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COMISIÓN DE
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AVIACIÓN **C**IVIL

Report A-004/2018

Accident involving a Boeing 737-8AS aircraft, registration EI-EKI, operated by Ryanair, in the Canaries airspace (Spain) on 10 February 2018

GOBIERNO DE ESPAÑA
MINISTERIO DE FOMENTO

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MINISTERIO DE FOMENTO
SUBSECRETARÍA
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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 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) nº 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.

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Abbreviations

° ' "	Sexagesimal degrees, minutes and seconds
AAPUC	Support of attention to
ACP	Air control procedural rating
ACS	Area control surveillance rating
ADI	Aerodrome control instrument rating
ADV	Aerodrome control visual rating
AESA	Spanish State Aviation Safety Agency
AIR	Air control endorsement
ALT HOLD	Altitude hold
APP	Approach control
APS	Approach control surveillance rating
ATC	Air traffic control
ATPL	Air transport pilot license
CAS	Calibrated airspeed
CEOPS	Operations Emergency Center
CPL	Commercial pilot license
CRM	Crew Resources Management
CVR	Cockpit Voice Recorder
EASA	European Aviation Safety Agency
EGPH	ICAO code for the Edinburgh Airport
FDR	Flight data recorder
FIR	Flight Information Region
FL	Flight level
ft	Feet
ft/min	Feet/Minute
g	Acceleration due to gravity
GCCC	Canaries control center
GCFV	ICAO code for the Fuerteventura Airport
GMC	Ground movement control endorsement
GMS	Ground movement surveillance endorsement
h	Hours

IAA	Irish Aviation Authority
ICAO	International Civil Aviation Organization
IFR	Instrument flight rules
IR	Instrument rating
kt	Knots
LVL CHG	Level change
m	Meters
MCP	Mode Control Panel
ME	Multi-engine
MEP	Multi-engine piston rating
MPA	Multi-pilot airplane
N	North
N/A	Not affected
NM	Nautical miles
PAA	Problems / Actions taken / additional information
QAR	Quick Access Recorder
RAD	Aerodrome radar control endorsement
s	Seconds
SEP	Single-engine piston rating
SIGMET	Significant Meteorological information
SPA	Single-pilot airplane
SPD	Speed mode
TCL	Terminal control endorsement
TMA	Terminal control area
TURB	Turbulence
TWR	Control tower
UTC	Coordinated universal time
W	West

Synopsis

Owner:	Ryanair
Operator:	Ryanair
Aircraft:	Boeing B737-8AS
Persons on board:	6 crew and 184 passengers, 1 passenger with serious injury and 1 passenger with minor injury
Type of flight:	Commercial air transport – Scheduled – International – Passenger
Phase of flight:	En route – Change in cruise level
Type of operation:	IFR
Date and time of accident:	10 February 2018 at 16:38[1]
Site of accident:	Canaries airspace (Spain)
Date of approval:	30 October 2018

Summary of event:

On Saturday, 10 February 2018, a Boeing 737-8AS aircraft operated by Ryanair was en route at FL370 in Canaries airspace, when the crew requested to descend to FL130, which they were cleared to do by air traffic control.

According to the radar data, at 16:38:04, as the aircraft was descending from FL370, it was instructed by the control service to stop the descent at FL360 due to a potential conflict with another aircraft.

Seconds later, at 16:38:07, according to flight recorder data, the aircraft's pilot selected the ALT HOLD mode on the mode control panel (MCP) in order to maintain the altitude. At that time the aircraft was passing through FL364 at a high rate of descent.

One second later, as the aircraft was crossing through FL363, the pilot decided to disengage the autopilot. The pilot, as per his statement, thought they had gone past their cleared flight level of FL360 and seeing that the recovery maneuver was

[1]. All times in this report are local time in the Canary Islands, where UTC time is the same as local time.

taking too long, he decided to manually return to the flight level instructed by air traffic control.

While executing this manual maneuver, one passenger fell, causing significant injuries to one leg. It was not possible to determine when exactly during the maneuver the passenger was injured, and therefore what the vertical acceleration was at the time. However, the data recorded in the flight recorder showed large swings in the position of the control column, which resulted in large increases in the pitch angle and in large vertical acceleration peaks. The maximum vertical acceleration value reached was 1.69 g.

The aircraft was not damaged.

The investigation has determined that the accident probably occurred when the crew executed a sudden manual maneuver to maintain the specified flight level.

A contributing factor is the fact that the autopilot was disengaged in order to carry out the manual maneuver, which contributed to its abrupt nature.

1. FACTUAL INFORMATION

1.1. History of the flight

On Saturday, 10 February 2018, a Boeing 737-8AS aircraft operated by Ryanair, was en route at FL370 in Canaries airspace, when the crew requested to descend to FL130, which they were cleared to do by air traffic control.

According to the radar data, at 16:38:04, as the aircraft was descending from FL370 to FL130, it was instructed by air traffic control to stop the descent at FL360 due to a potential conflict with another aircraft. At that time the aircraft was crossing through FL368.

Seconds later, at 16:38:07, according to flight recorder data, the aircraft's pilot selected the ALT HOLD mode on the mode control panel (MCP) in order to maintain the altitude. At that time the aircraft was passing through FL364 at a high rate of descent.

One second later, as the aircraft was crossing through FL363, the pilot decided to disengage the autopilot. The pilot, as per his statement, thought they had gone past their cleared flight level of FL360 and seeing that the recovery maneuver was taking too long, he decided to manually return to the flight level instructed by air traffic control.

While executing this manual maneuver, one passenger fell, causing significant injuries to one leg. It was not possible to determine when exactly during the maneuver the passenger was injured, and therefore what the vertical acceleration value was at the time. The maximum vertical acceleration value reached was 1.69 g.

The aircraft was not damaged.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Other
Fatal				
Serious		1	1	
Minor		1	1	N/A
None	6	182	188	N/A
TOTAL	**6**	**184**	**190**	

1.3. Damage to aircraft

The aircraft was not damaged.

1.4. Other damage

There was no other damage of any kind.

1.5. Personnel information

1.5.1. Information on the flight crew

The pilot, a 38-year old Italian national, had an airline transport pilot license (ATPL(A)), issued on 31 December 2009 by the Irish Aviation Authority (IAA), and a B737 300-900 rating, valid until 31 December 2018, and an ME IR (MPA) rating, IR valid only for MPA.

The pilot had a class-1 medical certificate that was valid until 25 February 2019.

The copilot, a 29-year old British national, had a commercial pilot license (CPL(A)), issued on 12 January 2016 by the Irish Aviation Authority and a B737 300-900 rating, valid until 28 February 2019, and ME IR(MPA), ME IR(SPA), MEP(land) and SEP(land) ratings.

The copilot had a class-1 medical certificate that was valid until 18 August 2018.

1.5.2. Information on the planning controller in the GCCCRNE sector of the Canaries TMA

The planning controller in the GCCCRNE sector of the Canaries TMA, a Spanish national, had a license with an initial issue date of 18 August 2008 and the following ratings: ADV, ADI (with AIR, GMC, TWR, GMS and RAD endorsements), APP, APS (with TCL endorsement), ACP and ACS (with TCL endorsement). For the GCCC unit, he had ACP and ACS ratings, which were valid until 24 November 2018.

He had a class-3 medical certificate that was valid until 22 August 2018. It included the following limitation: "Must wear corrective lenses for nearsightedness and carry a spare set".

1.5.3. Information on the executive controller in the GCCCRNE sector of the Canaries TMA

The executive controller in the GCCCRNE sector of the Canaries TMA, a Spanish national, had a license with an initial issue date of 29 July 2002 and the following ratings: ADV, ADI (with AIR, GMC, TWR, GMS and RAD endorsements), APP, APS (with TCL endorsement), ACP and ACS (with TCL endorsement). For the GCCC unit, he had ACP and ACS ratings, which were valid until 17 July 2018.

He had a class-3 medical certificate that was valid until 12 March 2019. It included the following limitation: "Must wear corrective lenses for nearsightedness and carry a spare set".

1.6. Aircraft information

The Boeing 737-8AS aircraft, registration EI-EKI and serial number 38496, was registered in the aircraft registry of the Irish Aviation Authority (IAA) on 28 March 2014. It has two CFM56-7B engines.

It has a certificate of airworthiness issued by the IAA and an airworthiness review certificate that is valid until 1 February 2019.

1.7. Meteorological information

1.7.1. General meteorological situation

At medium and high levels, there was intense circulation from the north over the Iberian Peninsula, at the exit of a powerful Atlantic ridge (maximum winds of 130 kt over the east of the Peninsula). There was also an extensive low-pressure trough with multiple vertices over the Mediterranean, interior/north of Africa and to the south of the Canary Islands. At low levels there was a powerful high-pressure system over the Atlantic, centered west of the Azores, which extended to the Peninsula and the Canaries, and low pressures over the Mediterranean, with a minimum in the Ionian Sea. Northerly air flowed between the two systems over the northeast of the Peninsula and the Balearic Islands, with very strong gusts and instability under the cold center near the Balearic Islands which saw showers and some storms, with snow in the mountains of Mallorca. There was also precipitation in the eastern Bay of Biscay and the upper Ebro River above around 1000 m. In the Canaries, there were moderate trade winds.

1.7.2 Meteorological situation in the accident area

Given this situation, the jet that skirted the ridge was causing turbulence to the

northeast of the Canary Islands, over Morocco. The wind was intense at FL340 and FL390. During the day, the Las Palmas meteorological monitoring office issued several SIGMETs:

WSCR31 LEMM 101137

GCCC SIGMET 3 VALID 101300/101700 GCGC-

GCCC CANARIAS FIR/UIR SEV TURB FCST S OF N29 AND N OF N23 FL180/360 MOV S NC=

WSCR31 LEMM 101145

GCCC SIGMET 4 VALID 101300/101700 GCGC-

GCCC CANARIAS FIR/UIR CNL SIGMET 3 VALID 101300/101700 GCGC=

WSCR31 LEMM 101200

GCCC SIGMET 5 VALID 101300/101700 GCGC-

GCCC CANARIAS FIR/UIR SEV TURB FCST WI N2840 W025 - N2350 W025 - N2240 W020 - N2240 W01310 - N2520 W012 - N2730 W00840 - N2850 W01250 - N2840 W025 FL180/360 MOV S NC=

WSCR31 LEMM 101639

GCCC SIGMET 6 VALID 101700/102100 GCGC-

GCCC CANARIAS FIR/UIR SEV TURB FCST S OF N28 AND N OF N22 FL180/340 MOV S NC=

The first of these called for severe turbulence moving south between the 23 and 29 north parallels from 13:00 until 17:00 UTC between FL180 and FL360 for the entire Canaries FIR. This SIGMET, issued at 11:37 UTC, was canceled at 11:45 so that another could be issued with more accurate information and indicating the presence of severe turbulence inside the polygon shown in the image below between FL180 and FL360, also from 13:00 to 17:00 UTC.

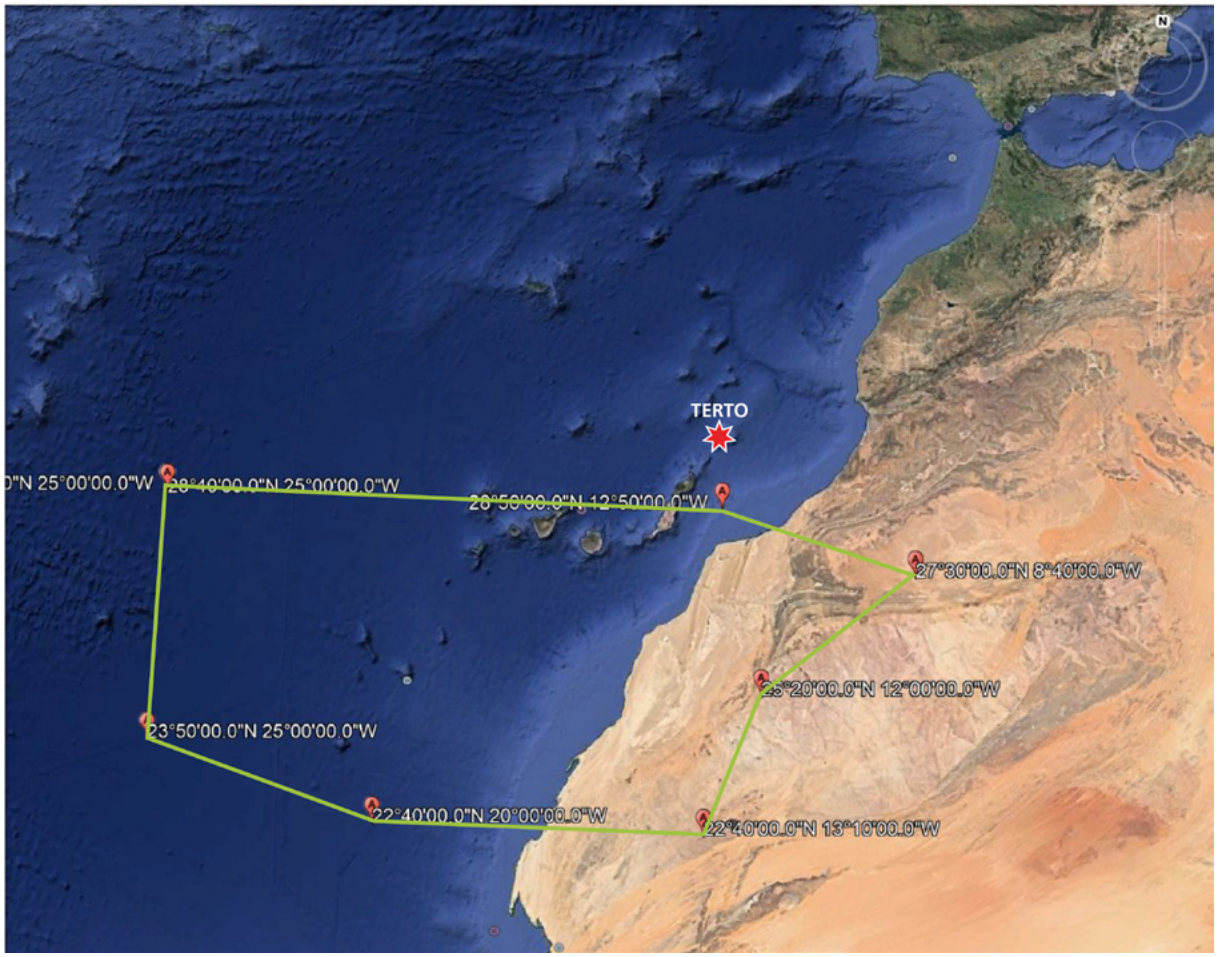

Illustration 1. Location of waypoint TERTO and of the polygon inside which severe turbulence was forecast

After 17:00, another SIGMET went into effect, issued at 16:39, that also warned of severe turbulence between FL180 and FL340 from the 23 to 28 north parallels.

Remote sensing images show that the cloud cover was low and that there was no convective activity.

Therefore, the presence of severe turbulence in the vicinity of the accident, even if not exactly at waypoint TERTO, was probable.

1.8. Aids to navigation

The most significant moments in the radar track of the aircraft involved in the accident are provided below.

The following image shows the position of the Boeing 737-8AS aircraft, with callsign RYR8421, and of the aircraft with callsign EZY91MT, at 16:37:28. The

controller identified a potential conflict with the latter and interrupted the descent maneuver of the Boeing 737-8AS.

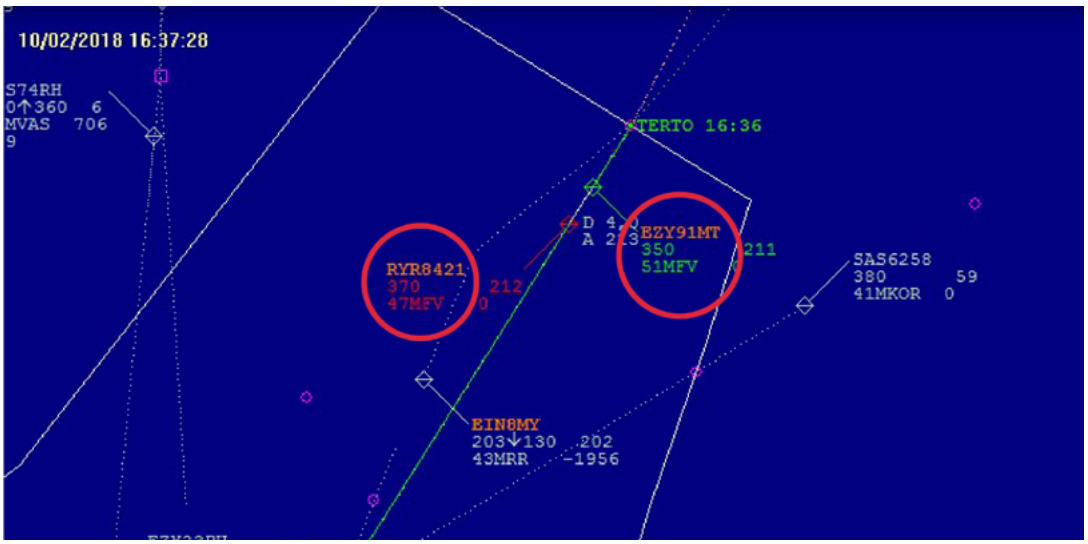

Illustration 2. Position of the aircraft at 16:37:28

Later, at 16:38:04, the Boeing 737-8AS aircraft with callsign RYR8421 was descending from FL370 and crossing through FL368:

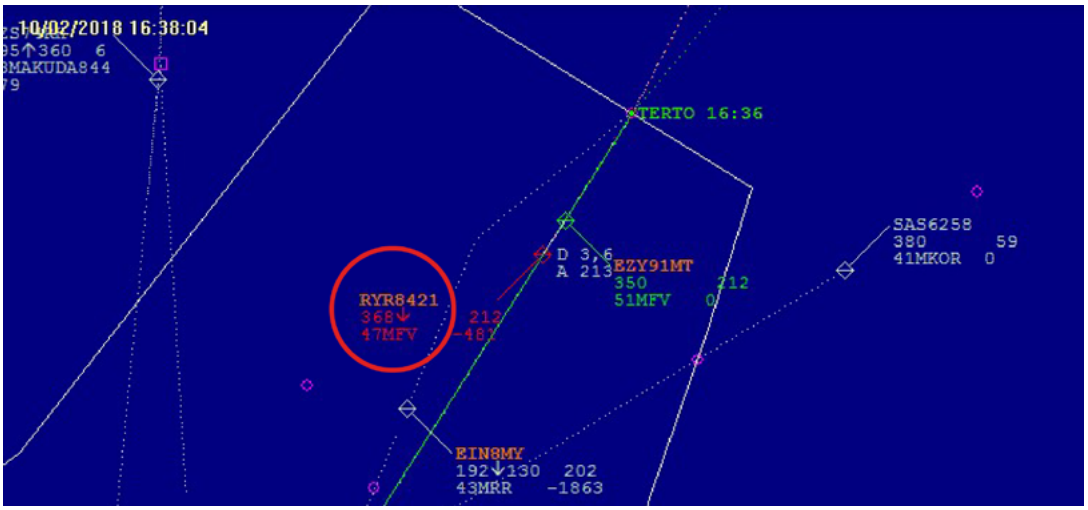

Illustration 3. Position of the aircraft at 16:38:04

A few seconds later, at 16:38:10, the Boeing 737-8AS with callsign RYR8421 was still descending and crossing through FL366.

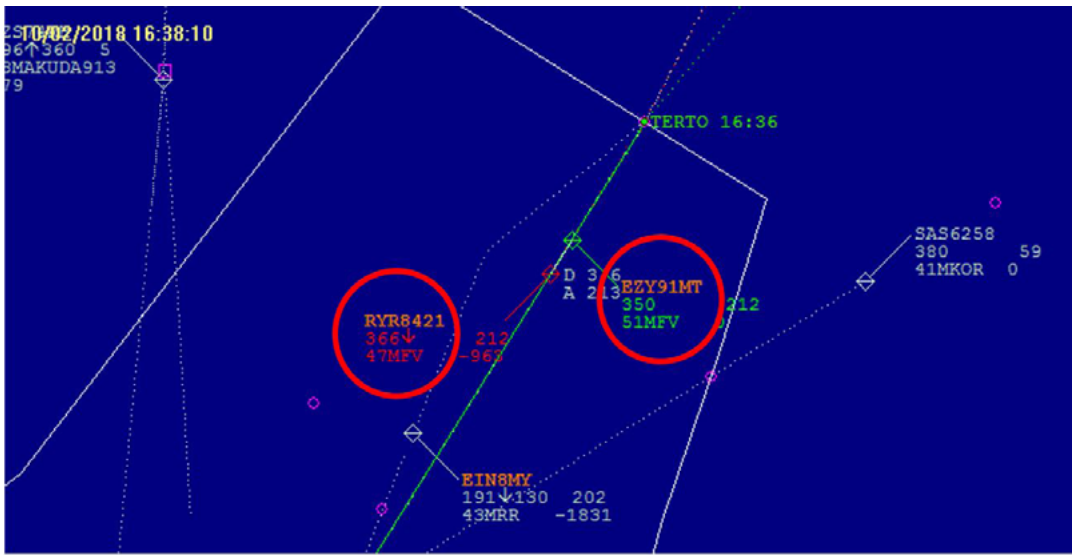

Illustration 4. Position of the aircraft at 16:38:10

At 16:38:40, the Boeing 737-8AS with callsign RYR8421 was crossing through FL358. Although the aircraft is shown on the radar display as descending, an analysis of the radar data reveals that in reality the aircraft had been climbing since 16:38:33, when the aircraft reached its lowest altitude, which was FL357.

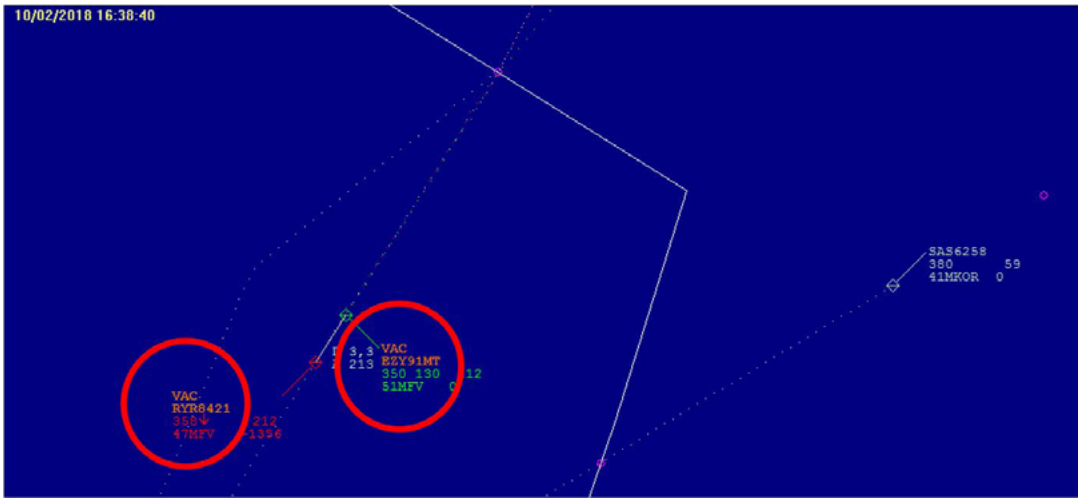

Illustration 5. Position of the aircraft at 16:38:40

1.9. Communications

The most significant communications between the air traffic controller and the pilots of RYR8421 and EZY91MT are provided in order to analyze the accident.

At 16:32:09, RYR8421 contacted the air traffic controller and stated that it was flying at FL370 direct to waypoint TERTO, which the controller acknowledged.

At 16:32:30, EZY91MT contacted the air traffic controller and reported it was flying at FL350 toward VEDOD. The controller acknowledged this report and instructed that the arrival was to be via route TERTO6S.

At 16:37:28, RYR8421 requested to descend. The controller cleared it to descend to FL130, arriving via route TERTO6S.

At 16:38:04, the controller amended his clearance and instructed RYR8421 to hold FL360 due to a possible conflict with another aircraft (EZY91MT).

At 16:38:14, the controller once more contacted EZY91MT and instructed it to start the descent to FL130. The controller informed it of the presence of another traffic some 3 NM away.

At 16:38:40, the controller contacted RYR8421 to inform it of the position and distance to the other traffic. The crew reported they were returning to FL360.

Once the conflict was clear, the controller continued by clearing both aircraft to descend.

At 16:47:25, RYR8421 reported that a passenger was injured with a broken foot and that they would require medical assistance upon reaching the airport. They said "*we just like to get some medical assistance on arrival*".

1.10. Aerodrome information

The aircraft had taken off from the Edinburgh Airport (ICAO code EGPH), in the United Kingdom, and was en route to the Fuerteventura Airport (ICAO code GCFV), in Spain.

The accident occurred in the Canaries airspace.

1.11. Flight recorders

Investigators did not have access to either the flight data recorder (FDR) or the cockpit voice recorder (CVR) because the CIAIAC was unaware of the accident until several days after it occurred, by which time the data were irretrievable. However, the operator was asked for a copy of the flight data contained on the quick access recorder (QAR), which were converted into engineering units by using a standard Boeing parameter data frame for this airplane model.

According to these data, the aircraft requested to descend at 16:37:25 from FL370. At that time it was flying at a calibrated airspeed (CAS) of 250 kt with the autopilot engaged in ALT HOLD mode.

At 16:37:40, the crew acknowledged the communication clearing them to descend to FL130. Simultaneous with this communication, the crew changed the active mode on the autopilot from ALT HOLD to MCP SPD, and started the descent to the cleared flight level. The pitch angle, which had been 3º when the descent started, gradually fell to -2º by 16:38:08.

At 16:38:07, the autopilot was placed in ALT HOLD mode and disengaged one second later. At the time, the aircraft was crossing through FL364 at a vertical rate of -3600 ft/min[2].

At 16:38:08, an input to the pitch control column was recorded, with the pitch changing from 1.38º in the previous second to 4.51º at that instant. This resulted in the pitch attitude increasing in one second from -2º to 0º, and generated a peak vertical acceleration value of 1.409 g. The descent rate fell instantly to -2340 ft/min.

Over the next 6 seconds, the input to the pitch control was eased until its position was at 0.94º, which translated into a reduction in the pitch attitude to -2.1º by 16:38:14, and an increase in the descent rate to -3660 ft/min. At that time the aircraft reached FL360.

At 16:38:15, the autopilot was engaged in ALT HOLD mode. This action resulted in an increase in the position of the control column to 6.02º, which translated into an increase in pitch angle from -2.3º to 1.6º over the course of one second, causing the vertical acceleration to spike once more, this time to 1.69 g.

The autopilot was again disengaged at 16:38:16, and the control column eased to the 1.58º position, with the vertical acceleration being reduced to 0.93 g.

Subsequently, at 16:38:21, the crew again increased the position of the control column to 6.77º, producing a third peak in vertical acceleration, to 1.41 g.

The control column was eased back for a fourth time to 0.94º, followed by an increase to 4.68º, yielding a fourth peak in the vertical acceleration, to 1.43 g, at 16:38:24.

This last maneuver reversed the descent profile of the aircraft, which crossed through FL357 to regain the requested level of FL360 at 16:39:01. A few seconds

[2]. The vertical speed was calculated based on the change in the recorded altitude values for each second.

earlier, at 16:38:49, the crew again re-engaged the autopilot.

The CAS during the maneuver remained at around 250 kt. The maximum lateral acceleration recorded during the event was 0.04 g.

From this moment on, the flight continued with no significant incidents, and the descent maneuver was resumed at 16:39:57.

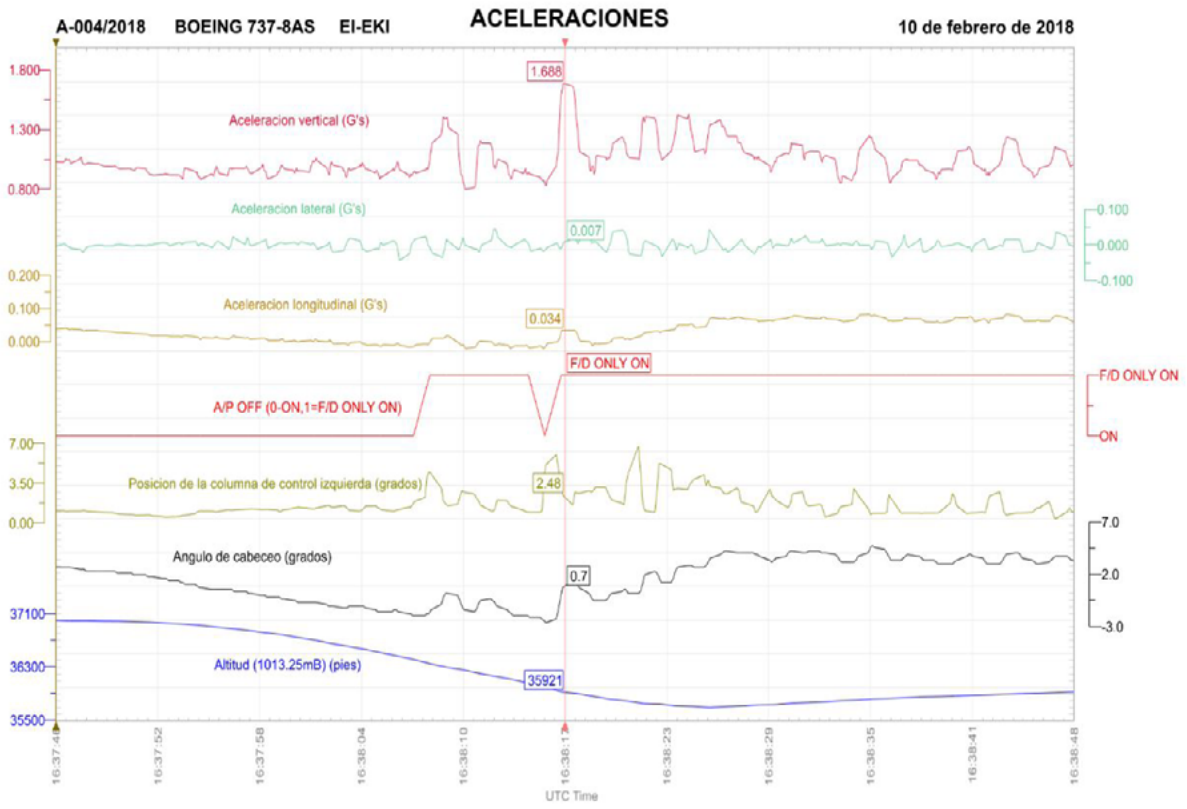

Illustration 6. Flight Data Recorder's data

1.12. Wreckage and impact information

The accident aircraft was not damaged.

1.13. Medical and pathological information

There was no indication that physiological factors or incapacitations affected the actions of the flight crew or the air traffic controllers.

1.14. Fire

There was no fire in the aircraft or the environment.

1.15. Survival aspects

Not applicable.

1.16. Tests and research

1.16.1. Statement from flight crew

Upon reaching the top of descent, we asked the Canaries air control service, on frequency 129.100, permission to start the descent maneuver. We were cleared to descend to FL130. We were already past our calculated top of descent, and we selected LVL CHG mode on the autopilot (to descend to the selected altitude, that is, to FL130). The aircraft started a steep descent at about 2000 ft/min or a little higher.

As we were crossing through FL364, the controller instructed us to stop the descent at FL360. We selected ALT HLD mode on the autopilot (to maintain altitude) and the airplane began to lower the pitch attitude.

As we passed FL360, I noticed that the recovery maneuver was being executed very slowly, so I disengaged the autopilot and stopped the descent just before crossing through FL357, and then climbed to regain the altitude requested, FL360.

The controller contacted us and explained the reason why we were cleared to level off at FL360. There was an Easyjet airplane behind us at FL350 that could be a conflict.

Shortly after levelling off, the cabin crew informed us that a passenger, who was standing at the rear waiting to use the bathroom, had fallen and was injured. The passenger was holding his child in his arms, who also fell and hit his head.

A doctor who was on board evaluated the passenger and determined that he could have a broken leg and should not be moved.

We informed the controller of the injury and requested medical assistance upon landing. Once at the airport, a nurse came on board and confirmed the need for an ambulance, which arrived 45 minutes after we reached the parking stand.

1.16.2. Interview of flight attendant

In an effort to identify how the maneuver that was made affected the passengers, the cabin crew were interviewed.

They stated that they had not been alerted of the descent maneuver and that all four were standing at the rear of the aircraft attending to passengers and stowing the service carts.

When asked about the number of passengers that were standing at the time of the event, they could not give a precise answer, with some stating there were two passengers, while others thought as many as five passengers could have been standing.

The seatbelt sign was not lit, though they expected the flight crew to turn it on in the next few minutes to begin the procedure to secure the cabin for landing.

They did agree in stating that the injured passenger had a child (approximately 5 years old) in his arms and that he was exiting the right-hand lavatory.

The crew felt a series of violent shakes, which they initially identified as turbulence. In all their experience as flight attendants, they had never experienced such a sudden movement in an aircraft.

These sudden movements caused all four flight attendants to fall to the floor. The injured passenger turned his body to the left to try to shield the child, which forced his legs into an unnatural position. He broke his ankle when he fell due to the jolts. The child hit the back of his head, which caused some bruising. No one else was injured.

After the event, the injured passengers cried out in pain. Their relatives were also upset and raised their voices at the flight attendants, complaining about what had happened.

Flight attendant number 2 played the role of intermediary with the flight crew, informing them of the event using the company's standard PAA format (problem/ actions taken/additional information).

They asked the flight crew to request medical assistance upon landing.

When they reached the parking stand, there was no medical assistance ready to treat them. The ramp agent was unaware of the need for medical assistance and called the airport nurse, who reported to the aircraft five minutes later. Upon arriving she was informed of the situation and she called an ambulance, since one was not available at the Fuerteventura Airport. The telephone operator instructed the nurse not to move the patient until the ambulance arrived, which happened one hour and ten minutes after the notification was made.

The crew made the return flight that same day despite stating that they had been affected by the event.

They noted a lack of communication and CRM with the flight crew, since after the event they received no information about what had happened. Even after landing, the flight crew did not go see the injured individuals or ask about the condition of the passengers or the crew. They also thought the response time of the medical services at Fuerteventura was unacceptable.

1.16.3. Statement from the executive controller in sector GCCCRNE of the Canaries TMA

Aircraft RYR8421 requested to descend as it was flying between waypoints TERTO and POKAB at FL370. I cleared it to descend to FL130.

As soon as I authorized the descent, I noticed there was no horizontal separation with aircraft EZY91MT, so I instructed RYR8421 to hold at FL360 due to a potential traffic conflict as it was crossing FL368.

I then instructed EZY91MT to descend to FL130 to allow them both to descend.

1.16.4. Statement from the planning controller in sector GCCCRNE of the Canaries TMA

Aircraft RYR8421, which was at FL370, requested to start its descent between waypoints TERTO and POKAB. The executive controller cleared it to descend to FL130.

As RYR8421 was crossing through FL368, the executive controller immediately realized that there was insufficient longitudinal separation with EZY91MT, which was at FL350.

He took corrective action and stopped the descent of RYR8421 at FL360 to provide vertical separation. The instruction was acknowledged by the pilot.

Then, in an effort to allow the aircraft to continue descending with vertical separation, the executive controller instructed EZY91MT to descend to FL130.

In his capacity as planning controller, he was in charge of the flight strip bay. He identified an immediate corrective action following the mistaken descent instruction, so he did not intervene.

1.17. Organizational and management information

Not applicable

1.18. Additional information

1.18.1. Use of seatbelts

The operator stated that the seatbelts are used during pushback, taxi, takeoff and climb to FL100. During the descent, they are used from FL150 until the engines are secured at the stand.

The operator has further specified the need to use the seatbelt in the following circumstances:

1 – If turbulence is present or expected during the flight, the operator's Operations Manual states:

"When turbulence is experienced or anticipated, the passenger seatbelt sign shall be switched. Best practice is that crew advise ATC of hazardous meteorological conditions en route which has the effect of notifying other traffic. It may be advisable also to limit cabin service".

2 – If any crew member needs to leave their post in the cockpit:

"Should either the captain or the first officer find it necessary to leave the flight deck during flight, on the fasten-seatbelt sign".

3 – Obviously the pilot can turn on the seatbelt sign in any other circumstance deemed appropriate during operations as per the contents of the Operations Manual.

In this accident, the seatbelt sign was not on. Since turbulent weather conditions were not present, the pilot did not think it necessary to turn on the seatbelt sign, as per the operator's procedures.

1.18.2. Aerodrome emergency plan

Regulation (EU) No 139/2014 of the Commission of 12 February 2014, laying down requirements and administrative procedures related to aerodromes, specifies in requirement ADR.OPS.B.005 that the aerodrome operator must establish an Aerodrome Emergency Plan that is commensurate with the aircraft operations and

other activities conducted at the aerodrome and provides for the coordination of appropriate organizations in response to an emergency occurring at an aerodrome or in its surroundings.

The Guidance Material for requirement ADR.OPS.B.005 (*GM3 ADR.OPS.B.005(a) Aerodrome emergency planning. Contents of an Aerodrome Emergency Plan Document*) specifies that an aerodrome emergency plan must include the following sections:

- "Section 2 — Aircraft accident on the aerodrome

……

e) Action by medical services:

(1) hospitals;

(2) ambulances;

(3) doctors; and

(4) medical personnel.

- Section 3 — Aircraft accident off the aerodrome

……

f) Action by medical services;

(i) hospitals;

(ii) ambulances;

(iii) doctors; and

(iv) medical personnel"

And, other Guidance Material for requirement ADR.OPS.B.005 (GM4 ADR. OPS.B.005) specifies:

"a) at least the following types of emergencies may be included in the aerodrome emergency plan:

Aircraft emergencies;

….

b) The aircraft emergencies for which services may be required are generally classified as:

Aircraft accident: an aircraft accident which has occurred on or in the aerodrome surroundings

The Fuerteventura Airport manager had laid down "Guidelines for requesting emergency medical assistance at the airport", applicable from 1 January 2016. These guidelines are contained in Annex I to this report.

According to these guidelines, the following actions should have been taken in this specific situation:

Medical emergency on board aircraft

If the medical emergency occurs on board an aircraft, the crew will inform the controller on duty in the control tower (TWR) of the need for medical assistance at the foot of the airplane.

The TWR personnel will gather all the information possible from the crew on the type of emergency and relay it to CEOPS.

CEOPS will immediately notify the first aid service, which will consider informing emergency services (112), in which case CEOPS will make all other notifications to ensure security gives priority access to the ambulance and escorts it. CEOPS will also inform the airline's representative or handling agent at the airport so that they can coordinate with the handling service the necessary response to the emergency at the foot of the airplane.

1.18.3. AESA's s interpretation on the content of the Aerodrome emergency plan

AESA, during the comment phase of this draft report, indicated that it considered that this accident was an individual medical emergency and as such should be outside the Aerodrome Emergency Plan. However, the CIAIAC according to the definition of accident contained in Regulation (EU) No. 996/2010, according to which an accident is, among other events, that during which a person suffers serious injuries as a result of being on the aircraft, considers that this medical emergency is the result of an aircraft accident and should be included in the Aerodrome Emergency Plan as recommended by EASA in its guidance material.

1.19. Useful or effective investigation techniques

No special investigation techniques were used.

2. ANALYSIS

2.1. Analysis of the pilot's actions

At 16:38:04, according to radar data and to the account of the air traffic controllers, as the aircraft was descending from FL370 to FL130, it was instructed by air traffic control to stop its descent at FL360 due to a potential conflict with another aircraft. At that time, the aircraft was crossing through FL368.

However, according to the pilot's statement, they were crossing through FL364 when this instruction from control was received.

At 16:38:07[3], according to flight recorder data, the aircraft pilot selected ALT HOLD mode on the mode control panel (MCP) in order to maintain altitude. At that time, the aircraft was crossing through FL364. This action is identified as a response to the instruction from ATC to hold FL360.

One second later, as the aircraft was crossing through FL363, the pilot decided to disengage the autopilot. The pilot stated that he thought they had dropped below their authorized flight level, which was FL360, and thinking that the maneuver to regain altitude was taking place too slowly, he decided to manually return to the flight level instructed by ATC.

After disengaging the autopilot, the data taken from the flight recorder show that the pitch attitude swung between positive and negative values, causing significant changes in the load factor.

These fluctuations are typical in an aircraft piloted manually at high altitudes, since a small input to the controls causes a significant change in the pitch.

The aircraft continued to descend and, at 16:38:15, as it approached the altitude authorized by the air traffic controller, the pilot unsuccessfully tried to engage the autopilot. At that time, the vertical acceleration reached its maximum value of 1.69 g.

While executing this manual maneuver, a passenger fell, causing significant injuries to one leg. It was not possible to determine the exact moment during the maneuver when the passenger was injured.

[3] Note that the data recorded by the flight recorder and those recorded by the radar may not be synchronized.

2.2. Analysis of the air traffic controller's actions

According to the communications between the controller and the pilot, at 16:37:28 the aircraft was cleared to descend from FL370 to FL130. At that time, there was another aircraft ahead of it, separated horizontally by 4 NM, and at FL350.

Thirty-six seconds later, the controller amended his clearance and instructed the aircraft to hold FL360 due to a possible conflict with the traffic ahead of it, which was flying slower. When the controller amended his clearance, the horizontal separation between the two aircraft was 3.6 NM and the aircraft was crossing through FL368, according to the radar track.

2.3. Analysis of the medical service's actions

According to the communications transcript, at 16:47:25 the crew informed the approach controller that there was an injured passenger on board who may have a broken leg, and requested medical assistance upon reaching the Fuerteventura Airport.

After this, at 16:48:55, the approach controller informed the tower controller at the Fuerteventura Airport that the aircraft operated by Ryanair had requested an ambulance.

At 16:50, the tower controller at the Fuerteventura Airport contacted the airport's CEOPS to coordinate the medical response, as noted in the airport's operations log. This log states that: *"TWR informs that RYR8421 requests nurse due to pax with broken leg on board"*. It further showed an estimated landing time of 17:25 for the aircraft. Thus, the entry in the airport's operations log does not agree with what the crew requested. The crew requested medical assistance, not a nurse.

According to the "Guidelines for requesting emergency medical assistance at the airport", laid down by the Fuerteventura Airport operator, after receiving this request for medical assistance, the CEOPS should have immediately notified the first aid service, which is run by nurses and who are tasked with evaluating if it is necessary to call the 112 emergency services number. Investigators were unable to determine when the first aid service was first informed of this medical emergency and if it ruled out the need to request an ambulance to treat the injured passenger.

The nurse who was on duty at the airport when the aircraft landed reported to the scene quickly to evaluate the condition of the injured passenger. After this initial assessment, she called for an emergency ambulance, which was delayed in arriving because it was on call at a location far away from the airport. There are several

ambulances on the island of Fuerteventura, but only one emergency ambulance. According to the airport's operations log, the incident was resolved at 18:24, after waiting 43 minutes for the ambulance.

Since the airport operator has only laid down guidelines, which were unsuccessful in providing the medical assistance needed in this particular case, a safety recommendation is issued to the Fuerteventura Airport operator to have it implement a procedure to provide medical assistance at the airport that clearly identifies and assigns tasks so that this procedure can be performed as part of the airport's Emergency Plan.

2.4. Analysis of the content of the Aerodrome Emergency Plan

As indicated above, CIAIAC disagrees with AESA's interpretation of what the Aerodrome Emergency Plan should contain.

CIAIAC considers that the Aerodrome Emergency Plan should include as an emergency, among others, the aircraft accident, as recommended by EASA in its guidance material. Understanding as an aircraft accident the definition contained in Regulation (EU) No. 996/2010.

To ensure that the Emergency Plans of Aerodromes certified by AESA are in accordance with the guidance material prepared by EASA, a recommendation is issued to AESA to review the Emergency Plans of the certified Aerodromes in order to ensure that they contain a procedure for providing the due medical assistance, in particular in the case of aircraft accident, clearly identifying responsibilities and responsible for the necessary actions.

3. CONCLUSIONS

3.1. Findings

- The aircraft's crew had valid licenses and medical certificates.

- The controllers at the station involved in the accident had valid licenses, unit endorsements and medical certificates.

- The aircraft's documentation was valid and it was airworthy.

- The controller cleared the aircraft to descend; however, 36 seconds later he amended his clearance and instructed it to hold at FL360.

- At 16:38:04, according to the radar track, as the aircraft was descending from FL370 and crossing through FL368, it was instructed by ATC to stop descending at FL360.

- At 16:38:07, according to data recorded in the flight recorder, the aircraft's pilot set the autopilot to ALT HOLD mode in response to the air traffic controller's instruction. At that time, the aircraft was crossing through FL364.

- One second later, as the aircraft was crossing through FL363, the pilot decided to disengage the autopilot.

- During the manual maneuver to hold at FL360, the aircraft's pitch angle experienced large swings, and the vertical acceleration reached a value of 1.69 g.

- While executing this manual maneuver, a passenger fell, causing significant injuries to one leg.

3.2. Causes/Contributing factors

The investigation has determined that the accident probably occurred when the crew executed a sudden manual maneuver to maintain the specified flight level.

A contributing factor was the decision to disengage the autopilot to carry out the maneuver manually, which contributed to the abrupt nature of the maneuver.

4. SAFETY RECOMMENDATIONS

Since the airport operator has only laid down guidelines, which were unsuccessful in providing the medical assistance needed in this particular case, the following safety recommendation is issued:

REC 50/18: It is recommended that the Fuerteventura Airport operator reviews its procedure to provide medical assistance at the airport, in case of medical emergency, and clearly identifies and assigns tasks so that this procedure can be performed as part of the airport's Emergency Plan.

To guarantee that the Emergency Plans of Aerodromes certified by AESA are in accordance with the guidance material prepared by EASA, the following recommendation is issued to AESA:

REC 51/18: AESA is recommended to review the Emergency Plans of certified aerodromes in order to ensure that they contain a procedure for providing proper medical assistance, particularly in the case of an aircraft accident, clearly identifying responsibilities and responsible for the actions necessary.

ANNEXES

ANNEX I: GUIDELINES FOR REQUESTING EMERGENCY MEDICAL ASSISTANCE AT THE AIRPORT FROM 1 JANUARY 2016

Starting 1 January, the new first aid service at the airport, staffed by medics, will go into effect at specific times. As a result, if any medical emergency arises within airport facilities, the following guidelines are to be followed:

IF IT OCCURS DURING SERVICE HOURS:

A) Medical emergency at airport facilities

If it occurs during the hours of the first aid service, inform the service by telephone or report directly to the offices of the service, where the staff will determine whether or not to call 112

B) Medical emergency onboard an aircraft

If the medical emergency occurs on board an aircraft, the crew will inform the controller on duty in the control tower (TWR) of the need for medical assistance at the foot of the airplane.

The TWR personnel will gather all the information possible from the crew on the type of emergency and relay it to CEOPS.

CEOPS will immediately notify the first aid service, which will consider informing emergency services (112), in which case CEOPS will make all other notifications to ensure security gives priority access to the ambulance and escorts it. CEOPS will also inform the airline's representative or handling agent at the airport so that they can coordinate with the handling service the necessary response to the emergency at the foot of the airplane

IF OUTSIDE SERVICE HOURS, THE PROCEDURE WILL BE THE SAME AS IT WAS BEFORE:

A) Medical emergency at airport facilities requiring immediate intervention and possible transfer in ambulance.

When faced with a medical emergency in the airport facilities requiring an immediate response, assistance from emergency services will be immediately requested by calling 112. This initial request for assistance should be made by someone who witnessed the event, whether it is airline personnel, handling agents or another employee of the companies that operate at the airport.

In addition to calling 112, the following instructions will be followed:

1- **The incident will be reported as soon as possible to CEOPS**, who will in turn inform the AAPUC or marshaller (depending on the location of the emergency) and the Civil Guard to monitor the actions taken and provide support as needed (provide the first aid kit, allow access to medical personnel, public address announcements, translation assistance by the green jackets and all other basic services). If the event occurs airside, in addition to the marshaller, CEOPS will also notify the vehicle access guards so they can expedite the access of the ambulance, as per the operating instruction for these cases.

In every case, the CEOPS operator will report the incident to the duty manager.

2- **If a heart attack is suspected**, the procedure for using one of the six defibrillator units located at specified points throughout the passenger terminal building will be activated.

B) Medical emergency on board aircraft.

If the medical emergency occurs on board an aircraft, the crew will inform the controller on duty in the control tower (TWR) about the need for medical assistance at the foot of the airplane.

The TWR personnel will gather all the information possible from the crew on the type of emergency and relay it to CEOPS.

CEOPS will immediately notify emergency services (112) and make all other notifications to ensure security gives priority access to the ambulance and escorts it. CEOPS will also inform the airline's representative or handling agent at the airport so that they can coordinate with the handling service the necessary response to the emergency at the foot of the airplane.

Hours of operation for the first aid service in the winter season.

	Schedule
Monday	From 7 am to 8 pm
Tuesday	From 8 am to 5 pm
Wednesday	From 11 am to 3 pm and from 5 pm to 7 pm
Thursday	From 8 am to 5 pm
Friday	From 8 am to 2 pm and from 3 pm to 8 pm
Saturday	From 9 am to 8 pm
Sunday	From 8 am to 3 pm and from 7 pm to 10 pm