

CIAIAC

**Comisión de Investigación
de Accidentes e Incidentes
de Aviación Civil**

A-036/2001

TECHNICAL REPORT

**Accident of EUROCOPTER
AS-350-B3, registration
F-OHCU, in Gorges de Nuria,
Queralbs (province of
Girona) on 26 June 2001**

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MINISTERIO
DE FOMENTO

SECRETARÍA GENERAL
DE TRANSPORTES

COMISIÓN DE INVESTIGACIÓN
DE ACCIDENTES E INCIDENTES
DE AVIACIÓN CIVIL

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FOREWORD

This report is a technical document that reflects the point of view of the Civil Aviation Accident and Incident Investigation Commission (CIAIAC) regarding the circumstances of the accident and its causes and consequences.

In accordance with the provisions of Law 21/2003 and Annex 13 to the Convention on International Civil Aviation, the investigation has exclusively a technical nature, without having been targeted at the declaration or assignment of blame or liability. The investigation has been carried out without having necessarily used legal evidence procedures and with no other basic aim than preventing future accidents.

Consequently, any use of this report for purposes other than that of preventing future accidents may lead to erroneous conclusions or interpretations. This report has originally been issued in Spanish language. This English translation is provided for information purposes only.

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ABBREVIATIONS

°C	Degrees Celsius
E	East
EEPROM	Electrical Erasable Programmable Read Only Memory
h: min: seg	Hours, minutes and seconds
kg	Kilogram(s)
kw	Kilowatt(s)
lb	Pound(s)
m	Metre(s)
N	North
N/A	Not applicable
SHP	Shaft Horse Power
VEMD	Vehicle and Engine Multifunction Display
VFR	Visual Flight Rules

SYNOPSIS

The helicopter model AS-350-B3 "Ecureuil" (Squirrel in French), manufactured by EUROCOPTER, registration mark F-OHCU, departed at around 7.00 h local time on June 26th, 2001, from the so-called "Ripollés Base" for the transportation of persons and equipment to the construction, consolidation and maintenance works of protection barriers preventing stone chippings falling to the rack railway line which links Queralbs to "Santuario de Nuria" (Nuria Shrine) through the Nuria gorge.

For disembarking the first occupant, the helicopter touched slightly the ground with a skid and after the first occupant and his equipment had already disembarked, the tips of the blades of the main rotor hit the rocks, impacted with the slope, and caught fire.

The aircraft was totally destroyed and the three occupants who stayed on board were fatal.

The investigation has concluded that the probable cause of the accident was the loss of control of the aircraft due to the impact of the main rotor with the rocks of the mountain while an occupant was disembarking. It has been considered as contributing to this consequence:

1 The physical characteristics of the landing zone that did not have enough obstacle clearance.

2 The lack of coordination between the pilot and the occupants due to a poor flight planning, the lack of previous knowledge of the zone by the pilot and the difficulties of mutual understanding due to the language.

1 FACTUAL INFORMATION

1.1 History of the flight

The helicopter model AS-350-B3 "Ecureuil" (Squirrel in French), manufactured by EUROCOPTER, registration mark F-OHCU, departed at around 7.00 h local time on June 26th, 2001, from the so-called "Ripollés Base" an area which had been conditioned for its operation close to the municipality of Queralbs (Girona), for the transportation of persons and equipment to the construction, consolidation and maintenance works of protection barriers preventing stone chippings falling to the rack railway line which links Queralbs to "Santuario de Nuria" (Nuria Shrine) through the Nuria gorge.

The flight had been operating regularly for several months, and was used by a number of local companies in order to transport personnel and equipment. In particular, the flight to which this report refers to, was operated under VFR rules and took off with four occupants on board. Landing was to take place in Sabadell airport.

Disembarking of personnel and equipment was to take place on a small, almost horizontal ledge (see diagram in Appendix A), its width being under two metres, following an inclined path at the steep rocky face where the aforementioned rack railway tracks are located. The ledge is situated in the upper part of the mountain, some 1,600/1,700 metres of altitude and at 200 metres from the end of the first tunnel of rack railway tracks in the Nuria direction.

The helicopter touched slightly the ground with a skid and after the first occupant and his equipment had already disembarked, the tips of the blades of the main rotor hit the rocks, impacted with the slope, and caught fire.

The wreckage of the helicopter was scattered within a radius of approximately two hundred metres downhill, and the three occupants who remained on board at the time of the accident sustained fatal injuries. The fourth occupant, who had already disembarked, was rescued later, without any physical injuries but under a strong emotional shock.

1.2 Injuries to persons

INJURIES	FATAL	SERIOUS	MINOR/NONE
CREW	3		1 ¹
PASSENGERS			
OTHERS			

1.3 Damage to the aircraft

Due to the nature of the accident, which involved explosion and fire, and the area in which it occurred, very steep and rock terrain, the helicopter was virtually burnt to ashes and its wreckage was scattered, as mentioned above, within a radius of some two hundred metres. Some parts of the wreckage rolled downhill due to the steep incline finally resting on the tracks of the rack railway line (see Appendix B).

The helicopter was completely destroyed.

1.4 Other damage

The undergrowth and part of the scrubland caught fire which had to be extinguished by the fire brigade helicopters.

1.5 Personnel Information

1.5.1 Pilot in command

Age: 35 years

Nationality: French

Licence: Commercial Pilot Licence Helicopter

¹ The occupant who suffered no injuries had already left the helicopter at the time of the accident.

First issued: October 27th, 1995

Licence:

- Renewal date: April 30th, 2001

- Expiry date : April 30th, 2004

Ratings: For helicopter models:

- S 313/318 from 1995
- HU30 from 1995
- HU 50 from 1999
- S 555 from 1999
- S 315/316/319 from 1999
- A 47G/BH 47 from 1999
- S 350 from 2000
- AS 350 B3 from 2001

Total flying experience: 2266 hours, 38 minutes.

Hours in this model: 35 hours, 10 minutes.

Hours, last 90 days: 35 hours, 10 minutes (including 8.30 hours of type rating training for this model).

Hours, last 30 days: 26 hours, 40 minutes.

Hours, last 48 hours: 2 hours, 35 minutes.

The pilot had been contracted by the company on 2/05/2001, approximately two months before the accident.

According to the information provided by the operator, the pilot was qualified to perform mountain aerial works and he had done other flights with sling and in mountainous areas before the accident.

According to the surviving occupant, who used to fly that route, the pilot were not the ones that usually covered that route. In fact, he did not know the pilot.

The person who flew beside the pilot spoke both French and Spanish perfectly. The other two occupants did not speak French.

1.6 Aircraft information

1.6.1 Airframe

Manufacturer: EUROCOPTER

Model : AS-350-B3
Manufacture No: 3288
Year of Manufacture:2000
Registration : F-OHCU
M.T.O.W.: 2,250 kg (4,960 lb)
Operator: HELIUNION FRANCE – COMMERC’AIR
Owner: HELITRANS (Andorra) for HELISWISS IBÉRICA, S. A.

1.6.2 Airworthiness Certificate

Number: 25089
Type: French Type Certificate 84.
Date of issue: April 12th, 2001
Expiry date: April 13th, 2003

1.6.3 Maintenance log

Total flying hours: 456:10 hours as of June 25th, 2001
Last 100 hours inspection: March 14th-27th, 2001.
Hours since last 100 hours inspection: 68:52 hours

1.6.4 Engine

Engine: Turbomeca
Model: Arriel 2B
Power: 847 SHP (equivalent to 632 kw)
Serial number: 2213

Total hours: 456:10 hours as of June 25th, 2001 (*)

Last 100 hours inspection: March 14th-27th, 2001 (*)

Hours from the last 100 hours inspection: 68:52 hours (*)

(*) They fully match the airframe information.

1.7 Meteorological Information

No detailed meteorological information is available on the site of the accident and it is a well-known fact that at high mountain altitudes, local conditions may change very quickly.

The general forecast for the area was sunny with some local storms including lightning and scattered showers.

None of the statements obtained in connection with the accident includes a reference to relevant meteorological conditions in the area or to any influence of the prevailing weather conditions in causing the accident.

1.8 Aids to navigation

It is not considered that the availability of these aids may have any bearing on this accident.

1.9 Communications

It is not considered that their use may have any bearing on this accident.

1.10 Aerodrome information

Not applicable.

1.11 Flight recorders

The helicopter did not have any flight recorder. They are not mandatory for this type of aircraft.

However, the helicopter had a VEMD (Vehicle and Engine Multifunction Display) system installed, which provides information on a number of parameters of the aircraft and the engine such as revolutions per minute of the compressor, turbine temperature and torque. This system is used for maintenance and flight operation purposes.

Additionally, this equipment stores in EEPROM memory, the last half hour of operation which was sent to the manufacturer for its decoding.

According to the information retrieved from the VEMD, there was an overtorque of 140%, which is the maximum value that this equipment can record.

1.12 Wreckage and impact information

The accident took place in the vicinity of the rack railway line between Queralbs and Santuario de Nuria (Nuria Shrine), through the Nuria gorge. This is a high mountain region of difficult access surrounded by a steep craggy rock face. The site is mostly uninhabited, although it is a tourist site accessed by the rack line.

The vegetation of the zone is composed by scrubland and bushes.

The helicopter touched the ground with the right skid on an almost horizontal 2 meters width area of the mountainside.

Once the rotor blades stroke the rock wall, the helicopter lost the control and impacted against the nearby rocks.

The wreckage of the helicopter was scattered within a radius of some two hundred metres downhill from the point of impact. Some of the wreckage burnt, particularly, the main rotor mast and some of the blades which caused local fires.

Studying the wreckage you could see that the right forward door was on the highest area. On the right, 10 meters downhill, was the main rotor and some blades. Following the slope there was a blade beside the helicopter lower fuselage and at last, very close to the railway track, it was the tail cone almost without damages.

1.13 Medical and pathological information

The three occupants of the helicopter at the time of the accident (the fourth occupant had already disembarked) were located dead nearby the site of the accident, the first at some 50 m NE from the tail of the helicopter, the body was almost completely charred; the second body was found some 20 m N of the first

one, it was partially charred, evidencing traumatic brain injuries and the third body, at some 20 m from the second one, also partially charred.

1.14 Fire

As already mentioned, following the explosion, fire burst out and the helicopter was almost completely burnt to ashes, except its tail, and the existing vegetation in the area caught fire, mainly low shrubs and brambles, within a radius of 200 m from the point of impact.

1.15 Survival aspects

At 7.34 h (local time) the ground flight operator contacted with the police reporting that he had heard a loud explosion in the mountain which he linked to the helicopter which was operating in the area of Barrier 9.

The rescue teams were alerted and a special rack train was dispatched to the Nuria junction, and burnt parts of the helicopter were found in the railway tracks after the first tunnel, and on seeing the fire, they climbed a steep mountain trail which led them to the rest of the wreckage and to the three corpses in the positions and location already mentioned. The photographs included in Appendix B provide a detailed view of the location of the wreckage.

The fourth occupant was located a short time later by the rescue teams, some two hundred metres East, in good physical state but under severe emotional stress.

Considering the nature of the accident, combining explosion and fire, and the terrain where it took place, a rocky steep and almost inaccessible site, there was virtually no chance of survival for the occupants of the aircraft.

1.16 Test and Research

1.16.1 Statement of witnesses

The most revealing declaration concerning the accident was made by the occupant who disembarked from the helicopter and who was rescued in good physical condition, although under severe emotional stress some two hundred metres East from where the corpses were found.

From the statements provided by this witness, the following may be highlighted:

- At around 7.00 hours (local time), he had gone to the municipality of Queralbs in order to board the helicopter which was to transport him to the area in which barriers were being set up in order to prevent stone slides.
- A few minutes after seven, he boarded the helicopter with the other occupants. They arrived to the site where they were to disembark, an area towering some 300 metres above the rack railway line with a steep incline.
- The helicopter pilot did not seem to know the area where he was to disembark and he made two approach manoeuvres; the first one was aborted and the second one was successful. The helicopter pilot flying the aircraft on that day was not the usual pilot and it was the first time he had flown with him.
- He unloaded the equipment and when he bent down to avoid the wind generated by the rotor, he noticed that some part of the helicopter brushed his leg and then he heard a thud as if the helicopter had collided with something, and immediately afterwards he heard a loud explosion.
- It was then that he suffered a nervous breakdown and he does not remember anything else.

The remaining statements obtained regarding this accident have been provided by employees of the companies who had hired or used the helicopter but they did not witness the accident and therefore could not offer any additional information for its analysis.

Additional details known subsequently indicate that the helicopter involved in the accident was replacing the one which was regularly operating this flight but which at the time was undergoing its maintenance inspection.

1.17 Organizational and management information

1.17.1. Flight Operation Manual

According to the Operations Manual prepared by the operator, as far as qualification and training of the pilot are concerned, the following requirements must be met:

- Aerial work pilots must hold a “Declaration of Level of Competence” in accordance with their experience and task they usually carry out, for which they have been properly monitored.
- Whenever a new pilot is hired, a proficiency check flight will be carried out (mountain or sling) after which the pilot will be considered suitable for the operation or will continue his training phase.

Regarding the operation, the Operations Manual states:

- The pilot in command has the authority to put off or cancel any flight to ensure compliance with regulations in force, aircraft flight manual contents and flight safety aspects.
- It is required a minimum period of time of 30 minutes to prepare every mission (in sling flights). This preparation time is also applicable to the helicopter mechanics, even if he is not a member of the crew.
- In the “recommendations” section it is stated that the cohesion of the team is important to optimum positioning of the helicopter and for the adequate course of the operation.
- In the helisurface section it is stated that it will have a square flat area of at least 4 m per 4 m.
- The human factors section points out the following aspects to be taken into account in every flight:
 1. The difficulty in calculating the distance to mountain walls.
 2. The importance of becoming familiar with the mission.
 3. Solutions involving too many uncertain factors must be discarded.
 4. The acceptance of risks must be carefully considered while maintaining safety margins.
 5. The management of every available resource to perform safe and efficient operations.
 6. Control of the both the internal and external pressure.

In the Operation Manual, the sections regarding sling and crane operations it is stated that no passenger will be able to be on board and if it is necessary someone from the company or from the customer can participate in the flight.

2 ANALYSIS

2.1 General

According to the available information, the helicopter manufactured by EUROCOPTER, model AS-350-B3 "Ecureuil" (Squirrel), registration marks F-OHCU, departed from the runway especially prepared for this type of use, from the so-called "Ripollés Base", located in the municipality of Queralbs, at 7 hours and a few minutes, (local time), in order to operate a flight under VFR rules. This helicopter, with its crew, replaced the one which usually operated this route, as it was undergoing maintenance inspection.

The purpose of the flight was the transportation of personnel and equipment from some companies to the construction, maintenance and consolidation works to avoid stone slides which are being conducted in the local area and which may not be accessed in any other way. The helicopter departed with four occupants, two of which, at least, would disembark during the flight and landing was expected to take place at Sabadell airport.

Meteorological conditions were adequate for this type of intended flight and it seems unlikely that they played any part in the accident.

2.2 Analysis of the information obtained from the wreckage

Once the accident site was inspected, it was noticed that there were marks on the rocks, probably due to the impact of the rotor blades.

This fact was confirmed by the data extracted from the recorder the aircraft had installed. Among them, the torque value of 140% must be highlighted. This is the maximum recordable torque value, and it largely exceeds the values achieved during normal flight conditions. It is considered that this value was reached when the main rotor blades hit the rocks. At that moment, the breakage of the shaft that joins the engine with the main gear box started and the torque began to descend to zero.

2.3 Assessment of the operation

2.3.1. Flight planning

During the flight preparation phase and according to the statement of the survivor, a briefing between the crew and the occupants was not carried out, as required by the Operations Manual. During that briefing they could have defined

the mission of every person on board and how to carry out the disembarking operations.

The helicopter that took off from Ripollés at 7:00 h and the pilot were not the ones that usually covered that route. In fact, the surviving occupant, who used to fly that route, did not know the pilot, who was replacing other pilot that usually flew that flight.

The pilot also did not know the zone, and therefore it maybe thought that he was not very familiar with the flight. This could be the reason why he had to carry out two approaches.

Additionally, language could have been a barrier because the pilot was French and two of the occupants could not speak his language.

With all the previous information, it is possible to suppose that they did not form a solid team, against the content of the Operations Manual, which in turn implies that the workload of the pilot during the operation is increased.

This lack of coordination probably forced the pilot to check that the person disembarking reached a safe place and closed and locked the door. To carry out that check, the pilot would have had to turn his head to the right to look rearwards, which could have produced an unconscious movement of the cyclic control with the result of the blades hitting the rocks.

2.3.2. Selection of disembarking area

The site to disembark was a very small mountain side flat area some 2 meter width. The recommended area of a helisurface should have 4 x 4 m as a minimum.

In this situation, the pilot should have selected a wider area, as stated in the Operations Manual, to allow for a safer operation, but this site was routinely used to disembark occupants and the pilot was probably told to carry out the disembark there.

It is possible that the helicopter pilot was somewhat prone to land on an unsuitable zone. The history of routine use of that place to land probably encouraged the pilot to adopt this solution. The most appropriate course of action would have been to look for a more suitable zone.

2.4 Crew training aspects

The pilot was qualified to perform mountain aerial works and, according to the information provided by the operator, before the accident flight he had done other flights with sling and in mountainous areas in accordance with the statements of the Operations Manual. Therefore, the pilot training was initially adequate.

3 CONCLUSIONS

3.1 Findings

- The pilot had a current Commercial Pilot Licence for Helicopters , and its rating included helicopters of model AS 350 B3.
- The helicopter was of recent manufacture, and its Airworthiness Certificate was in force and it had cleared the last 100 hours inspection according to its Maintenance Programme, and the Maintenance works had been carried out by a duly certified organization.
- The meteorological conditions were suitable for a flight under VFR rules.
- The operation was not carried out in accordance with the Operations Manual, which caused that the pilot and the occupants did not act as a united team.
- The zone selected for the disembarking of the occupant did not comply with required dimensions of a helisurface according to the Operations Manual of the Operator.

3.2 Causes

The probable cause of the accident was the loss of control of the aircraft due to the impact of the main rotor with the rocks of the mountain while an occupant was disembarking.

Contributory factors could have been:

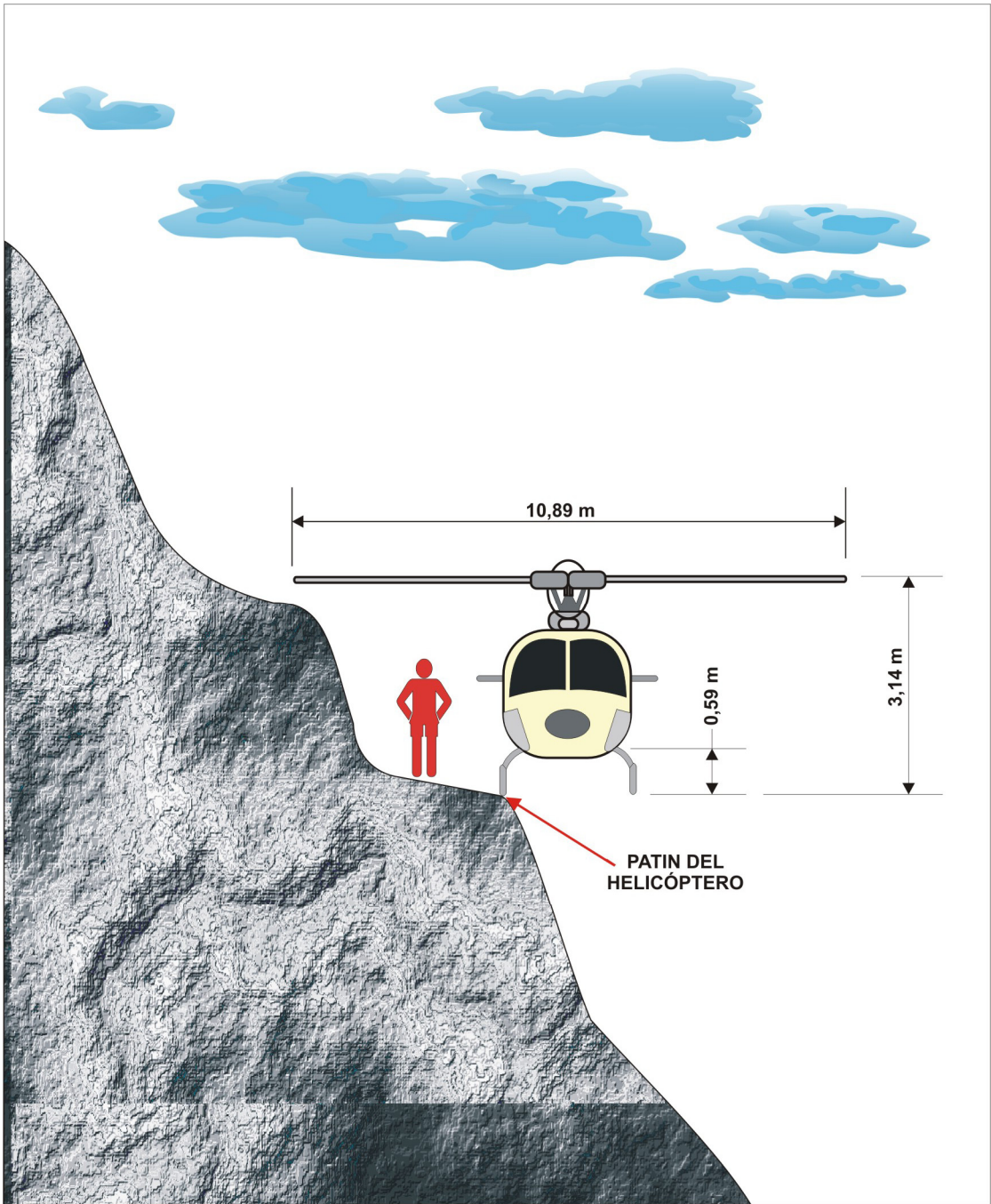
1. The physical characteristics of the landing zone that did not have enough obstacle clearance.
2. The lack of coordination between the pilot and the occupants due to a poor flight planning, the lack of previous knowledge of the zone by the pilot and the difficulties of mutual understanding due to the language

4 SAFETY RECOMENDATIONS

None.

APPENDIX A

Zone of the accident



ANEXO B

Location and damage to the wreckage of the main elements of the helicopter



Figure 1.- Tail boom



Figure 2.- Engine



Figure 3.- Main rotor hub