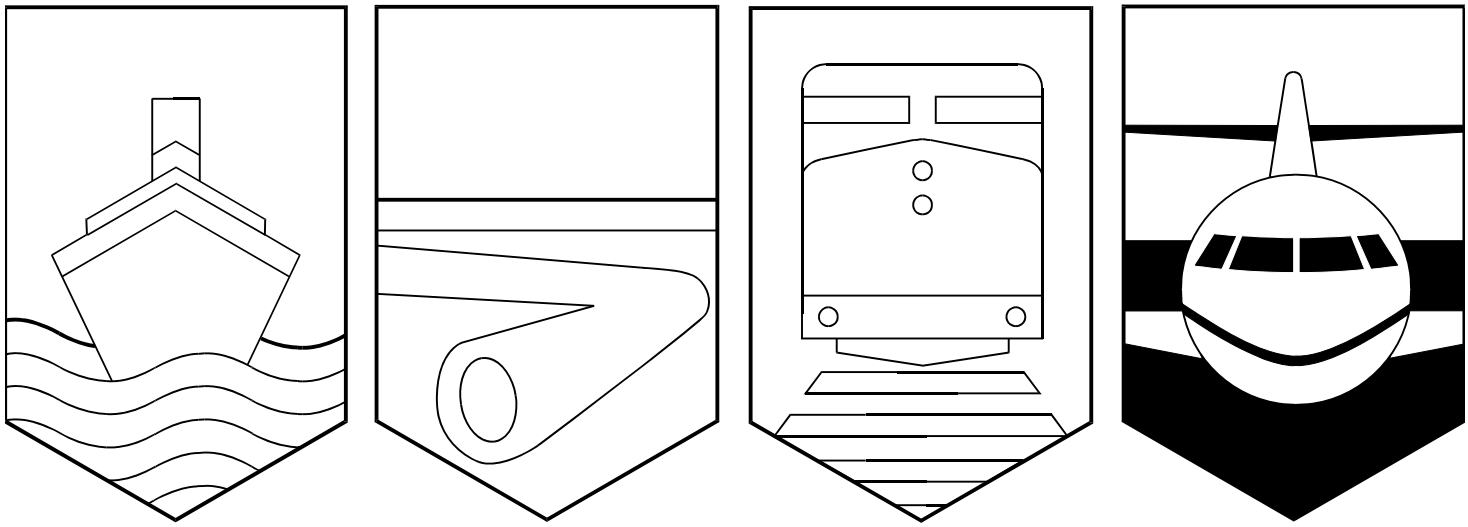
Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada



AVIATION OCCURRENCE REPORT

WIRESTRIKE

GOVERNMENT OF CANADA, CANADIAN COAST GUARD
BELL 206L (HELICOPTER) C-GCHN
MARGAREE RIVER, NOVA SCOTIA
25 FEBRUARY 1995

REPORT NUMBER A95A0040

Canada

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.

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Aviation Occurrence Report

Wirestrike

Government of Canada, Canadian Coast Guard
Bell 206L (Helicopter) C-GCHN
Margaree River, Nova Scotia
25 February 1995

Report Number A95A0040

Synopsis

The pilot of the Canadian Coast Guard helicopter departed East Margaree, Nova Scotia, on a fisheries surveillance flight with his daughter and two Department of Fisheries and Oceans officers on board. The flight was nearing completion and they were flying at a low altitude over the Margaree River when the helicopter struck a power line which spanned the river. The helicopter became uncontrollable and struck the ice-covered surface of the river. The pilot was fatally injured, and the three passengers were seriously injured.

The Board determined that the pilot did not see the power line in time to take avoidance action. Contributing to the accident were the pilot's decision to conduct the portion of the flight over the river at low altitude without having first completed a reconnaissance of the area for obstructions, and the absence of clearly defined procedures on the conduct of fisheries surveillance flights.

Ce rapport est également disponible en français.

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1.0 Factual Information

1.1 History of the Flight

The Canadian Coast Guard helicopter had been flown to the East Margaree Airport from its base in Shearwater, Nova Scotia, on the morning of the occurrence. The helicopter was to be used to conduct a Department of Fisheries and Oceans (DFO)[1] surveillance patrol in the Cape Breton Highlands and Lake Ainsley area.

After arriving at East Margaree, the pilot met with two fisheries officers and discussed the mission. The pilot then departed East Margaree with his daughter and the two DFO officers on board the helicopter. After they had inspected several lakes in the Cape Breton Highlands, the helicopter was refuelled at Neil's Harbour, on the northeast coast of Cape Breton Island. The pilot then resumed the surveillance patrol and flew to the Lake Ainsley area, and then along the western coastline of Cape Breton Island to the mouth of the Margaree River.

The pilot followed the river upstream towards East Margaree. As the helicopter was being flown over the river at low altitude, it struck a power line which spanned the river. The helicopter became uncontrollable and struck the ice-covered surface of the river.

The pilot was fatally injured, and the three passengers were seriously injured.

The accident occurred at latitude 46°24'N and longitude 061°05'W[2], at approximately 1321 Atlantic standard time (AST)[3] during daylight hours.

1.2 Injuries to Persons

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

1.3 Damage to Aircraft

The helicopter was destroyed.

1.4 Other Damage

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[1] See Glossary for all abbreviations and acronyms.

[2] Units are consistent with official manuals, documents, reports, and instructions used by or issued to the crew.

[3] All times are AST (Coordinated Universal Time [UTC] minus four hours) unless otherwise stated.

The power line was severed. Approximately 100 homes in the local area were without electrical power until a temporary replacement power line was installed the following day.

1.5 Personnel Information

	Pilot
Age	44
Pilot Licence	CPL
Medical Expiry Date	01 Feb 96
Total Flying Hours	3,813
Hours on Type	1,636
Hours Last 90 Days	42
Hours on Type Last 90 Days	19
Hours on Duty Prior to Occurrence	5.5
Hours Off Duty Prior to Work Period	20

The pilot was qualified on Bell 206 helicopters and held a valid licence. He held a valid category 1 medical with the restriction "Glasses must be available." The pilot was wearing his glasses at the time of the occurrence.

The pilot had flown these DFO surveillance flights in the past.

1.6 Aircraft Information

Manufacturer	Bell Helicopter Textron Inc.
Type	Bell 206L
Year of Manufacture	1977
Serial Number	45136
Certificate of Airworthiness (Flight Permit)	Valid
Total Airframe Time	7,157 hr

Engine Type (number of)	Allison 250-C20B (1)
Propeller/Rotor Type (number of)	Semi-Rigid (1)
Maximum Allowable Take-off Weight	3,950 lb
Recommended Fuel Type(s)	Jet A, Jet A-1, Jet B
Fuel Type Used	Jet A

Documentation indicates that the helicopter was certified, equipped and maintained in accordance with existing regulations and approved procedures.

The weight and the centre of gravity were within the prescribed limits at the time of the occurrence.

1.7 Meteorological Information

1.7.1 Meteorological Information - Sydney

The Environment Canada weather reporting station closest to the accident site is Sydney, Nova Scotia, located 47 miles to the east.

The Terminal Forecast (FT) for Sydney was issued on 25 February 1995 at 1630 UTC and was valid for the period 1700 UTC to 1700 UTC the following day.

At the time of the accident, the following conditions were forecast: broken cloud at 2,000 feet above ground level (agl), visibility greater than 6 miles, and winds from 250° magnetic (°M) at 15 gusting to 25 knots. The following variable condition was forecast during the same period: scattered cloud at 2,000 feet agl, high scattered cloud with the visibility greater than 6 miles.

The Surface Actual (SA) report for Sydney taken at 1704 UTC was as follows: measured broken ceiling at 3,000 feet agl with a second overcast layer at 25,000 feet agl. The visibility was 15 miles and the winds were 270°M at 16 gusting to 22 knots.

1.7.2 Meteorological Information - Margaree

Witnesses to the accident indicated that there was generally clear sky with good visibility. The wind was variable between 10 and 20 knots from the southwest. The sun was about 70° above the horizon and was overhead and slightly in front of the helicopter at the time of the occurrence.

The survivors described the visibility and flight conditions as very good. Turbulence was described as light.

1.8 Communications

The helicopter was equipped with serviceable very high frequency (VHF) and VHF-frequency modulated (FM) radio communication equipment. A continuous FM flight watch system was

maintained between the helicopter and the Canadian Coast Guard (CCG) Operations Centre in Sydney, Nova Scotia.

There were no recorded radio transmissions from the accident helicopter just prior to the occurrence.

1.9 Pertinent Information

1.9.1 Eyewitness Observations

The distance from the mouth of the river to the location of the wire strike is approximately 2.5 miles. Witnesses along this portion of the river saw the helicopter descend to an estimated 100 feet agl at the mouth of the Margaree River and then fly up the river at this altitude.

1.9.2 Survivor Recollections

The DFO officer who was seated in the front left cockpit seat recalled that, during the flight up the Margaree River, a small evergreen tree on the river's ice-covered surface was attracting his attention. Such small evergreen trees are known by DFO officers to be used by poachers to prevent holes cut in the ice from freezing. These holes are then used to set illegal fish nets under the ice surface.

The DFO officer could not recall any conversations in the aircraft during this short flight segment up the Margaree River. He recalled that, after overflying the small tree, the pilot completed a low-level 360-degree turn to the left. The pilot had completed the turn and had just initiated a climb when the helicopter struck the power line. The DFO officer only saw the power line after it had been struck by the helicopter. He recalled that, after the wirestrike, the pilot tried to regain control of the helicopter until the impact with the ice-covered surface.

All three survivors stated that there was no evidence of a technical problem with the helicopter at any time prior to the wirestrike.

1.10 Power Line

1.10.1 General Information

The power line was a 3/8-inch diameter, galvanized steel wire. Nova Scotia Power Inc. survey records indicate that the line was erected prior to 23 February 1940.

Immediately after the accident, a new aluminum power line was erected on the same poles. The following measurements were taken from the survey plan of the new power line:

- the total span of the power line between poles is 1,183 feet;
- the top of the pole on the west shore is 67.09 feet above datum elevation;
- the top of the pole on the east shore is 119.31 feet above datum elevation; and,

- the helicopter contact with the power line was estimated to be at an elevation of between 64 and 73 feet above the datum elevation.

The datum elevation is the Nova Scotia Control geodetic reference datum which is used on site survey plans.

Nova Scotia Power Inc. engineers indicated that the sag of the 3/8-inch diameter galvanized steel wire would have been lower than that of the newly erected aluminum conductor. The exact amount of sag of the original wire could not be determined.

1.10.2 Conspicuity of the Power Line

The power line was greyish-white in colour and provided little contrast with the ice-covered surface of the river and the higher snow-covered terrain in the background.

The power line was suspended from poles on either side of the river. Both of the supporting poles were surrounded by tall evergreen foliage and dense deciduous trees, and the cut-line normally associated with hydro lines had been overgrown with vegetation.

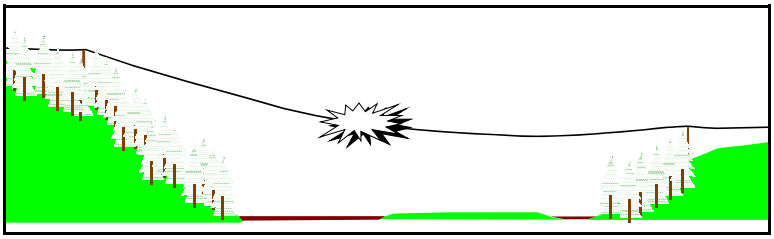

Figure 1 - Location of Power Line

The power line was not marked, nor was it required to be marked in accordance with existing regulations. In addition, the power line was not depicted on aviation navigation charts.

Following the erection of the new power line, investigators overflew the area at the approximate altitude flown by the accident helicopter. It was determined that, even with optimal vision and under ideal visibility conditions, the line and its support structure were extremely difficult to detect due to the camouflaging effect of the surrounding terrain and vegetation.

When overflown at an approximate altitude of 300 feet, the wire itself remained virtually invisible; however, the wire's support structure and the associated cut lines were visible on either side of the river.

1.10.3 Power Line Marking Requirements

The Canadian standards for marking of wires deemed a hazard to air navigation are contained in the Transport Canada publication TP 382E, *Standards Obstruction Markings*. According to these standards, wires higher than 300 feet above ground level require obstruction marking.

In certain circumstances, wires lower than 300 feet may be the subject of an aeronautical study to determine whether marking and/or lighting is necessary to increase the wire's conspicuity. Prior to undertaking such a study, the following factors are considered: the location of objects on high terrain; the surrounding topography; air traffic density; and the proximity of obstructions to water aerodromes and heliports.

As a rule, wires deemed to be a hazard to air navigation and to require marking would also be depicted on air navigation charts. No records were found of an aeronautical study having been conducted on this specific power line.

1.11 Wreckage and Impact Information

1.11.1 Power Line Impact

The helicopter was in a level attitude, about 70 feet above the river and at about the midpoint of the width of the river, flying at an estimated airspeed of 80 knots, when it struck the power line.

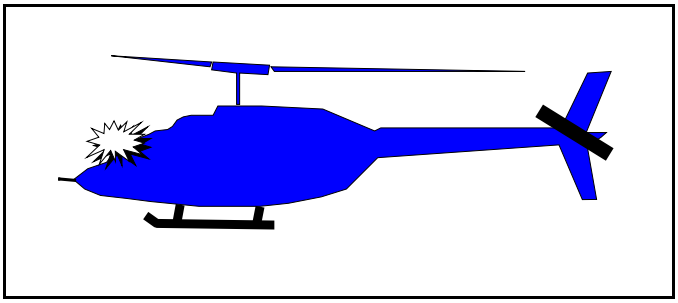

Figure 2 - Helicopter/Power Line Contact

The power line contacted the front of the helicopter in the area of the bottom of the main windscreen. The power line broke in two places: where it contacted the helicopter and where it joined onto the western pole. The broken section of the power line made contact with one main rotor blade and was then thrown forward. It was found 1,063 feet from the initial point of the power line contact.

1.11.2 Ground Impact

The helicopter was on a heading of 185°M when it struck the ice-covered surface in a nose-down, 15° right-banked attitude, 660 feet from the point of initial wire contact. The main lower fuselage section was torn away, and the fuel tanks were ruptured. After initial ground impact, the main cabin area slid forward 170 feet and the cockpit nose area was located 54 feet from the main cabin area. The total wreckage trail extended 883 feet.

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

1.11.3 Aircraft Damage

There was no evidence of pre-impact airframe failure or engine malfunction. The engine was further examined at the regional wreckage examination facility in Moncton, New Brunswick, and it was determined that the engine was operating normally at the time of impact.

Six instruments were analyzed at the TSB Engineering Branch laboratory in Ottawa, Ontario; however, only three instruments were able to provide reliable information as to their readings at impact.

1. Dual Tachometer Indicator - the power turbine pointer was indicating between 99% and 100%.

2. Torquemeter - the pointer was indicating in the 50% to 52% range.

3. Horizon Reference Indicator - the instrument indicated a 15° right bank.

The following six annunciator warning lamps were also examined: Low Rotor rpm, Engine Out, Engine Relight, Transmission Oil, Battery Hot, and Float Arm. It was concluded that these lamps were off at impact.

1.12 Medical Information

There was no evidence that incapacitation or physiological factors affected the pilot's performance.

1.13 Fisheries Surveillance Operations

1.13.1 Purpose of the Flight and Agencies Involved

The purpose of this flight was to monitor fishing activities in the Cape Breton Highlands and Lake Ainsley areas. The flight also included monitoring of the specific area of the occurrence site on the Margaree River because of a report to the DFO of illegal fishing activity.

The objective of DFO surveillance patrols is to gather intelligence with regards to any illegal activity, to obtain the identity of violators, and then to issue a warning and summons at a later time. It is not the normal practice to arrest a violator during the course of these patrols; however, DFO officers are armed and, in exceptional circumstances, are prepared to effect an arrest and transport the violator in the helicopter.

The two agencies involved in this operation were Transport Canada (TC) and the Department of Fisheries and Oceans (DFO). The personnel directly involved in the surveillance flight were the pilot from TC Aircraft Services and the two DFO fisheries officers. The helicopter was owned by the Canadian Coast Guard.

1.13.2 Flight Requirement and Operations

The fisheries patrol requires that the pilot fly at an altitude that provides adequate obstacle clearance and an airspeed that allows the DFO officers to view any activity on the ground.

Generally, an altitude of 200 to 300 feet agl and an airspeed of about 80 knots is appropriate for the flight. Whenever an item of specific interest is located, the helicopter may be flown at lower altitudes and slower airspeed depending on the circumstances.

This operation is not part of the normal CCG flying duties. Rather, it is occasionally undertaken as an extra operation, usually on weekends, when requested by DFO. There is a Memorandum of Understanding (MOU) between TC and DFO concerning the charter of these surveillance flights. This MOU contains agreement between the two agencies on administrative matters; however, the MOU does not establish the terms of reference for the operational conduct of the flight.

1.13.3 Standard Operating Procedures

There were no standard operating procedures (SOP) agreed to by the two agencies which would have delineated the duties of the persons involved in the surveillance flights, nor was any awareness training provided.

According to Degani and Wiener (1994)[4], standard operating procedures enhance coordination between agents within the system and provide a common ground for agents who may be unfamiliar with one another's experience and requirements. Typically, the system involves company crew and agents; however, the system can be extended to include anyone directly involved in flight operations, as in this occurrence, law enforcement. These standard operating procedures provide the personnel with clear guidance for carrying out the operation. Adherence to such formal standard operating procedures is widely known to enhance the safety of flight operations.

In general, SOPs exist in order to specify, unambiguously, six items:

1. What the task is.
2. When the task is conducted (time and sequence).
3. By whom the task is completed.
4. How the task is done.
5. What the sequence of actions consists of.
6. What feedback mechanism is to be used to alert management of procedural weaknesses.

1.14 Wire Strike Protection

1.14.1 Wire Strike Protection System (WSPS)

A WSPS is available for the Bell 206L helicopter under approved Supplementary Type Certificate (STC) SH4083SW. The system is engineered to prevent entry of a wire into the cockpit area, reduce the possibility of flight control damage during a wire strike, and decrease the chance of wires becoming entangled in the landing gear. The WSPS manufacturer states that the system has been demonstrated at angles up to 45° and at speeds as low as 4 mph, and that it is effective against multiple wire strikes.

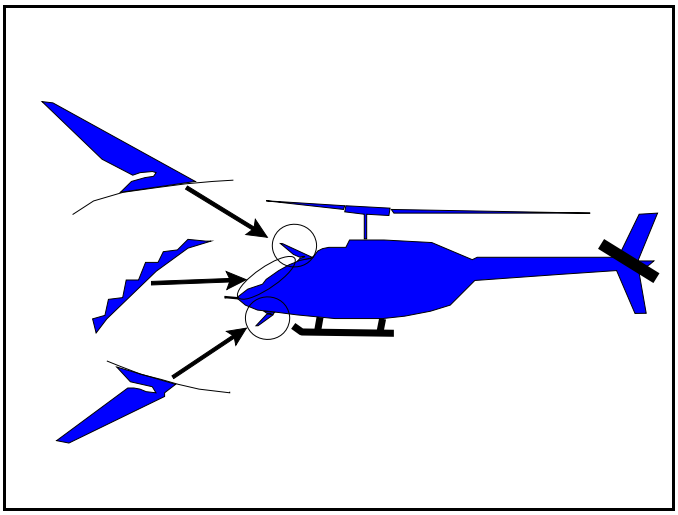

Figure 3 - Wire Strike Protection System

The system comprises three components: an upper and a lower cutter/deflector, and a windshield deflector/guide. Each is equipped with a high tensile steel sawtooth edge. The windshield deflector/guide serves to move the wire over the cockpit area and into the cutters.

The helicopter was not equipped with a WSPS, nor was one required by regulation.

[4] A. Degani and E. Wiener, "Philosophy, policies, procedures and practices: the four 'p's of flight deck operations," *Aviation Psychology in Practice*, eds. Johnston, McDonald, Fuller (Hant, England: Avebury Technical, 1994)

1.14.2 Air Carrier Advisory Circular (ACAC) 0020

On 24 April 1991, Transport Canada Aviation, Flight Standards Branch, issued ACAC 0020, which addressed the issue of wire strike protection systems. The purpose of this circular was to advise operators of rotorcraft involved in low-level special-purpose operations of the effectiveness of wire strike protection systems.

This ACAC was based on Canadian Aviation Safety Board (CASB) Safety Recommendation 90-50, which recommended that:

> The Department of Transport
> (a) energetically promote the fitment of wire strike protection systems on all helicopters engaged in low-level special-purpose operations: and,
> (b) develop appropriate legislation requiring the mandatory fitment of such equipment.

In response to the Board's recommendations, Transport Canada concluded that, because the fitment of a WSPS is not possible on all helicopters, installation of a WSPS will have to remain at the discretion of the operators. However, in its advisory circular, Transport Canada strongly urged helicopter operators to consider installation of a WSPS where possible, as the benefits greatly outweigh the costs of both equipment and crews in the event of a wire strike.

1.15 Low-Level Helicopter Flight Operations

The airspace below 300 feet agl is generally regarded by the helicopter pilot community as a hostile environment. Helicopter pilots are habitually cautioned about the increased risks of wirestrikes at these low altitudes and are warned not to venture into this airspace before taking measures to reduce the risk of a wirestrike. One such measure is the widely accepted practice of conducting an overflight of the area at a higher altitude to examine the area for the presence of obstructions, such as wires, prior to descending to low altitudes.

1.16 Passengers - DFO Surveillance Flights

On the morning of the occurrence, and in accordance with existing CCG directives, the pilot requested and received approval from the Coast Guard Operations Centre to bring his daughter along on the flight. The presence of the pilot's daughter was not essential for the conduct of the law-enforcement mission.

Sections 4.6.2, Coast Guard Flights, and 4.6.3, Hydrographic Flights, of the TC Aircraft Services *Helicopter Flight Operations Manual* (HFOM) address the carriage of passengers. Both sections state that passengers may be carried when their carriage will not interfere with the purpose of the flight.

There is no section in these flight manuals that deals specifically with the carriage of passengers on DFO surveillance flights.

1.17 Survival Aspects

1.17.1 Seat-Belts

The occupants' seat-belt buckles remained attached throughout the crash sequence. With the destruction of the cockpit/cabin area, the fuselage structures around the seat-belt attachments failed. The pilot and the two DFO fisheries officers were found lying on the ice outside of the cockpit/cabin area.

1.17.2 Fuel Spill

The fuel system incorporates three single-bladder type fuel cells, one located below and aft of the passenger seat and the other two located under each of the aft-facing passenger seats. All three fuel cells burst during the impact sequence and a significant quantity of fuel pooled in the vicinity of the final resting place of the main wreckage and its occupants.

All persons on board were soaked by the pooled fuel, which resulted in substantial chemical burn injuries to the occupants.

1.17.3 Emergency Locator Transmitter (ELT)

The ELT was affixed to the bottom frame of the windshield, inside the cabin just in front of the passenger door. The ELT became detached from the helicopter during the crash sequence and was found on the ice in the "OFF" position. The ELT mounting location is approved by Transport Canada. TSB investigations of previous accidents with similar ELT mounting locations indicate that the ELT is vulnerable to becoming detached from the helicopter during the crash sequence.

Pilots and aircraft maintenance engineers indicated that, as part of their daily inspection, they check the security of the ELT but not the switch position. Evidence indicates that the ELT had been in the "OFF" position for some time prior to the accident flight.

1.17.4 Pilot Protective Helmets

Helicopter Directive Number AAFDB-9 of the TC HFOM addresses the use of protective helmets. This directive states as follows:

> Effective immediately, for personal protection, all pilots and engineers shall wear protective helmets when engaged in helicopter operations. When justified, exceptions may be granted by AAFDB for medical and physical dimensions. In case of unserviceability, a headset will be worn until such time as the helmet can be repaired.

The pilot was not wearing his helmet during the flight. His helmet was unserviceable and had been sent to the TC repair facility in Ottawa four days prior to the accident. The pilot was wearing a headset in accordance with the above-mentioned directive. Additional helmets were available in the Coast Guard facilities in Shearwater. It was reported that it was highly likely that the occurrence pilot was not aware of the availability of these helmets.

The TC HFOM has no existing provisions for the wearing of helmets by passengers on specialty low-level flights.

The three survivors suffered varying degrees of head injuries. Although the pilot also suffered some head injuries, these head injuries were determined to be relatively minor.

2.0 Analysis

2.1 General

The aircraft records indicate that the helicopter was certified, equipped, and maintained in accordance with existing regulations and approved procedures. The examination of the aircraft wreckage revealed no pre-impact control failures or engine malfunction. Based on this information and on the survivors' recollections that there were no apparent mechanical problems prior to the occurrence, a control or other mechanical malfunction is not considered a likely factor in this occurrence. Similarly, in light of the known visibility and in-flight conditions, weather is not considered a factor either.

Several elements specific to this occurrence affected the pilot's ability to see the unmarked power line during the low-level flight. The 3/8-inch diameter of the power line presented a very small visual target which, at a distance, even under ideal circumstances, would have been virtually invisible. The power line's support structures were difficult to detect due to the surrounding foliage. Moreover, the greyish-white power line itself blended with the ice-covered river and snow-covered surrounding terrain.

Based on witness observations and survivor recollections, as well as the inconspicuousness of the power line, it was determined that the pilot did not detect the power line in time to take avoidance action. The analysis will explore several operational elements associated with this event.

2.2 Conduct of Low-Level Flight

It could not be determined why the pilot descended below the normal fisheries surveillance flight altitude of 200-300 feet during the final segment of the flight without first doing a reconnaissance of the area at a higher altitude.

There were no apparent operational requirements for the pilot to descend as low as he did without having first completed a reconnaissance of the area, nor did the pilot make any comments which would explain his intentions.

Had a reconnaissance overflight been conducted, it is possible that the power line or its associated support structure would have been observed and the flight profile could have been altered accordingly.

2.3 Fisheries Surveillance Operations

This surveillance operation involved two organizations. Each organization had its own role in the mission: Transport Canada to fly the aircraft safely and DFO to spot illegal activity and conduct related law-enforcement operations. While the two roles were quite distinct, they were closely linked and complemented one another.

Despite the relationship between the two roles, and the differences between them, the agencies did not meet to discuss operational requirements or to reach agreement on in-flight procedures.

In the case of the accident flight, had standard operating procedures been in effect for such elements as altitudes, airspeeds, and reconnaissance overflights prior to descents to low altitudes, the risks inherent within the mission would have been mitigated, ensuring a safer and more predictable operation.

2.4 Marking of Power Line

This power line was erected prior to 23 February 1940, and this occurrence was the first reported aviation accident related to the line. The fitment of markers on the power line would have made the line more visible and increased the possibility of it being detected by the pilot. Had an aeronautical study been conducted on this specific power line, it is likely that the power line would not have been marked for several reasons. The height of the power line above the Margaree River was well below the altitude expected to be flown by helicopters or fixed wing aircraft. In addition, that portion of the Margaree River is not on a visual flight route normally flown by helicopters or other aircraft, nor is the power line in the vicinity of an aerodrome or heliport.

2.5 Wire Strike Protection Systems

As ACAC 0020 recommends, the installation of WSPS equipment on helicopters engaged in low-level operations can only enhance the safety of the operation.

In this accident, the helicopter contacted the wire in a position where WSPS has been demonstrated to be effective. Had this helicopter been fitted with a WSPS, it is very likely that the power line would have been cut. In that event, the outcome of the occurrence would likely have been considerably less severe.

2.6 Passengers - DFO Surveillance Flights

The carriage of non-essential passengers is not specifically addressed in the TC HFOM; however, in general, passengers may be carried in the helicopter when their presence will not interfere with the purpose of the flight.

Notwithstanding the hazards posed by the law-enforcement nature of the flight, helicopter fisheries surveillance flights require that the helicopter be flown at low altitudes for extended periods. The carriage of non-essential passengers on such high-risk, low-level operations unnecessarily exposes additional persons to the dangers inherent in such operations.

3.0 Conclusions

3.1 Findings

1. The pilot was certified and qualified for the flight in accordance with existing regulations.

2. The helicopter was certified, equipped, and maintained in accordance with existing regulations and approved procedures.

3. There was no evidence of pre-impact airframe failure or engine malfunction.

4. The power line was not marked nor was it required to be marked by regulations.

5. The helicopter contacted the power line in the area of the bottom of the main windscreen.

6. No operational requirement or reason could be found that would explain why the helicopter was being flown as low as it was without first having overflown the area to ensure that the area was free of wires or other obstacles.

7. There was no formal agreement in place between TC and DFO establishing the terms of reference of the operation, nor was there communication between the two agencies regarding the risks associated with this type of operation.

8. No standard operating procedures for this type of surveillance operation were available to the pilot, nor was any awareness training provided.

9. The helicopter was not equipped with a WSPS, nor was one required by regulation.

10. Had this helicopter been fitted with a WSPS, it is very likely that the power line would have been cut.

11. The ELT became detached from the helicopter during the crash sequence and was found on the ice in the "OFF" position.

12. The pilot was not wearing his helmet during the flight.

3.2 Causes

The pilot did not see the power line in time to take avoidance action. The pilot's decision to conduct the portion of the flight over the river at low altitude without having first completed a reconnaissance of the area for obstructions, and the absence of clearly defined procedures on the conduct of fisheries surveillance flights were contributing factors in the accident.

4.0 Safety Action

4.1 Action Taken

4.1.1 ELT Arming

The ELT was found intact on the river surface with the function switch in the "OFF" position and intact. The absence of damage to the switch and the area surrounding the switch led to the conclusion that the ELT was in the "OFF" position prior to impact. It could not be determined when the "OFF" selection had been made.

Transport Canada pilots have been reminded to follow the Standard Operating Procedures regarding the confirmation of the ELT armed switch location. During a check, or training flight, the position of the switch would be a debriefing point if it were not checked.

4.1.2 Passengers - DFO Surveillance Flights

Helicopter fisheries surveillance flights require that the helicopter be flown at low altitudes for extended periods. The carriage of non-essential passengers on such high-risk, low-level operations unnecessarily exposes additional persons to the dangers inherent in such operations.

Transport Canada has issued instructions to preclude the carriage of passengers on board aircraft conducting specialty operations.

4.1.3 Wire Strike Protection Systems

In this accident, the helicopter contacted the wire in a position where WSPS has been demonstrated to be effective. The Board notes that devices are being developed to warn crews of wires and cables.

The installation of WSPS on all Transport Canada's helicopters will be completed within 15 months. By December 1995, each region will have at least one helicopter equipped with a WSPS.

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 Maurice Harquail, authorized the release of this report on 08 November 1995.

Appendix A - List of Supporting Reports

The following TSB Engineering Branch Report was completed:

LP 37/95 - Instrument Analysis.

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

Appendix B - Glossary

ACAC	Air Carrier Advisory Circular
agl	above ground level
AST	Atlantic standard time
CASB	Canadian Aviation Safety Board
CCG	Canadian Coast Guard
CPL	Commercial Pilot Licence
DFO	Department of Fisheries and Oceans
ELT	emergency locator transmitter
FM	VHF frequency modulated
FT	terminal forecast
HFOM	Helicopter Flight Operations Manual
hr	hour(s)
inc.	incorporated
knots	nautical miles per hour
lb	pound(s)
MOU	Memorandum of Understanding
mph	miles per hour
SA	Surface Actual Weather Report
SOP	standard operating procedure
STC	Supplementary Type Certificate
TC	Transport Canada
TSB	Transportation Safety Board of Canada
UTC	Coordinated Universal Time
VHF	very high frequency
WSPS	Wire Strike Protection System
°	degree(s)
°M	degrees of the magnetic compass

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

*Services available in both official languages

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
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17803 - 106 A Avenue
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24 Hours (403) 495-3999
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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
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24 Hours (604) 666-5826
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