CIAIAC

COMISIÓN DE
INVESTIGACIÓN
DE ACCIDENTES
E INCIDENTES DE
AVIACIÓN CIVIL

Report A-011/2009

Accident involving
a Eurocopter AS 350 B3,
registration EC-IOJ, in Mollet
del Vallés (Barcelona),
on 22 June 2009

GOBIERNO DE ESPAÑA
MINISTERIO DE FOMENTO

Report

A-011/2009

Accident involving a Eurocopter AS 350 B3, registration EC-IOJ, in Mollet del Vallés (Barcelona), on 22 June 2009

GOBIERNO DE ESPAÑA
MINISTERIO DE FOMENTO
SUBSECRETARÍA
COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

Edita: Centro de Publicaciones
Secretaría General Técnica
Ministerio de Fomento ©

NIPO: 161-12-073-9

Diseño y maquetación: Phoenix comunicación gráfica, S. L.

COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

Tel.: +34 91 597 89 63
Fax: +34 91 463 55 35

E-mail: ciaiac@fomento.es
http://www.ciaiac.es

C/ Fruela, 6
28011 Madrid (España)

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 object of the investigation, and its probable causes and consequences.

In accordance with the provisions in Article 5.4.1 of Annex 13 of the International Civil Aviation Convention; and with articles 5.5 of Regulation (UE) n° 996/2010, of the European Parliament and the Council, of 20 October 2010; Article 15 of Law 21/2003 on Air Safety and articles 1, 4 and 21.2 of Regulation 389/1998, this investigation is exclusively of a technical nature, and its objective is the prevention of future civil aviation accidents and incidents by issuing, if necessary, safety recommendations to prevent from their reoccurrence. The investigation is not pointed to establish blame or liability whatsoever, and it's not prejudging the possible decision taken by the judicial authorities. Therefore, and according to above norms and regulations, the investigation was carried out using procedures not necessarily subject to the guarantees and rights usually used for the evidences in a judicial process.

Consequently, any use of this report for purposes other than that of preventing future accidents may lead to erroneous conclusions or interpretations.

This report was originally issued in Spanish. This English translation is provided for information purposes only.

Table of contents

Abbreviations

00°	Degrees
00 °C	Degrees centigrade
ARM	Armed
ATZ	Aerodrome Traffic Zone
ATPL(H)	Airline Transport Pilot License (helicopter)
CPL(H)	Commercial Pilot License (helicopter)
DGAC	Dirección General de Aviación Civil (Spain's Civil Aviation Authority)
EASA	European Aviation Safety Agency
ELT	Emergency Locator Transmitter
FAA	Federal Aviation Administration (USA)
ft	Feet
GRAE	Grupos de apoyo de actividades especiales (Special Activity Support Group)
h	Hour(s)
hPa	Hectopascal(s)
IR(H)	Instrumental Rating (Helicopter)
kt	Knot(s)
km	Kilometer(s)
LH	Left Hand
m	Meter(s)
METAR	Aerodrome Meteorological Report
MHz	Megahertz
min	Minute(s)
QNH	Barometric pressure adjusted to sea level
RH	Right Hand
S/N	Serial number
SAR	Servicio Aéreo de Rescate (Air Rescue Service)
STC	Supplemental Type Certificate
UTC	Coordinated Universal Time
VFR	Visual Flight Rules

Synopsis

Owner and operator:	TAF HELICOPTERS, S.L.
Aircraft:	Eurocopter AS 350 B3; S/N 3701
Date and time of accident:	22 June 2009; 11:45 UTC[1]
Site of accident:	Mollet del Vallés (Barcelona)
Persons onboard:	2, deceased
Type of flight:	Aerial work – Commercial – Firefighting
Date of approval:	28 June 2012

Summary of accident

On 22 June 2009, an Eurocopter AS 350 B3 helicopter took off with two persons onboard from the Sabadell (Barcelona) airport at 11:17 en route to the Mollet del Valles area to take part in a firefighting operation. The helicopter, equipped with a belly tank that is attached to a fill pump via a hose, was picking up water from a pond near the site of the fire. It was the third or fourth refilling operation. According to eyewitness accounts, as the helicopter climbed it was dragging a rope attached to the fill pump. After climbing a few meters, the tank emptied its contents and the rope shot upwards, becoming entangled in the main rotor and dragging with it the fill pump, which impacted the main rotor blades. The helicopter immediately started descending in a parabolic trajectory until it impacted the ground. The two occupants onboard the aircraft perished as a result of the impact and the aircraft was destroyed.

[1] All times in this report are in UTC. To obtain local time, add two hours to UTC.

1. FACTUAL INFORMATION

1.1. History of the flight

On 22 June, two fires broke out in the region of Vallés Oriental, one in the locality of Les Franqueses del Vallés and the other in Parets del Vallés, specifically in a farming field located on the Can Serra road. As a result of the latter fire, two firefighting teams were activated, along with two civil protection teams and the local police from Parets del Vallés, as well as the aerial resources from the base in Sabadell, which were taking part in fighting the fire in Les Franqueses. These included a firefighting coordination helicopter, callsign H-02, and another helicopter from the Catalonia Firefighters Service, registration EC-IOJ and callsign B-41, which was engaged in the actual firefighting efforts.

At 11:14, the helicopter with callsign B-41, an Eurocopter AS 350 B3, contacted ATC at Sabadell Airport requesting clearance to take off. According to the tower's control card, it took off at 11:17. At 11:19 the crew reported being in the vicinity of point E[2].

Their intention was to proceed to the area of Mollet del Valles to take part in the firefighting operation. The helicopter was equipped with a belly tank that was attached to a fill pump with a hose. Onboard were the pilot and a flight operator. According to eyewitnesses, on what was probably the third or fourth refilling operation at a pond close to the site of the fire, the helicopter climbed into the air while dragging a rope that was attached to the fill pump. After climbing several meters, the contents of the tank were emptied. At the same time, the rope shot upward and became entangled in the main rotor, dragging with it the fill pump, which struck the rotor blades. The helicopter immediately started descending in a parabolic trajectory until it impacted the ground. The two occupants onboard the aircraft perished as a result of the impact and the aircraft was destroyed.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal	2		2	
Serious				
Minor				Not applicable
None				Not applicable
TOTAL	2		2	

[2] Reporting point as per the Procedure for Exiting the Visual Approach Circuit at Sabadell Airport.

1.3. Damage to aircraft

The aircraft was destroyed as a result of the impact.

1.4. Other damage

There was no additional damage.

1.5. Personnel information

The pilot in command, seated in the RH seat, was a 36-year-old Spanish national. He had valid commercial (CPL(H)) and airline transport pilot (ATPL(H)) licenses, along with the following ratings:

- AS350/350B3 valid until 13/01/2010.
- EC135 valid until 13/01/2010.
- IR(H) valid until 13/01/2010.
- Agricultural firefighting valid until 04/07/2009.

He had a valid Class-1 medical certificate.

According to information provided by the company, the pilot had 2,083 h and 46 min of flying experience, of which 471 h and 32 min had been on the type. In the last 90 days, he had flown 50 h and 58 min, in the last 30 days 24 h and 1 min, and 2 h and 34 min in the last 24 hours. On the day of the accident he had gone on duty at 7:39, prior to which he had rested for 12 hours.

The LH seat was occupied by the flight operator, a 30-year-old Spanish national who also held a valid commercial pilot license (CPL(H)) with the following ratings:

- AS350/350B3 valid until 14/01/2010.
- VFR.

He had a valid Class-1 medical certificate.

1.6. Aircraft information

The aircraft, an Eurocopter AS350B3 helicopter, registration EC-IOJ, serial number 3701 and manufactured in 2003, was equipped with a Turbomeca Arriel 2B engine, S/N 22232, and landing skids (see Figure 1).

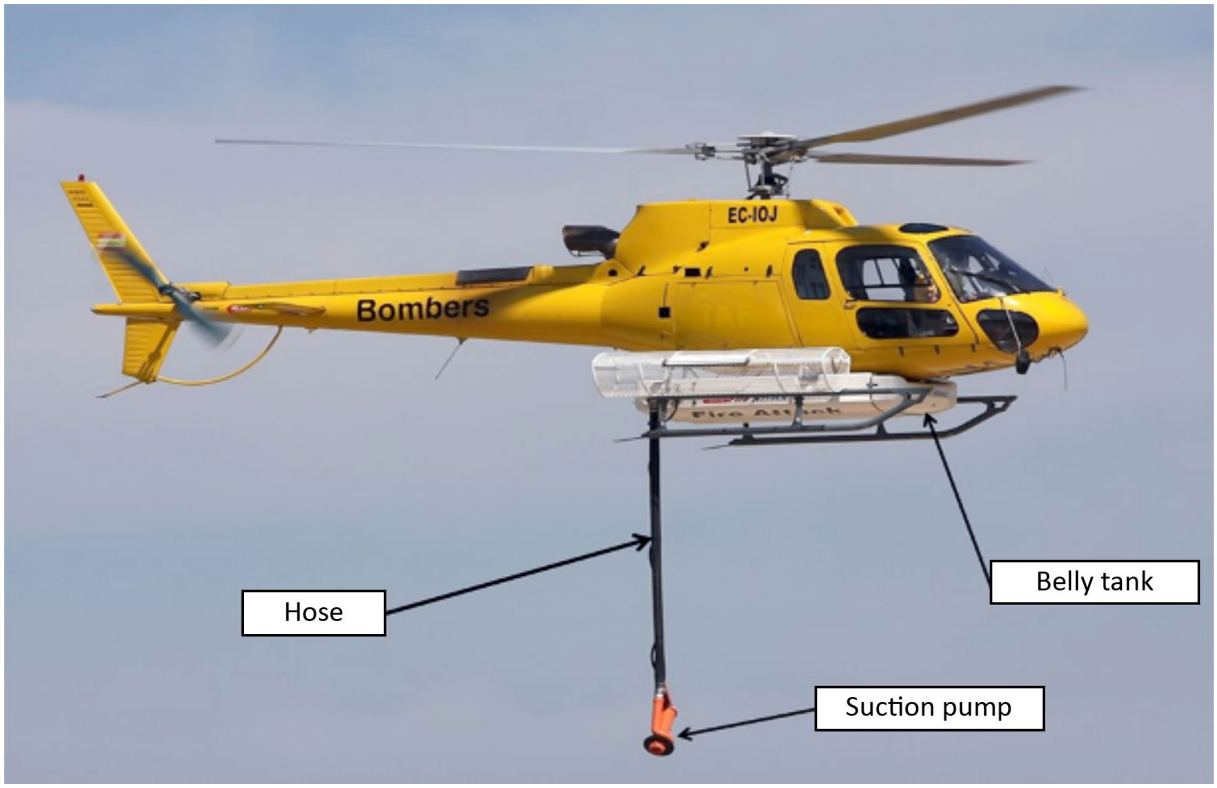

Figure 1. Accident helicopter outfitted with firefighting system

The helicopter was equipped with a firefighting system called the "Simplex Fire Attack System", Model 310. The system's design was covered under EASA Supplementary Type Certificate IM.R.S 0078, Revision 1, validated by the EASA.

The system features a belly tank and, connected to it via a hose that extends underneath the helicopter's landing gear, a fill pump. The tank has a 1,200-liter capacity and has two hydraulically-actuated doors located at the bottom of the tank, thus allowing for rapid and complete water drops. Its design allows filling the tank at a high flowrate from a low-pressure source. The system is electrically controlled and operated from the pilot's position by way of various controls mounted on the center console and the pilot's cyclical control.

Based on information in the STC, the helicopter is required to be configured with a mirror that allows the pilot to see water refilling operations at all times, and with high landing skids that allow for the installation and operation of the 310 model.

Likewise, in terms of the limitations of the filling equipment, it states that the source of the supply water must be sufficiently deep so as to keep the pump and hose from becoming entangled.

As regards potential emergency situations, the STC indicates that:

- The pilot or copilot can dump the liquid held in the tank by placing the Master switch in the OFF position.
- In the unlikely event that the hose detaches from its coupling points to the tank, the electrical cables charged with sending electrical signals to the pump are capable of maintaining the pump attached to the helicopter until a safe landing can be carried out.

The commanded detachment of the hose-pump assembly in the event that an object ensnares it while loading is not considered.

1.6.1. *Aircraft documentation*

The aircraft had the necessary administrative documentation. The Spanish registration certificate was valid and had been issued on 25 July 2003. The airworthiness certificate had been issued on 5 May 2005, and was revised on 22 April 2009, valid until 21 April 2010.

The aircraft also had an Aircraft Station License, valid until 21 April 2010, and an insurance certificate valid until 14 April 2010, which included water drops among the permitted aircraft activities. The information provided by the operator revealed that the inspections contained in the Maintenance Program had been performed.

1.7. Meteorological information

According to information from the State Weather Agency, the weather conditions on 22 June 2009 at 12:00 for the province of Barcelona were mostly sunny skies with low clouds, and a light wind predominantly from the south. The temperature was mild.

The METAR data for the Sabadell Airport, which is 11 km west of the accident site, on the date and hours immediately prior to and following the accident, were as follows:

11:30 UTC

Wind 140°, 9 kt, variable from 100° to 190°, visibility in excess of 10 km, few clouds at 2,300 ft, temperature 24 °C and dew point 12 °C. QNH 1,018 hPa.

12:00 UTC

Wind 170°, 10 kt, variable from 120° to 230°, visibility in excess of 10 km, few clouds at 2,300 ft, temperature 24 °C and dew point 12 °C. QNH 1,018 hPa.

1.8. Aids to navigation

Not applicable.

1.9. Communications

The helicopter was in radio contact with the Sabadell Airport tower to request clearance for takeoff and to report leaving the Sabadell ATZ at 11:19. During firefighting operations, it was in contact with the company's operations director and with the helicopter with callsign H-02, charged with coordinating the firefighting efforts. No abnormalities were noted during any of these exchanges.

1.10. Aerodrome information

Not applicable.

1.11. Flight recorders

There were no flight recorders onboard, nor were they required for this type of aircraft.

1.12. Wreckage and impact information

The accident took place in the vicinity of the Mollet del Vallés skeet shooting facilities, very close to the area of the fire. These facilities are situated between Tiro Olimpico Avenue and the road to San Valeria, north of the AP-7, the Mediterranean highway. Next to this facility is Catalonia's Public Safety Institute, where the firefighters who first responded to the accident scene, and some of whom were direct eyewitnesses to the event, were attending a training course. Inside the complex is a pond for collecting rain water that was being used by the helicopter crew to supply the belly tank. The pond is square shaped, approximately 10 m on a side and is enclosed by a metal fence with an access gate. Although the exact depth of the pond could not be established, a visual inspection revealed that it was sufficiently deep for the operations being conducted, as also evidenced by the fact that the tank had already been refilled several times.

The main aircraft wreckage was concentrated in an area about one meter away from the right edge of the entrance road to the shooting range. A small amount of debris was found elsewhere (see Figure 2).

Figure 2. Location of wreckage and eyewitnesses

The helicopter showed signs of having impacted at a high pitch angle and at a slight right bank angle. While the aircraft's nose and cabin exhibited severe damage, the rest of the airframe and the tail section showed no evidence of an impact, nor were there drag marks along the ground. The main aircraft wreckage was oriented on a heading of 130° (see Figure 3).

Between the pond and the impact point there were debris with impact marks, belonging mainly to the suction pump —filter, guard, spiral tubing, electric motor assembly, protective housing— as well as components that had detached from the main rotor blades.

The blades were severely damaged, though the only damage exhibited by the yellow blade was delamination at the tip. The other two —red and blue— had fractured and lost a large amount of material, showing signs of high impact damage.

There was red paint at a point 1.8-m away from the root on the leading edge and top surface of the blue main rotor blade, which was resting on the ground to the right side of the helicopter, and a broader patch of orange paint on the leading edge and lower surface. The blade had fractured 2.45-m away from the root with severe impact marks on the leading edge.

Figure 3. Main wreckage

The red blade, which was toward the front part of the helicopter, was partially sheared 2.75-m away from the root due to an impact from its leading edge and to its side impacting the ground (see Figure 4). The counterweight that is located behind the leading edge in this area (see Figure 5) was ejected and found some 240 m west of the crash site.

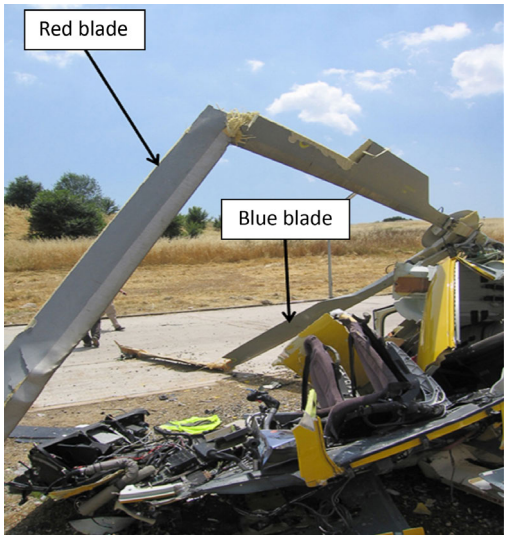

Figure 4. Condition of red and blue blades

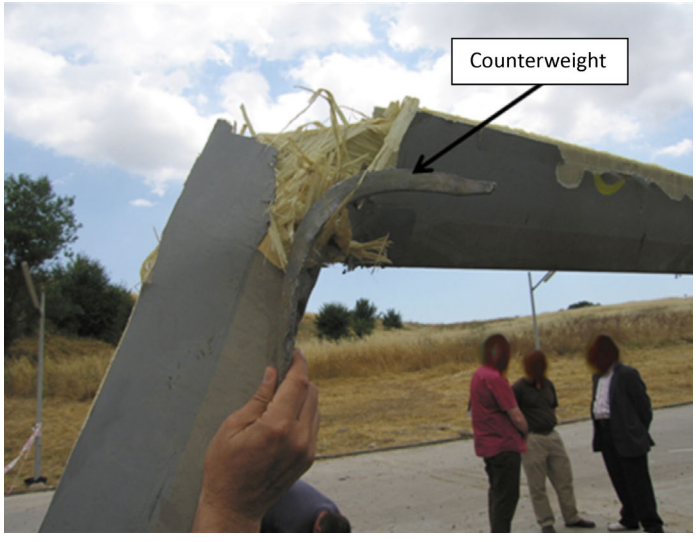

Figure 5. Red blade. Close-up of detached counterweight

About 25 m of rope was found wrapped around the main rotor. Of these 25 m, all but approximately 4 m (estimated from the number of turns and the rotor diameter) were able to be uncoiled. When the 21 m length was laid out on the ground, a loop of considerable size was noted. On occasion, ponds of this type are provided with a rope attached at a point outside the pond with a counterweight at the free end that keeps the rope inside the water, its purpose being to serve as a lifeline in the event that someone were to fall inside the pond.

A further 17 m of rope was found tied to one of the posts on the fence surrounding the pond. This rope exhibited two colors, distinguishing the part that had been submerged from the part that had not.

Linear marks at a 30° angle were observed on the right engine housing, indicating that the lower part was offset with respect to the top part. It was also possible to observe sand and water marks at the same 30° angle.

The extinguisher located in the helicopter was found some 110 m west of the impact point, between the first and second set of bleachers (see Figure 2). It was broken and bent such that a portion of its circumference along the midpoint was completely flat.

Inside the cockpit, the switch for opening the doors on the water tank was in the ON position.

The cockpit switch for the emergency locator transmitter (ELT) was in the Armed position.

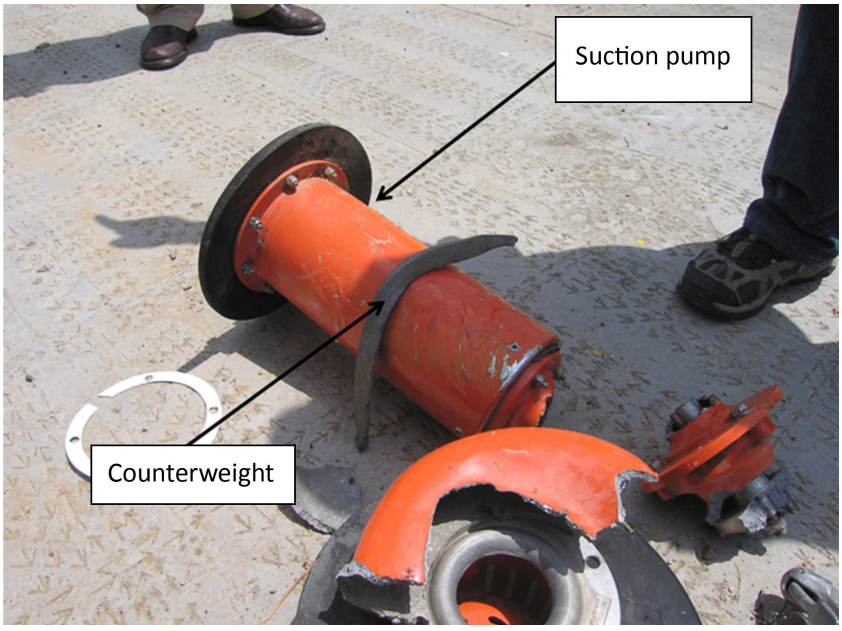

Figure 6. Parts of the suction pump and counterweight ejected from the red blade

1.13. Medical and pathological information

The autopsy reports for the victims of the accident were not available.

1.14. Fire

There was no fire.

1.15. Survival aspects

Both occupants were wearing three-point safety harnesses.

Three ambulances from the Medical Emergency System, three teams of firefighters and two teams from the regional police force responded to the site of the accident.

The helicopter's two occupants were extracted from the aircraft and taken a safe distance away by a group of firefighters who were taking a training course at the Catalonia Public Safety Institute (located next to the shooting range), and who wanted to secure the scene in light of the potential fire hazard. One of the occupants was dead and the other, who was gravely injured, was given first aid by the responders who reported to the scene and subsequently taken to a hospital, where he died.

The helicopter was doused with foam as a preventive measure against a fuel leak and the area was cordoned off. The entire aircraft was covered in foam and then topped with a canvas cover.

Despite the treatment received, given the characteristics of the accident, the occupants had practically no chance of surviving it.

The helicopter was outfitted with a Kannad 406 AF-H emergency locator transmitter (ELT), which emits a signal on the 406 MHz, 121.5 MHz and 243 MHz frequencies to activate the emergency response and facilitate the location of the aircraft in the event of an accident. It is the inertia of the impact itself that must activate the ELT. In the case at hand, it is unknown whether the ELT was activated at the instant the accident occurred.

The remote control switch in the cockpit for the ELT was in the ARM position. The position of the switch on the ELT itself is not known.

1.16. Tests and research

The accident occurred at 11:45 on 22 June. The Air Rescue Service (SAR in Spanish) reported that the initial signal from the ELT was received at 10:23 on 24 June.

Given the gap between the time of the accident and the receipt of the ELT activation, the ELT was analyzed in a specialized laboratory. The results of this study revealed the following findings:

- No internal damage was found in the ELT.
- The parameters were in agreement with the recorded and expected data.
- The condition of the battery was normal.
- The inertial sensor was working properly.
- The transmission power in the 406 MHz band was correct.
- The ELT was activated for approximately 18 hours.
- The ELT was operating even after the accident.

The study concluded that based on the testing protocol employed, the ELT was not damaged and was operational.

1.17. Organizational and management information

In an effort to plan for the various missions associated with its activity, the Fire Prevention, Control and Rescue Office of the government of Catalonia entered into a contract with the company TAF Helicopters to conduct missions that included directly fighting forest fires, coordinating air-ground operations, transporting personnel and materials for fire prevention and control, search and rescue operations in concert with personnel from the firemen special activities support group (GRAE in Spanish) and any other missions associated with its activity. The Technical Specifications associated with the contract detail the relevant terms and conditions which, among others, specify that an aircraft's crew shall consist of a pilot in command and a flight operator. The TAF Basic Operations Manual, approved by the DGAC, states as much, describing their functions in detail. The role of the operator shall be to handle operational communications, aid the pilot with external safety aspects of the flight (identifying obstacles, cables, the location of other aircraft, etc.), locate and identify water sources and read maps. When taking on water and taking off, the operator must be alert and be ready to actuate the emergency switch on the tank control box so as to release the water if necessary.

The flight operator cannot manipulate any helicopter controls.

Additionally, and as reported by the operator, it is routine to clean the tank by filling it and emptying it once the final water drop has been made.

1.18. Additional information

1.18.1. *Eyewitness statements*

The accident was seen by four eyewitnesses situated at different locations, labeled T1, T2, T3 and T4 (see Figure 2), close to the impact site. Their statements revealed the following:

Two different helicopters, one carrying water and the other not, were taking part in fighting a nearby fire behind some pine trees situated north of the impact site. During what they thought was the third or fourth water pick-up from the pond, and while directly above said pond, the accident helicopter rose and dropped a curtain of water. It was hooked to a rope that broke and jumped upwards, after which a loud whistle was heard as the rope became entangled in the main rotor. The water suction hose also rose up and struck the main rotor blades. Following that, the helicopter proceeded to the south, facing the highway, at a slight downward pitch angle with the hose and the rope at an angle. The helicopter appeared to be flying under power as taking off, but it was losing altitude. In a matter of seconds the helicopter ran nose first into the ground.

The sergeant of the firefighting squad responsible for the ground team reported that he had taken charge of the fire scene minutes before the accident, and that he had ordered the office for the North Metropolitan Region to inform the helicopter not to make any more water drops and to return to the base.

1.19. Useful or effective investigation techniques

Not applicable.

2. ANALYSIS

The helicopter was taking part in efforts to control a fire that had broken out in Les Franqueses del Vallés (Barcelona). To this end, it was taking on water from a pond near the site of the fire and within the confines of a skeet range in Mollet del Vallés.

The pilot was in the aircraft's RH seat and the operator in the LH seat. Both had valid licenses and medical certificates. The aircraft had the corresponding Airworthiness Certificate and had been maintained in accordance with the Maintenance Program.

The weather conditions were ideal for the flight.

Tied to one of the posts of the fence surrounding the water supply pond was a 17-m long nylon rope, cut at one end and exhibiting two different colors. In addition, a further 25 m of rope with a loop in it was found wrapped around the main rotor. The dimensions and colors of this section of rope were similar to those of the 17-m long segment with a broken end. Tied to the rope was a weight to keep it inside the water, the purpose being that it would serve as a lifeline in the event that someone fell inside the pond. The two different colors differentiated the part that had been submerged from the part that had not.

Based on the position in which the main wreckage was found, and as corroborated by various eyewitnesses, the helicopter impacted the ground at a high pitch angle and a slight right bank angle.

Scattered between the pond and the impact point were the remains of various suction pump components —filter, guard, spiral tubing, electric motor assembly and protective housing— all with impact marks. Also found in this area were pieces that had detached from the main rotor blades.

There were red paint marks on the leading edge and top surface of the blue blade at a distance of 1.8 m from the root, corresponding to where this blade impacted the extinguisher, which was located to the right and below the pilot's seat and was ejected when the helicopter impacted the ground. The extinguisher was found some 110 m west of the impact point. It was broken and bent such that part of its circumference at the halfway point was completely flat, consistent with an impact with a flat surface such as the blade's. This same blade also had orange paint marks on the leading edge and bottom surface, evidence of an impact with the suction pump, possibly in the area of the spiral tubing, which has a lower strength than the part with the electric motor. This caused this area to break into several pieces, which were scattered over the ground. Moreover, the blade was broken at a point 2.45 m from the root, exhibiting irregular marks on the leading edge from a severe impact against a blunt object. The irregular shape of this impact area and the lack of orange paint rule out an impact against the suction pump, and seem to indicate that the blade could have

struck the stone that was tied to the rope to weigh it down and keep it submerged in the pond.

The red blade was also broken near its halfway point, with the outer part hanging vertically. The impact was extremely violent and resulted in a portion of the blade's counterweight detaching, this part being found 240 m west of the impact site. The deformation of the detached counterweight —it was round and matched the cylindrical shape of the suction pump housing perfectly— and the marks on said housing indicate that these two components impacted each other, leading to the fracture of the blade.

The right fairing covering the engine area featured linear marks and signs made by water and sand, both at a 30° angle, such that their top parts were forward of their bottom parts. This indicates the relative positioning of the rope with respect to the helicopter and is consistent with the scenario described by an eyewitness, namely that of a slight downward pitch angle initiating the translational movement.

The water tank doors were found open, consistent with the "ON" position of the door selection switch in the cockpit and with the cleaning operation that was being carried out after receiving the order to return to base.

As regards the activation of the emergency beacon (ELT), a long time elapsed between the time of impact and said activation. As a result, a detailed study of its operation was conducted that concluded, based on the battery of tests performed, that the ELT was not damaged and was operational, having remained activated for approximately 18 hours.

Based on the manufacturer's own data, it is possible for the signal from a transmitting ELT not to be received, especially if the coaxial antenna cable and its connections are not in good condition. The delay in the start of the transmission, therefore, cannot be directly attributed to a malfunctioning ELT.

Based on the various accounts collected and on the layout of the wreckage, it may be concluded that once the tank was refilled, the helicopter started to climb with a rope attached to the suction pump - the whirlwind effect created by the power of the suction pump is capable of drawing a rope inward toward the hose. Since the helicopter's time on station was over, the crew then proceeded to empty the tank in preparation for cleaning it. From that moment on, the helicopter, with a slight downward nose angle, started moving to the side, tensing the rope and causing it to break. The rebound effect resulted in the rope going toward the main rotor where, after becoming entangled, the rotation of the rotor caused it to wind around the rotor, pulling with it the rest of the rope and the hose-suction pump assembly of the firefighting system. During the climb, two of the blades impacted objects caught on the rope, such that the blue blade probably struck the spiral tubing on the suction pump, the pump's weakest part, which broke into several pieces that scattered on the ground. This same blade then hit the

stone that was tied to the rope and served as a counterweight, causing the blade to break. Finally, the same blade also hit the extinguisher, which was located to the lower right of the pilot's seat and was ejected from its housing when the helicopter struck the ground.

The red blade violently struck the suction pump motor, resulting in the fracture and detachment of part of that blade's counterweight.

With both blades broken, the helicopter was impossible to control and started on a parabolic trajectory that caused it to impact the ground, first with the nose and then with the tail.

The slight downward pitch angle is consistent with the start of a sideways movement, and indicates that the crew did not notice that the rope had become stuck, since this maneuver must only be started when the pump is fully clear of all obstacles. Furthermore, if they had noticed, the conditions on the ground and the length of rope available would have allowed them to carry out a safe landing.

The design of the SIMPLEX firefighting system does not envision the possibility of voluntarily detaching the hose-pump assembly should it become entangled with an object when loading water.

Though in this particular case it did not affect the course of events, since if the crew had noticed the situation with the rope its available length would have allowed them to land on the surrounding terrain without any problems, it does highlight the impossibility of freeing the system from any objects with which it becomes entangled, especially considering that it is designed to be submerged in all kinds of water containers, be they natural or artificial. Even if the crew is occasionally able to distinguish the presence of submerged objects capable of being ensnared by the pump, such a check would be difficult in the majority of cases.

3. CONCLUSIONS

3.1. Findings

In light of the information gathered and of its analysis, the following conclusions have been drawn:

- The helicopter's occupants were qualified to fly it.
- The occupants' licenses were valid and in effect.
- The helicopter's documentation was complete and in order.
- On the day of the accident, the helicopter was engaged in firefighting activities.
- The weather conditions were adequate for the flight.

3.2. Causes

The cause of the accident is regarded to be the loss of control of the aircraft that resulted from the in-flight fracture of two main rotor blades.

This circumstance was caused by the fact that the helicopter became airborne with a rope attached to the suction pump. Said rope was pulled taught, since its other end was tied to a post on the fence that surrounded the pond, and ended up breaking. It then shot upwards into the vicinity of the rotor blades, dragging with it a stone that was tied to the other end, as well as the suction pump itself, both of which eventually impacted the main rotor blades.

The whirlwind effect produced by the suction pump on the firefighting system while filling the tank resulted in one of the ends of the rope becoming entangled with the pump.

4. SAFETY RECOMMENDATIONS

REC 12/12. It is recommended that SIMPLEX modify the design of the water-dropping system so that it can be detached from the aircraft in the event that the suction pump or hose on the system is inadvertently ensnared.

REC 13/12. It is recommended that the EASA and the FAA establish the mechanisms necessary to ensure that water-dropping system SIMPLEX 310 can be detached from a helicopter in the event that the suction pump or hose on the system is inadvertently ensnared.