

# Technical report

## A-017/2022

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Accident involving an EC145 (MBB-BK117 C-2) helicopter, registration EC-MSD, on 28 March 2022 at Tenerife Sur Airport (Tenerife)

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## Notice

This report is a technical document that reflects the point of view of the Civil Aviation Accident and Incident Investigation Commission regarding the circumstances of the accident that is the object of the investigation, its probable causes, and its consequences.

In accordance with the provisions of Article 5.4.1 of Annex 13 of the International Civil Aviation Convention, Article 5.6 of Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010; Article 15 of Law 21/2003 on Air Safety; and Articles 1 and 21.2 of RD 389/1998, this investigation is exclusively of a technical nature, and its objective is the prevention of future aviation accidents and incidents by issuing, if necessary, safety recommendations to prevent their recurrence. The investigation is not intended to attribute any blame or liability, nor to prejudge any decisions that may be taken by the judicial authorities. Therefore, and according to the laws specified above, the investigation was carried out using procedures not necessarily subject to the guarantees and rights by which evidence should be governed in a judicial process.

As a result, the use of this report for any purpose other than the prevention of future accidents may lead to erroneous conclusions or interpretations.

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# ABBREVIATIONS

° ‘ “	Sexagesimal degrees, minutes and seconds
°C	Degrees Celsius
%	Per cent
AD	Aerodrome
AGL	Above ground level
cm	Centimetres
CTR	Aerodrome air traffic control zone
CVR	Cockpit voice recorder
CVFDR	Cockpit voice & flight data recorder
E	East
FATO	Final approach and take off area
FDR	Flight data recorder
FM	Flight Manual
GCTS	Tenerife Sur – Reina Sofia Airport.
ft	Feet
h	Hours
HEMS	Commercial air transport helicopters used to provide emergency medical services
hPa	Hectopascals
kg	Kilograms
km	Kilometres
km/h	Kilometres per hour
kts	Knots
LAPL	Light Aircraft Pilot License
m	Metres
m/s	Metres per second
MAF	Multi-axis fixed-wing
METAR	Aviation routine weather report (in aeronautical meteorological code)
MHz	Megahertz
N	North
QNH	Altimeter setting to obtain elevation above sea level when on the ground
rpm	Revolutions per minute
S/N	Serial number
STOL	Vertical take-off and landing
TULM	Ultralight Aircraft Pilot License
TWR	Aerodrome control tower

ULM	Motorised ultralight aircraft
UTC	Coordinated universal time
VFR	Visual Flight Rules

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## Synopsis

<b>Owner and Operator:</b>	Babcock
<b>Aircraft:</b>	Airbus Helicopters EC145 (MBB-BK117 C-2), registration EC-MSD
<b>Date and time of the incident:</b>	Monday 28 March 2022, 12:00 hours UTC <sup>1</sup>
<b>Site of the accident:</b>	Emergency apron at Tenerife Sur Airport (GCTS)
<b>Persons on board:</b>	Crew: 2, unharmed; Passengers: 2, unharmed
<b>Type of flight:</b>	Commercial air transport – Other – Emergency medical services
<b>Phase of flight:</b>	Landing
<b>Flight rules:</b>	VFR
<b>Date of approval:</b>	

### **Summary of the incident:**

The crew were returning to the Helicopter Emergency Medical Service (HEMS) operational base at Tenerife South-Reina Sofia Airport. According to their testimony, they used the final approach area on taxiway T, in communication with the control tower, and proceeded to their usual parking place on the emergency apron.

During the positioning manoeuvre, the helicopter began to vibrate violently, so the captain, who had the controls at the time, decided to make immediate contact with the ground and set it down on the landing surface.

The helicopter suffered damage to its tail rotor blades, vertical stabiliser and gearbox, which partially detached. The occupants were unharmed.

The accident is thought to have occurred because the crew failed to adequately account for the strong wind while positioning the helicopter above the parking apron. This oversight was then further exacerbated by the captain taking over the flight controls with low awareness of the instability condition of the helicopter. Consequently, the helicopter overshot the helipad's obstacle-free area, and its tail hit a tree.

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<sup>1</sup> All times used in this report are UTC

## 1. FACTUAL INFORMATION

### 1.1. Overview of the accident

The crew of the EC145 helicopter, registration EC-MSD, were transporting a patient from the island of El Hierro. Having delivered the patient to the La Candelaria hospital, they were returning to the helicopter's base at Tenerife Sur airport.

During the flight, they had been informed of maximum wind speeds of 57 kts and above at 1,500 ft. On approach, the wind information provided by control was 250° and 26 kts, with gusts of 31 kts. They used the airport's final approach and take-off area (FATO) on taxiway T for the landing.

During the subsequent air taxi to their helipad, K-3, the captain told the co-pilot, who was at the controls, that they would try to position the helicopter with the tail towards the garden, with a heading of approximately 70°, to make it easier for the ground personnel. This entails turning the helicopter 90° to the right, with respect to the direction of the air taxi, when positioning it above the surface.

However, as setting the helicopter down with a tailwind proved challenging during the manoeuvre, the captain told the co-pilot to leave it and land facing into the wind instead. The captain then decided to take over the flight controls, after which they noticed an intense vibration, and the autopilots disengaged.

At that point, he made the decision to land on the helipad immediately, setting the helicopter down on its two skids.

On shutting down the engines and descending from the helicopter, it was observed that both blades of the tail rotor were damaged and that the blades, shaft and gearbox were hanging down to the left of the vertical stabiliser, which also showed evidence of impacts and cuts. The crew were unharmed.



Fig no. 1. - Condition of the helicopter's tail rotor and vertical stabiliser.

## 1.2. Injuries to persons

<i>Injuries</i>	<b>Crew</b>	<b>Passengers</b>	<b>Total in the aircraft</b>	<b>Others</b>
Fatal				
Serious				
Minor				
Unharmred	2	2	4	
TOTAL	2	2	4	

## 1.3. Damage to the aircraft

The aircraft suffered impact damage to both tail rotor blades, the tail rotor shaft and its gearbox, which was partially detached. There were also signs of impact damage and cuts on the left side of the vertical stabiliser.

## 1.4. Other damages

Branches were severed from a tree in the vicinity of the K-3 helipad on the emergency apron at Tenerife South Airport.

## 1.5. Information about the personnel

### 1.5.1. Captain

The 56-year-old helicopter captain, seated on the cockpit right side, had held a transport helicopter pilot's licence since September 2008, with an EC145 (BK117) type rating and instrument and multi-pilot ratings valid until 31 March 2023. He had a medical certificate valid until 27 July 2022.

This pilot had a total flight experience of 5,137 flight hours, of which 1,149 hours were in type. In the last month, he had flown 23:51 hours, all in the EC145 (BK117) helicopter type.

### 1.5.2. Co-pilot

The 51-year-old helicopter co-pilot, seated on the cockpit left side, had held a transport helicopter pilot's licence since March 2018, with an EC145 (BK117) type rating and instrument and multi-pilot ratings valid until 28 February 2023. He had a medical certificate valid until 08 January 2023.

This pilot had a total flight experience of 3118 flight hours, of which 972 hours were in type. In the last month, he had flown 08:25 hours, all in the EC145 (BK117) helicopter type.

## 1.6. Information about the aircraft

The Airbus Helicopters EC145 helicopter has a maximum take-off weight of 3,585 kg, with an empty weight of 2,364 kg. Its dimensions are 13.03 m long and 3.45 m high, with a rotor



diameter of 11 m. It can carry up to 9 passengers plus 2 crew and is widely used for emergency medical services. The MBB-BK117 C-2 version is fitted with two Arriel 1E2 engines.

This particular aircraft, with registration EC-MSD, S/N 9673, was manufactured in 2014 and registered in Spain in March 2019. Its Airworthiness Review Certificate was valid until 02 June 2022. The helicopter had a total of 3,943:41 h of flight time and 8,788 cycles or landings.

The last maintenance tasks performed were the 100 h and 300 h checks when the helicopter had 3,891 total flight hours in December 2021.

### **1.7. Meteorological information**

On the morning of 28 March 2022, a special report was issued at 10:08 h, indicating wind at 240°, 17 kts, visibility 9,000 m, rain, overcast at 3,000 ft, broken clouds at 5,000 ft, temperature 19°C, dew point 16°C, QNH of 1011 HPa, no other significant phenomena.

The METAR at 11:30 h indicated wind at 270°, 15 kts, variable wind from 230° to 300°, visibility 9,000 m, rain, few clouds at 2,000 ft, broken clouds at 4,000 ft, temperature 17°C, dew point 16°C and QNH of 1011 HPa.

The corrected METAR at 12:00 h indicated 240° wind at 22 kts, unlimited visibility, broken clouds at 2,500 ft, temperature 19°C, dew point 18°C, QNH of 1010 HPa and occasional rain.

In the landing clearance provided by Tower control at 11:54:55 h, the crew were cleared to land on the usual FATO, runway 25 direction, and informed that the wind conditions at that time were wind at 240° and 26 kts with maximum gusts of 32 kts.

### **1.8. Aids to navigation**

Not applicable.

### **1.9. Communications**

On the return from their emergency medical service flight, the crew established radio contact with the Tenerife South Airport Tower at 11:49 h, when they reached entry point E on the visual flight chart. The controller cleared them to point N, informing them of the QNH, the runway in service (25), and that there was surface wind.

At 11:54, the controller gave the crew the option to go straight to the FATO on taxiway T, in the direction of runway 25. In this landing clearance, the controller reported the wind at that time, and the pilot replied with his position, on final.

At 11:57 h, the pilot notifies the control tower that they are in the usual parking place and thanks TWR, to which the controller replies that he is closing the Flight Plan.

There were no subsequent radio communications with control relevant to the analysis of the event.

### **1.10. Information about the aerodrome**

Tenerife South-Reina Sofia Airport is located in Granadilla de Abona in the southeast of the island of Tenerife; its reference altitude is 64 m, 210 ft.

Its movement area comprises runways 07/25, located to the south, and a main taxiway designated T, which runs parallel to the runway and is linked to it by several entry/exit taxiways, designated B, and which connects to the apron and terminal located in the central/western part of the airport to the north.

To the north of taxiway T and in the eastern part of the airport, there is a restricted-use apron for special service or emergency helicopters. This apron has three stands or helipads of different diameters, K1, K2 and K3. K1 is for Agusta Westland AW-139 helicopters, K2 is for Sikorski S-61 helicopters, and K3 is for Agusta Westland AW-109 helicopters.

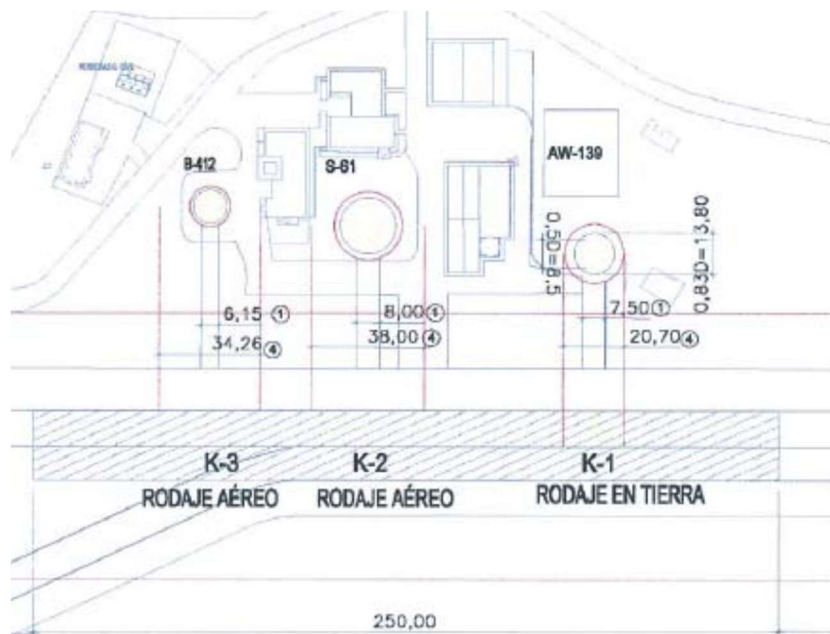


Fig no. 2. - Layout of the restricted-use emergency apron at Tenerife Sur - Reina Sofia Airport.

an asphalt taxiway for ground taxiing to taxiway T, stand K2 has a diameter of 23 m and a non-asphalted taxiway for air taxiing to taxiway T, and stand K3 has a diameter of 13.80 m and a non-asphalted taxiway for air taxiing to taxiway T.

## 1.11. Flight recorders

The EC145 helicopter has a combined Honeywell AR-204C voice and data recorder (CVFDR), which was operational at the time of the incident and from which the recordings could be extracted. In addition, the data from the operator's fleet tracking recorder has been made available.

All the recordings have been synchronised with the radio communications, whose timings have been used as a reference.

### 1.11.1. Voice recording, CVR

A final approach and take-off area (FATO) for the two runways in use is defined on taxiway T in front of the restricted-use apron, which, with permission from the control tower, operates under VFR and with the special landing/take-off procedure for duly justified operational flights. Helicopters taxi to and from their parking stands either by air or ground to the FATO.

Parking stand K1 has a diameter of 20 m and

In the recording recovered from the cockpit voice recorder, both pilots spoke of the indicated wind speed almost half an hour before landing, mentioning speeds of 56 and 61 kts when they were flying at an altitude of 1,500 ft.

A few minutes later, on the initial approach to their operational base at Tenerife Sur Airport, the captain can be heard telling the crew, " even if there's a lot of wind, I'd rather position the helicopter like we normally do, for safety reasons; we'll see what it's like when we get there and decide, but it's preferable because otherwise, the tail sticks out a long way. Let's see if the trees provide a bit of shelter from the wind".

After the last radio communication with the tower at 11:57 hours, having landed without incident and indicating that they had completed the approach on the taxiway T FATO, both pilots focused on the aerial taxi manoeuvre required to reach and park on their stand, K3.

Forty-four seconds after the air taxi, in the conversation between the two pilots, the co-pilot at the controls can be heard saying that he's doing well, although struggling a little with the wind. The captain replies that the manoeuvre can't be prolonged, and the pilot at the controls responds by saying that he wants to get it right and avoid an "*aporrizaje*" (a hard landing). The captain urges him to set it down.

Shortly after that, the captain exclaims, "Careful, careful!" followed by "Mine, mine, mine!" presumably as he takes over the helicopter's flight controls. Fifty-two seconds elapse between the co-pilot attempting the positioning manoeuvre and the captain taking the controls.

Three seconds later, the captain announces that he'll leave the helicopter facing the other way. And eleven seconds later, a new noise can be heard, which persists in the recording. Some seventeen seconds later, you can hear a startled exclamation from the captain, "What's happening?" to which the co-pilot replies that it seems like a vibration.

The captain asks him to shut down the engines and then exclaims, "The autopilots have tripped!" Thirty-two seconds later, one of the medical crew members can be heard indicating that the helicopter is leaking fluid from its rear.

Thirty-five seconds later, before the recording was stopped, someone can be heard on the CVR speaking from outside the helicopter, although it's too faint to transcribe, and the captain responds to them, saying: "What tree? Did we hit the tree? With the tail rotor?"

### **1.11.2. Flight data recording, FDR**

We used the data obtained from the flight data recorder to reconstruct the helicopter's air taxiing and positioning manoeuvre on the K3 emergency apron. This was supplemented and supported by the fleet tracking data provided by the operator, Babcock, allowing us to recreate the helicopter's sequence of movements and attitudes from the moment they confirmed to the control tower that they had completed their final approach on the taxiway T FATO until the moment they came to a stop on the K3 helipad.

To summarise, the sequence can be divided into 44 seconds of air taxiing, 52 seconds of positioning on K3 by the co-pilot, and a further 36 seconds of positioning by the captain until the helicopter lands. During the manoeuvre to position the helicopter, it turns 90° to the right to face the building but then oscillates slightly above the apron as the co-pilot clearly struggles to stabilise it sufficiently to set it down facing in that direction.

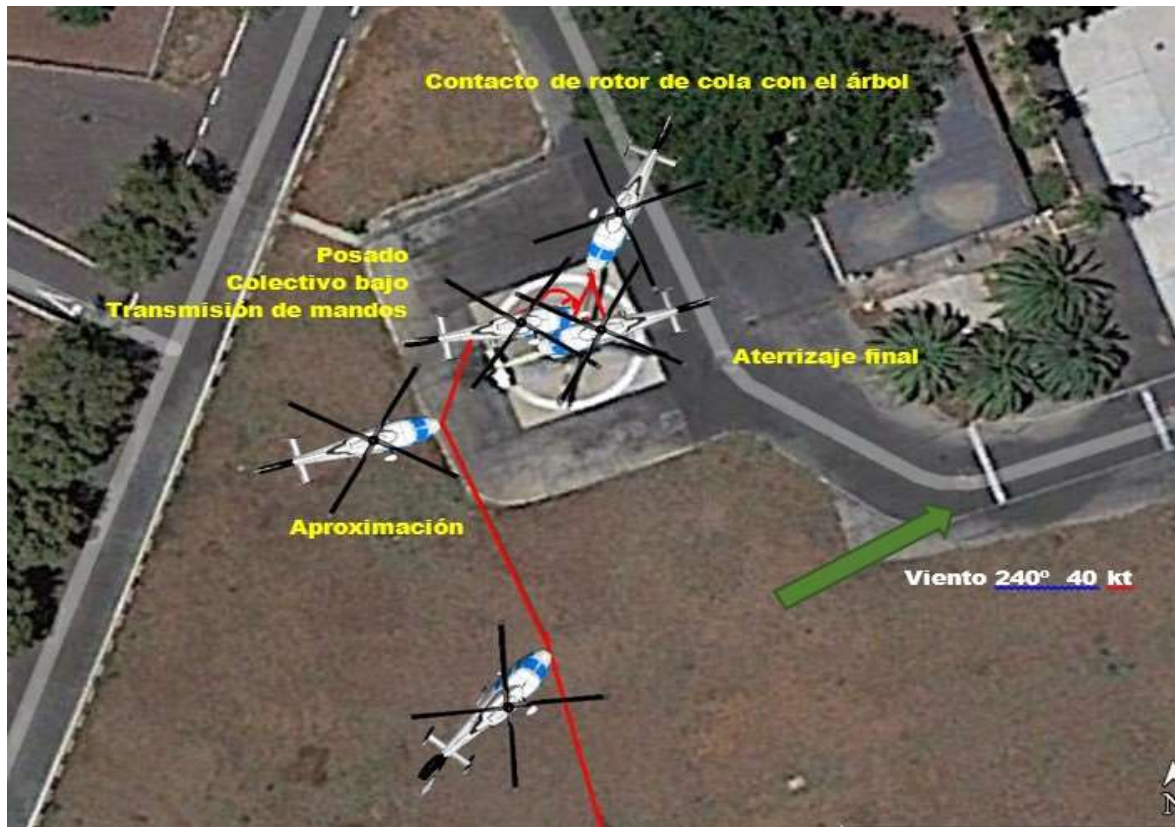


Fig No. 3. - The helicopter's significant positions during the parking manoeuvre.

In the final 36 seconds after the captain has taken over the controls, the helicopter rises a few metres and turns 180° to the right, with a more exaggerated range of movement to the rear, turning its tail to the service building before landing on the helipad.

### 1.12. Aircraft wreckage and impact information

The severed branches from a large tree located to the northeast of the K3 stand and to the right of the K3 service building, at a height of more than five metres above the ground, were found to have been impacted by the tail rotor as the helicopter was being positioned to park.

The impact with the tree branches severely damaged the tail rotor blades, and as a consequence of this damage and the progressive deterioration that occurred as they continued to rotate, they subsequently impacted the vertical stabiliser. In addition, the gearbox on the tail rotor shaft was partially dislodged from its position on the stabiliser and tilted downwards.

The helicopter came to rest on its skids in the centre of the K3 helipad, with its tail facing the service building, which was the opposite position to the one initially attempted by the crew.

Although mast overload warnings were issued and the autopilots tripped, subsequent verification confirmed that there were no overloads on the main rotor mast and that the maximum reference values had not been exceeded.

### **1.13. Medical and pathological information**

There was no evidence to suggest the presence of physiological or psychological factors that could have affected the performance of the pilots.

### **1.14. Fire**

Not applicable.

### **1.15. Survival aspects**

The harnesses and restraint systems worked adequately, and the cabin interior maintained its structural integrity.

### **1.16. Tests and research**

Not applicable.

### **1.17. Organisational and management information**

#### **1.17.1. Information about the operator, Babcock.**

The operator of the Helicopter Emergency Medical Service (HEMS) based at Tenerife South-Reina Sofia Airport, Babcock, which has the use of apron K3 and its service buildings on the restricted-use emergency apron, has been conducting these operations for a long time and is familiar with the meteorological environment at this base of operations, which is prone to frequent episodes of strong southeasterly and southwesterly winds.

The crews that operate this service frequently, as is the case of the two pilots involved, have, according to the information gathered in the investigation, become accustomed to positioning the helicopter facing towards the service building, regardless of wind conditions, for increased efficiency when loading/unloading the helicopter and for the safety of the auxiliary personnel.

Because of this tendency, and despite being aware of the strong wind they encountered during the flight, they tried to land the helicopter in the aforementioned direction; however, they had discussed trying to do so within the limits of the helicopter's manoeuvrability, not as an imperative requirement.

#### **1.17.2. Airport information - restricted-use apron for special service or emergency helicopters**

Tenerife Sur - Reina Sofía Airport has a general standard procedure for taxiing helicopters as well as a specific procedure for the use of the restricted-use emergency apron, both of which form part of the Aerodrome Manual.

The airport's operating procedures refer to two important values in terms of helicopter dimensions: the diameter of the rotor and the overall or maximum length. The helicopters used by the Helicopter Emergency Medical Service operator, the Agusta-Westland AW-109

and Eurocopter EC145, have no significant differences, and both have similar dimensions: Rotor diameter of 11 m and maximum overall helicopter length of approx. 13 m.

The K3 helipad or parking stand is large enough to accommodate these helicopters and has a maximum diameter of more than 13 m. The aerial taxiway for exit and entry, which is also designated as K3 and runs perpendicular to taxiway T, is more than 34 m wide.

Although the large tree near the landing apron, at its current size, did not hinder the use of the K3 apron, it did reduce its obstacle-free area due to its natural growth and the increase in the volume of its branches. The airport took the initiative to prune it to increase the obstacle-free area and the safety margins for helicopter positioning manoeuvres on the apron.

## **1.18. Additional information**

### **1.18.1. Statements.**

The captain was asked to submit a detailed statement on what happened inside the cockpit of the helicopter:

During the flight, the captain and the co-pilot, who was the pilot at the controls, discussed landing on the helipad with the tail towards the garden rather than the building and the support personnel to make it safer to board and easier to manoeuvre the fuel truck through the area.

However, on landing, it became clear that the tailwind was making it difficult to set the helicopter down safely, and they broached the subject again, with the captain saying to leave it and land into the wind with the tail facing the building.

Before the co-pilot set the two skids down on the helipad, he noticed the lateral instability and took charge of the flight and the controls. At that point, he felt a strong vibration, and the autopilots disengaged, so he immediately set the helicopter down on the ground.

### **1.18.2. Wind limitations affecting the EC-145 C2**

The EC145, MBB-BK117 C-2 helicopter Flight Manual has been studied for references to the influence of high winds on control during hover manoeuvres. The only references found appear in section 02, in relation to starting and stopping the helicopter.

Point 2.16.2 - Rotor starting and stopping in high wind: Starting and stopping the rotor is authorised in up to max. 50 kts wind from all directions.

For hover turns, the maximum turn speed depends on the weight: if above 3,200 kg, the maximum speed should be 30°/s (12 seconds for a 360° turn).

There is some additional information in Ch. 5.1.9. It has to be noted, that the statements are valid for max. gross weight. Lower weight and lower altitude increase the margin.

Point 5.1.9 - Hover ceiling: The hover ceiling charts for hover in ground effect (HIGE) (Fig.5-9 to 5-16) are provided for all engines operating (AEO) conditions, with takeoff power (TOP) and various combinations of pressure altitude, outside air temperature and gross mass.

For hover in ground effect in density altitudes up to 7000 ft controllability is assured for winds up to 30 kts from all directions, above 7000 ft for winds up to 17 kts from all directions.

The hover ceiling charts for hover out of ground effect (HOGE) (Fig.5-17 to 5-20) are provided for all engines operating (AEO) conditions, with takeoff power (TOP) and maximum continuous power (MCP), and various combinations of pressure altitude, outside air temperature and gross mass.

For hover out of ground effect in density altitudes up to 7000 ft controllability is assured for winds up to 30 kts from all directions, above 7000 ft for winds up to 17 kts from the right side and up to 30 kts from all other directions.

#### **1.19. Special investigation techniques**

Not employed.

## **2. ANALYSIS**

### **2.1. General aspects**

The HEMS flight to transport a patient from the island of El Hierro with the EC145 helicopter, registration EC-MSD, had passed without incident, and the team were returning to their operational base on the restricted-use emergency apron at Tenerife Sur - Reina Sofía Airport.

After closing the flight plan with the control tower, the helicopter was air-taxied to the parking stand and positioned on this surface. During this last manoeuvre, which lasted 52 seconds, it became clear that the co-pilot, who was at the controls, was struggling to control the helicopter.

When the captain took control of the aircraft, it initially became even more unstable and, in addition to veering to the left, it rose a few metres and moved backwards until its tail hit the branches of a tree at more than five metres high.

After impact, the captain quickly landed the helicopter on the pad before the cascade or progression of damage to the tail rotor rendered it uncontrollable.

The damage inspection found that the tail rotor had been rendered useless, and the shaft gearbox had partially separated from its shaft and the vertical stabiliser; however, there was no overload on the main rotor mast, even though the exceedance warning had been triggered.

### **2.2. The operation of the helicopter on landing**

#### **2.2.1. Assessment of the weather conditions**

From the information they had received and verified during the flight, the crew were aware of the strength of the winds both at altitude and on the ground. However, they, and their operating company, Babcock, did not believe the helicopter to be sensitive to or operationally limited by high winds either in cruise flight or when manoeuvring, hovering or moving at low ground speeds.

In addition, the inertia of the day-to-day operation and the crew's concern for the safety of the ground staff caused them to give more consideration to the final orientation of the helicopter than to the direction of the surface wind.

The reality was that the surface wind conditions hampered the helicopter's manoeuvrability when hovering and hindered the transfer of the flight controls, as can be seen in the reaction and attitude of the helicopter shown in Fig. 3. The helicopter's wide rotation and lift occurred just after the captain took over the controls.

#### **2.2.2. Assumption of the flight controls**

The captain monitored the performance of the pilot at the controls, as demonstrated by the flight recordings, during the approach to the FATO and the subsequent air taxi to the pad to land the helicopter.



However, the final positioning manoeuvre was prolonged, due to the instability caused by the high wind, for almost a minute before the captain intervened by taking control of the aircraft.

### **3. CONCLUSIONS**

#### **3.1. Findings**

- The crew closed the flight plan without incident after the final approach to the taxiway T FATO and then air taxied to the K3 helipad.
- The crew intended to position the helicopter facing the service building on the apron with its back to the prevailing wind because of the enhanced safety this position offers the ground support service.
- The strength and direction of the wind were known to the crew.
- The helicopter became unstable during the positioning manoeuvre on the K3 apron, and the captain took over the flight controls before the co-pilot, who was at the controls up to that point, could position the helicopter in the intended direction.
- With the captain at the controls, the helicopter climbed and turned 180° to the right before landing on the K3 platform with its back to the service building.
- During this positioning turn, the tail rotor hit the branches of a tree near the K3 stand and the building.
- The captain set the helicopter down before it was destabilised by the damage to its tail rotor.

#### **3.2. Causes/contributing factors.**

The accident is thought to have occurred because the crew failed to adequately account for the strong wind while positioning the helicopter above the parking apron. This oversight was then further exacerbated by the captain taking over the flight controls with low awareness of the instability condition of the helicopter. Consequently, the helicopter overshot the helipad's obstacle-free area, and its tail hit a tree.

#### **4. OPERATIONAL SAFETY RECOMMENDATIONS**

No operational safety recommendations are issued.