HCL No 62/96 (accident)

Aircraft:	Ecureuil AS350 B1, OY-HEC	Year of Manufacture: 1987
Date and time:	13 September 1996 at 1515 UTC	
Location:	Mouth of the Ice Fjord, Ilulissat, Greenland	6910.23N 05109.87W
Nature of damage:	Destroyed	
No & type of engines:	1 Turbomeca Arriel 1D	
Type of flight:	Other commercial operation (photography), VFR	
Commander:	48 years of age, BH licence	
Flying experience:	9876 hours of which 712 hours were on type	
Persons on board:	Crew - 1	Passengers - 1
Injuries:	Crew - Serious	Passengers - Fatal
Source of information:	Telephone information from the company, report (HCL FORM 1) submitted by the pilot and the investigations made by the Aircraft Accident Investigation Board	

FACTUAL INFORMATION

History of the flight

The company was under contract to carry out a number of flights in connection with the filming of scenes for a feature film. The last sequence, the filming of a dummy representing a submarine periscope, was to be shot at the mouth of the Ice Fjord at Ilulissat. As wind and weather conditions were favourable on 13 September 1996, the last flight was planned for the afternoon of that day.

The photographer, who was very skilled, also had great experience in filming from a helicopter. It was therefore the photographer who arranged the equipment needed for the shooting. The left-hand rear passenger seat was folded so that the space could be used for equipment. Batteries for operating the equipment were placed on the floor and were secured behind the left-hand pilot seat. Cables and wires for the hand-held equipment that the photographer would use were passed to the left (on the far side) of the photographer's seat. Flight controls, collective, cyclic and pedals were removed from the left-hand side of the cockpit.
Before take-off the pilot checked that the equipment was secure and that the photographer had put on both his lap and diagonal belts.

After take-off from Ilulissat airport the pilot flew east of the town directly to the position in the Ice Fjord. On arrival the pilot radioed the boat that carried divers and other assistants. The boat had gone on ahead and had already taken up its appointed position.
In order to prepare for shooting, a test flight to the selected area was made, and the approach was made without any problems. When the pilot was making his second test approach, the photographer asked him to abort the approach and find a place to land as he had problems with his photographic equipment.

The approach was aborted and the photographer began working with his equipment to find the fault. This meant that he moved around in his seat a lot and - having placed the equipment on a shelf in front of his seat - he turned the upper part of his body and reached backwards to the area behind his seat.

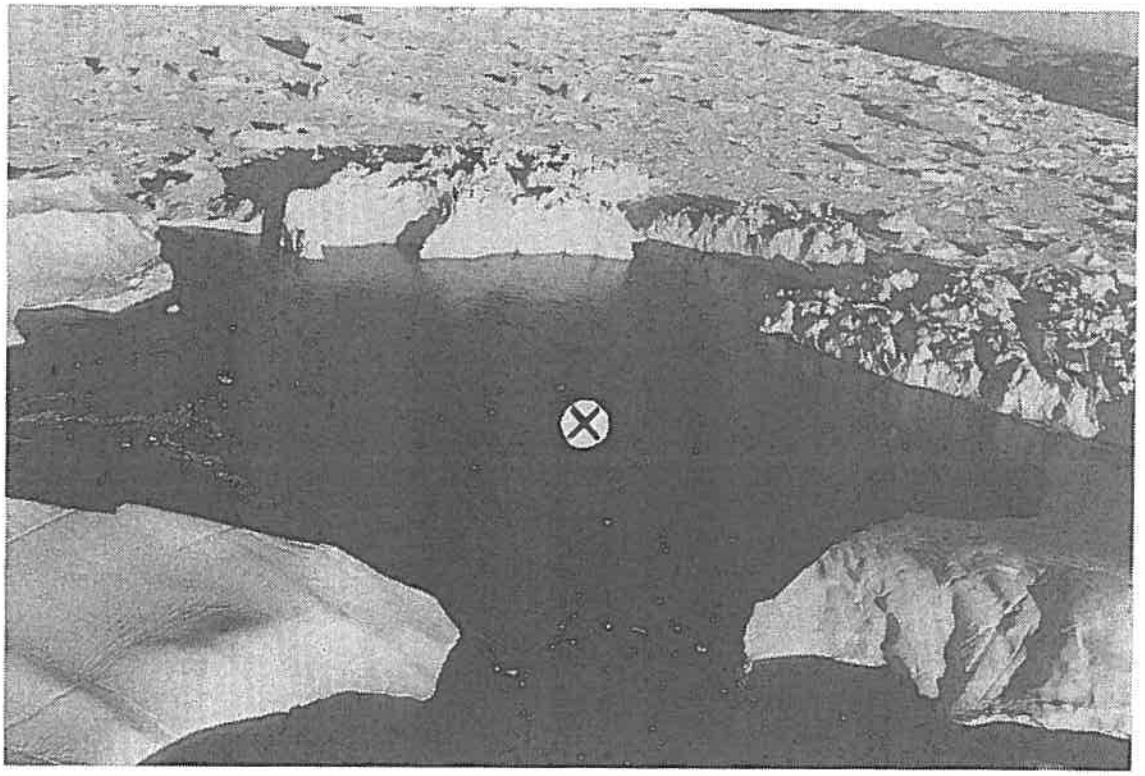
Shortly afterwards the photographer said that the equipment was now working again, and the pilot began another approach. Although the pilot was concentrating on flying the aircraft he noticed that the photographer again turned in his seat and reached behind him as though he had problems with the

equipment again. However, as the pilot was not asked to abort the approach, he continued as previously agreed.

At a height of 100 ft the pilot felt some movements in the helicopter (like turbulence or gust) and the warning horn for low rotor RPM started. The pilot immediately began an autorotation and at the same time as by reflex he reached with his left hand to the fuel control lever and found that it was in an unusual position "somewhere between open and closed". The pilot quickly pushed the lever down to open position but did not feel the expected increase in the engine/rotor effect.
The pilot has stated that at this point he experienced problems in judging the attitude and height of the helicopter in relation to the glassy sea. His next reaction was therefore to deploy the armed emergency floatation gear system of the helicopter. However, before the pilot had time to break the safety guard of the switch, the helicopter hit the surface of the water, tipped onto its back and sank.

Below the surface of the sea the pilot succeeded in releasing himself from his safety belts, getting free of the helicopter and swimming to the surface where he was picked up by the staff on the auxiliary vessel.

Despite an intensive search the passenger (the photographer) was not found and is presumed killed.



The site of the accident

Investigations made by the Aircraft Accident Investigation Board

The weight and balance of the helicopter were not a factor in these events.

According to the Flight manual, section 2, page 3, item 8.1 Main Rotor Speed the revolutions of the main rotor are: ***In stabilized flight - - - 390 +4/-5 RPM.***

The warning horn in the cockpit is sounded in the following circumstances:

An intermittent signal when:	The hydraulic pressure drops below 30 BAR.
An intermittent signal when:	The main rotor revolutions exceed 410 revolutions.
A constant signal when:	The main rotor revolutions drop below 360 and 250 revolutions.

The helicopter sank at a point in the mouth of the Ice Fjord where the depth is 250-300 metres and where there is a constant movement of large icebergs and ice floes. Consequently, for both technical and safety reasons, search and lifting of the wreckage is impossible.

The pilot has stated that the helicopter had no technical problems of any kind before take-off, and that during flight - until the engine failed - the helicopter had operated without problems.

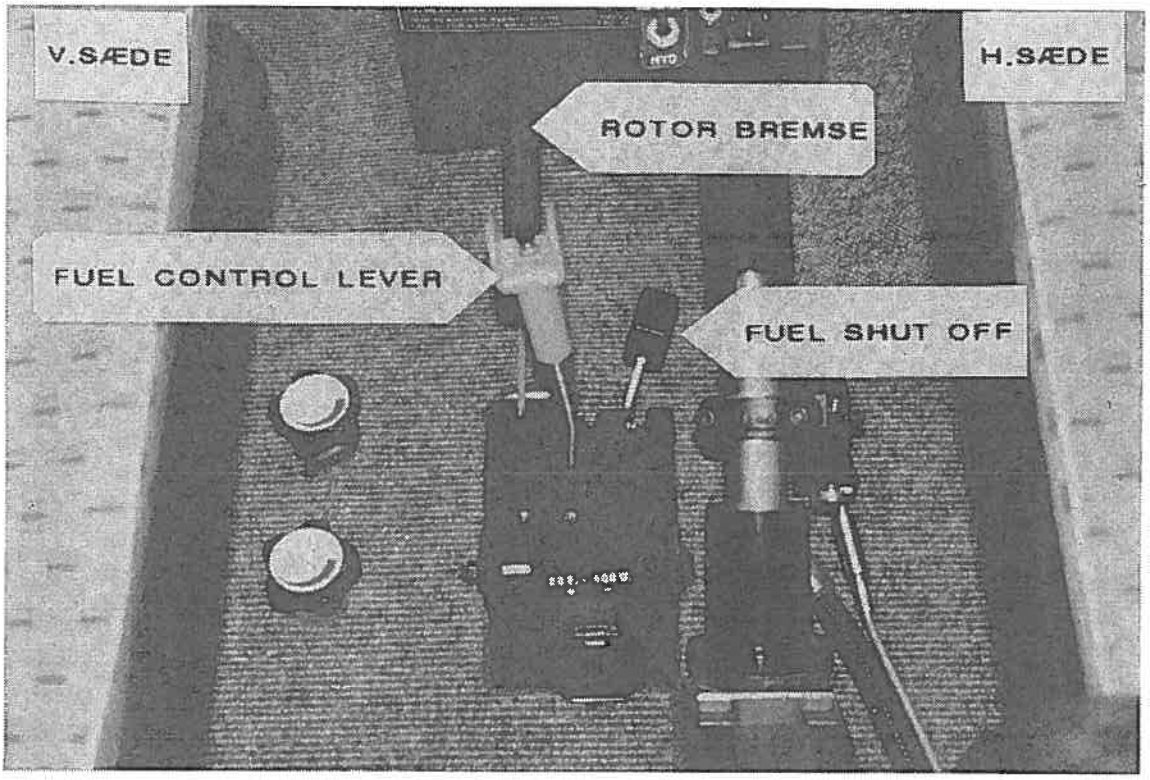
After the accident the Aircraft Accident Investigation Board reviewed all the available technical documentation for OY-HEC. The documentation was not found to contain any mistakes or omissions.

Based on these findings it is the opinion of the Aircraft Accident Investigation Board that the engine failure that resulted in the pilot losing control of the helicopter at a critical stage during flight cannot be attributed to any technical problem with the helicopter.

Fuel Control Lever

The helicopter type AS350 B1 is not equipped with a conventional "helicopter throttle" - a so-called twist grip mounted as a handle on the collective.

On the AS350 B1 the fuel control lever is mounted in the centre of a console which is installed on the floor between the forward end of the two pilot seats. The rotor brake lever is mounted to the left of the fuel control lever and the emergency fuel shut off lever is placed to the right in the console.
All three levers are moved between the horizontal and the vertical plane in cut-outs in the console. The cut-outs are provided with notches for the functions of the levers. The normal positions of the rotor brake and the emergency fuel shut off levers are horizontal level with the floor.
When the engine is stopped, the fuel control lever is in a vertical position, slightly spring-loaded, in the top notch. When the engine is started, the lever is moved out of the notch and a little forward/downward. This movement turns on the fuel. By pressing the starting push button, which is at the top of the lever, the ignition procedure begins and the engine starts. The idle revolutions are found by moving the lever until the number of revolutions is established.
When full power is required, the lever is steadily moved approx. 25-30 mm further down to the next notch, where it is held in place by a slight spring-load. In this position the lever is unprotected at an angle of approx. 45° to the floor (as mentioned the rotor brake lever and the emergency fuel shut off lever are level with the floor).
The fuel control lever is left in this position during take-off, flight and landing. The varying fuel requirement of the engine during its various operations is controlled automatically.
The lowest position of the lever - level with the floor - is an emergency position that is only used if the automatic function should fail.



The fuel control lever console

The engine failure

As mentioned in **History of the flight** the photographer moved about in his seat quite a bit, when he experienced problems with his equipment. He also turned his upper body round and reached behind him for equipment or in an attempt to correct the problem.

Although the pilot did not notice it, it is possible that the photographer during these movements has released his diagonal and lap belts to get freedom of movement.

- As the fuel control lever must necessarily have been in the normal full power notch during take-off, flight to the target area and during the first two approach runs (otherwise the manoeuvres could not have been executed) and

- As the pilot as a reflex reached for the fuel control lever and found it "somewhere between open and closed"

it is the opinion of the Aircraft Accident Investigation Board that during his movements in and around the left-hand seat the photographer may unintentionally have pushed the fuel control lever out of the notch and up towards idle/shut down. A distance equal to approx. 25-30 mm in the cut-out.

On inspection of a similar helicopter the Aircraft Accident Investigation Board attempted to duplicate the sequence of events and found that the position of the lever in normal operations may easily be disturbed by an accidental action by a person in the left-hand seat.

It is the opinion of the Aircraft Accident Investigation Board that the engine most probably was stopped. Had the engine been running in - or nearly in - idle, when the pilot quickly moved the lever down full to power, the sudden supply of fuel to a "slowly" running engine would have resulted in some sort of explosion.

During its investigations the attention of the Aircraft Accident Investigation Board was drawn to an almost identical incident which happened in 1993. The mission here was also photography, but in this case it was the straps attached to the equipment that accidentally got caught in the fuel control lever and moved it towards the idle position. At the critical moment the helicopter was in a sufficient altitude so that the pilot could manage to restart the engine and carry out a normal landing.

In connection with the investigations into the accident with OY-HEC at Ilulissat on 13 September 1996 it has been ascertained that there are various aspects concerning the construction of the helicopter type AS350 B which make it possible that during flight the fuel control lever may be unintentionally touched and moved to a position that jeopardizes the safety of the helicopter and the persons on board.
The situation arises when the left-hand front seat is occupied by a passenger, for instance a photographer, and the flight controls, collective, cyclic and pedals have been removed on the left-hand side. In the opinion of the Aircraft Accident Investigation Board in these circumstances it is quite easy to "happen to" push against the unprotected fuel control lever either with the right foot/heel or with equipment placed on the floor.

In consequence the Aircraft Accident Investigation Board therefore recommends that

The Civil Aviation Administration consider implementation of a system to protect the fuel control lever on the AS350 B helicopter types when during flight the lever is in the normal flight operation position in which it is unprotected at an angle of approx. 45° to the cockpit floor.
The protection shall prevent a passenger in the left-hand seat from unintentionally touching and moving the fuel control lever, thereby jeopardizing the safety of the helicopter.
The protection system must be easy to install as it shall only be in place when the left-hand front seat is occupied by a passenger. (REC-11-96).