

# CIAIAC

COMISIÓN DE  
INVESTIGACIÓN  
DE ACCIDENTES  
E INCIDENTES DE  
AVIACIÓN CIVIL

## Report IN-005/2017

Incident involving a BOEING 737, registration EC-JBK, operated by AIR EUROPA, and a CESSNA Citation C510, registration EC-LCX, operated by CALADERO AVIATION, 13 NM north of the Palma de Mallorca Airport (Illes Balears, Spain) on 20 April 2017



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DE ESPAÑA

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DE ACCIDENTES E INCIDENTES  
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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](mailto: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.

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### **Abbreviations**

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A/P	Autopilot
A/T	Autothrust
ACAS	Airborne collision avoidance system
ACC	Area control center
AEMET	Spain's National Weather Agency
AESA	Spain's National Aviation Safety Agency
ATCO	Air traffic controller
ATPL (A)	Airline transport pilot license (airplane)
ATC	Air traffic control
°C	Degree centigrade
CAVOK	Ceiling and visibility OK
CFL	Cleared flight level
CPL (A)	Commercial pilot license (airplane)
FL	Flight level
ft	Foot
h	Hour
IFR	Instrument flight rules
km	Kilometer
Km/h	Kilometer per hour
Kt	Knot
LECP	ICAO location indicator for the Palma de Mallorca ACC
LEIB	ICAO location indicator for the Ibiza Airport
LEPA	ICAO location indicator for the Palma de Mallorca Airport
m	Meter
MEL	Minimum equipment list
METAR	Aviation routine weather report (in meteorological code)
min	Minute
MFD	Multi-function display
MP	Multipilot
N	North
NE	Northeast

NM	Nautical mile
OJT	On-the-job training
OJTI	On-the-job training instructor
PAC	Conflict caution alert of the SACTA system
PF	Pilot flying
PFD	Primary flight display
PM	Pilot monitoring
QAR	Quick access recorder
RA	Resolution advisory
s	Second
S	South
SACTA	Automated air traffic control system
SID	Standard instrument departure
SP	Single pilot
STAR	Standard instrument arrival
STCA	Short-term conflict alert
TA	Traffic advisory
TCAS	Traffic alert and collision avoidance system
UTC	Universal time coordinated
VAC	Conflict violation alert of the SACTA system



## Synopsis

Operator	Air Europa	Caladero Aviation
Aircraft	Boeing 737-800 registration EC-JBK	Cessna Citation C510 registration EC-LCX
Persons on board	168, no injuries	2, no injuries
Type of flight	Commercial air transport – Scheduled – Domestic – Passenger	General aviation – Business
Flight phase	En route – normal descent	En route – ascending for cruise level
Flight rules	IFR	IFR
Date and time of incident	20 April 2017 at 06:58 UTC <sup>1</sup>	
Site of incident	13 NM north of the Palma de Mallorca Airport at an altitude of 12000 ft	
Date of approval	September, 26 <sup>th</sup> 2018	

### Summary of event:

On 20 April 2017, a Boeing 737-800 operated by Air Europa, registration EC-JBK, was on approach<sup>2</sup> to the Palma de Mallorca Airport, inbound from Barcelona (Spain), while a Cessna Citation C510 operated by Caladero Aviation, registration EC-LCX, was climbing after taking off<sup>3</sup> from the Palma de Mallorca Airport.

Both aircraft were in radar and radio contact with sector F1X of the Palma ACC.

The Air Europa aircraft was instructed to maintain FL120 and was stabilized at this flight level at 06:56:30. The Caladero Aviation aircraft had been instructed to stop climbing and hold at FL110; however, the crew of this aircraft acknowledged FL120 and stabilized at this level at 06:57:45, at which time the horizontal distance between the two aircraft, which were on a collision course, was 2.5 NM.

The crews on both aircraft had the other in sight, and their respective ACAS systems were issuing TCAS TA.

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<sup>1</sup>. All times in this report are in UTC. Local time is UTC + 2

<sup>2</sup>. STAR TOLSO1R

<sup>3</sup>. SID BAVER1T

Due to their converging flight paths, the Air Europa aircraft received a resolution advisory (RA) from the ACAS and initiated a descent maneuver, as instructed. The Caladero Aviation aircraft also conducted an evasive descent maneuver, at the crew's discretion.

According to radar data, at 06:58:19 the aircraft reached the closest point of approach, which was 0.9 NM horizontally and 0 ft vertically.

From that moment on, the distance between the aircraft increased since, horizontally, the Caladero Aviation aircraft followed the instruction to turn left given by the sector F1X controller, and vertically, due to the change in direction given by the ACAS RA (from descend to climb) to the Air Europa aircraft, which its crew also followed.

After the incident, both aircraft continued their respective flights without further incident.

## 1. FACTUAL INFORMATION

### 1.1. History of the flight

On 20 April 2017, a Boeing 737-800 operated by Air Europa, registration EC-JBK and callsign AEA6007, was flying from the Barcelona-El Prat Airport to the Palma de Mallorca Airport. At the same time, a Cessna Citation C510 operated by Caladero Aviation, registration EC-LCX, was taking off from the Palma de Mallorca Airport on its second scheduled flight of that day, between that airport and the Malaga-Costa del Sol Airport (Spain).

The Air Europa aircraft was flying standard instrument arrival (STAR) TOLSO1R to runway 06L.

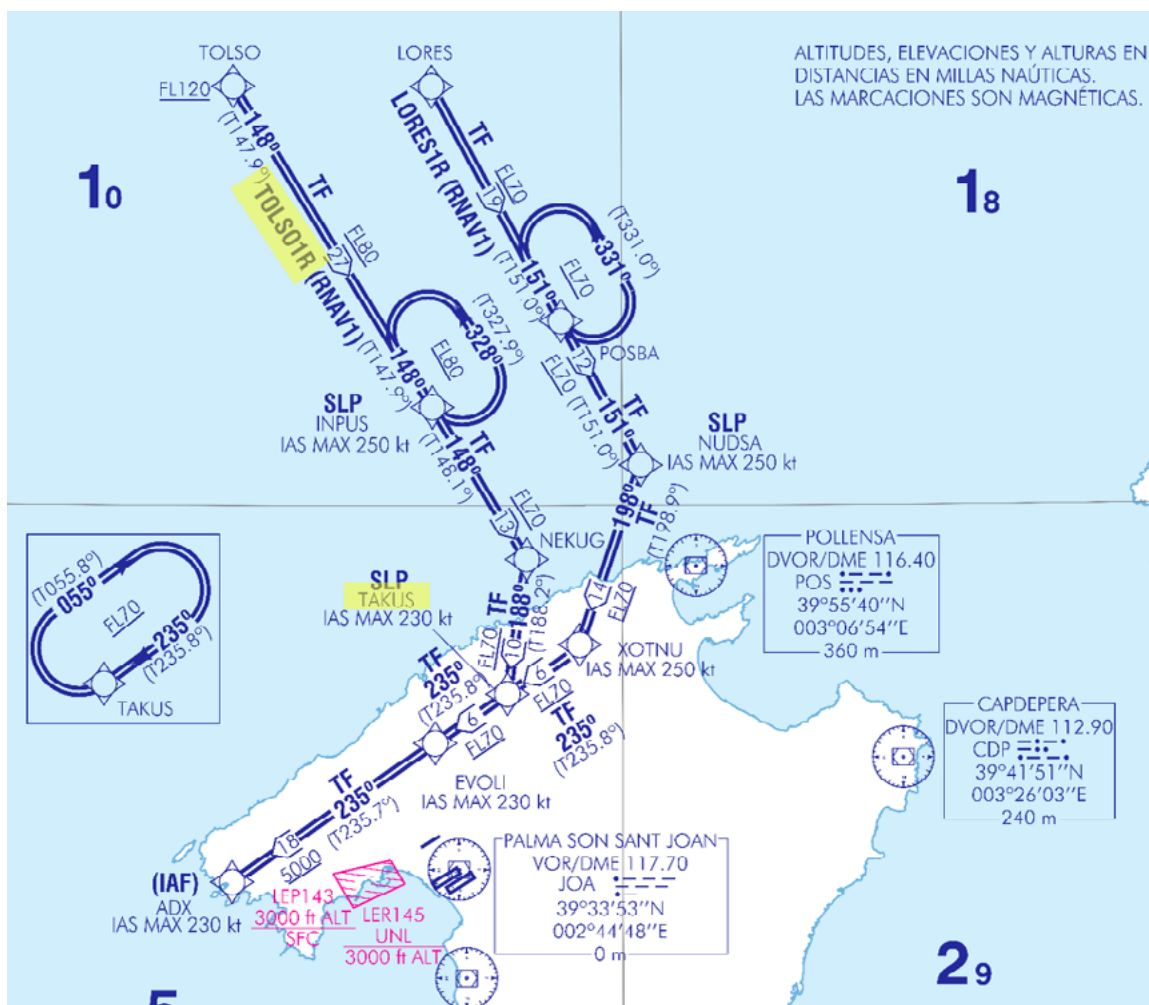


Fig. 1. Section of chart AD 2 – LEP/LESJ STAR 2.1 (STAR TOLSO1R)

The Caladero Aviation aircraft was cleared to fly standard instrument departure (SID) BAVERT after having taken off from runway 06R.

As figures 1 and 2 show, the flight paths of the two aircraft cross in the vicinity of point TAKUS. Sector F1X of the Palma ACC was charged with ensuring separation between arriving and departing aircraft in that area for the operational configuration in use on that day.

Both aircraft contacted sector F1X on its frequency. At that time, the sector was being handled by a controller receiving on-the-job (OTJ) training, an executive controller acting as the instructor<sup>4</sup> and a planning controller. Communications with the aircraft were handled at all times by the controller under instruction, while the executive controller explained the situation to the trainee. The controllers were in the final 40 minutes of their watch prior to turnover, which was scheduled for 07:00.

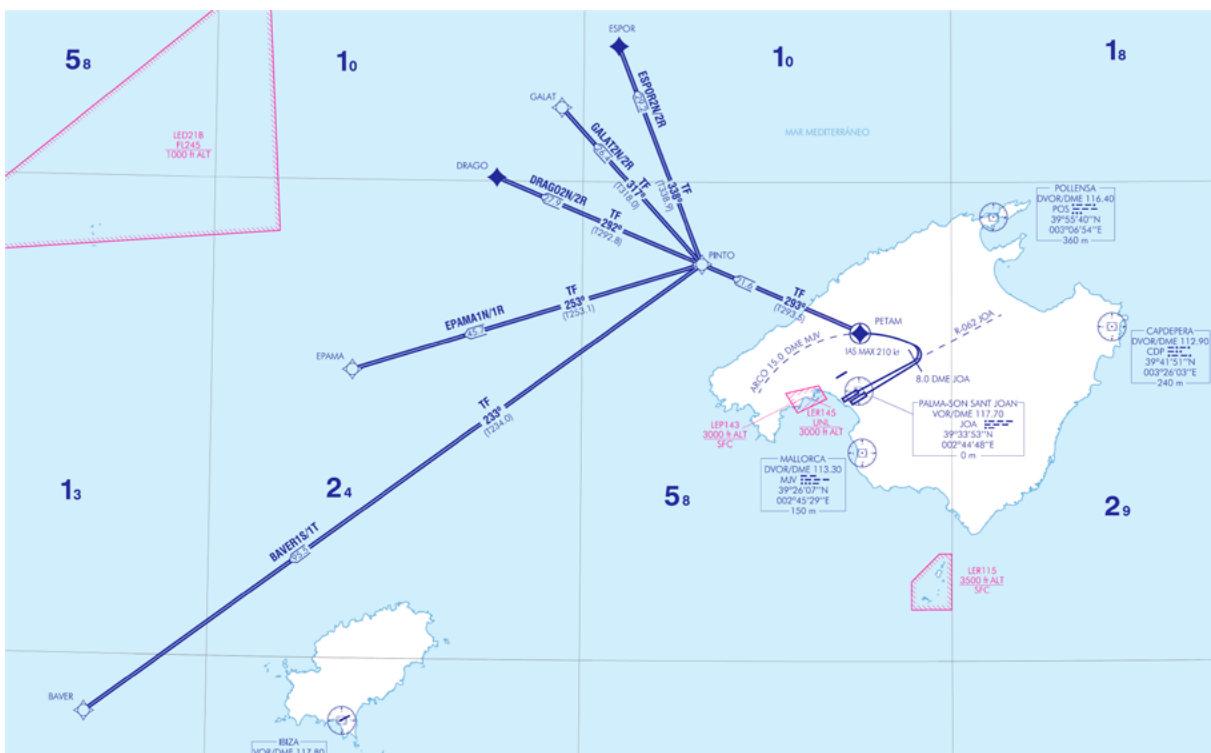


Fig. 2. Section of chart AD 2 – LEPA/LESJ SID 3.1 (SID BAVERT1T)

AEA6007 was cleared to make a series of descents until it was instructed to descend to and maintain FL120. EC-LCX was cleared to make a series of climbs until, at 06:56:21, the controller instructed it to continue climbing to FL110. The crew of the aircraft acknowledged FL120. As a result, EC-LCX continued climbing and leveled off at FL120. The aircraft were at the same altitude on converging flight paths, which caused the TCAS on AEA6007 to activate and issue a descent resolution advisory. The captain of EC-LCX also carried out an evasive descent maneuver.

<sup>4</sup>. When the trainee is on the frequency, it is understood that he is performing the duties of the executive controller, and his actions are the responsibility of the instructor.

At the closest point of approach during the event, the aircraft were 0.9 NM and 0 ft apart.

## 1.2. Injuries to persons

### 1.2.1. Aircraft EC-JBK

Injuries	Crew	Passengers	Total in the aircraft	Other
Fatal				
Serious				
Minor				
None	6	162	168	
<b>TOTAL</b>	<b>6</b>	<b>162</b>	<b>168</b>	

### 1.2.2. Aircraft EC-LCX

Injuries	Crew	Passengers	Total in the aircraft	Other
Fatal				
Serious				
Minor				
None	2		2	
<b>TOTAL</b>	<b>2</b>		<b>2</b>	

## 1.3. Damage to aircraft

The aircraft involved in the incident were not damaged.

## 1.4. Other damage

None.

## 1.5. Personnel information

### 1.5.1. Information on the crew of EC-JBK

The captain of the aircraft, a 47-year-old Spanish national, had an airline transport pilot license for airplanes (ATPL(A)) issued by Spain's National Aviation Safety Agency

(AESA) with B-737 300-900 type and instrument ratings that were valid until 31 March 2018. He also had a class-1 medical certificate that was valid until 8 February 2018. He had a total of 11,100 flight hours, of which 10,853 had been on the type.

The first officer of the aircraft, a 33-year-old Spanish national, had an airline transport pilot license for airplanes (ATPL(A)) issued by AESA with B-737 300-900 type and instrument ratings that were valid until 31 July 2017. He also had a class-1 medical certificate that was valid until 11 September 2017. He had a total of 4,300 flight hours, of which 447 had been on the type.

### **1.5.2. Information on the crew of EC-LCX**

The captain of the aircraft, a 46-year-old Spanish national, had a commercial pilot license for airplanes (CPL(A)) issued by AESA with a C510/SP/MP<sup>5</sup> type and instrument ratings that were valid until 31 July 2017. He also had a class-1 medical certificate that was valid until 24 June 2017. He had a total of 4,459 flight hours, of which 1,414 had been on the type.

The first officer of the aircraft, a 25-year-old Spanish national, had a CPL(A) issued by AESA with a C510/MP type and instrument ratings that were valid until 30 September 2017. He also had a class-1 medical certificate that was valid until 25 February 2018. He had a total of 334 flight hours, of which 80 had been on the type.

This same crew had been flying together since October 2016, and had last flown on 17 April 2017 (three days before the incident).

On the day of the incident, they had five domestic flights scheduled: Zaragoza - Palma de Mallorca - Malaga - Barcelona - Palma de Mallorca - Zaragoza.

They had prepared for the flights of 20 April 2017 on the previous day in Zaragoza.

### **1.5.3. Information on control personnel**

The air traffic control unit that was handling the two aircraft in question (sector LECPF1X) was staffed by three people: a planning controller, an executive controller and a controller in training.

The executive controller was also doubling as the instructor of the controller in training, who had experience in the route sectors and was receiving OJT for the

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<sup>5</sup>. This rating allows flying the C510 aircraft as a single pilot or as a copilot (multi-pilot). This aircraft offers the option of both single- and multi-pilot operations.

Palma de Mallorca approach. The trainee was giving clearances and instructions with constant oversight from the instructor, who was explaining to the trainee the various scenarios for the upcoming tasks involving the traffic.

The trainee, a 39-year-old Spanish national, had an air traffic controller license, first issued by AESA on 2 December 2009. He also had a medical certificate that was valid until 13 May 2019. He had three and a half years of experience at the unit and had unit endorsements with route and approach ratings for the LEIB sector that were valid until 6 September 2017. At the time he was being trained to obtain the LEPA approach rating.

The executive controller (and instructor), a 53-year-old Spanish national, had an air traffic controller license, first issued by AESA on 1 June 1993. He also had a medical certificate that was valid until 22 April 2018. He had some twenty years of experience at the unit. He had unit endorsements with route and approach ratings (LEIB and LEPA sectors) that were valid until 9 May 2018. His license also had the OJTI (OJT Instructor) endorsement, which was valid until 9 May 2020.

The planning controller, a 56-year-old Spanish national, had an air traffic controller license, first issued by AESA on 30 January 1993. He also had a medical certificate that was valid until 23 February 2018. He had some seventeen years of experience at the unit. He had the LECP endorsements, which were valid until 26 September 2017, and was rated for route and approach at the LEIB and LEPA positions.

## **1.6. Aircraft information**

### **1.6.1. Information on aircraft EC-JBK**

The aircraft with registration EC-JBK, a BOEING 737-800 with serial number 33973, had a valid certificate of airworthiness issued by Spain's Civil Aviation General Directorate on 19 November 2004. The airworthiness review certificate, issued by AESA, was valid until 14 November 2017. Its last line maintenance activity had been an A-check on 9 March 2017, and its last base maintenance activity had been a C and structural check done on 23 December 2016, with 34816.9 flight hours on the aircraft.

### **1.6.2. Information on aircraft EC-LCX**

The aircraft with registration EC-LCX, a Cessna 510 Citation Mustang with serial number 510-0235, had a valid certificate of airworthiness issued by AESA on 23 October 2009. The airworthiness review certificate was valid until 21 July 2017. The last significant maintenance activities had been an overhaul of the engines, painting of the entire aircraft and update of all maintenance phases on 24 July 2016, with

3568.5 flight hours on the aircraft. Between that date and the day of the incident, the aircraft had flown 93.4 hours. The aircraft had no deferred items, as its MEL requires all items to be operational.

The aircraft was outfitted with an ACAS I. This system displays nearby aircraft that present the threat of a mid-air collision and issues acoustic traffic advisories (TA). This system does not issue resolution advisories (RA).

### 1.7. Meteorological information

According to information provided by Spain's National Weather Agency (AEMET), and based on radar and lighting strike images, there was no convective activity in the Balearic Islands at the time of the incident. The situation on the ground also did not exhibit intense wind speeds or reduced visibility.

At the weather stations closest to the site of the incident (Binissalem, 14 km southeast, and Santa María de Camí, 13 km south-southeast), the wind was from the NE at 18 km/h, gusting to 38 km/h, the temperature was about 12° C and the humidity was between 50 and 60%. This situation reflected the forecast, which called for cloudy intervals with a predominance of high clouds, falling nighttime temperatures, constant daytime temperatures and winds from the northeast.

The METARs for the Palma de Mallorca Airport (13 NM<sup>6</sup> south of the incident site) closest to the time of the event were as follows:

LEPA 200630Z 06010KT 9999 FEW028 11/05 Q1023 NOSIG

LEPA 200700Z 06010KT 020V090 9999 FEW028 13/03 Q1024 NOSIG

Both indicate surface winds of 10 kt, visibility in excess of 10 km, few clouds covering only 1 to 2 oktas at 2800 ft, high pressure and no significant changes.

The pilots of both aircraft confirmed that visibility conditions were ideal (CAVOK<sup>7</sup>), with no clouds, and they recalled no significant conditions involving the wind or any other weather phenomenon of interest.

### 1.8. Aids to navigation

All navigation systems were working correctly.

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<sup>6</sup>. 13 NM is equivalent to some 24 km.

<sup>7</sup>. CAVOK (Ceiling And Visibility OK). This condition requires visibility equal to or greater than 10 km, no clouds below 5,000 ft or below the highest minimum altitude in the sector, whichever is higher, and no cumulonimbus clouds or significant weather events.



## 1.9. Communications and radar data

The recording of the voice communications between ATC and the aircraft in sector F1X were available to investigators, as well as the radar data taken from the Palestra<sup>8</sup> system. The information of most significance to this incident is presented below.

After contacting sector F1X, the controller at the sector cleared AEA6007 to continue flying the TOLSO1R STAR and descend to FL140.

At 06:53:06, EC-LCX contacted the sector for the first time and it was cleared to climb to FL080.

Later, at 06:54:30, the controller cleared AEA6007 to descend to FL120.

At 06:54:57, EC-LCX was cleared to climb to FL100. Half a minute later it was instructed to proceed direct to point PINTO.

At 06:56:21, the controller cleared EC-LCX to continue climbing to FL110, and gave it traffic information: *"Echo Charlie Lima Charlie X-ray, continue to flight level one one zero and hold due to traffic, now at your two o'clock position, higher level"*<sup>9</sup>. The crew acknowledged: *"Copy, one two zero and hold, Echo Charlie Lima Charlie X-ray"*. The audio shows that the communication was clear, with suitable levels of speed and intonation.

Immediately following the acknowledgement by the crew of EC-LCX, the controller provided radar contact and climb instructions to another aircraft that had contacted the frequency at 06:56:14 and that it had been unable to respond to yet.

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<sup>8</sup>. This system reproduces the data recorded by SACTA after the fact, meaning the representations of the displays shown here may differ slightly from those presented in real time during the incident.

<sup>9</sup>. Referring to EC-JBK

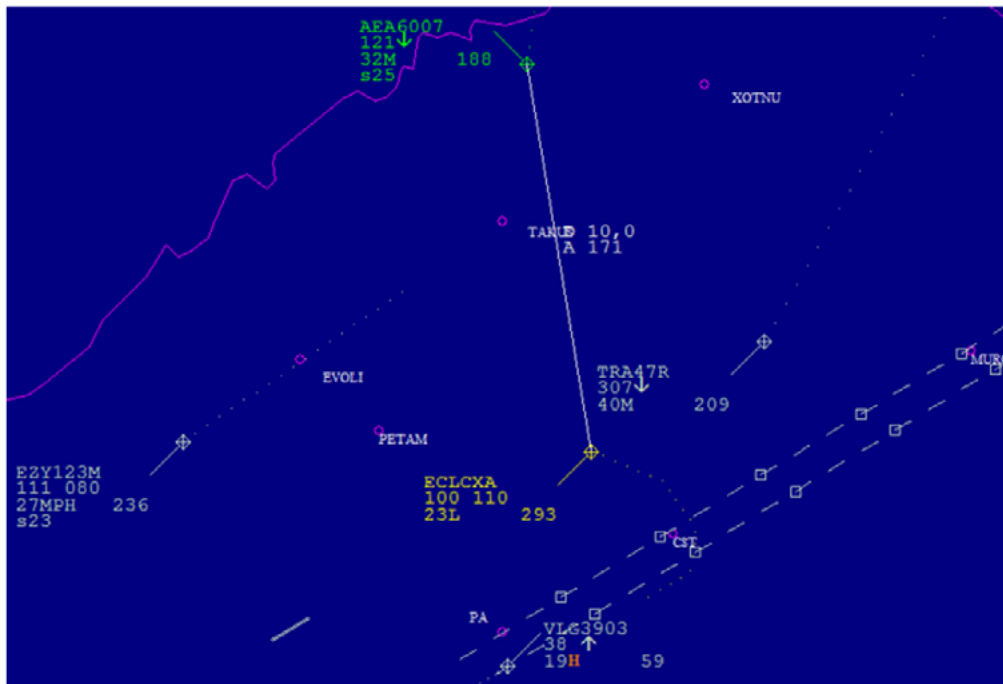


Fig. 3. Palestra image for 06:56:28

Figure 3 shows that the controller set FL110 in the CFL (cleared flight level) field of the label (in yellow) for aircraft EC-LCX. The green label corresponds to EC-JBK, with callsign AEA6007.

At 06:57:02, the controller instructed AEA6007 to hold FL120 due to departing traffic at its 12 o'clock position<sup>10</sup>.

By 06:57:22, the aircraft had climbed to 11300 ft, and it was 4.2 NM away horizontally from AEA6007.

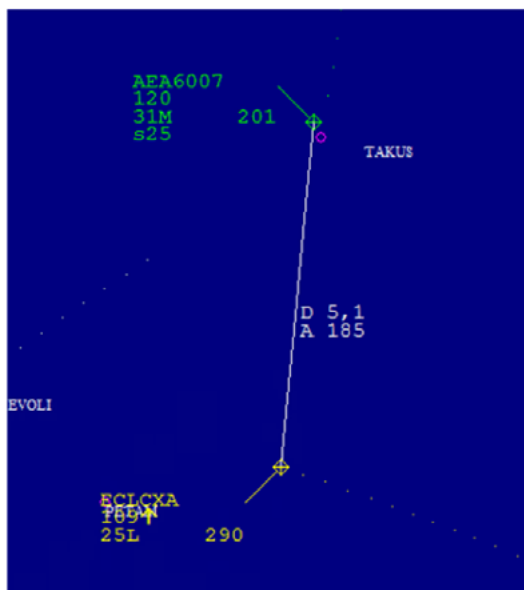


Fig. 4. Palestra image for 06:57:13

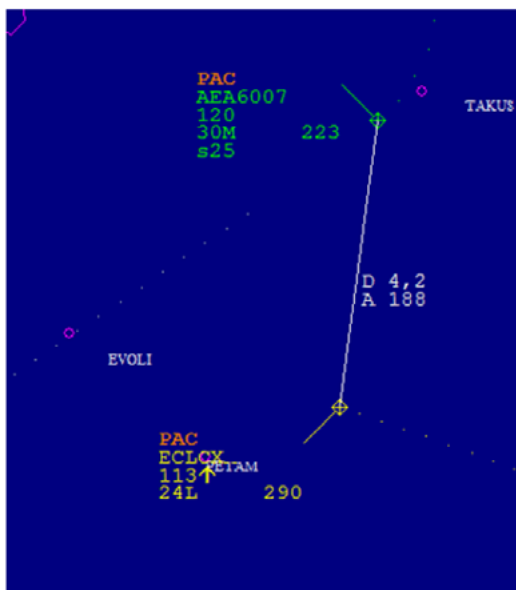


Fig. 5. Palestra image for 06:57:22

<sup>10</sup>. Referring to EC-LCX

Although the figures (generated after the fact by Palestra) show the conflict alert through the PAC (conflict caution alert) and VAC (conflict violation alert) warnings, this is not what was displayed to the controller on his screen. In fact, these warnings were not shown to the controller since the system that generates them (STCA system) was not implemented<sup>11</sup> in this airspace volume on the date of the incident. If it had been, a PAC warning would have been generated at 06:57:22, according to the data from the Palestra system.

At 06:57:30, EC-LCX exceeded its CFL of 11,000 ft by 400 ft.

Between 06:57:16 and 06:57:47, the controller was in contact with another aircraft that was in the sector (EZY123M).

At 06:57:52, the controller instructed EC-LCX to turn left immediately heading S, and then instructed AEA6007 to turn right (he did not give a reason to either crew). The crew of the latter reported it had received a TCAS RA. At that point, the horizontal distance between them was 2.2 NM. Both were level at FL120.



Fig. 6. Palestra image for 06:57:51

<sup>11</sup>. At other control stations it was already implemented, and it is expected to be implemented in all of them in the future; in fact, it was implemented at this unit in April 2018.

The table shows the parameters for the aircraft at the following times:

TIME	AEA6007	EC-LCX	HORIZONTAL DIST.
06:58:00	11800 ft	12000 ft	1,5 NM
06:58:05	11600 ft	11800 ft	1,2 NM
06:58:10	11400 ft	11600 ft	1,0 NM
06:58:16	11300 ft	11300 ft	0,9 NM
06:58:20	11100 ft	11000 ft	0,9 NM
06:58:30	11200 ft	10900 ft	1 NM

AEA6007 was the first to descend from FL120. A few seconds later, EC-LCX also started to descend. From 06:58:10, EC-LCX had a descent rate that was higher than that of AEA6007, and their flight paths began to diverge since EC-LCX had started a left turn a few seconds earlier.



Fig. 7. Palestra image for 06:58:10



Fig. 8. Palestra image for 06:58:16

At 06:58:29, the crew of AEA6007 reported they were returning to their cleared flight level after completing the instructions of the TCAS RA.

### 1.10. Aerodrome information

Not applicable.

### **1.11. Flight recorders**

The flight recorders from the aircraft were not available since by the time the investigation started, the data from the incident flight were no longer recorded on them.

However, the data on the incident flight were able to be recovered from the quick access recorder on aircraft EC-JBK (AEA6007). The most relevant information is as follows.

At 06:57:49, a TCAS descend RA was issued. The aircraft then immediately descended, reaching a maximum descent rate of 2870 ft/min. At 06:58:08, the direction of the TCAS RA changed to climb, which the crew complied with. This RA lasted until 06:58:19, at which time the clear of conflict notification was issued.

### **1.12. Wreckage and impact information**

Not applicable.

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

Not applicable.

### **1.14. Fire**

There was no fire.

### **1.15. Survival aspects**

Not applicable.

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

#### ***1.16.1. Statement from the captain of EC-JBK***

The following information was taken from the report written by the captain of EC-JBK after the incident.

The captain of EC-JBK (AEA6007) reported that the flight had been uneventful, and that they were on the approach phase to the Mallorca Airport, holding FL120 as cleared and en route to ADX from EVOLI, as instructed by ATC.

He also stated that he heard the crew of EC-LCX acknowledge FL120 when they had been instructed to stop climbing at FL110. Since that was their own flight level, this put him on alert. He was in visual contact with the aircraft (which was to his left) and saw that it was approaching at high speed and climbing quickly. When he saw on the display that EC-LCX was reaching FL120, he stopped looking outside to focus on the TCAS resolution he was expecting that system to issue.

Once activated (“DESCEND, DESCEND” acoustic warning), he disengaged the AP and AT<sup>12</sup> and instructed the first officer to report the TCAS RA, which he did immediately and on various occasions. He did not receive a reply from ATC, which was still communicating with other aircraft.

He then heard the controller instruct EC-LCX to turn left heading S.

The TCAS RA went from indicating descend to climb, which he immediately did. During this phase, the other aircraft had already changed its course and was moving away.

He did not recall receiving instructions from ATC to take evasive action, and they flew toward ADX at all times.

### **1.16.2. Statement from the captain of EC-LCX**

The captain of EC-LCX was interviewed after the incident. The information below was taken from his statement.

The incident flight was a ferry flight from Palma de Mallorca to Malaga without passengers on board. It was the second flight of the day and both pilots were rested after three days without flying.

They had just taken off from runway 06R at the Palma de Mallorca Airport and had been cleared to climb to FL180 when the controller told them to level off at FL120. He acknowledged (the captain was handling communications and was the PM ). He did not hear the controller correct him. The first officer (who was the PF ) dialed it into the altitude selector and he replied “check”.

As for the on board equipment, he stated that the aircraft has an S transponder and ACAS I, which gives TA but not RA. The aircraft has two PFD (one for each pilot) and a MFD in the center for selecting different displays. In this case, they selected the map, flight route and traffic (with position and relative altitude, the accuracy of the overhead view depends on the range selected, and for the altitude

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<sup>12</sup>. Autopilot and auto-thrust, respectively

it is 100 ft). This display shows the information from ACAS, giving the relative position of other aircraft, their altitude (with respect to own aircraft, using two digits) and attitude (whether climbing or descending). If another aircraft is on the same flight path (if looking forward along the line of flight), it would also be shown on the PFD, since it offers a synthetic view (this was not the case on the day of the incident). If the traffic in question is deemed to be a threat, an acoustic "TRAFFIC, TRAFFIC" signal would also be received. As it is not a TCAS II, it does not announce "Clear of conflict".

Once level at FL120, a TCAS TA was received, and the diamond representing that traffic on the MFD turned solid white and the acoustic "TRAFFIC, TRAFFIC" alert sounded. At that point, he took control of the aircraft (after saying "mine", after which the first officer turned control over). The first officer did not perform any tasks during the emergency and the captain continued to handle the communications.

He was in visual contact with the other aircraft (it was at his 2 o'clock position), though he could not determine the type or the airline (the first officer was also in visual contact with the aircraft). He saw they were on convergent flight paths and were at the same altitude, so he decided to initiate an evasive maneuver by turning left and at the same time descending (he had previously disengaged the AP so he could do the maneuvers manually).

When he started the descent, he had not yet received a communication from ATC, which occurred a short time later. He seemed to recall that he was instructed to turn to 180 and descend to FL110.

The decision to descend was his, since the ACAS I does not provide resolutions (RA) and he thought that descending was the fastest and safest maneuver that would allow him to maintain visual contact with the aircraft (though he stated that once he started to turn, he lost visual contact with the other aircraft, which was now behind him).

From then on, the TCAS signal cleared and he received vectors from the controller to leave the sector. He did not report the TCAS so as not to saturate the frequency.

By the time the event occurred, they had already done the climb, altimeter and pressurization checks in the cockpit and were heading direct to PINTO, as instructed.

Despite the FL120 acknowledgment (which was incorrect, since the instruction had been FL110), he stated that it must have been his mistake, but that it was also the first officer's, who set it in the AP and repeated FL120. In hindsight, it seemed strange to him that he was not corrected by ATC, though he also noted that there was a lot of chatter on the frequency.

He also stated that there were no problems with the communications, which could be heard clearly. As for the weather, he said that conditions were very good with ideal visibility.

He added that he had never had to make a similar maneuver in a civil flight, but that he was very familiar with the actions to take, which are drilled during training.

After the incident, they continued the flight normally.

**1.16.3. Statement from the executive controller in sector LECPF1X**

The information below was taken from the report written by the executive controller after the incident.

He stated that “the workload was high in instruction mode, with a high degree of difficulty. Inbound aircraft AEA6007 was cleared to FL120, while EC-LCX, outbound from Palma, was cleared to FL110. The latter continued climbing to FL120, and minimum separation was lost”.

**1.16.4. Statement from the planning controller in sector LECPF1X**

The information below was taken from the report written by the planning controller after the incident.

He stated that “he was organizing the bay, placing the strips, since no other actions were required at that point”.

**1.16.5. Statement from the shift supervisor**

The information below was taken from the report written by the supervisor after the incident.

He stated that “the runway configuration was the most complex one (runways 06), especially for sector F1X, with a high number of arrivals, since the communications congestion on the frequency makes it easier for pilots to misinterpret the instructions given. This runway configuration creates, in his opinion, a crossing point in sector F1X (where the incident occurred) that leads to conflicts between arriving and departing aircraft”.

**1.16.6 Information on duty and rest periods**

Both the executive controller/instructor and the planning controller had last been on duty on Sunday, 16 April (totaling five duty days in a row following three rest



days). They had rested on Monday the 17th and Tuesday the 18th. On Wednesday the 19th, the day before the incident, they had both attended training, which had been scheduled as part of the monthly shift schedule. It lasted six hours and was held outside the control room.

The controller under instruction went to work on 20 April after two days off (18th and 19th). Before this time off, he had worked five days in a row, having worked the afternoon shift on the final day (17 April).

### **1.17. Organizational and management information**

Not applicable.

### **1.18. Useful or effective investigation techniques**

Not applicable.

### **1.19. Additional information**

#### ***1.19.1 Result of the analysis done by the air navigation service provider***

The navigation service provider, ENAIRE, did an internal investigation into the event, as a result of which it internally proposed the series of improvement actions listed below (information on the level of implementation of these actions as of September 2018, which was requested from ENAIRE, is also presented):

- The report was sent to the ATCOs involved, to the unit and the Training and Evaluation Department. It was also sent to Air Europa and Caladero Aviation.
  - The report on the incident was presented to all ATCOs, and the event and the recommendations contained in the internal report were explicitly explained during training sessions to ATC personnel in 2017. The level of satisfaction with the contents of this module was very high, as it gave ATCOs the chance to purposely study the analysis and history of the event.
- Creation of a regional safety alert on this type of incident.
  - The safety alert was created and distributed to all ATCOs in 2017.
- Review in training modules of incidents in which the failure to listen actively to an incorrectly acknowledged clearance was the determining factor in the incident, especially in an OJTI setting. Preparation of a specific training module, or dissemination of the specific factors associated with OJTI that can affect safety, in particular as it concerns distractions involving:

- a) the additional cognitive risks inherent to the instructor's task: divided attention, required anticipation, simultaneous listening, attention to surroundings, intervention, etc.
  - b) the interaction between the instructor and trainee in changing traffic conditions.
  - c) monitoring the display and consistency between clearances, acknowledgments and observation of the traffic's behavior
    - This module is still being prepared and is expected to be taught to reinforce training in units with similar events, and to prevent them in the rest. A deadline of 31 December 2018 has been set for preparing the content so that the required training can be scheduled and provided at a later date.
- The air navigation service provider also plans to finish replacing its radars to mode S in 2020 and to update its Automated Air Traffic Control System (SACTA). This new update will display the flight level set by the crew of the aircraft on the controller's screen. If the flight level set does not match that cleared, a message will be displayed.
- The radar at Palma has already been upgraded to mode S. Furthermore, the STCA was implemented on 16 April 2018 and has proven highly satisfactory, from the standpoint of its use and the improvement it offers in terms of avoiding events like the one in this investigation.

## **2. ANALYSIS**

### **2.1 General considerations**

On 20 April 2017, a Boeing 737-800 operated by Air Europa, registration EC-JBK and callsign AEA6007, was flying from the Barcelona-El Prat Airport to the Palma de Mallorca Airport. The aircraft was flying the TOLSO1R STAR.

At the same time, a Cessna Citation C510 operated by Caladero Aviation, registration EC-LCX, was taking off from the Palma de Mallorca Airport to make its second flight of the day, between the airport of Palma to the Malaga-Costa del Sol Airport. It was flying the BAVR1T SID.

The crews of both aircraft had the licenses and medical certificates required for the flights, and they were valid and in force.

The documentation for both aircraft was valid and in force, and the aircraft were airworthy.

The executive, planning and trainee controllers had licenses, unit endorsements and medical certificates valid and in force.

Their duty periods prior to the incident flight are also deemed to have been within the norm.

The weather during the incident flight was not limiting and did not have an adverse effect on the flight.

### **2.2 Initial considerations**

The flight paths of the two aircraft converged in the vicinity of point TAKUS. Approach sector F1X of the Palma ACC is charged with providing separation between arriving and departing aircraft in this area.

At that time, the sector was being handled by a controller receiving on-the-job (OTJ) instruction, an executive controller acting as the instructor and a planning controller. Communications with the aircraft were handled at all times by the controller under instruction, while the executive controller explained the situation to the trainee. The controllers were in the final 40 minutes of duty prior to turnover, which was scheduled for 07:00.

## 2.3 Conflict

The controller identified the potential conflict between the flight paths of EC-LCX and AEA6007, and as a result, he correctly planned the instructions to give to ensure vertical separation between them. He instructed AEA6007 to descend to FL120 and hold, and EC-LCX to climb and maintain FL110. He also gave traffic information to both aircraft. The phraseology used and the way in which the messages were made by ATC were clear and in keeping with procedure.

However, the captain of EC-LCX, who was handling communications at the time and was acting as the PM, (incorrectly) acknowledged FL120. This message was also clear. The aircraft's captain stated that he did not know why he heard the clearance incorrectly, but he indicated that after his acknowledgment, the first officer set FL120 and he replied "check", just as required by procedure. In other words, both pilots made the same mistake.

However, the captain of AEA6007 heard perfectly that the controller's instruction entailed stopping the climb of EC-LCX at FL110, and also heard how said aircraft acknowledged FL120. This put him on the alert, since he was holding at FL120 and could see EC-LCX climbing quickly on his left on a flight path that converged with his.

As a result, the possibility that ATC's instruction was incorrect can be ruled out, and the misinterpretation of the instruction received is confirmed, which caused EC-LCX to climb higher than the level instructed to an incorrect level.

Neither the trainee nor the executive controller, both of whom were responsible for the communications, noticed the incorrect acknowledgment by the crew of EC-LCX, even though it was received clearly. This indicates that both controllers were focused on other tasks and were not actively listening to the acknowledgment from the aircraft. Specifically, seconds after the acknowledgment from the crew of EC-LCX, the controller under instruction was giving instructions and radar and radio contact to another aircraft that had made contact on the frequency earlier and that he had been unable to reply to until then. As stated, the instructional stage that the trainee controller was in required constant communications between the trainee and the instructor, which forced the latter to focus on multiple areas in order to maintain situational awareness of the traffic while providing the explanations.

The air navigation service provider, ENAIRE, stated that it identified similar incidents occurring on other occasions during periods of instruction. As a result, it took the actions listed in point 1.19.1, which are repeated below:

- The report was sent to the ATCOs involved, to the unit and the Training and Evaluation Department. It was also sent to Air Europa and Caladero Aviation.

- Creation of a regional safety alert on this type of incident.
  
- Review in training modules of incidents in which the failure to listen actively to an incorrectly acknowledged clearance was the determining factor in the incident, especially in an OJTI setting. Preparation of a specific training module, or dissemination of the specific factors associated with OJTI that can affect safety, in particular as it concerns distractions involving:
  - a) the additional cognitive risks inherent to the instructor's task: divided attention, required anticipation, simultaneous listening, attention to surroundings, intervention, etc.
  - b) the interaction between the instructor and trainee in changing traffic conditions,
  - c) monitoring the display and consistency between clearances, acknowledgments and observation of the traffic's behavior

These actions by the provider are deemed adequate, and thus there is no need to issue any additional safety recommendations.

## **2.4 Conflict detection and management**

### ***2.4.1 Detection and management by sector F1X***

Aircraft EC-LCX exceeded FL110 at 06:57:16, and 14 seconds later was climbing through 11400 ft. This activated the level change alert which involves a color change in the CFL field of the radar label. However, the controllers did not notice this, since between 06:57:16 and 06:57:47, they were focused on contacting and giving instructions to another aircraft (EZY123M). Both controllers may have believed that the potential conflict between EC-LCX and AEA6007 had been addressed, since they had given instructions that separated them vertically by 1000 ft, along with traffic information to both aircraft, so they did not actively monitor the radar.

Upon detecting the conflict, at 06:57:52, the controller under instruction told EC-LCX to turn left heading south. By that point, the aircraft had reached FL120 and the aircraft were some 2.2 NM and 0 ft apart. Thus, both the measure adopted to alter the flight path horizontally and the phraseology used, which included the term "immediately", were in keeping with procedure. AEA6007 was then instructed to turn right, but its crew reported that they were responding to a TCAS RA. Before that moment, the controller had not been informed by the crew of AEA6007 that they were executing a TCAS RA maneuver, and thus the instruction given to AEA6007 is not deemed incorrect.

The conflict alert system (STCA) had not yet been implemented in the airspace in which the aircraft were flying. According to data provided by the Palestra system, if the STCA had been implemented, the initial visual and aural alert would have been issued at 06:57:22, at which time EC-LCX was climbing through FL113 and

the horizontal distance was 4.2 NM. It is estimated that the controllers would have been able to detect the conflict some 30 seconds in advance.

The fact that the navigation service provider implemented the STCA system in April 2018 will very likely help to identify situations such as this one. As a result, it is not necessary to issue an additional safety recommendation.

#### ***2.4.2 Management of the conflict by the crews***

The crew of AEA6007 stated that they were in visual contact with the other aircraft at all times, and realized it was closing, so they were waiting for the TCAS activation. Thus, when the resolution advisory was issued (06:57:49), they reacted quickly in the indicated direction (climb). According to QAR data, the crew began to climb once the RA was received. The controller instructed the aircraft to turn right heading north, but the crew reported the TCAS RA and did not alter their flight path.

Aircraft EC-LCX has an ACAS I system on board, which gives traffic alerts (visual and aural), but it does not issue resolution advisories. According to the crew's statement, when they acquired visual contact of the aircraft in conflict, the captain, who at that time was acting as the PM, took control of the aircraft and executed an evasive descent maneuver (at his discretion). He opted for that maneuver in order to remain in visual contact with AEA6007 (although when he started the maneuver to descend and turn left, he lost sight of the other aircraft). He also complied with the instruction given by the controller to turn left immediately, which finally made the flight paths of the two aircraft diverge.

The fact that both aircraft executed descent maneuvers caused a change in the direction of the TCAS resolution advisory on board AEA6007, which now instructed the crew to climb. According to QAR data, following this activation, the aircraft started to reduce its descent rate, which caused the vertical separation between the two aircraft to increase.

According to radar data, the aircraft came at the closest point of approach within 0.9 NM and 0 ft of each other.

### 3. CONCLUSIONS

#### 3.1. Findings

- Aircraft EC-JBK (callsign AEA6007) was flying the STAR TOLSO1R approach to the Palma de Mallorca Airport.
- Aircraft EC-LCX had taken off from the Palma de Mallorca Airport and was flying SID BAVER1T.
- The crews of both aircraft had the licenses and medical certificates required for the flights, and they were valid and in force.
- The documentation for both aircraft was valid and in force, and the aircraft were airworthy.
- The weather during the incident flight was not limiting and did not have an adverse effect on the flight.
- The flight paths of both aircraft converged in the vicinity of point TAKUS.
- Approach sector F1X of the Palma ACC is charged with providing separation between departing and arriving aircraft in this area.
- At the time, sector F1X was staffed by an executive controller acting as an instructor, a controller under instruction and a planning controller.
- The executive, planning and trainee controllers had licenses, unit endorsements and medical certificates valid and in force.
- Their duty periods prior to the incident flight are also deemed to have been within the norm.
- Communications with the aircraft were handled at all times by the controller under instruction, whose instructor was interacting with him constantly. The controllers were in the final 40 minutes of their watch before their scheduled 07:00 turnover.
- The controller correctly planned the instructions to give to the two aircraft to ensure vertical separation between them.
- The controller instructed AEA6007 to descend to FL120 and hold, and EC-LCX to climb and maintain FL110. He also gave both aircraft traffic information.

- The phraseology used and the way in which communications were handled by ATC were clear and correct.
- The crew of EC-LCX (incorrectly) acknowledged FL120 with a clear reply and continued climbing to FL120.
- The captain of AEA6007 heard perfectly that the controller's instruction entailed stopping the climb of EX-LCX at FL110, and also heard how said aircraft acknowledged FL120.
- This put him on the alert, since he was holding at FL120 and could see EC-LCX climbing quickly on his left on a flight path that converged with his.
- Neither the trainee nor the executive controller, both of whom were responsible for the communications, noticed the incorrect acknowledgment by the crew of EC-LCX.
- EC-LCX exceeded FL110 but this was not noticed by the controllers, who were focused on contacting and giving instructions to another aircraft (EZY123M).
- They then detected the conflict, and the controller under instruction instructed EC-LCX to turn left heading south.
- By then, the aircraft had reached FL120 and the aircraft were 2.2 NM and 0 ft apart.
- Both the measure adopted to alter the flight path horizontally and the phraseology used, which included the term "immediately", were in keeping with procedure.
- He then instructed AEA6007 to turn right, but its crew reported they were following the TCAS RA.
- Before that moment, the controller had not been informed by the crew of AEA6007 that they were executing a TCAS RA maneuver.
- The conflict alert system (STCA) had not yet been implemented in the airspace in which the aircraft were flying. This system was implemented in April 2018.
- The crew of AEA6007 followed the instructions provided by the on-board TCAS II at all times.
- The crew of EC-LCX, whose on-board TCAS I does not issue resolution advisories, were in visual contact with the conflicting aircraft and executed an evasive descent



maneuver (at their discretion). They also complied with the instruction received from the controller to turn left immediately, as a result of which the aircraft's flight paths ultimately did not cross.

- According to the radar data, the aircraft came the closest point of approach within 0.9 NM and 0 ft of each other.
- The aircraft continued on their respective flights without further incident.
- The corrective measures taken by air navigation service provider are deemed to be sufficient, and thus no additional safety recommendations are contained in this report.

### **3.2. Causes/Contributing factors**

The incident is deemed to have been caused by the failure of the controller to correct a faulty acknowledgment by the crew of EC-LCX.

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

None.



