



FLIGHT SAFETY FOUNDATION

HELICOPTER SAFETY

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For Everyone Concerned with the Safety of Flight

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Too Fast and Too Low

A fatal chain of events began with inadequate preflight preparation and ended with insufficient inflight safety precautions.

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by

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The Canadian Aviation Safety Board (CASB), Report Number 87-H70001, dated March 20, 1990, contains a caveat that states, "It is not the object of the Board to determine or apportion any blame or liability." However, the synopsis states, "The helicopter was being flown at low altitude over Lac Grand when it struck unmarked wires strung between the mainland and an island. The pilot and four members of a television film crew were fatally injured when the aircraft crashed into the water immediately after striking the wires. The Canadian Aviation Safety Board (CASB) determined that the pilot operated the aircraft at high speed and low altitude without adequate pre-planning for the flight or reconnaissance of the area."

Setting the Scene For Disaster

On 16 May 1987, the Hughes 500C helicopter was supporting two other company helicopters used for sightseeing at sites in Gatineau and Ottawa. After being fully refueled at Gatineau Airport, the pilot flew to a temporary heliport at a shopping center in Gatineau where he found

that the other helicopters could handle the existing sightseeing traffic. He then flew to the Ottawa site to confer with a company pilot operating there but, while on the ground, was recalled to the Gatineau site to take a television crew for a short local flight to obtain film footage for an upcoming fish and game show.

When he returned to Gatineau, the pilot remained in the helicopter with the engine running while he spoke to the police constable who was organizing activities at the temporary heliport. The policeman told the pilot to be back at the heliport in five minutes, because a later return would be in conflict with other planned activities.

Meanwhile, the television crew, consisting of a soundman, a cameraman and two announcers, boarded the aircraft. The aircraft took off immediately.

A videotape recovered from the wreckage showed that the helicopter flew to the north end of Lac Grand, then turned northwest to fly over the east shore of Lac MacArthur. The pilot then followed an easterly track to the eastern tip of Lac de la Montagne where a descending right turn to the southwest was completed. He leveled the aircraft

at 10 to 20 feet (skid height) above the water and headed down the lake at an indicated airspeed of about 105 knots. At the end of that lake, he turned left and climbed slightly to clear the trees and a cottage on the neck of land between Lac de la Montagne and Lac Grand.

Once clear of the trees, the pilot again descended to about 20 feet and headed toward the bay north of Round Top Island and Puddington's Island. Left and right turns were made to pass between Puddington's and Round Top. He then initiated a left turn, climbing slightly, and entered the channel between Round Top and the mainland. While still in the turn, at about 35 degrees of bank and in a relatively level pitch attitude, the helicopter simultaneously struck a Hydro-Quebec power line and a Bell Canada telephone line which were strung across the channel.

The helicopter momentarily pitched nose-up, then pitched nose-down and rolled to the right. At this point, the videotape ended. The helicopter flew directly into the water after it struck the wires and sank immediately. There were no survivors.

The accident occurred at 1202 hours Eastern Daylight Time (EDT). The weather was reported as scattered clouds at 10,000 feet and 26,000 feet asl (above sea level), visibility 15 miles, wind 220 degrees at 12 knots.

Aircraft Wreckage Revealed No Faults

There was no evidence of a pre-impact airframe failure or engine malfunction. The damage to the axial compressor section of the engine showed that the compressor was still rotating when airframe distortion, that occurred as a result of the water impact, broke the air intake. The shaft between the engine and main transmission failed as a result of torsional overload, indicating the engine was producing power when the rotor system was suddenly decelerated.

A black rub mark on the left front landing gear leg was assessed as having been caused by the telephone wire. The lower portion of the leg contacted the wire which then slid up to the step area and broke.

Evidence indicated that the initial contact with the power line was directly into the main rotor swash plate area. There was evidence of wire contact on two of the main rotor blades but it could not be determined whether this occurred before or after the wire was engaged by the hub. The wire was snagged by the arms of the rotating swash

plate early in the sequence and was wrapped around the rotor head. This action pulled, then broke all the main rotor blade pitch control rods, severing the collective and cyclic pitch control and made the helicopter uncontrollable.

Full Use of Restraints May Have Helped Occupants

An autopsy was completed on the pilot, but not on the other occupants. The pilot's death was attributed to a ruptured aorta, possibly following a heavy impact to his upper back and complete rupture of the spine. The spinal injury was about 24 inches high on his back. The right front seat passenger also suffered a spinal injury at about the same height.

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All occupants were using lap belts and, except for the right front seat belt, all the lap belts failed. Shoulder harnesses were available at the two front cockpit positions but were not worn. Laboratory tests showed that the lap belts failed when subjected to a tensile force of 2,100 pounds — assuming an average occupant weight of 175 pounds, a deceleration force of at least 12 Gs would be required to break the belt. Because one belt did not fail, the CASB concluded that the horizontal de-

celeration forces were in fact about 12 Gs. This force is within the generally accepted range for survivable impacts if proper restraints are used.

The lap belt anchor for the left front seat failed as a result of extensive local structural damage caused by the impact. The other belts failed because the belt webs were overloaded. Tensile strength tests of two samples of belt webbing confirmed the acceptability of the belts in accordance with existing requirements.

The CASB determined that had the available shoulder harnesses been used, the severity of some injuries would have been reduced. This was evident in the case of the pilot, whose injuries probably resulted from the lack of upper body forward and rearward restraint. The medical investigation noted the similarity of the heights of back injuries to both the pilot and the right front seat passenger and the height of the seat backs.

Factors That Affected the Pilot

The pilot, age 37, received his commercial rotorcraft license on August 17, 1973. He was employed as a helicopter pilot operating from a variety of bases throughout the Province of Quebec and other parts of Canada until

1985, when he joined the company he was employed by at the time of the accident. He had significant experience in the aerial application of pesticides and in low-altitude flight operations.

The pilot was company vice president and chief of operations, chief pilot and part-owner of the company. On the day before the accident, he had completed preparations to buy the balance of the company shares in order to become the sole owner of the company.

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

At the request of the CASB, a psychologist completed a factors analysis which focused on the pilot's normal work habits, his emotional well-being and his ability to deal with stress. Lifestyle stresses, work-related stresses and stress related to the fatal flight were examined including local stresses such as fatigue leading to lapses in concentration or pressure from the client to carry out high-risk activities.

The pilot had agreed initially to limit the flight to five minutes but a longer flight was carried out. The analyst stated that the pilot may have experienced some pressure as a result and concluded that this could have led to a momentary lapse of concentration.

The analyst concluded that there were no predisposing factors which would have caused the pilot to change his flying habits. However, the analyst could not ascertain whether there was pressure on the pilot from the television crew to carry out the low-level flight. He noted that any commercial helicopter pilot is likely to experience some role conflict from time to time between his responsibility as a pilot and the need to please clients to ensure commercial success. He also noted that this conflict may be particularly sharp when the pilot is also a senior executive or part-owner of the company.

Customers were surveyed to determine whether the pilot had done any low-flying operations in their presence and, if so, under what circumstances. Answers were that the pilot did not conduct unsolicited low flying and that, on occasion, had refused to fly low when asked to do so if it was not required for the operation or was contrary to regulations. When required to fly at altitudes at or below 100 feet above ground level, he completed a thorough aerial reconnaissance first, then carried out the exercise at very low airspeeds. There was also evidence that he was conscious of wires and similar hazards to low-flying aircraft. (There were no reports that the helicopter performed a low altitude flight at low speed near or over the

accident site that morning.)

Taking a Close Look At Pilot Decisions

The CASB found no evidence that prior arrangements had been made for the flight. At the takeoff site, the pilot stayed in the aircraft and spoke only to the policeman who was organizing the sightseeing flights. He did not leave the aircraft or consult with anyone else on the ground, including his company representative. There was insufficient time on the ground for detailed discussion with the television crew as to the route of flight.

The fact that the pilot took off at a weight approximately 300 pounds above the maximum permissible takeoff weight (not considered to be contributory to the accident) is indicative that the normally prudent pilot did not use good judgment.

Given the pilot's local knowledge, it would not have been unusual for him to embark on this type of operation with only a general plan for the flight, and the five-minute duration set by the policeman may have influenced him to depart quickly. Such an approach would, however, have dictated careful airborne planning and reconnaissance at the film site if a high-speed, low-altitude flight was contemplated.

The safety board determined that the helicopter was flying near its maximum speed just prior to the wire strike. It could not be determined whether or not the pilot was responding to pressure to carry out the low-altitude flight, or if he was attempting to complete the filming quickly in order to return to the shopping center site. The CASB concluded that the decision to fly at high speed and low altitude through an area which he had not previously surveyed was not characteristic behavior by this pilot.

Unmarked Wires Lay in Waiting

Later flight surveys of the area established that the wires struck by the helicopter, which had not been marked, blended with the background and were not conspicuous. It was also established that, although the wires or their supporting poles would likely have been seen by a helicopter pilot conducting a careful low-altitude, low-speed survey, they could not be easily spotted by the pilot of any aircraft overflying them at cruise speed at a height of 300 to 500 feet agl (above ground level).

The helicopter engaged both wires in a way that a wire

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flight.***

strike protection system would not likely have functioned. The pitch links in the rotor system failed when the power line was wound around it and, as a result, the aircraft became uncontrollable.

CASB Expresses Safety Concerns

To the CASB, this accident provided another disturbing example of an experienced pilot who operated his aircraft without his usual careful attention to preflight preparation and in-flight safety precautions.

Although no Canadian statistics are readily available, the U.S. Federal Aviation Administration (FAA) Office of Aviation Medicine has estimated that 52 percent of fatal and 35 percent of non-fatal accidents involve pilot judgment errors. FAA research suggests that a possible explanation for this is that traditional pilot training programs stress the acquisition of flying skills while judgment or decision-making is regarded as a offshoot of flying experience.

Reading Between the Lines In Search of Underlying Causes

Government accident reports deal with facts. Given the fact that the pilot was depicted as one who normally adhered to sound safety practices, why would there be a radical departure from his normal procedures? Can suppositions be built into the accident scenario?

Here is a pilot, soon to become the sole owner of the company he worked for, who accepted an unplanned flight to take a television crew on a filming flight and who was given a restriction to limit the flight to five minutes by a police constable, a person who probably had little knowledge of the scope of the intended flight. The fact that the four-man television crew (no mention is made of the equipment each or all may have carried) created an overload probably did not concern the pilot. There was apparently no time to review or discuss any of the normal safety practices before or during aircraft loading.

After the flight became airborne, who would dictate the route of flight and the altitudes. The television crew? The pilot? One supposition would be that the television crew was determining where and at what altitude the aircraft was to go. The pilot, who probably had the five-minute flight time limitation on his mind, probably was concerned with airspeed and, consequently, chose higher rather than lower airspeeds to make the flight of a shorter duration.

This normally prudent and safe pilot apparently chose

not to make a low-speed reconnaissance flight to check out the area. Why not? This supposition could be twofold. One, he had some familiarity with the area (The CASB reported that he had conducted a recent real estate evaluation flight in the same area.) and did not deem it necessary. Two, the time it would take to make the reconnaissance flight would extend the duration of the flight beyond the five-minute limitation which, obviously, could not be met.

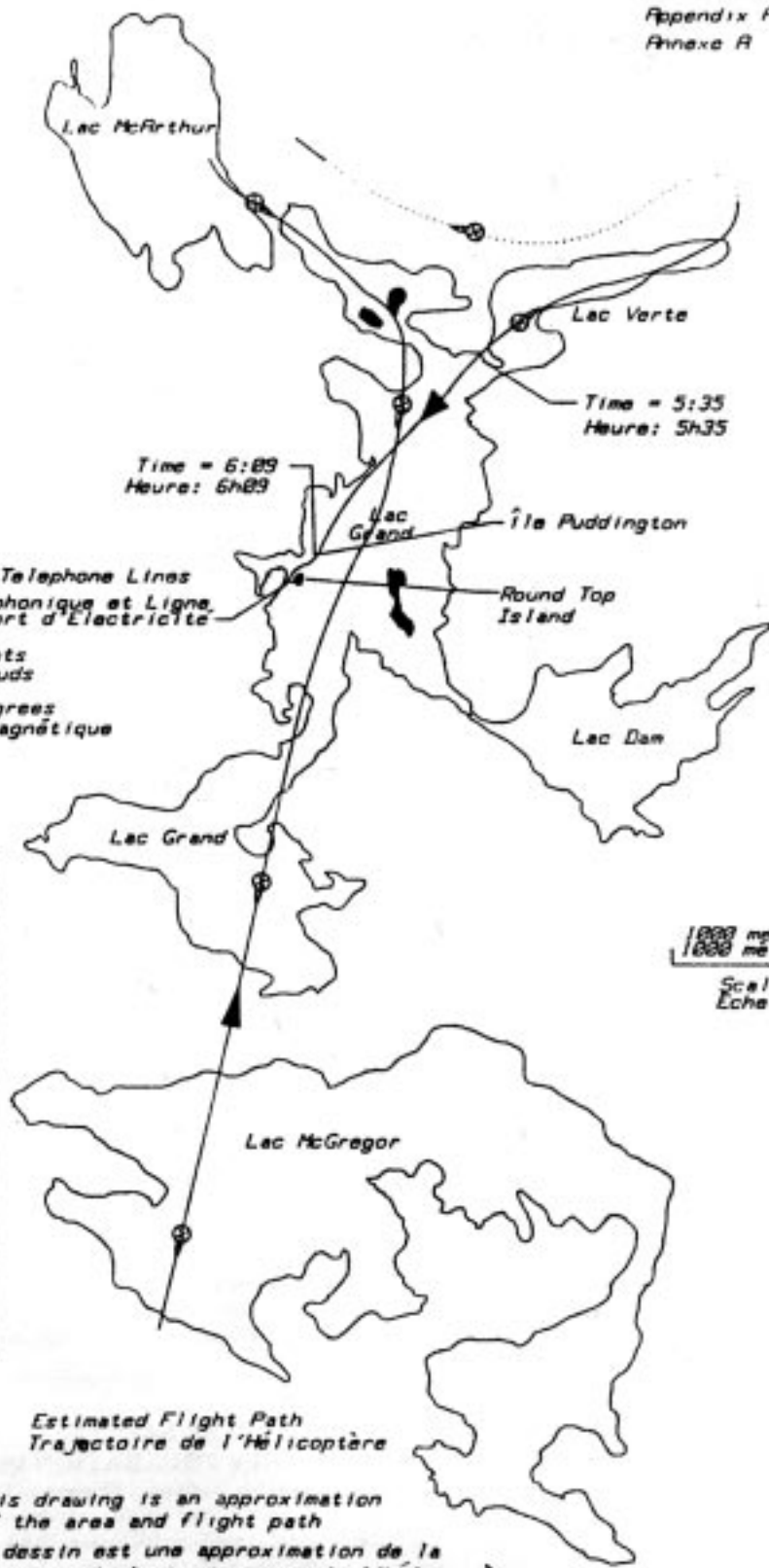
Considering the absence of pre-planning, is it possible to imagine cockpit conversation between the pilot and the television crew composed of a soundman, a cameraman and two announcers? One of the television crew had to be directing the photography and telling the pilot where to position the helicopter; the pilot had to respond to the positioning instructions, and he had to fly the helicopter. Given the conversation and the possible positioning of the television crew in the cockpit, can the supposition be made that there was enough activity to distract the pilot from flying the helicopter and from paying attention to the potential hazards outside the aircraft?

Would the pilot, who on the next day be the sole owner of the company, have a concern about repeat business and be anxious to accommodate to the extent that safety precautions would be lessened or ignored? The supposition would lean toward a concern about customer satisfaction but not to the extent of overriding safety precautions.

In Flight Safety Foundation's July/August 1990 issue of *Helicopter Safety*, "Decision Making for Air Ambulance Administrators," reference is made to a 1980 Canadian study of personality traits that had the goal of developing tools to select pilot and air traffic controller candidates. Approximately 25 helicopter student pilots, 80 fixed-wing student pilots and 60 air traffic controllers were tested.

The study showed that helicopter pilots were indeed different than the other pilots tested. Helicopter pilots tended to be low in conformity. They expressed a need to control others. The author of the study also suggested that persons with this type of personality may be easily influenced. More specifically, they can succumb to pressures of the situation or be coerced into a high-risk situation. In addition, helicopter pilots scored very high in their need for "achievement." This study indicated that the "can do" attitude is an inherent personality characteristic of the successful helicopter pilot.

Does the aforementioned study provide more clues to the pilot's behavior on the accident flight? If he fit the pattern described, the answer would be "yes" to being easily influenced and "yes" to succumbing to the pressures of the situation.



Hydro & Telephone Lines
Ligne Téléphonique et Ligne
de Transport d'Electricité

Wind 12 knots
Vent 12 noeuds
Mag. 228 degrees
228 degrés magnétique

Time = 6:09
Heure: 6h09

Time = 5:35
Heure: 5h35

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| | Video camera off caméra arrêtée |
| | Helicopter Hélicoptère |

1000 metres
1000 mètres
Scale
Echelle

Estimated Flight Path
Trajectoire de l'Hélicoptère

Note: This drawing is an approximation of the area and flight path
Remarque: Ce dessin est une approximation de la Région et de la trajectoire de l'hélicoptère

Derived From Figure 1 of Engineering Project LP89/87
Tiré de la Figure 1 du Projet d'Ingénierie LP 89/87

The article makes this prophetic observation: "The (pilot) motivational factors, combined with the slow speed and high maneuverability of the helicopter and the mindset that the helicopter can land almost anywhere, strongly contribute to a chain of poor decisions which, unless broken, may result in an accident. In essence, the pilot's attitudes predispose him to making the go decision even when the situation, his training and standard operating procedures indicate that it is not a safe decision."

This Canadian helicopter accident is very similar to a number of other helicopter accidents worldwide. And, because those accidents continue to happen, the need to educate, inform and train must be re-emphasized. ♦

About the Author

John A. Pope established John A. Pope & Associates, an aviation consulting firm located in Arlington, Va., U.S., after retiring in 1984 as vice president of the U.S. National Business Aircraft Association. He specializes in developing comprehensive operations manuals for corporate flight departments.

Pope, former Washington editor for "Aviation International News," is a frequent contributor to Flight Safety Foundation's publications.

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