

Technical report IN-033/2019

Accident on 16 July 2019 involving a Boeing 737-800 aircraft operated by Air Europa, registration EC-LYR, and a Boeing 737-8AS aircraft operated by Ryanair, registration EI-FRP, to the south of Écija (Seville)

Please note that this report is not presented in its final layout and therefore it could include minor errors or need type corrections, but not related to its content. The final layout with its NIPO included (Identification Number for Official Publications) will substitute the present report when available.



Notice

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

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

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

CONTENTS

Notice	ii
CONTENTS	iii
ABBREVIATIONS	v
Technical Report IN-033/2019	vii
Synopsis	vii
1. THE FACTS OF THE INCIDENT	9
1.1. Overview of the incident.....	9
1.2. Injuries to persons	11
1.2.1. Information about the crew on board aircraft AEA1036.....	11
1.2.2. Information about the crew on board aircraft RYR61NN	11
1.3. Damage to the aircraft	11
1.4. Other damage.....	12
1.5. Personnel information.....	12
1.5.1. Information about the crew of aircraft AEA1036.....	12
1.5.2. Information about the crew of aircraft RYR61NN	12
1.5.3. Information about the LECSMA4 sector controllers.....	12
1.5.4. Information about the LEMGAPM sector controllers	12
1.5.5. Information about the LECSAPT sector controllers	13
1.6. Aircraft information.....	13
1.6.1. Information about the AEA1036 aircraft (EC- LYR).....	13
1.6.2. Information about the RYR61NN aircraft (EI-FRP).....	13
1.7. Meteorological information.....	13
1.8. Aids to navigation	14
1.9. Communications.....	20
1.10. Aerodrome information.....	22
1.11. Flight recorders	23
1.12. Aircraft wreckage and impact information.....	23
1.13. Medical and pathological information	23
1.14. Fire.....	23
1.15. Survival aspects	23
1.16. Tests and research	24
1.16.1. Statements relevant to the investigation:	24
1.16.2. Study of the 'free for turning' measure in the LECS-LEMG letter of agreement	25
1.17. Organisational and management information	26
1.17.1. Information about Air Europa	26
1.17.2. Information about Ryanair	26
1.17.3. Information about the control services.....	26
1.18. Additional information.....	28
1.18.1. Information about the flow of aircraft in the LECSMA4 sector.....	28
1.18.2. Regulatory vertical distance	29
1.18.3. ENAIRE's internal investigation report.....	29
1.19. Special investigation techniques	30
2. ANALYSIS	31
2.1. Cause of the conflict	31

2.2. Resolution of the conflict.....	33
2.3. Assessment of the actions taken by ENAIRE.....	34
3. CONCLUSIONS.....	35
3.1. Findings.....	35
3.2. Causes/contributing factors	35
4. OPERATIONAL SAFETY RECOMMENDATIONS	36

ABBREVIATIONS

° ' "	Sexagesimal degrees, minutes and seconds
°C	Degrees Celsius
A	Aircraft (in flight ratings and licenses)
ACC	Air control centre
ACS	Air control surveillance rating
ADI	Aerodrome control instrument rating
AESA	Spain's National Aviation Safety Agency
AIP	Aeronautical information publication
AoR	Area of responsibility assigned to an air control sector
APP	Approach control service
APS	Approach control surveillance rating
ARP	Aerodrome reference point
ARR	Arrival
Art	Article
ATC	Air traffic control
ATPL	Airline transport pilot license
ATS	Air traffic service
CPL	Commercial pilot license
ECCAIRS	European Co-ordination Centre for Accident and Incident Reporting Systems
ENR	On route
FL	Flight level (in hundreds of feet)
ft	Feet
ft/min	Feet per minute
h	Hour(s)
IAA	Irish Aeronautical Authority
IFR	Instrumental flight rules
ILS	Instrument landing system
IR	Instrument rating
km	Kilometre(s)
kt	Knot(s)
LAD	Azimuth distance line (Function of the SACTA system)
LECS	Callsign for Seville control centre
LEMG	Callsign for Malaga Airport
LEMO	Callsign for Morón air base
LEPA	Callsign for Palma de Mallorca Airport
LEZL	Callsign for Seville Airport
LFPG	Callsign for Paris-Charles de Gaulle Airport
LoA	Letter of Agreement
m	metre(s)

METAR	Aviation routine weather report (in aeronautical meteorological code)
MHz	Megahertz
MPA	Multi-pilot aircraft
MTOM	Maximum take-off mass
N	North
no.	Number
NM	Nautical mile
ICAO	International Civil Aviation Organisation
PAC	Conflict prediction alert
pg.	Page
QNH	Altimeter setting to obtain elevation above sea level when on the ground
RA	Resolution Advisory from the TCAS system
RAD	Aerodrome radar control endorsement
RD	Royal Decree
ROD	Rate of descent
s	Seconds
SACTA	Automated Air Traffic Control System
SERA	Standardised European Rules of the Air
SID	Standard instrument departure
STAR	Standard terminal arrival route
STCA	Short-term conflict alert
TA	Traffic alert from the TCAS SYSTEM
TCAS	Traffic Collision Avoidance System
TWR	Aerodrome control tower and control tower endorsement
EU	European Union
UTC	Coordinated universal time
CAV	Conflict alert violation
VHF	Very high frequency
W	West

Aircraft no.1:

Operator: Air Europa, S.A.
Aircraft: Boeing 737-800, with registration EC-LYR and flight callsign AEA1036
Persons on board: 6 crew members and 177 passengers, unharmed
Type of flight: Commercial air transport - Scheduled - International - Passengers
Phase of flight: Approach
Type of operation: IFR

Aircraft no. 2:

Operator: Ryanair
Aircraft: Boeing 737-8AS, with registration EI-FRP and flight callsign RYR61NN
Persons on board: 6 crew members and 172 passengers, unharmed
Type of flight: Commercial air transport - Scheduled - International - Passengers
Phase of flight: Approach
Type of operation: IFR

Date and time of incident: 16 July 2019, 13:11 UTC¹
Site of incident: Approximately 15 km to the south of Écija, Seville
Date of approval: 28/07/2021

Synopsis

Summary of the investigation:

On Tuesday 16 July 2019, a loss of separation occurred between a Boeing 737-800 aircraft operated by Air Europa (with registration EC-LYR and callsign AEA1036) and a Boeing 737-8AS aircraft operated by Ryanair (with registration EI-FRP and callsign RYR61NN), when they crossed paths approximately 15 km south of Écija, Seville, during their descents to the airports of Malaga and Seville, respectively.

A few minutes before the incident, the sector controller of the Seville Area Control Centre, LECSMA4, had both aircraft under his control and instructed them to transfer to the approach sectors of their respective airports, with aircraft AEA1036 following a route from north to south and aircraft RYR61NN travelling east to west. He was aware of the distance between them and that their trajectories intersected in his area of responsibility (AoR), generating a potential conflict, but he maintained the regulatory vertical separation as they descended.

About 2 minutes before the loss of separation, the controller of this sector transferred control of the AEA1036 aircraft to the Malaga Airport approach sector (LEMGAPM) and waited for the RYR61NN aircraft to cross its path before handing it over it, in turn, to the

¹ All times used in this report are UTC. To calculate the local time, add 2 hours.

Seville Airport approach sector (LECSAPT), assuming that the risk of a conflict between them no longer existed. However, a few seconds earlier, the controller of the LEMGAPM sector had instructed the newly transferred AEA1036 aircraft to turn west, causing the trajectories of the two aircraft to converge.

Despite the fact that 29 seconds before the loss of separation occurred, the air control system STCA-PAC proximity alert activated, the controllers of the different units failed to coordinate in time to prevent an infringement of the regulatory separation distance, which occurred at 13:11:02. In the end, the aircraft crossed paths at a minimum distance of 1.3 NM horizontally and 0 ft vertically, at 13:11:17.

Following the incident, both aircraft continued their respective flights, and there was no damage of any kind.

The investigation has determined the cause of the incident was the early transfer of the YR61NN aircraft from the LECSMA4 sector to the collateral sector, resulting in the loss of separation between the two traffics.

The letter of agreement between the units, which allows them to make changes to an aircraft's course while it's still in the previous control area, is considered to have been a contributing factor.

The following safety recommendation has been issued to Enaire:

REC 37/21: It is recommended that Enaire makes the necessary changes to ensure that LECS and LEMG APP controllers do not instruct aircraft to turn before they are in their area of responsibility unless there has been prior coordination between the units.

1. THE FACTS OF THE INCIDENT

1.1. Overview of the incident

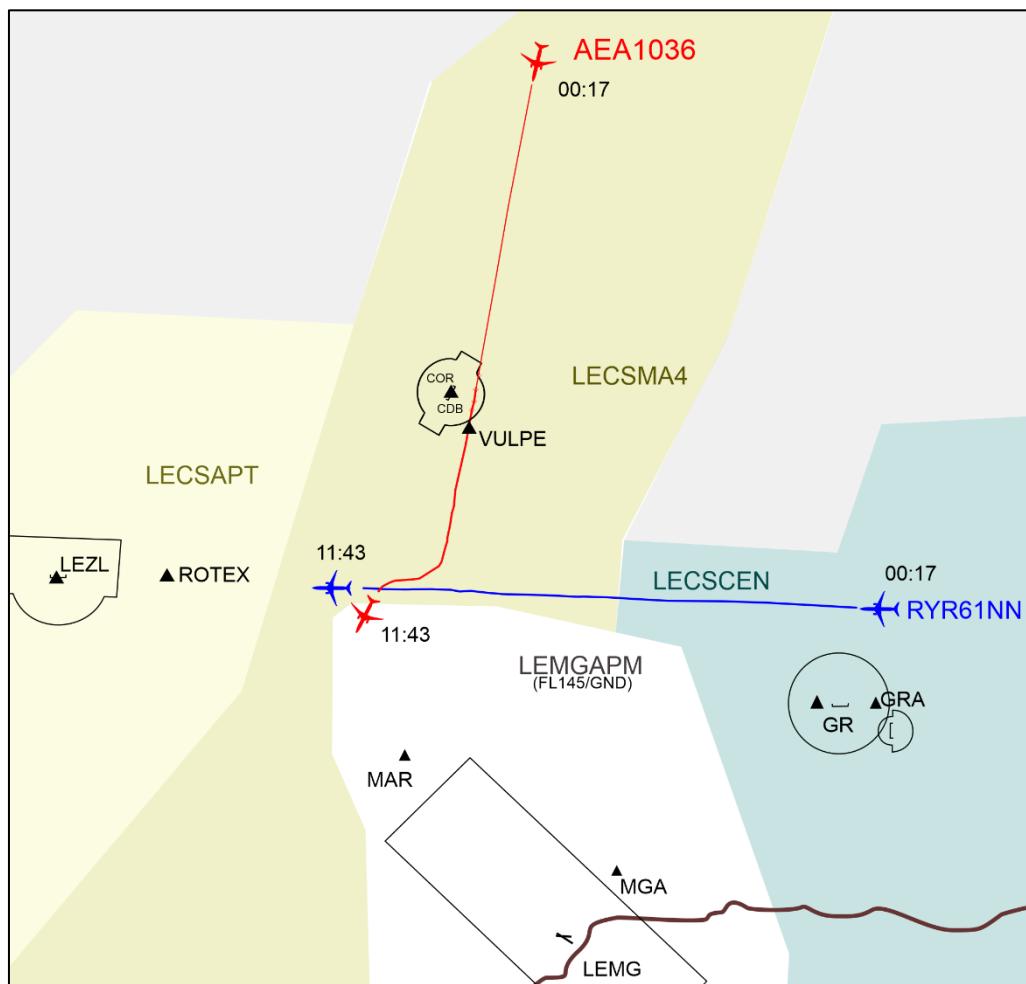


Illustration 1: Overview of the trajectories of both aircraft and the affected control sectors

On Tuesday, 16 July 2019, at 11:00 UTC, the Boeing 737-800 aircraft operated by Air Europa, with callsign AEA1036 and registration EC-LYR, took off from Paris-Charles de Gaulle Airport (LFPG) bound for Malaga Airport (LEMG).

At 12:08, the Boeing 737-8AS aircraft operated by Ryanair, with call sign RYR61NN and registration EI-FRP, took off from Palma de Mallorca Airport (LEPA) bound for Seville Airport (LEZL).

At 12:52, the crew of aircraft AEA1036 contacted the LECSMA4 sector controller as it was heading north to south, following airway B42/UN864. The controller instructed it to descend and reduce speed, thus sequencing it for the approach to Malaga Airport.

At 13:05, an Airbus A320 aircraft not involved in the incident informed the LEMGAPM sector that, having landed in Malaga, it needed to remain on the runway to have its tyres checked. Although control offered it runway 12 (RWY 12), the crew refused, requesting to remain on the runway in use at the time, RWY 13. This incident forced a runway change for the

subsequent approaching aircraft. Aircraft AEA1036 was the second in the approach sequence to RWY 12. The LEMGAPM sector controller reported the runway change to the LECSMA4 controller, who, in turn, notified the crew of aircraft AEA1036.

At 13:06, the crew of the RYR61NN aircraft established contact with the LECSMA4 sector. At that moment the aircraft was heading east to west.

During the following minutes, the LECSMA4 controller calculated the distances between the two aircraft with the SACTA system's LAD tool and instructed the RYR61NN aircraft to descend as the AEA1036 aircraft vacated flight levels, thus ensuring the regulatory vertical distance was maintained between the two aircraft.

Approximately 3 minutes before the loss of separation, the LECSMA4 sector controller transferred aircraft AEA1036 to the Malaga approach sector (LEMGAPM) as it was descending through FL 178 to FL 150 and approximately 15 NM from the sector boundary. After establishing contact, the LEMGAPM controller instructed the newly transferred aircraft to turn 74° to the west. This put it on a new trajectory that converged with that of the RYR61NN aircraft. The controller later stated that he instructed the turn to increase the distance between the AEA1036 aircraft and the preceding aircraft bound for Malaga airport due to the incident that had caused the runway change.

Approximately one minute before the loss of separation, when the RYR61NN aircraft crossed the path that the AEA1036 aircraft had been following prior to being transferred, the LECSMA4 sector controller instructed the first aircraft to descend to FL 130 and handed it over to the Seville approach sector (LECSAPT). At that moment, the aircraft was approximately 20 NM from the sector boundary, descending through FL 190 to FL 130. Shortly afterwards, it began to increase its rate of descent (ROD) to around 3,200 ft/min, while aircraft AEA1036 was descending through FL 161 with a ROD of approximately 1,000 ft/min.

Thirty seconds before the loss of separation, the STCA-PAC (conflict prediction alert without a violation of the minimum prescribed distance) activated when the distance between the two aircraft reached 1.7 NM and 1,700 ft. At this point, both aircraft were on different sector frequencies (belonging to different units) but still within the area of responsibility of the LECSMA4 sector.

This alert was initially noticed by the LEMGAPM sector controllers, who mistakenly called the LECSCEC sector (from which the RYR61NN aircraft had come but already left 5 minutes previously) to ask if they could see their aircraft. LECSCEC answered in the affirmative but did not specify that it was no longer under their control. The LEMGAPM controller then instructed aircraft AEA1036 to turn south and accelerate its descent in an attempt to prevent a loss of separation.

Sixteen seconds before the loss of separation, the aircraft were on convergent headings, with a difference of 6° and a distance of 1.6 NM and 1,500 ft between them, with aircraft RYR61NN descending through FL 169 and aircraft AEA1036 through FL 154. At that moment, the RYR61NN aircraft contacted the LECSAPT sector controller, who instructed it

to descend to 4,000 ft, despite the STCA-PAC warning of insufficient separation between the aircraft.

At 13:11:02, the loss of regulatory separation between the two aircraft occurred, which activated the STCA-VAC (minimum distance violation) alert. At this moment, the distance between them was 1.5 NM and 800 ft. Fifteen seconds later, they reached the point of closest proximity to one another, being separated by 1.3 NM and 0 ft.

As the aircraft crews subsequently stated, no TCAS TA or RA alerts activated on either aircraft.

1.2. Injuries to persons

1.2.1. Information about the crew on board aircraft AEA1036

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>	<i>Total in the aircraft</i>	<i>Others</i>
Fatal				
Serious				
Minor				
Unharmed	6 ²	177	183	
TOTAL	6	177	183	

1.2.2. Information about the crew on board aircraft RYR61NN

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>	<i>Total in the aircraft</i>	<i>Others</i>
Fatal				
Serious				
Minor				
Unharmed	6 ¹	172	178	
TOTAL	6	172	178	

1.3. Damage to the aircraft

Neither aircraft sustained damage as a result of the incident.

² 2 flight crew and 4 cabin crew

1.4. Other damage

There was no further damage of any kind.

1.5. Personnel information

1.5.1. Information about the crew of aircraft AEA1036

At the time of the incident, the 39-year-old commander had an ATPL(A) airline transport pilot license, issued on 28 April 2006 by AESA, and B737 and IR(A) ratings valid until 31 January 2020. He was the pilot in command of the aircraft at the time of the incident. He had more than 12,100 flight hours, of which 6,276:50 h were on B737 300-900 aircraft. He had a Class 1 medical certificate valid until 23 November 2019.

The 24-year-old co-pilot had a CPL(A) commercial pilot license, issued on 27 December 2019 by AESA, and B737 and IR(A) type ratings valid until 31 January 2020. He had more than 2,050 flight hours, of which 1,745 h were on B737 300-900 aircraft. He had a Class 1 medical certificate valid until 11 April 2020.

1.5.2. Information about the crew of aircraft RYR61NN

At the time of the incident, the 46-year-old commander had an ATPL(A) airline transport pilot license, issued on 07 October 2013 by the Irish Aviation Authority (IAA), and B737 and IR(A) ratings valid until 29 February 2020. He was the pilot in command of the aircraft at the time of the incident. He had 8,500 flight hours at the time of the incident. He had a Class 1 medical certificate valid until 05 June 2020.

The 37-year-old co-pilot had an CPL(A) commercial pilot license, issued on 15 November 2018 by the Irish Aviation Authority (IAA), and B737 and 300-900 ratings valid until 30 April 2020. He had 395 flight hours at the time of the incident. He had a Class 1 medical certificate valid until 18 January 2020.

1.5.3. Information about the LECSMA4 sector controllers

Two controllers were operating the LECSMA4 sector of Seville ACC:

The 46-year-old LECSMA4 sector executive controller had an air traffic controller license first issued by AESA in April 2006, with the LECS endorsement (ACS) valid until March 2020.

He had a Class 3 medical certificate valid until November 2019.

The 48-year-old Spanish planning controller had an air traffic controller license first issued by AESA in November 2003, with the LECS endorsement (ACS+APS) valid until April 2020.

He had a Class 3 medical certificate valid until November 2019.

1.5.4. Information about the LEMGAPM sector controllers

The Malaga approach sector (LEMGAPM) was staffed by two controllers:

The 47-year-old LEMGAPM executive controller had an air traffic controller license first issued by AESA in December 2006, with the LEMG endorsement and APS +ADI/TWR/RAD ratings valid until February 2021. He had a Class 3 medical certificate valid until April 2020.

The 43-year-old Spanish planning controller had an air traffic controller license first issued by AESA in November 2004, with the LEMG endorsement and APS+ADI/TWR/RAD ratings valid until November 2020. He had a Class 3 medical certificate valid until April 2020.

1.5.5. Information about the LECSAPT sector controllers

The Seville approach sector (LECSAPT) was staffed by two controllers:

The 56-year-old LECSAPT executive controller had an air traffic controller license first issued by AESA in October 1998, with the LECS endorsement and ACS+APS ratings valid until October 2020. He had a Class 3 medical certificate valid until March 2020.

The 48-year-old Spanish planning controller had an air traffic controller license first issued by AESA in July 2002, with the LECS endorsement and ACS+APS ratings valid until December 2020. He had a Class 3 medical certificate valid until March 2020.

1.6. Aircraft information

1.6.1. Information about the AEA1036 aircraft (EC-LYR)

The Boeing 737-800 aircraft, with registration EC-LYR and serial number 36595, was built in 2014 and registered with AESA's aircraft registry on 07 April 2017. It has two CFMI engines, model CFM56-7BE. Its maximum take-off mass is 78,999 kg.

At the time of the incident, it had an airworthiness certificate issued by AESA and an airworthiness review certificate valid until 14 January 2020.

1.6.2. Information about the RYR61NN aircraft (EI-FRP)

The Boeing 737-8AS aircraft, with registration EI-FRP and serial number 62692, was built in 2016 and registered with the Irish aircraft registry on 23 May 2016. It has two CFMI engines, model CFM56-7B26E. Its maximum take-off mass is 66,990 kg.

At the time of the incident, it had a valid airworthiness certificate issued by the Irish Aviation Authority (IAA) and an airworthiness review certificate valid until 22 May 2020.

1.7. Meteorological information

The low-level map shows that there was no cloud at FL 150 in the incident area. At that level, the wind speed was moderate (around 20 kt), and the temperature was 0°.

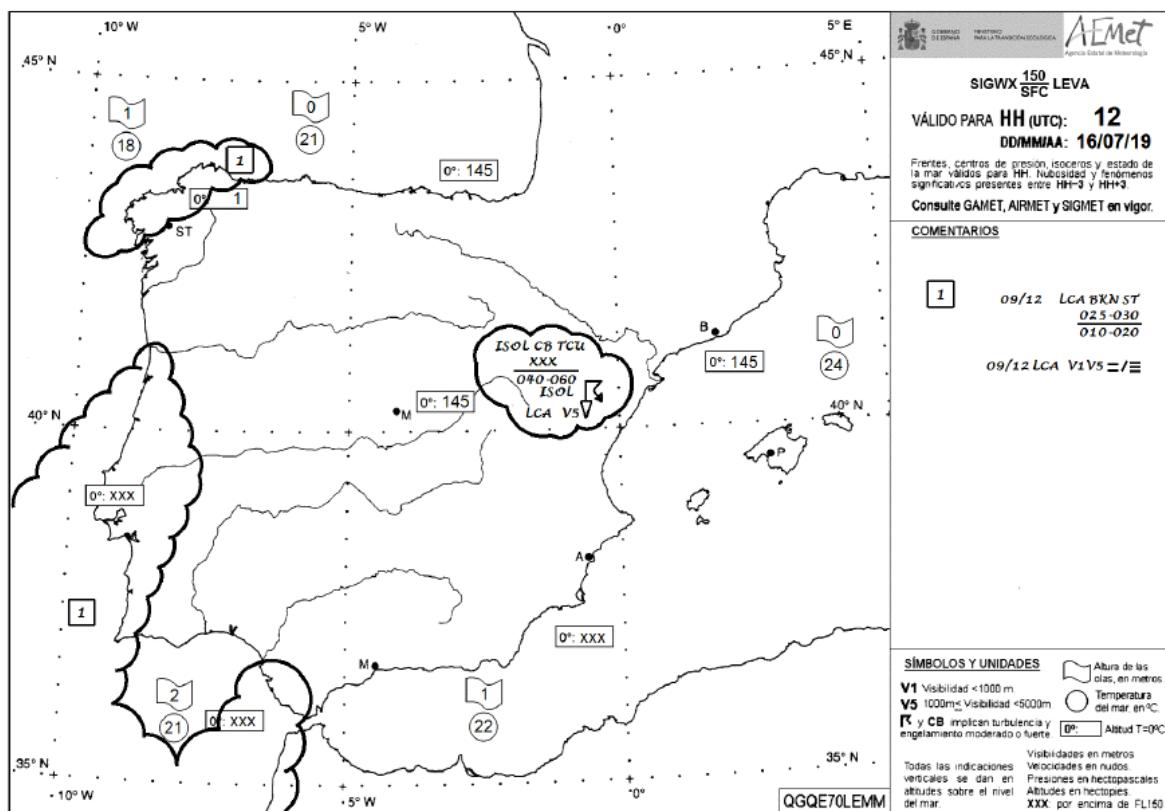


Illustration 2: Low-level map for the 16/07/2019

1.8. Aids to navigation

A brief description of the sectors involved is provided below:

The LECSMA4 sector was the last route sector for the AEA1036 aircraft. It was subsequently transferred to the LEMGAPM sector to complete its instrument approach to Malaga airport. The vertical boundary of this last sector is from FL 145 to the ground.

The LECSCE4 sector was a route sector for the RYR61NN aircraft that was flying east to west. This aircraft was subsequently transferred to the collateral route sector, LECSMA4, which later handed it over to the LECSAPT sector for its approach to Seville Airport.

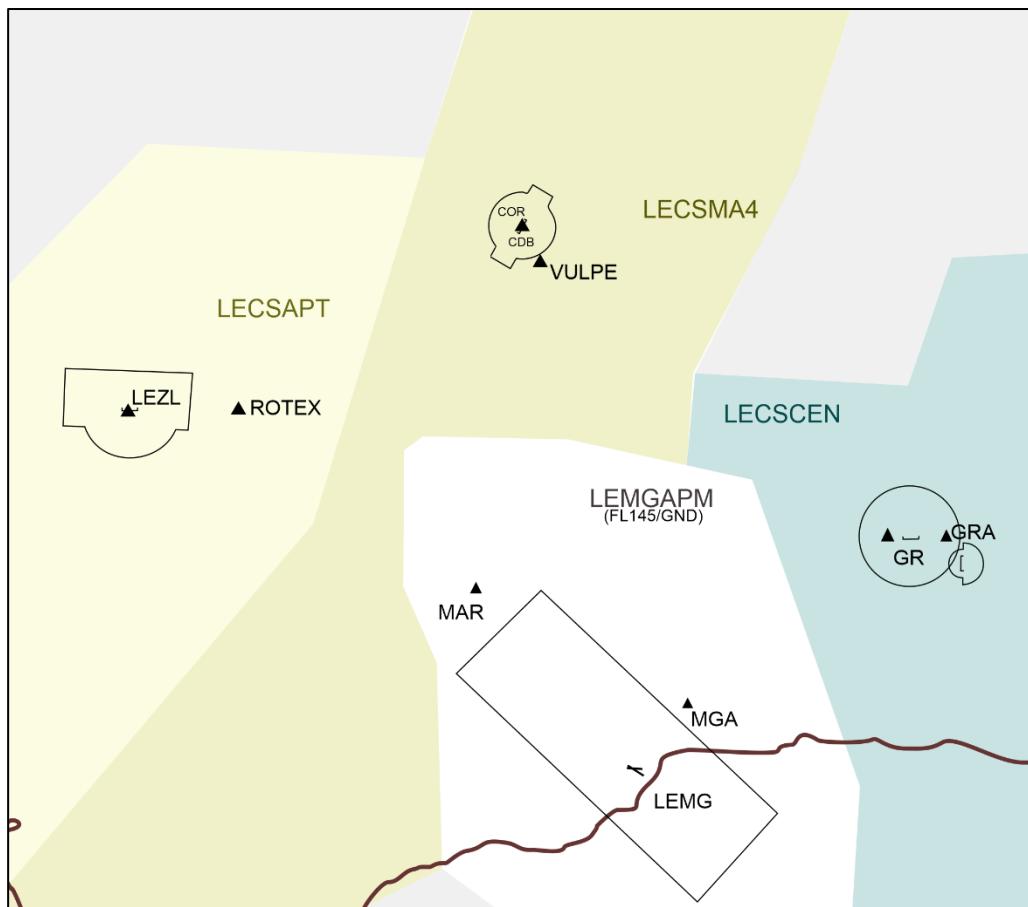


Illustration 3: Configuration of the sectors involved during the incident.

The table below shows the Palestra³ flight parameters for each aircraft at the most significant moments during the incident. It details the flight levels of the aircraft when they were cleared to descend, the level to which they were cleared to descend to, their heading and descent rate. Images of each moment with a description of the situation follow.

³ This system provides an a posteriori reproduction of the data recorded by the automated air traffic control system (SACTA). Therefore, the screen displays shown here may differ slightly from the real-time display seen by the controllers during the incident.

		AEA1036			RYR61NN		
Time	Observations	FL initial ↓ cleared	Heading (°)	ROD ft/min	FL initial ↓ cleared	Heading (°)	ROD ft/min
13:08:32	LECSMA4 transfers control of AEA1036	187↓150	191	2,000	200	272	0
13:09:25	LEMGAPM contacts AEA1036 and instructs it to turn	187↓150	191	1,725	193↓180	272	1,550
13:10:06	LECSMA4 transfers control of RYR61NN	161↓150	219	1,725	187↓130	272	1,406
13:10:33	Activation of STCA-PAC	157↓150	265	750	174↓130	272	2,050
13:10:46	LECSAPT contacts RYR61NN	154↓150	266	1,180	169↓130	272	2,769
13:11:02	Activation of STCA-VAC	154↓100	267	1,113	159↓040	272	3,263
13:11:17	Moment of least distance between the aircraft	150↓100	250	600	150↓040	272	3,269
13:11:27	Divergent trajectories	148↓100	216	394	146↓040	272	3,398
13:11:43	Divergent trajectories	147↓100	216	500	139↓040	272	3,444

At 13:08:32, the LECSMA4 sector controller transferred aircraft AEA1036 to the LEMGAPM sector, while it was still approximately 15 NM from the sector boundary. See Illustration 4.

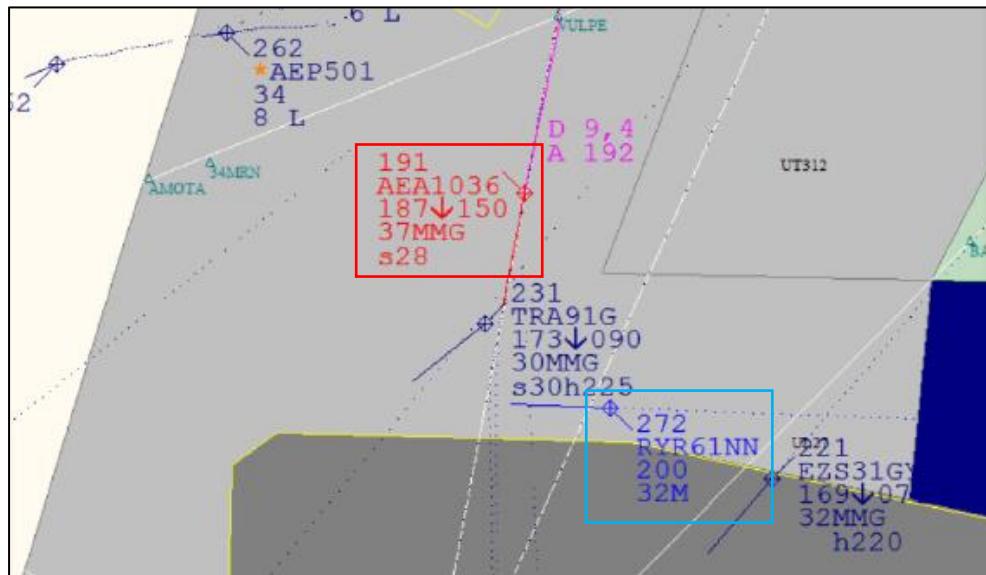


Illustration 4: Moment aircraft AEA1036 was transferred (boxed in red) to LEMGAPM (13:08:32).

At 13:09:25, the LEMGAPM sector contacted the AEA1036 aircraft and instructed it to turn to a heading of 265° and descend to FL 150. The aircraft had previously been on a 191° heading, which meant it had to adjust its course by 74°. The aircraft's speed at that time was 350 kt, and that of the aircraft ahead of it in the sequence (whose callsign was TRA91G) was 290 kt. This aircraft had also been instructed to turn west a few seconds earlier. See Illustration 5.

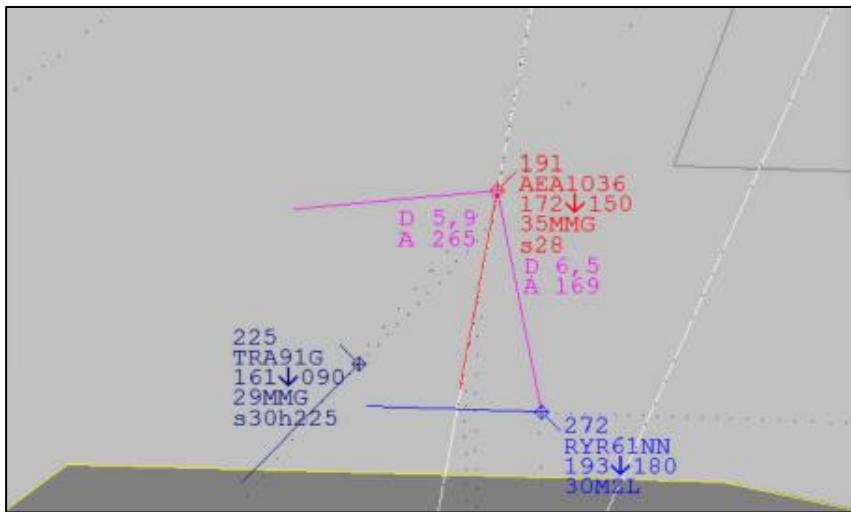


Illustration 5: Position of the aircraft at 13:09:25.

Due to the way the SACTA system works, when the LEMGAPM sector controller accepted the AEA1036 aircraft and assumed its control, it changed from green to white on the LECSMA4 sector display screen (indicating a traffic not under their control), as you can see from the real-time recording of his screen at 13:09:32 (Illustration 6). This signifies that the aircraft is now under the control of another sector.



Illustration 6: Image of the LECSMA4 sector's screen at 13:09:32

At 13:10:06, the LECSMA4 sector controller transfers the RYR61NN aircraft to the LECSAPT sector while it's still approximately 20 NM away from crossing the sector boundary. At that moment, the distance between the aircraft was 2.8 NM and 2,200 ft. Aircraft AEA1036 had already started its turn to the west. See Illustration 7.

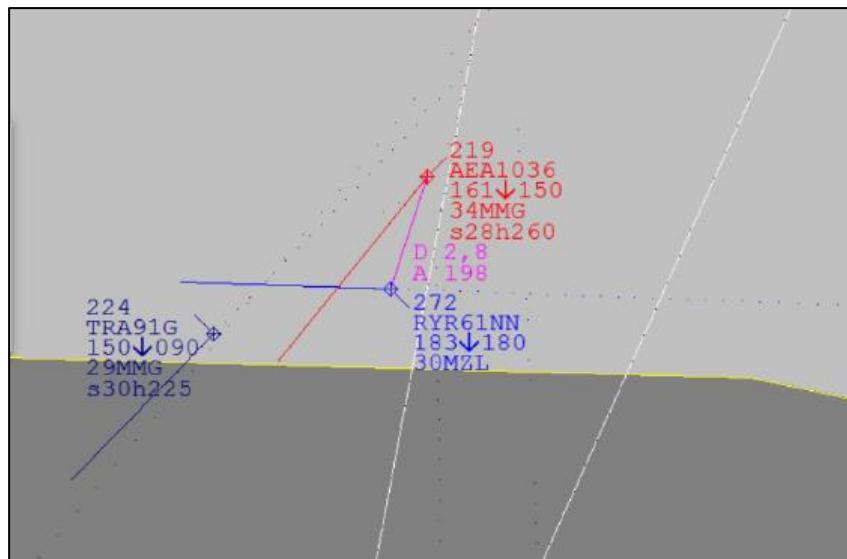


Illustration 7: Moment aircraft RYR61NN was transferred to LECSAPT (13:10:06).

According to Palestra, at 13:10:33, the STCA-PAC function was activated. At that moment, the aircraft were separated by 1.7 NM and 1,700 ft. The AEA1036 aircraft had started to reduce its ROD while the RYR61NN aircraft was continuing to increase it. See Illustration 8

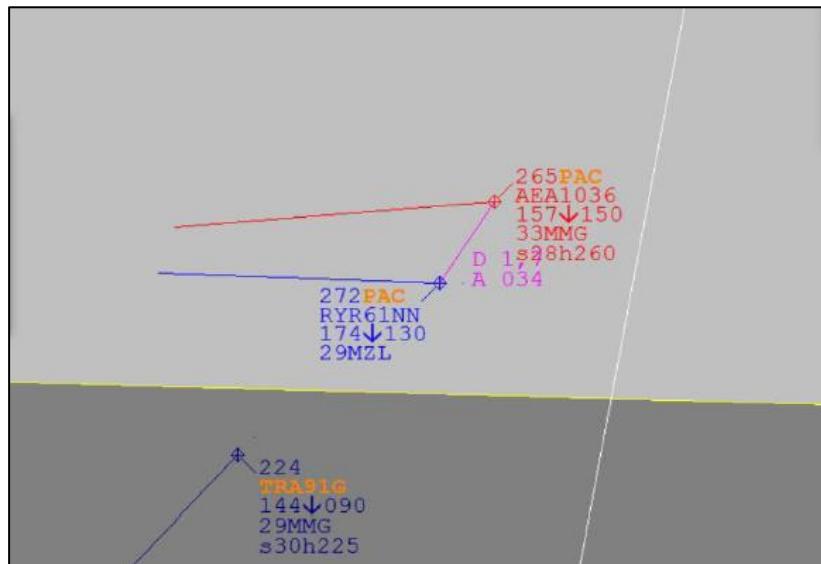


Illustration 8: Position of the aircraft when the STCA-PAC function was activated (13:10:33)

At 13:10:46, aircraft RYR61NN contacted the LECSAPT sector controller, who immediately instructed it to descend to 4,000 ft.

At 13:11:02, the STCA-VAC alert was activated due to the prescribed separation being violated. At this point, the distance between the aircraft was 1.5 NM and 800 ft. See Illustration 9.

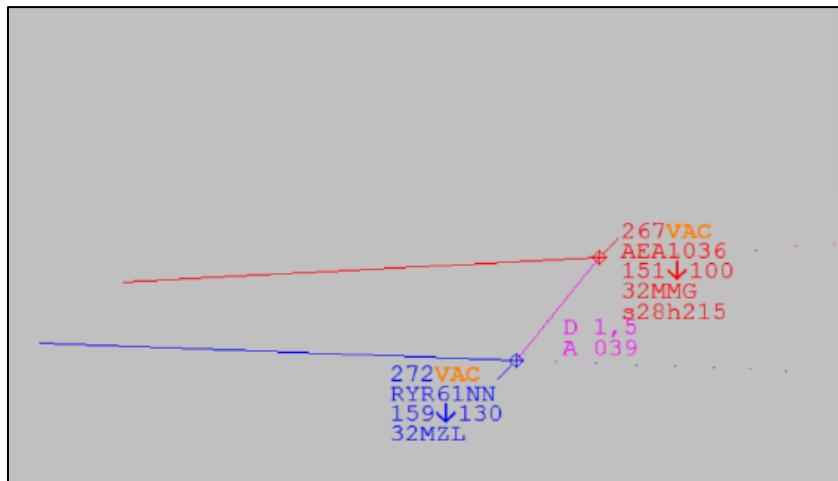


Illustration 9: Position of the aircraft at 13:11:02.

Finally, the aircraft reached the minimum recorded distance between them at 13:11:17, being separated by 1.3 NM and 0 ft. At that moment, aircraft AEA1036 had already started a turn towards 215°, as instructed by the LEMGAPM sector controller. See Illustration 10.

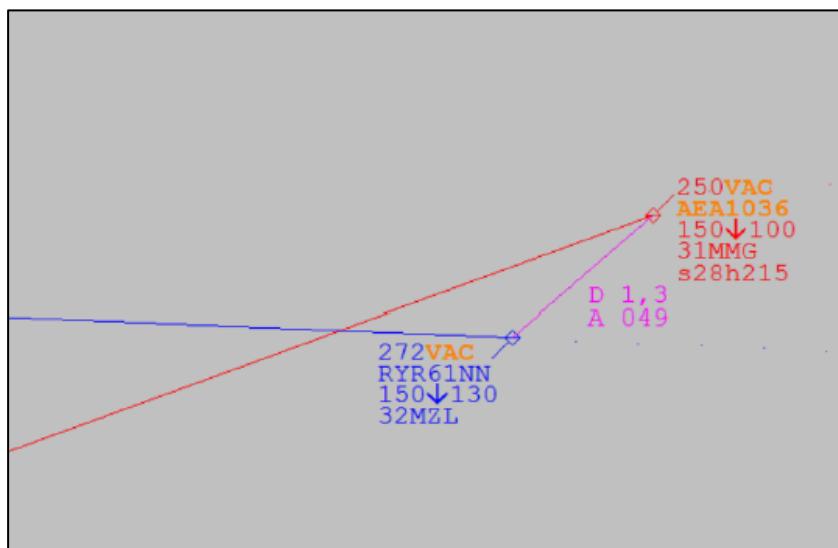


Illustration 10: Position of the aircraft at 13:11:17. Minimum distance (1.3 NM and 0 ft)

Ten seconds after the aircraft crossed paths, the distance between them was already 1.3 NM, 300 ft and increasing. The AEA1036 aircraft had reduced its ROD while the RYR61NN aircraft continued to increase it.

At 13:11:43, the prescribed minimum separation had already been re-established, with the distance between the aircraft being 2.1 NM and 1,100 ft. The AEA1036 started to increase its ROD slightly again.

1.9. Communications

To illustrate the course of events more clearly, the most relevant communications at the times of the images showing the positions of the aircraft are included below.

At 12:52:49, the crew of aircraft AEA1036 contacted the LECSMA4 sector controller when it was on a 191° heading. At 13:06:13, the controller instructed them to descend to FL 150 (at that point, it was at FL 236).

At 13:06:26, the RYR61NN crew contacted the LECSMA4 sector controller and reported that it was descending to FL 220 and heading to the ROTEX waypoint. The controller instructed them to descend to FL 200.

At 13:07:16, a thirty-second conversation begins between the LECSMA4 and LEMGAPM sector controllers, in which the latter communicates that an aircraft needed to occupy RWY 13, so all other aircraft would have to use RWY 12 (aircraft AEA1036 would be the second aircraft to land on this runway). At 13:08:16, the LECSMA4 sector controller informs aircraft AEA1036 that they should expect to land on RWY 12.

At 13:07:20, the LECSMA4 controller asked aircraft AEA1036 for its descent rate. The crew answered that it was 2,000 ft/min.

At 13:08:32, the LECSMA4 sector controller instructed aircraft AEA1036 to contact the Malaga approach sector (LEMGAPM), giving it the frequency to use and saying goodbye. The positions of the two aircraft at this point can be seen in Illustration 4.

At 13:08:42, the LECSMA4 sector controller instructed aircraft RYR61NN to descend to FL 190 (at that moment, aircraft AEA1036 was at FL 183, descending at 2,000 ft/min).

At 13:09:21, the LECSMA4 sector controller instructed aircraft RYR61NN to descend to FL 180 (at that moment, AEA1036 was at FL 172 and the distance between them was 6.5 NM).

At 13:09:25, the LEMGAPM sector controller instructed aircraft AEA1036 to turn to a 265° heading and descend to FL 150 (the aircraft being on a 191° heading at that time). This implied a 74° turn. The Illustration 5 shows the positions of the two aircraft at that moment.

At 13:10:06, the LECSMA4 sector controller instructed aircraft RYR61NN to descend to FL 130 and contact the Seville approach sector (LECSAPT), informing it of the frequency to use and saying goodbye. See Illustration 7.

At 13:10:41, the LEMGAPM sector controller called LECSCEN on the hotline to ask if it could see aircraft AEA1036 (note that LECSCEN is the sector from which RYR61NN had come but left 5 minutes ago). At 13:10:56, LECSCEN called LECSMA4 and LECSAPT on the hotline expressing the LEMGAPM sector's concern. The LECSMA4 controller expressed surprise at the AEA1036 aircraft's turn to the west and reported that he no longer had it under his control. He also asked the LECSAPT controller to halt the descent of the RYR61NN aircraft.

At 13:10:43, the LEMGAPM sector controller instructed aircraft AEA1036 to continue its descent to FL 100 and 10 seconds later instructed it to turn to 215°.

At 13:10:46, the RYR61NN crew made initial contact with the LECSAPT sector frequency and reported that it was descending to FL 130 on course for the ROTEX waypoint. Eight seconds later, the LECSAPT controller instructed it to descend to 4,000 ft with QNH 1013.

At 13:11:11, the LEMGAPM sector controller requested aircraft AEA1036 accelerate its descent due to the nearby traffic, which was descending through FL 155. He also asked for confirmation of traffic in sight. The crew of aircraft AEA1036 acknowledged and reported that they did not have the traffic in sight but could see it on the radar screen (at that moment, the point of minimum distance between aircraft had already occurred). The controller responded by explaining that the other traffic was on a different frequency and was already below and ahead. At 13:11:37, the Air Europa crew replied that they had it in sight at 3 o'clock and that they had noticed its wake. The LEMGAPM controller explained that the other traffic was with Seville and that he didn't understand how they could have lowered the flight level so much. He also informed him that he would be landing on runway 12 and had emergency traffic ahead.

At 13:11:21, the LECSAPT sector controller informed aircraft RYR61NN that there was traffic behind it, one mile away and at the same level. Subsequently, the controller apologised and informed him that the other traffic was on the Málaga APP frequency and it wasn't possible to contact it but that it was already 1,000 ft above them. He, therefore, asked the RYR61NN aircraft to continue its descent to 4,000 ft.

1.10. Aerodrome information

Due to the incident that caused the change of runway-in-use a few minutes before the loss of separation, the most relevant airport for the investigation is Malaga. Malaga airport is located 8 km south-west of the city, its aerodrome reference point (ARP) has the coordinates $36^{\circ}40'30''$ N, $4^{\circ}29'57''$ W, and it has an elevation of 16 m. It has two runways: Runway 12/30 and 13/31 (See Illustration 11).

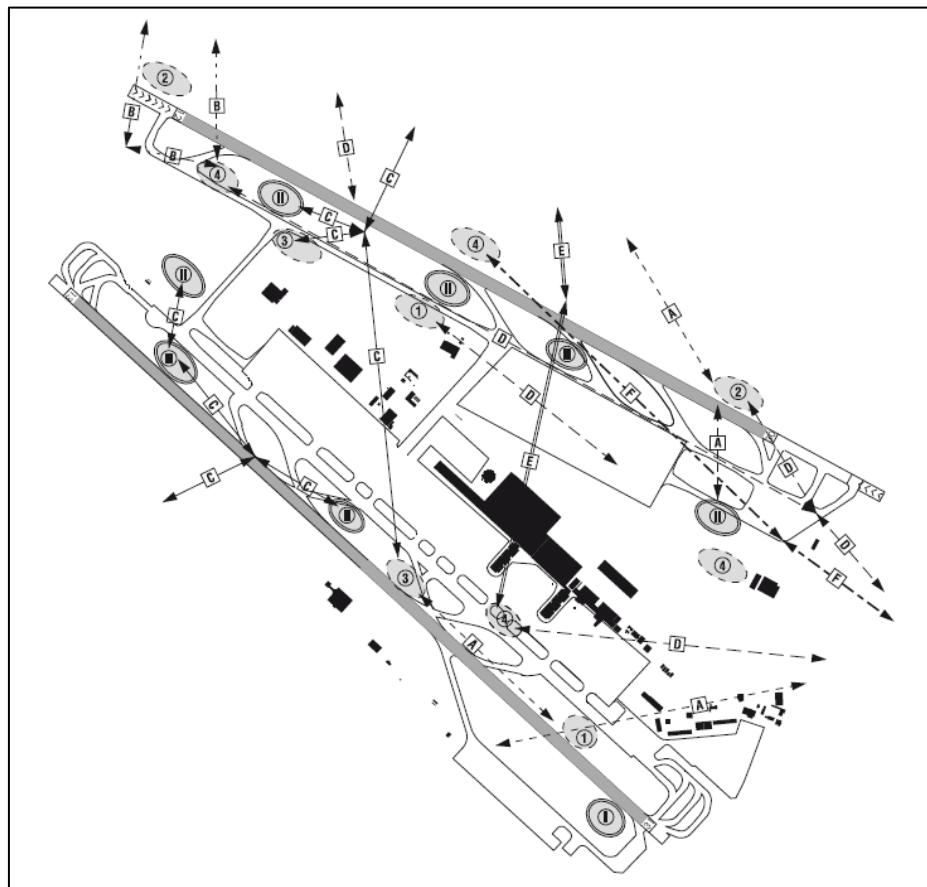


Illustration 11: Plan of Malaga Airport

During the incident, the airport was operating in the South configuration and with a single sector, which comprised all 4 airspace volumes (MGW, MGCEN, MGE and MGSUR). Because an aircraft was blocking RWY 13, the runway-in-use was changed from RWY 13 to RWY 12. Aircraft AEA1036 would be the second to land on RWY 12 after the runway change.

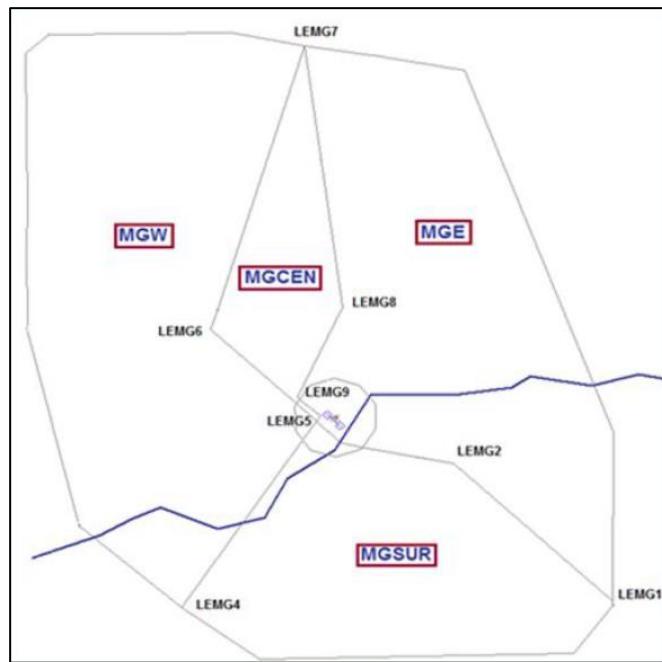


Illustration 12: Single-sector configuration (arrivals and departures)

1.11. Flight recorders

The aircraft involved in this incident were both equipped with flight recorders. However, no data relevant to the analysis of the incident was extracted from them.

1.12. Aircraft wreckage and impact information

The aircraft involved in the incident did not sustain any damage.

1.13. Medical and pathological information

There is no evidence that physiological factors or disabilities affected the performance of the aircraft crews or the air traffic controllers.

1.14. Fire

No fire broke out in the aircraft or the surroundings.

1.15. Survival aspects

N/A.

1.16. Tests and research

1.16.1. Statements relevant to the investigation:

Aircraft crews:

The commander of the RYR61NN aircraft stated that they were informed of nearby traffic by the air traffic controller when they were descending towards Seville Airport. After being advised of this, they were able to see the nearby traffic 800 ft above and behind their trail on the TCAS system. They stated that there was no TCAS TA or RA warning.

LECSMA4 control sector:

The following information has been extracted from the report written by the executive controller after the incident:

They transferred aircraft AEA1036 to Malaga approach (LEMGAPM sector) as it was descending to F150 and aircraft RYR61NN to Seville approach (LECSAPT sector) as it was descending to F130. After transferring the traffics, there was an apparent loss of separation.

The planning controller adhered to the same statement as the executive controller.

LEMGAPM control sector:

The following information has been extracted from the report written by the executive controller after the incident:

They transferred the TRA91G aircraft through the VULPE waypoint. This aircraft would be the first traffic to be changed to RWY 12 at Malaga. As the EZS31GY aircraft needed to remain on RWY 13 after landing, he lowered the TRA91G aircraft to FL 90 and turned it right to a 225° heading in order to comply with the 12 NM separation specified in the operating manual for a runway change. He stressed that they were focused on the traffic experiencing problems and coordinating with Malaga tower to open the new runway (RWY 12). It took some time for the previous sector to transfer aircraft AEA1036 over to him, so by the time that aircraft called him, it was quite close to the TRA91G aircraft and going much faster. He decided to keep the AEA1036 aircraft initially at FL 150 and gave it a right vector at 260° to increase its distance from the TRA91G aircraft, which he would then shortly be able to descend without restrictions, decreasing his workload. At that point, he wasn't aware of the RYR61NN aircraft crossing from east to west in white (like all overflying aircraft that don't affect them). Upon receiving the traffics, he moved them freely, understanding that the letter of agreement in force at that time (LoA LECS-LEMG, section E.2.2., See 1.17.3) allowed him to do so. They became aware of the conflict when the SACTA conflict alert was activated. At that time, aircraft RYR61NN was on the Seville frequency and descending through FL 170 above aircraft TRA91G and aircraft AEA1036, but it was cleared to FL 130 (below the current FL of both the other aircraft). He asked the Seville controller if he was taking the AEA1036 aircraft into account, to which the reply was affirmative. He didn't have any more time to think about it, but he assumed Seville would stop it at FL 160 (the AEA1036 aircraft was reaching FL 150 and the Seville aircraft was still above FL 160). As his traffic was lower, he descended it to FL 100 and turned it to its left at 215°, requesting they accelerate their descent and informing him of the traffic. However, Seville did not halt the descent of the RYR61NN aircraft, and the AEA1036 aircraft stopped at FL 150, the two

aircraft crossing paths a short distance from one another at that level. Fortunately, the RYR61NN aircraft had increased its ROD while the AEA1036 aircraft had reduced its speed considerably so that the latter passed behind the former, reporting only that they had noticed its trail without having had the traffic in sight. The operation continued without further mishap.

The planning controller adhered to his colleague's statement.

1.16.2. Study of the 'free for turning' measure in the LECS-LEMG letter of agreement

The definition of 'Free for Turning' in the LoA between LECS and LEMG specifies that in order to transfer a flight, the accepting unit must be able to turn the aircraft away from its previous flight path by up to 45° before the point of control transfer (see point 1.17.3).

However, this could be interpreted as specifying that the accepting unit should not instruct a turn of more than 45° on accepting an aircraft. To check whether this interpretation would have prevented the conflict, we performed a simple calculation to plot the trajectories the two aircraft would have followed if the AEA1036 aircraft only made a 45° turn and maintained that heading and speed. To do this, we used the Palestra image at 13:10:06, the time at which the aircraft had just started to turn (30 seconds after acknowledging). For aircraft AEA1036, we used a heading of 236° (which is the original 191° plus 45°). The RYR61NN aircraft maintains its heading (272°).

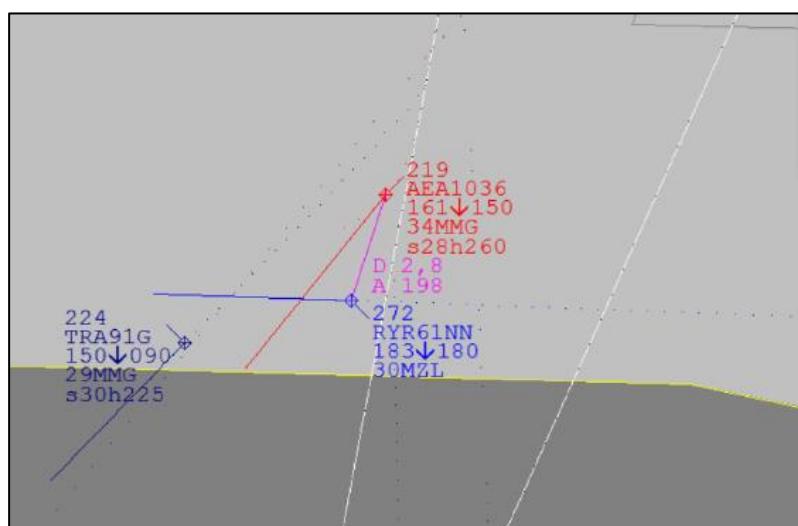


Illustration 13: Position at the beginning of the calculation (13:10:06).

With these calculations, a minimum horizontal distance between them of 1.17 NM is reached 44 seconds later. Therefore, even with a turn of only 45°, the minimum distance would still have been violated.

1.17. Organisational and management information

1.17.1. Information about Air Europa

Aircraft AEA1036 (registration EC-LYR) is operated by Air Europa, which holds an AESA-issued Air Operator Certificate for the commercial air transport of passengers and goods.

1.17.2. Information about Ryanair

The operator of the RYR61NN aircraft (registration EI-FRP) is Ryanair, which holds an Air Operator Certificate issued by the Irish Aviation Authority (IAA) for the commercial air transport of passengers and goods.

1.17.3. Information about the control services

The air traffic control services at both Seville ACC and Malaga Airport are provided by ENAIRE.

The following procedures are relevant to this report:

AIP, ENR 1.6:

In the aeronautical information publication, ENR 1.6 (En Route - General rules and procedures - ATS surveillance services and procedures), section 4.2.3 stipulates that the minimum horizontal separation between aircraft in a radar surveillance area and between 0 to 60 NM from Malaga ARP is 3 NM (the same applies to Seville Airport). At the time of the incident, the aircraft were within 60 NM of their respective airports and, therefore, this prescribed minimum distance of 3 NM applied to them.

For the applicable vertical separation minima, see point 1.18.2.

The Seville ACC Operating Manual:

In the Seville ACC Operating Manual, Annexe B: Unit operating procedures (p. B32/108), the following is established:

Traffic within the MARX airspace (as is the case for the LECSMA4 sector) must leave said sector bound for the LEZL/LEMO airports on descent to FL 130 and will be transferred to the LECSASN or LECSAPT sector (procedure used for the RYR61NN aircraft).

Malaga Operating Manual, Annexe B:

- *In Section 8.3.3.1 (p. B148/176).* For flights from Malaga APP to Malaga TWR, it indicates that for runway 13, the separation between arrivals should be 7 NM.

- *In Section 7.3.4. South configuration ARR 12-DEP 13 (p. B120/176).* It indicates the following for a single arrival sector (LEMGAPM in the case of the incident):

- “1 runway in use: the transfer to LEMG TWR will be made with a minimum separation of 7 NM between successive aircraft.

- To achieve a 7 NM separation between successive aircraft, controllers must use the published approach manoeuvres, vector guidance, speed reduction, or a combination of all three, depending on the traffic circumstances and their best judgement".

- In Section 7.5.1 *ILS RWY 13/12 approaches* (p. B124/176). The following information regarding runway changes is indicated:

- "To optimise the arrival sequence when transitioning from a one to two-runway operation in the SOUTH configuration, the minimum distance between the last aircraft landing on RWY 13 and the first landing on RWY 12 will be 12 NM. During this period, Approach must operate both traffics as if they were in a single sequence to the same runway".

Letter of Agreement between Seville ACC and Malaga APP (LoA LECS-LEMG):

Annexe E, section E.1 of *The Letter of Agreement between Seville ACC and Malaga APP*, which entered into force on 31 May 2018, establishes the following in regard to the transfer of control:

"E.1.1. The transfer of control takes place within the boundaries of the Area of Responsibility (AoR), except as specified in paragraph E.2.2".

- In section E.2 on the transfer of communications, it establishes the following:

"E.2.2. Communications transfers will imply the transfer of control of the traffic, which must be transmitted when the aircraft is free for ascent in the case of take-offs, for descent in the case of arrivals, and for turning in both situations".

For its part, Annexe A provides definitions of the terms included in the aforementioned LoA between the units, stipulating the following:

"A.1.7.2. Free for Descent: Authorisation for the accepting unit to descend a specific aircraft prior to the transfer of control.

Note: Unless otherwise agreed, the transferring unit continues to be responsible for the separation within its Area of Responsibility".

"A.1.7.3. Free for Turning: Authorisation for the accepting unit to turn a specific aircraft prior to the transfer of control.

Note: Unless otherwise agreed, the transferring unit continues to be responsible for the separation within its Area of Responsibility".

- In Annexe D on coordination procedures, in section *D.3. Special procedures*, the following is established:

"D.3.2. RWY 12/30 in the single-runway configuration (for contingencies only).

D.3.2.1. Although RWY 12/30 is commonly used in a two-runway configuration, controllers must also consider the possibility of having to use it in a single-runway configuration as a contingency for RWY 13/31 in the following circumstances:

- Clearing landings on RWY 12 or take-offs from runway 30, whenever the wind allows it if work is being carried out on RWY 13/31. This would generally be at night-time and in periods without planned aircraft operations.

- In the southern configuration (single runway), clearing an aircraft to land on RWY 12 instead of RWY 13 due to an anticipated landing problem, therefore preventing the disabling of RWY 13/31 while the aircraft in question clears the runway.

D.3.2.2. Should either of the contingencies foreseen in the previous point occur, LEMG will inform LECS of the intention to use RWY 12 for arrivals or 30 for take-offs; similarly, it will inform LECS of the moment in which the runway configuration changes.

D.3.2.3. The STARs to RWY 12 and the SIDs from runway 30 are shown in tables D.2.1 and D.2.2:

TABLA D.2.1		TRÁFICO DE LECS A LEMG							
RWY	RUTA (*)			STAR	FL Autorizado	COP (**)	FREC LEMG APP	SLP (***)	FL DE CRUCE / PUNTO (****)
	Nº	VIA	IAF						
SUR: ver D.3.2) RWY12 (dos pistas/pista única RWY 13 (pista única)	1	CRISA	OMIGO	VULPE 1K	FL 150	VULPE	123,850 MHz	250 KTS 10 NM>OMIGO	VULPE/FL 250
		SVL		SVL 1K (1)		Limite AoR o >FL150		N/A	
		JRZ		JRZ 1K		118,450 MHz	250 KTS 11 NM>MAR	34 DME/JRZ FL 210	
		VJF		VJF 1K					
CONFIGURACIÓN RWY12 (dos pistas/pista única RWY 13 (pista única)	2	BAENA	TOLSU	BLN 1Q	FL 150	BAENA	123,850 MHz	250 KTS 10 NM>TOLSU	BAENA FL 220
		VIBAS		VIBAS 1Q (2)		GDA		250 KTS GDA	GDA FL 170
		ROLAS		ROLAS 1Q (3)		Limite AoR o >FL150		N/A	N/A
	3	NESDA-MGA		NESDA 1Q		118,450 MHz			
		BOLKA-MGA		BOLKA 1Q (4)					
		GONZA-MGA		GONZA 1Q (4)					
	4	PEKOP-MGA		PEKOP 1Q	FL 140		EPATA		
		PIMOS-MGA		PIMOS 1Q	FL 150		Limite AoR o >FL150		

Illustration 14: Table showing traffic transfer from LECS to LEMG (South Configuration)

1.18. Additional information

1.18.1. Information about the flow of aircraft in the LECSMA4 sector

Perseo is Enaire's data analysis platform. One of its functions is to show the flow of aircraft over a sector and the percentage of the system's capacity it represents. According to Perseo, the workload in the LECSMA4 sector was at 40% at the time of the incident.

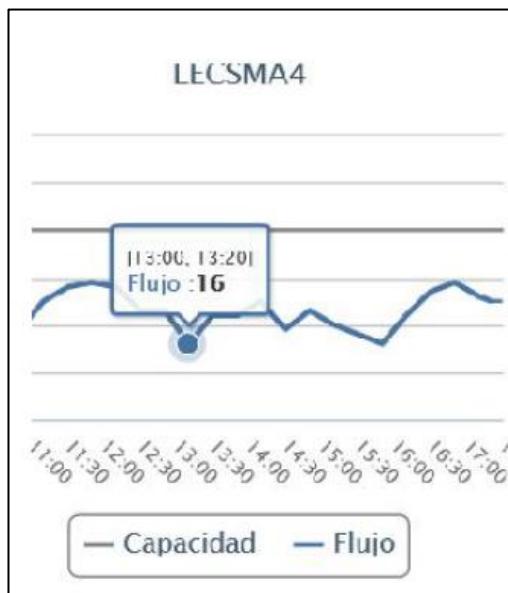


Illustration 15: Workload in LECSMA4 on 16/07/2019

1.18.2. Regulatory vertical distance

According to the European air regulations (SERA), point 8005 c), the vertical separation that an air traffic control unit must provide will be obtained by assigning different flight levels, the minimum vertical separation being 300 m (1,000 ft) nominal up to and including FL 410, and 600 m (2,000 ft) nominal above that level.

1.18.3. ENAIRE's internal investigation report

The navigation service provider, ENAIRE, carried out an internal investigation into the event, on the basis of which it made the following internal recommendations:

1. An incident study session with the controllers involved.
2. Include the analysis of the incident in the continuous professional training given to the Seville ACC controllers.
3. Review the Letter of Agreement (LoA) between LEMG APP/TWR and Seville ACC to better define the area in which the accepting unit can give vector guidance freely.

All three recommendations were subsequently implemented, with the new inter-unit LoA coming into effect on 31 December 2019. The preceding version was modified to establish that the transfer of control would take place at the boundary of the area of responsibility (AoR), and not before. The modified paragraphs in the LoA are shown below:

"E.1.1. The transfer of control takes place at the boundary of the AoR".

"E.2.2. Communications transfers will imply that the traffic is being transferred free for ascent in the case of take-offs, for descent in the case of arrivals, and for turning in both situations".

"F.2.5. The transfer of radar identification between both units will be carried out through the transfer-with-alert function".

1.19. Special investigation techniques

No special techniques were used in the investigation.

2. ANALYSIS

2.1. Cause of the conflict

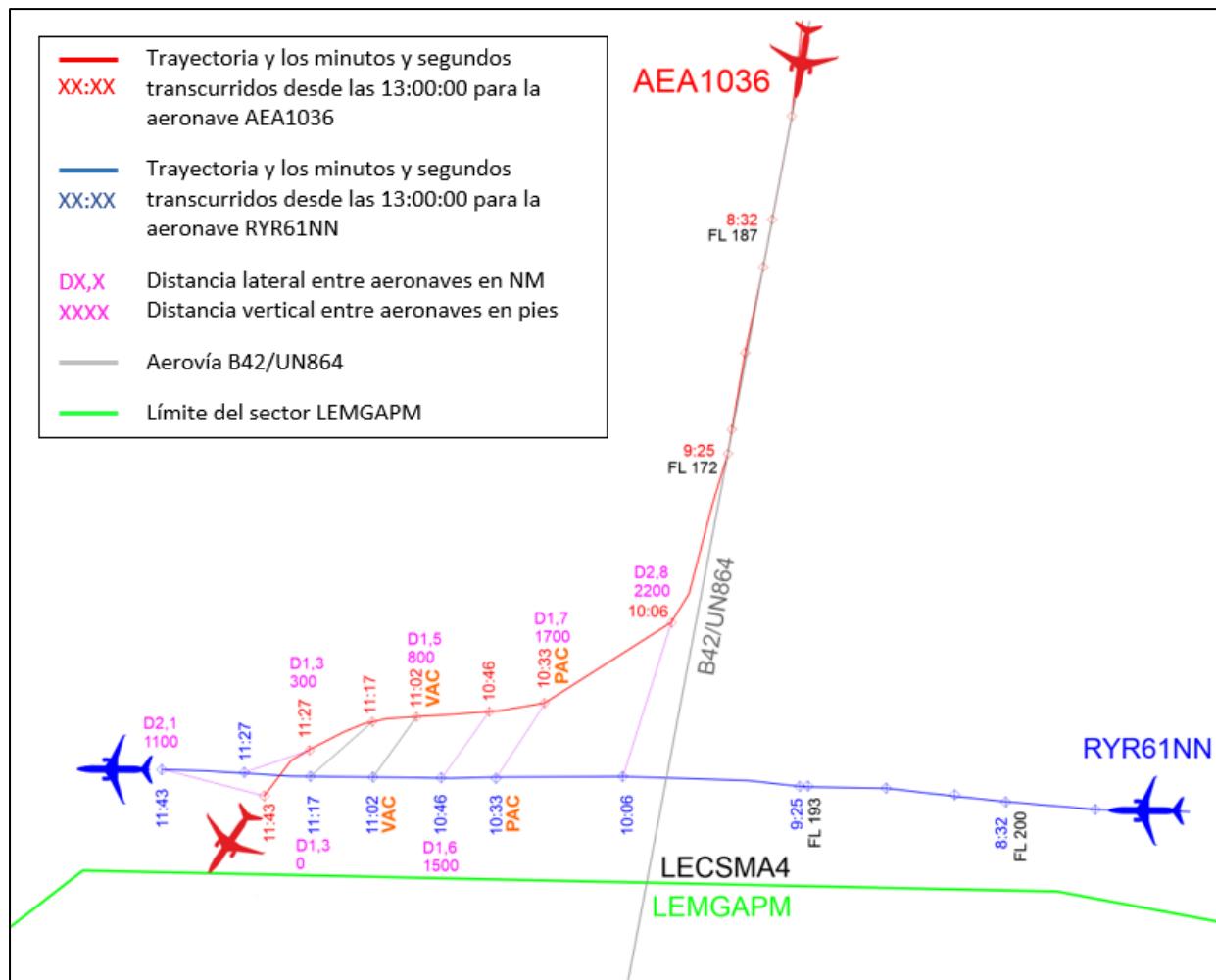


Illustration 16: Trajectory of both aircraft and their positions at different times.

Prior to transferring the AEA1036 and RYR61NN aircraft, the LECSMA4 sector controller was aware of the potential conflict that could arise between them because:

- He used the LAD tool to observe the distance between the two aircraft.
- He asked aircraft AEA1036 for its descent rate, and until the RYR61NN aircraft did not cross its path, he closely monitored the vertical distance between them, instructing the latter to descend to flight levels as the AEA1036 aircraft vacated them to guarantee a vertical distance between them of at least 1,000 ft.

At 13:06:13, aircraft AEA1036 was on a southbound route following the B42/UN864 airway. The LECSMA4 sector controller instructed it to descend to FL 150 to comply with the transferral procedure established in the letter of agreement (LoA) between LECS and LEMG (section D.2.1.).

At 13:08:32, the LECSMA4 sector controller transferred communications, and therefore also control, of aircraft AEA1036 to the LEMGAPM sector, as per section E.2.2 (in relation to E.1.1) of the LoA between LECS and LEMG. Less than a minute later, the LEMGAPM sector

controller instructed it to turn to its right to follow a 265° heading (a turn of 74°) and descend to FL 150 as cleared, which caused the trajectories of the two aircraft to converge.

Regarding this turn:

- It was instructed to increase the aircraft's distance from the preceding aircraft on the same route, which, in turn, was affected by the aircraft blocking RWY 13. This was because the unit's Operating Manual specifies, in section 7.5.1 on runway changes, that the distance between the last aircraft to land on a closing runway and the first one to land on the new one must be 12 NM, instead of the usual 7 NM for arrivals (separation applied previously).
- The aforementioned LoA stipulates that the transfer of communications must be made when an aircraft is free for descent and, in the case of arrivals, for turning. The definition of 'free for turning' says that the accepting unit is authorised to turn the aircraft by a maximum of 45° from its current trajectory before the actual transfer of control. The 45° limitation applies only until control is transferred and not after. However, in this specific case, we have already demonstrated in point 1.16.2 that even if the aircraft had only been instructed to turn 45°, it would still have been necessary to maintain the vertical distance between them.

At 13:10:06, aircraft RYR61NN, which was flying from east to west through FL 183 to descend to FL 180, was instructed by the LECSMA4 sector controller to descend to FL 130 in order to comply with the procedure established in the unit's Operating Manual. It was then transferred to the LECSAPT sector when it was approximately 20 miles from the sector boundary. Regarding this transfer:

- It occurred when the RYR61NN aircraft was crossing the airway the AEA1036 aircraft had been following until a few seconds earlier. It seems clear that the LECSMA4 controller did not foresee the possibility of the AEA1036 deviating from its route so quickly, nor did he notice the turn that it had commenced a few seconds earlier.
- From this moment on, the RYR61NN aircraft considerably increased its ROD, doubling it in less than 1 minute.
- By instructing a flight level lower than that of the AEA1036 aircraft, the vertical separation between the two aircraft was no longer guaranteed. This means the LECSMA4 controller transferred the RYR61NN aircraft while it was in conflict, failing, therefore, to adhere to the procedures stipulated in the LoA.
- The transfer took place at around 20 NM from the edge of the sector, which means there was still room to have kept it under his control.

Consequently, at 13:10:33, the newly convergent trajectories of the aircraft activated the STCA-PAC alert. The distance between them was 1.7 NM and 1,700 ft (the minimum prescribed separation for this airspace being 3 NM and 1,000 ft), but the altitude difference was rapidly reducing as the RYR61NN's ROD was more than double that of the AEA1036 (2,050ft/min and increasing v 750 ft/min). The aircraft were still in the LECSMA4 sector's area of responsibility (AoR) but had already been transferred to the collateral sectors.

Shortly afterwards, the LEMGAPM sector controller noticed the activation of the STCA-PAC alert with the AEA1036 aircraft under his control, and at 13:10:41, he called the LECSCEC sector to ask if they saw his aircraft. The LECSCEC sector controller answered affirmatively, without indicating that it wasn't in his sector. Nonetheless, 15 seconds later, the latter called the LECSMA4 and LECSAPT sectors to convey the concern of the LEMGAPM controller. However, even if the LEMGAPM controller had called the LECSMA4 sector immediately, it had already transferred the communications of the RYR61NN aircraft to the LECSAPT sector.

At 13:10:46, aircraft RYR61NN made contact with the LECSAPT sector controller and 8 seconds later it was instructed to descend to 4,000 ft. The distances between the two traffics were reducing, and the STCA-PAC alarm had already activated, which should have alerted the LECSAPT sector. However, it didn't provide the essential information about the traffic until 27 seconds later, when the aircraft had already crossed paths.

At 13:11:02, the first violation of the prescribed minimum separation occurred with the aircraft being 1.5 NM and 800 ft apart, activating the STCA-VAC function between them. The ROD of the RYR61NN aircraft was almost 3 times higher than that of the AEA1036 aircraft (3,263 v 1,113 ft/min).

In conclusion, we have determined the loss of separation was caused by the LECSMA4 sector controller's early transfer of the RYR61NN aircraft to the collateral sector before it was free for descent due to the prior turn of the AEA1036 aircraft.

In terms of the workload, we have ruled out the possibility that the LECSMA4 controller was saturated with work because, according to the Perseo tool, the flow of aircraft at the time of the incident was only 40% of the system's maximum capacity.

2.2. Resolution of the conflict

At the same time as the loss of separation occurred, the call mentioned above was made, during which the LECSCEN sector controller informed the LECSMA4 and LECSAPT sectors of LEMGAPM's concern about whether they were aware of their aircraft (AEA1036). The LECSMA4 sector controller replied that it was no longer under his control. Until that moment, this last sector had not taken any measures to prevent the loss of separation, despite the fact that the distances were violated while both aircraft were within their AoR.

Next, the LECSMA4 sector controller called the LECSAPT sector on the hotline to tell it to stop the descent of aircraft RYR61NN. There is no evidence of a response from the LECSAPT sector controller, but in any case, the minimum distance between the aircraft occurred just a few seconds later, and it would have been difficult to avoid the loss of separation at that late stage.

At 13:11:11, the LEMGAPM sector controller instructed aircraft AEA1036 to continue its descent, informed it about the other aircraft (RYR61NN) and asked the crew to notify him when they had the traffic in sight. The crew acknowledged and reported that they did not have the traffic in sight but could see it on their screen.

The request to accelerate the descent was counterproductive because the RYR61NN aircraft was only 600 ft above and descending at a much higher rate, 6 seconds away from reaching the minimum distance. However, despite acknowledging, the crew of the aircraft AEA1036 had already begun to reduce the ROD a few seconds before (from about 1,400 ft/min to less than 400) and did not follow the controller's instruction until a few seconds later, when the aircraft had crossed paths and the prescribed minimum distance between them had been restored, which was a wise decision.

At 13:11:17, the minimum distance occurred, which according to the radar data was 1.3 NM and 0 ft, as the aircraft crossed levels.

At 13:11:21, the LECSAPT sector controller informed aircraft RYR61NN that it had traffic a mile behind and at the same level. As the aircraft had already crossed paths and it no longer made sense to take further action, he apologised and asked it to continue the descent.

Shortly afterwards, both aircraft were following their divergent trajectories to their respective airports, and the distances between them were increasing.

2.3. Assessment of the actions taken by ENAIRE

The navigation service provider, ENAIRE, carried out an internal investigation into the event, on the basis of which it made three recommendations (see 1.18.3), which were subsequently implemented.

The decision to include the incident in the continuous training is a good way to ensure controllers avoid similar incidents in the future.

In regard to the change in the LoA between ACC Seville and Malaga APP:

According to the old wording of the LoA, when an aircraft's communications are transferred from one unit to another, its control is also transferred (point E.2.2). This implied that the accepting unit had total freedom to turn the aircraft, as the 45° turn limitation specified in point A.1.7.3 applied only before the control transfer point. However, the transferring unit continued to be responsible for the aircraft in its AoR (as denoted by points A.1.7.2 and A.1.7.3).

According to the new wording of the LoA, control of the aircraft is no longer transferred at the same time as communications. Although the accepting unit can still instruct the transferred aircraft to turn, the 45° restriction now applies, making it easier for the transferring unit to limit the movements the aircraft could make once transferred.

However, this measure is considered insufficient to prevent similar incidents from occurring in the future. As already seen in point 1.16.2, even with a 45° turn limit, the loss of separation would probably still have occurred.

In conclusion, we have determined that the existence of a system that allows controllers to turn aircraft outside of their area of responsibility was a contributing factor in the incident and that the measures taken by Enaire are not sufficient to prevent a similar event from occurring in the future.

3. CONCLUSIONS

3.1. Findings

- RWY 13 at Malaga airport was blocked by an aircraft that had declared an incident. As a result, the subsequent traffic had to be diverted to RWY 12. The LEMGAPM controller instructed the affected aircraft to make wide turns in order to increase the distance between them, complying with his unit's procedures.
- The LEMGAPM sector controller coordinated with the LECSMA4 sector and informed the aircraft involved of the change to RWY 12 at Malaga.
- The LECSMA4 sector controller was alert to the possible conflict between the two aircraft until he transferred their control.
- The LECS-LEMG letter of agreement stipulates that although the LECSMA4 sector controller had transferred control of the aircraft, he was still responsible for the separation between them as they were still in his area of responsibility (AoR).
- The transfer of aircraft AEA1036 was not free for turning unless sufficient vertical separation from aircraft RYR61NN was maintained. The vertical separation ceased to be maintained when the LECSMA4 sector controller instructed aircraft RYR61NN to descend to a lower flight level than that of aircraft AEA1036 at the time.
- At 13:11:17, the minimum distance between the aircraft was 1.3 NM horizontally and 0 ft vertically, with both aircraft in the LECSMA4 sector's AoR.
- At the time of minimum distance, the affected aircraft were under the control of controllers from different sectors and units and in the AoR of a third sector, which made it difficult to avoid the conflict after it was detected.
- No TCAS TA or RA warnings were activated on either aircraft.

3.2. Causes/contributing factors

The investigation has determined the cause of the incident was the early transfer of the RYR61NN aircraft from the LECSMA4 sector to the collateral sector, resulting in the loss of separation between the two traffics.

The letter of agreement between the units, which allows them to make changes to an aircraft's course while it's still in the previous control area, is considered to have been a contributing factor.

4. OPERATIONAL SAFETY RECOMMENDATIONS

The fact that the letter of agreement between LECS and LEMG APP allows controllers to turn an aircraft before it enters their area of responsibility without requiring prior coordination is considered a safety risk. Therefore, the following recommendation has been issued to Enaire:

REC 37/21: It is recommended that Enaire makes the necessary changes to ensure that LECS and LEMG APP controllers do not instruct aircraft to turn before they are in their area of responsibility unless there has been prior coordination between the units.