lodge operator to undertake the flight.

1.13 *Fire*

There was no evidence of fire either before or after the occurrence.

1.14 *Survival Aspects*

A search was initiated when the helicopter failed to arrive at the lodge. The lodge operator contacted the helicopter operator's base at Golden Airport by radio telephone and reported that the helicopter was one-half hour overdue. Another helicopter was dispatched from Golden and located the crash site. The pilot and passengers of the accident helicopter were then transported to Golden for medical attention.

The emergency locator transmitter activated but did not transmit a useful signal because the antenna had become disconnected during impact.

The injuries to the occupants were not life-threatening; the most serious of these was a back injury resulting from the high vertical forces at impact. The ground was covered by deep snow, which would have attenuated some of the vertical loads transferred to the occupants.

1.15 *Wreckage Examination and Tests*

The Turbomecca Arriel 1B turbine engine was test-run at Canadian Helicopters' maintenance facility. The engine operated normally, within specifications. No pre-impact discrepancy with respect to the engine was identified.

The fuel control unit examination and tests did not identify any fault which would have adversely affected the operation of the helicopter engine.

The wreckage examination established that there was main and tail rotor drive continuity prior to the accident.

There was collective and cyclic control continuity prior to impact. All failures in the control systems were of an overload nature resulting from impact forces.

2.0 *Analysis*

2.1 *Evidence of an Engine Power Loss*

Wreckage examination and evaluation established that the engine was likely operating at reduced power prior to the rotor striking the tree. Except for the damage to the transmission support strut which was due to vertical impact forces, there was no deformation of the transmission deck support structure. The absence of damage to the transmission deck and support structure indicates that the power delivered to the main rotor blades when they struck the tree was minimal.

Examination of the forward and aft flexible coupling on the engine-to-transmission drive shaft did not reveal any distortion or material failure. This finding supports the conclusion that when the main rotor struck the tree and slowed down, there was no sudden increase in engine power which would normally result as the engine accelerates to compensate for the loss of rotor speed. Had the engine responded to the loss of rpm on striking the tree with a sudden torque increase, the torsional load would probably have caused deformation of the flexible coupling.

2.2 *Loss of Engine Power*

The pilot reported that the aircraft experienced a partial loss of power which required him to lower the collective in order to maintain Nr. The descent angle which resulted was steep and the aircraft rotor blades contacted a tree at the edge of the clearing, the pilot's intended landing spot.

When the engine was test run it operated within normal specifications. No evidence as to the cause of the partial power loss was established.

2.3 *Flight in Snow*

Engine power loss as a result of snow ingestion was considered and rejected as a probable cause of the loss of engine power. Historically, if falling snow presents a problem, it will result in a complete loss of engine power (flame-out), not a partial and prolonged decrease in power.

Given that the engine did not flame out and that there was no evidence of snow or ice accumulation on the aircraft, it is unlikely that the partial power loss was the result of ingestion of snow by the engine.

3.0 *Conclusions*

3.1 *Findings*

1. The aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures.
2. The weight and centre of gravity were within the prescribed limits.
3. There was no evidence found of any airframe or engine defect or failure prior to or during the flight.
4. The engine power was low when the main rotor blades struck the tree.
5. The engine lost power for undetermined reasons prior to impact.
6. The pilot was certified, trained, and qualified for the flight in accordance with existing regulations.

3.2 *Causes*

It was determined that there was a partial loss of engine power; the cause of the loss of power was not established.

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 Gerald E. Bennett, Zita Brunet, the Hon. Wilfred R. DuPont and Hugh MacNeil, authorized the release of this report on 16 November 1994.

Appendix A - List of Supporting Reports

The following TSB Engineering Branch Laboratory report was completed:
LP 68/94 - Engine Fuel Components.

This report is available upon request from the Transportation Safety Board of Canada.

Appendix B - Glossary

ADF	automatic direction finder
agl	above ground level
asl	above sea level
FM	frequency modulation
hr	hour(s)
lb	pound(s)
mi	statute mile(s)
nm	nautical mile(s)
N _r	main rotor rpm
OAT	outside air temperature
PST	Pacific standard time
TSB	Transportation Safety Board of Canada
VFR	visual flight rules
VMC	visual meteorological conditions