



**COMISIÓN DE
INVESTIGACIÓN
DE ACCIDENTES
E INCIDENTES DE
AVIACIÓN CIVIL**

Report IN-038/2016

Incident involving a BOEING 737-400, registration SP-ENA, operated by ENTER AIR, and a CESSNA 172, registration EC-JOB, operated by BARCELONA FLIGHT SCHOOL, at the Barcelona TMA (Spain) on 28 September 2016



GOBIERNO
DE ESPAÑA

MINISTERIO
DE FOMENTO

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Foreword

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

In accordance with the provisions in Article 5.4.1 of Annex 13 of the International Civil Aviation Convention; and with articles 5.5 of Regulation (UE) 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

ACC	Area control center
AESA	Spain National Aviation Safety Agency
AMSL	Above mean sea level
ATCO	Air Traffic Controller
ATPL(A)	Airline transport pilot license (airplane)
CECOA	Coordination Center at airport
CPL(A)	Commercial pilot license (airplane)
CTOT	Calculated take off time
CTR	Control zone
DME	Distance measuring equipment
EHEH	Eindhoven (The Netherlands) airport ICAO designation
EPWA	Warsaw Chopin (Poland) airport ICAO designation
ELR	TMA east configuration
FI	Flight instructor rating
FL	Flight level
FP	Flight Plan
ft	Feet
h	Hour(s)
hPa	Hectopascals
IAF	Initial approach fix
IFR	Instrument flight rules
IMC	Instrumental Meteorological Conditions
IR(A)	Instrument rating (airplane)
Kt	Knots
Km/h	Kilometers per hour
LEBL	Barcelona (Spain) airport ICAO designation
LECB	Barcelona (Spain) ACC ICAO designation
LEGE	Girona (Spain) airport ICAO designation
LELL	Sabadell (Barcelona, Spain) airport ICAO designation
LNAV	Lateral navigation
m	Meters
MEPL(A)	Multi-engine piston land rating (airplane)
mb	Millibars
MHz	Megahertz
MSSR/S	Monopulse Secondary Surveillance Mode-S Radar
N	North
NM	Nautical miles
PPL(A)	Private pilot license (airplane)
PSR	Primary Surveillance Radar
QAR	Quick access recorder
QNH	Altimeter subscale setting to obtain elevation when on the ground
RA	Resolution advisory
REDAN	Air navigation data network
RWY	Runway
S	Seconds
SCV	Communications Systems by voice
SEPL(A)	Single-engine piston land rating (airplane)
SACTA	Automated air traffic control system
SSR	Secondary surveillance radar
SW	Southwest
TA	Traffic advisory
TCAS	Traffic collision avoidance system
Teoista	Air traffic service operations and information technician
TMA	Terminal control area
TWR	Tower
UTC	Coordinated universal time

VMC	Visual meteorological conditions
VFR	Visual flight rules
VOR	VHF omnidirectional range
W	West
WRL	TMA east configuration

Synopsis

Operator	Enter Air	Barcelona Flight School
Aircraft	Boeing 737-400	Cessna 172
	registration SP-ENA	registration EC-JOB
Persons onboard	6, none injured	2, none injured
Type of flight	Commercial air transport	General aviation
	– Non-scheduled	– Instruction
	– Positioning	– Other
Date and time of incident:	28 September 2016 at 09:05 UTC ¹	
Site of accident:	Barcelona TMA (Spain)	
Date of approval:	28 June 2017	

Summary of the event

On Wednesday, 28 September 2016 at 09:05 UTC, an incident occurred due to the loss of separation between a Boeing 737-400 aircraft, operated by Enter Air, which was inbound from the Warsaw-Chopin Airport (Poland) to Girona (Spain), and a Cessna 172 aircraft, operated by Barcelona Flight School and which was inbound from the Sabadell Airport (Spain) to Girona.

The two aircraft had been cleared by the Barcelona ACC to make a VOR approach to runway 02 at the Girona Airport. At approximately 09:05, there was a loss of separation between the two in the vicinity of the intermediate approach fix, some 11 NM away from the airport, which resulted in a TCAS RA on aircraft SP-ENA.

After the incident, both aircraft continued their flights with no further problems.

¹ All times in this report are in UTC. To obtain local time, add 2 hours to UTC.

1. FACTUAL INFORMATION

1.1. History of the flight

On 28 September 2016, a Boeing 737-400 registration SP-ENA, operated by Enter Air, was making a flight with callsign ENT1237 from the Warsaw-Chopin Airport (Poland) to the Girona Airport (Spain). A Cessna 172 aircraft, registration EC-JOB, operated by Barcelona Flight School, was on an instruction flight, with callsign ECJOB, from the Sabadell Airport (Spain) to the Girona Airport. Runway 02 was in use at the Girona Airport and the approach control service was being provided by the Barcelona ACC.

According to the information provided, the REDAN network went off-line at 08:44 for 26 min, which resulted in a loss of the Girona radar signal, of the communications between LEGE and the Barcelona ACC and of the SACTA system.

At 08:50, there was a configuration change at the Barcelona TMA, which went from a west to an east configuration. After this, a new control sector was opened, going from sector T1E to sectors D1E and TGR, as shown in figures 4 and 5. The controllers in charge of T1E went on to handle D1E, and two new controllers went on duty, assigned to sector TGR.

At 08:59:23, aircraft EC-JOB was instructed by the D1E sector of the Barcelona ACC to make an approach to runway 02 at Girona without sector TGR being informed of the transfer of said traffic. Following this, at 09:00, the aircraft operated by Enter Air was cleared by the sector TGR controllers to make an approach to runway 02 at Girona. As a result, there was a loss of separation between the two aircraft at the intermediate fix of the TISGO approach. According to data from the radar track, the separation at the closest point of approach was 0.4 NM horizontally and 200 ft vertically, which caused a TCAS RA on the aircraft operated by Enter Air.

The two aircraft were in visual contact at all times. Aircraft EC-JOB made a 360° turn to the left and SP-ENA continued its approach and landed on runway 02.

1.2. Injuries to persons

1.2.1. Aircraft SP-ENA

Injuries	Crew	Passengers	Total	Others
Fatal				
Serious				
Minor				
None	6		6	
TOTAL	6		6	

1.2.2. Aircraft EC-JOB

Injuries	Crew	Passengers	Total	Others
Fatal				
Serious				
Minor				
None	2		2	
TOTAL	2		2	

1.3. Damage to aircraft

The aircraft involved in the incident were not damaged.

1.4. Other damage

There was no other damage.

1.5. Personnel information

1.5.1. Information on the personnel in aircraft SP-ENA

The captain of the aircraft, a 52-year old Serbian national, had an ATPL(A) license from the Civil Aviation Authority of the Serbian Republic, with B-737-900 and IR(A) ratings that

were valid until 31 March 2017. He also had a class-1 medical certificate that was valid until 26 November 2016. He had 11,500 total flight hours and 11,250 hours on the type.

The aircraft's copilot, a 52-year old Polish national, had a CPL(A) license from the Civil Aviation Authority of the Polish Republic, with B-737-900 and IR(A) ratings that were valid until 30 April 2017. He also had a class-1 medical certificate that was valid until 9 October 2017. He had 3,864 total flight hours and 1,622 hours on the type

1.5.2. Information on the personnel in aircraft EC-JOB

The captain of the aircraft, a 44-year old Spanish national, had a CPL(A) license issued by Spain's National Aviation Safety Agency, with a SEPL(A) rating that was valid until 31 May 2017, MEPL(A) and IR(A) ratings that were valid until 31 January 2017, and an FI rating that was valid until 31 August 2019. He also had a class-1 medical certificate that was valid until 12 July 2017. He had about 5,000 total flight hours and 3,500 hours on the type.

The student, a 40-year old Spanish national, had a PPL(A) license issued by Spain's National Aviation Safety Agency, with a SEPL(A) rating that was valid until 31 August 2018. He also had a class-1 medical certificate that was valid until 13 October 2017. He had about 94 total flight hours.

1.5.3. Information on the control personnel

The executive controller in sector D1E, a 44-year old Spanish national, had an air traffic controller license issued by Spain's National Aviation Safety Agency that was valid until 2 November 2017. He also had a class-3 medical certificate that was valid until 19 July 2017. He had a total of 18 years of experience at the unit.

The planning controller in sector D1E, a 44-year old Spanish national, had an air traffic controller license issued by Spain's National Aviation Safety Agency that was valid until 28 May 2017. He also had a class-3 medical certificate that was valid until 23 October 2016. He had a total of 13 years of experience at the unit.

The executive controller in sector TGR, a 53-year old Spanish national, had an air traffic controller license issued by Spain's National Aviation Safety Agency that was valid until 27 April 2017. He also had a class-3 medical certificate that was valid until 24 July 2017. He had a total of 19 years of experience at the unit.

The planning controller in sector TGR, a 44-year old Spanish national, had an air traffic controller license issued by Spain's National Aviation Safety Agency that was valid until 13

March 2017. He also had a class-3 medical certificate that was valid until 14 May 2017. He had a total of 17 years of experience at the unit.

The tower controller at the Girona Airport, a 41-year old Spanish national, had an air traffic controller license issued by Spain's National Aviation Safety Agency that was valid until 20 October 2017. He also had a class-3 medical certificate that was valid until 3 October 2017. He had a total of 9 years of experience at the unit.

1.6. Aircraft information

1.6.1. Information on aircraft SP-ENA

The aircraft with registration SP-ENA, a BOEING 737-400 serial number 26320, had a valid certificate of airworthiness issued on 12 March 2010. The airworthiness review certificate was valid until 4 March 2017. The most recent maintenance activity had been a 50-h inspection conducted on 26 September 2016. The aircraft had about 51,500 flight hours at the time of the incident.

1.6.2. Information on aircraft EC-JOB

The aircraft with registration EC-JOB, a CESSNA 172-S serial number 172S9949, had a valid certificate of airworthiness issued on 3 December 2010. The airworthiness review certificate was valid until 7 December 2016. The most recent maintenance activity had been a 50-h inspection conducted on 25 May 2016. The aircraft had 3,588 flight hours at the time of the incident.

1.7. Meteorological information

According to information provided by Spain's National Weather Agency, and in light of the observations at the Girona Airport station, satellite and radar images and adverse weather phenomena, the most likely weather conditions at the site of the incident were:

Wind: Direction: N (360°)

Speed: moderate, at about 2 km/h

Maximum gusts: 6 km/h

Visibility: good visibility on the surface

Clouds cover: clear

Temperature: around 17°C

QNH: around 1027 hPa

Relative humidity: around 84%

The Meteosat satellite images showed completely clear skies.

1.8. Aids to navigation

1.8.1. Arrival and approach charts for the Girona Airport

The instrument arrival and approach charts for runway 02 at the Girona Airport are shown below.

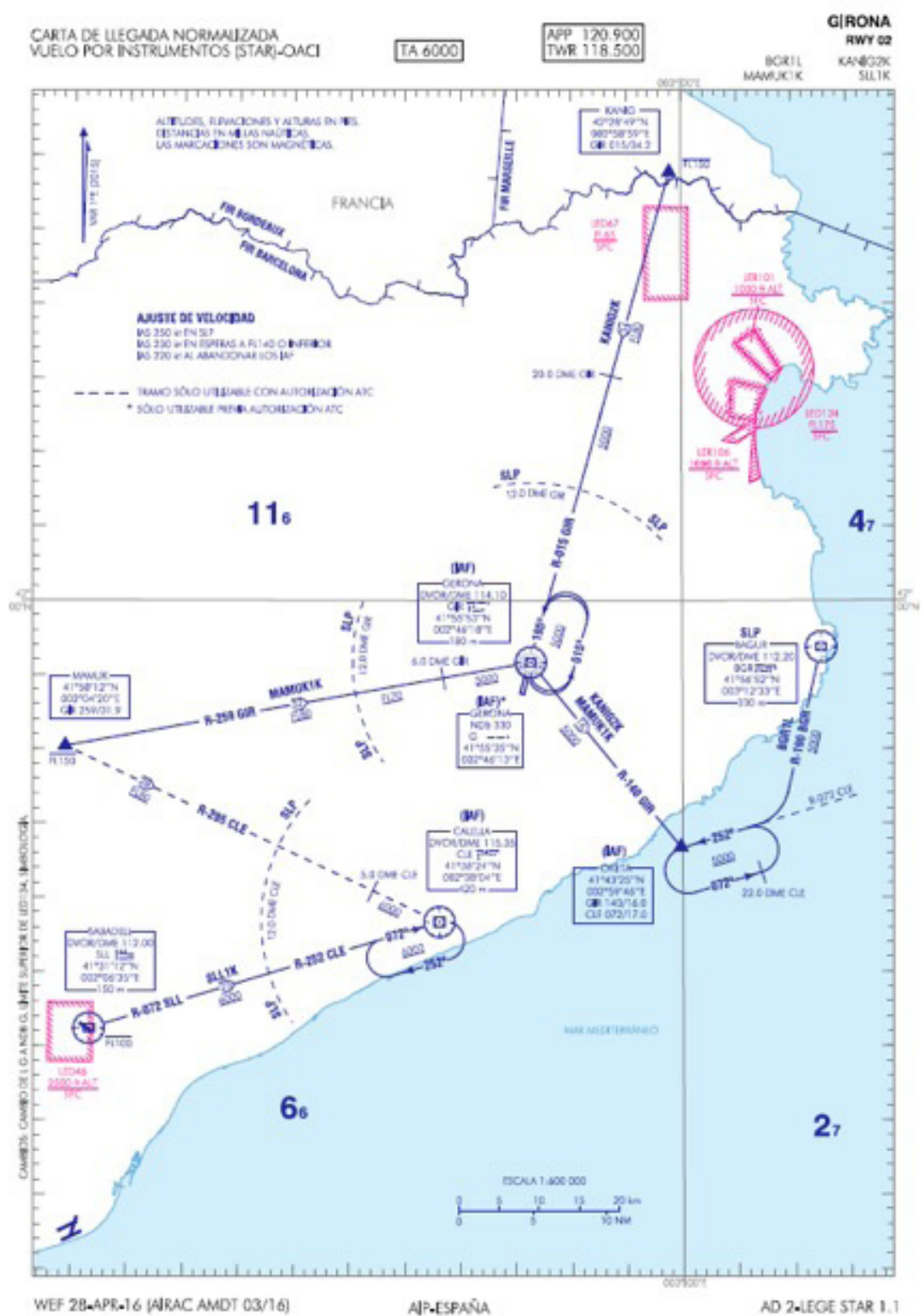


Figure 1. Instrument arrival chart for Girona RWY02

GIRONA
VOR
RWY 02

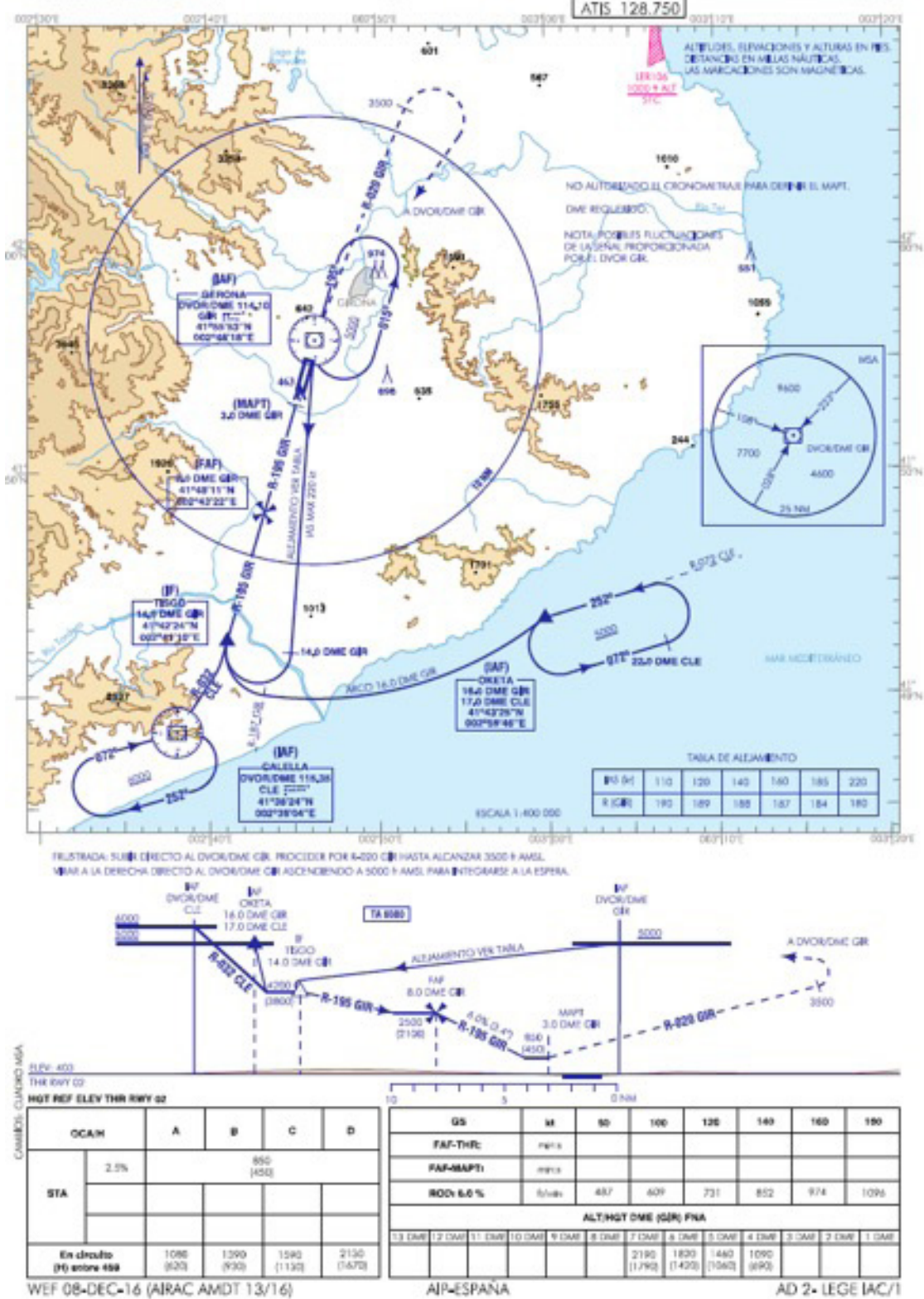


Figure 2. Instrument approach chart for Girona RWY02

1.8.2. TMA Barcelona sectors involved

The sectors of the Barcelona TMA involved in the incident are shown below.

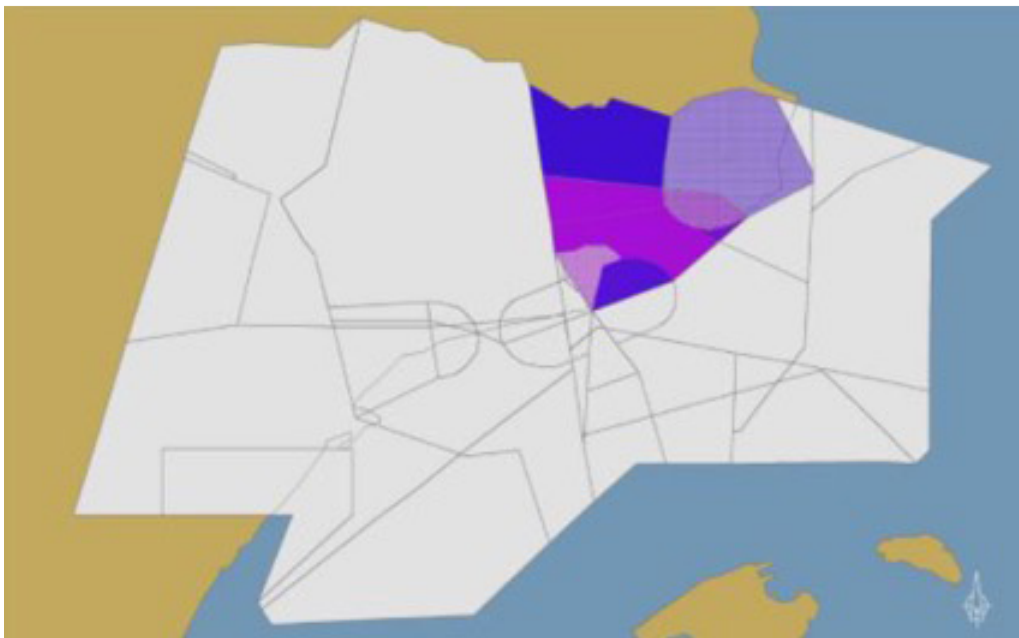


Figure 3. Sector T1E

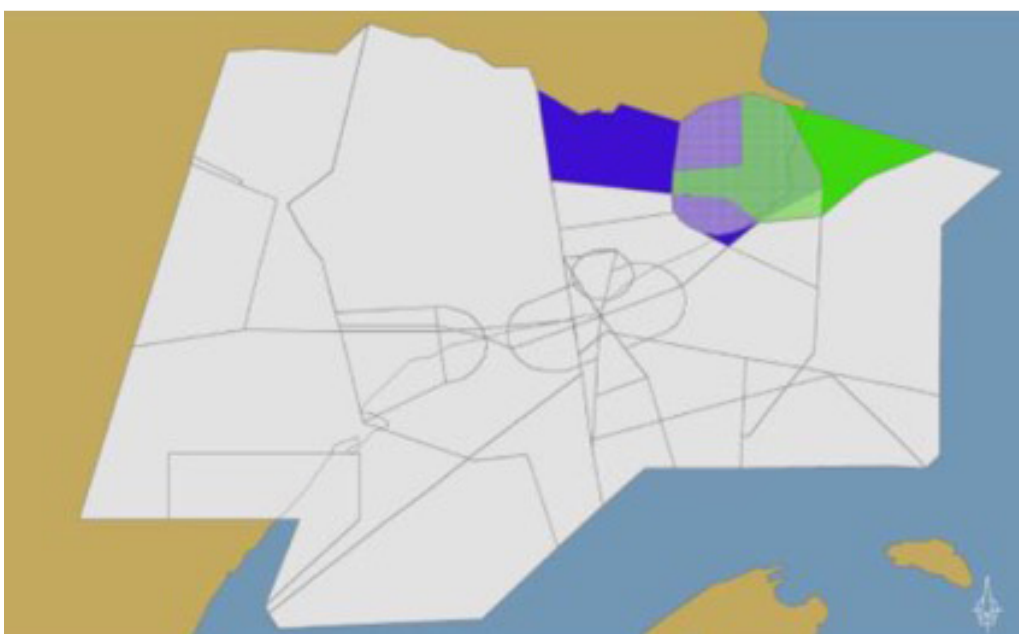


Figure 4. Sector TGR

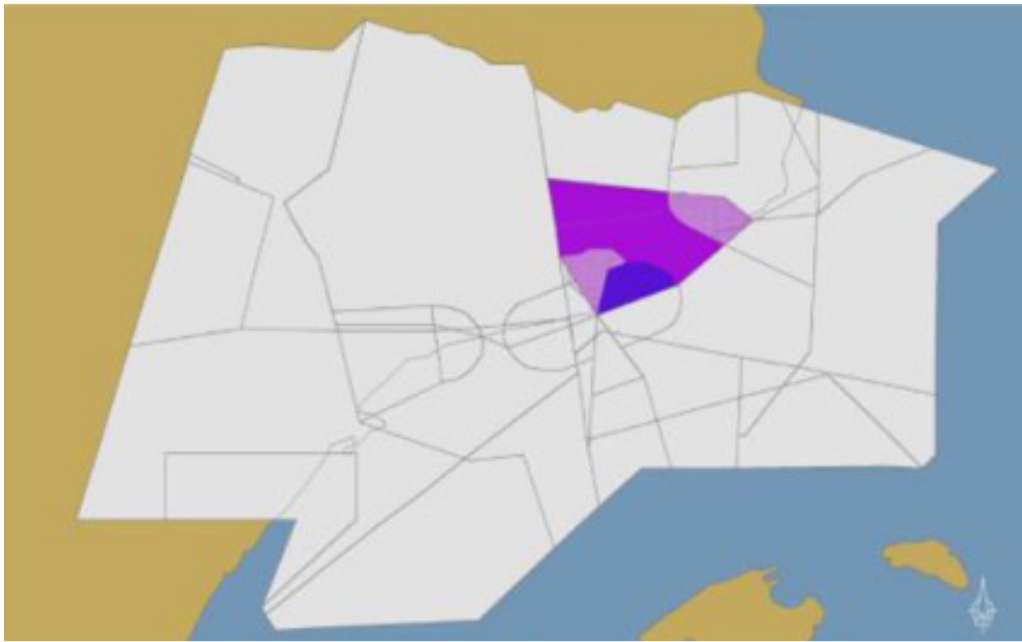


Figure 5. Sector D1E

1.9. Communications

Below is a summary of the most relevant events and communications involved in the incident.

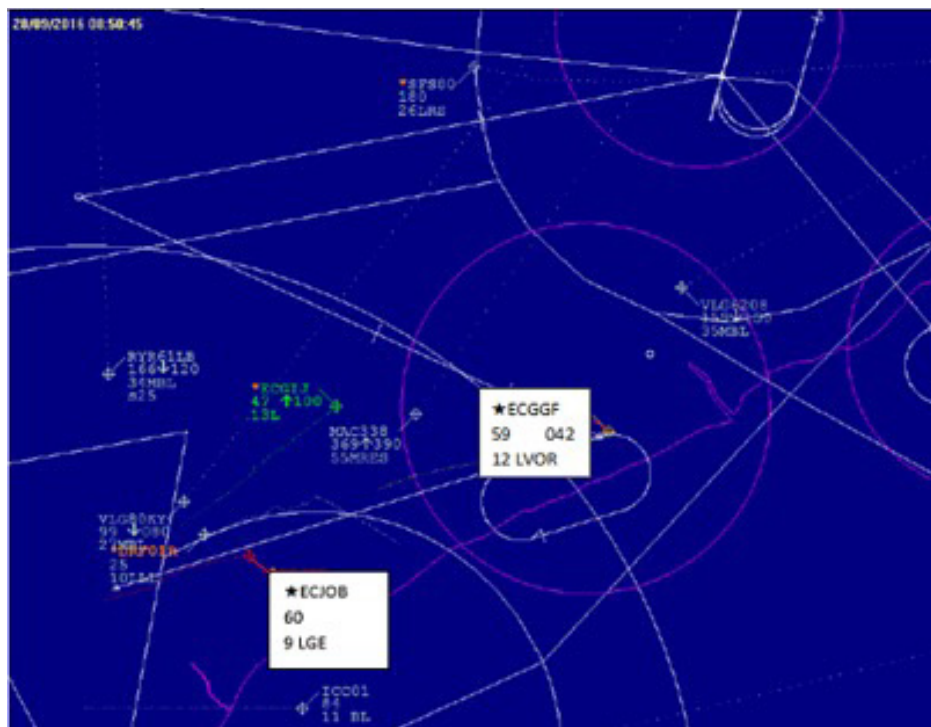


Figure 6. Aircraft EC-GGF on approach to LEGE (08:50:45)

08:48:17 Aircraft EC-GGF, under IFR from LELL to LEGE, approaches CLE, holding at 6000 ft, and reports to sector T1. The ATCO in the sector tries to communicate with the Girona TWR, to no avail. The traffic is instructed to descend to 4200 ft and complete the VOR/DME approach to runway 02 at Girona.

08:50:00 The configuration at the Barcelona TMA is changed from WRL to ELR. In this configuration, sector T1E is expected to be overloaded, so the decision is made to change the sectors.

08:50:45 The ATCO in sector T1E transfers EC-GGF to the Girona TWR. On the same route (SLL-CLE) is aircraft EC-JOB, flying under IFR, which is also going from LELL to LEGE at 6000 ft.

08:51:07 Aircraft EC-GGF communicates with the Girona TWR, with the TWR instructing it to continue the VOR/DME approach to runway 02 and requests confirmation 5 NM out on final.



Figure 7. SELZU aerial work traffic (08:52:37)

08:52:37 The sector T4 ATCO informs the ATCO in T1E of the presence of an aircraft at FL180 that is doing aerial work near GEMAS (visible in Figure 7, with callsign SELZU).

08:53:24 The sectors are changed, such that sector T1E is divided into D1E and TGR. Sector D1E is managed by two ATCOs from sector T1E, and sector TGR is opened and handled by two new ATCOs.

08:53:25 Sector XAL transfers ENT1237, which is descending to FL130 and en route to BGR, to sector TGR. The sector ATCO instructs it to continue descending to FL090.

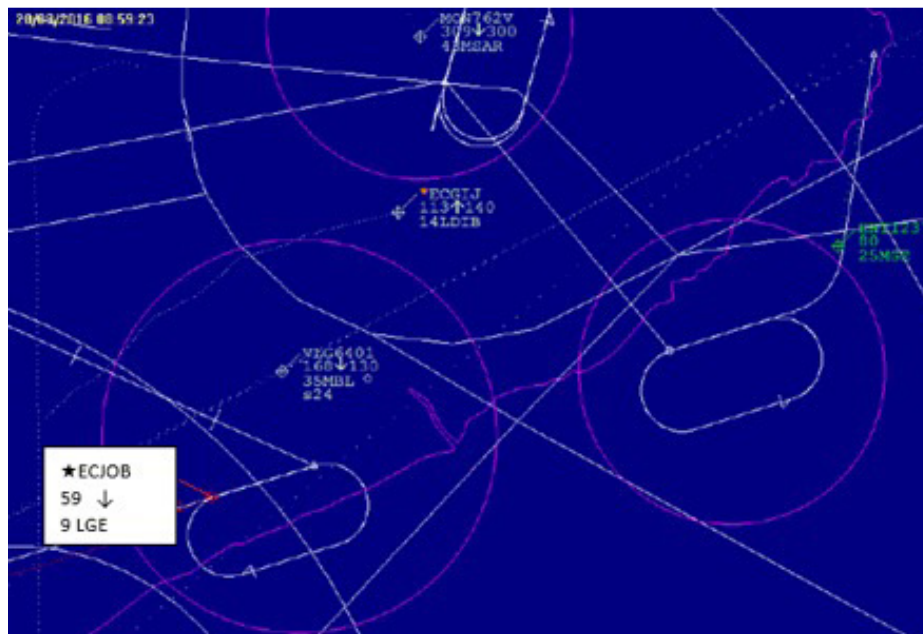


Figure 8. Last radar track for EC-GGF (08:54:37)

08:54:37 At approximately 08:44, the REDAN network goes offline at the Girona Airport. This prevents receiving information from the Girona radar, and results in the signals from aircraft below 3200 ft being lost on the displays at the Barcelona ACC and the Girona TWR. The track for EC-GGF, which is in the Girona CTR and descending through 3200 ft, disappears.

08:54:46 The Girona TWR asks EC-GGF to report its distance from the airfield. The traffic confirms that it is 8 NM away on final.

08:55:42 The TGR sector communicates via telephone with the Girona TWR to coordinate ENT1237. They discuss the loss of communications 10 min earlier. Sector TGR indicates that ENT1237 is making the VOR approach to RWY02, which the TWR confirms, stating that it will be number 2 in the approach, that EC-GGF is number 1, and asks if EC-JOB will be next, to which there is no reply. The ATCO in sector TGR says that he does not see EC-GGF, and that he has ENT1237 on final, to which the TWR replies that this is due to the loss of the Begas radar. After a series of exchanges between the TWR and sector TGR, and after asking EC-GGF its position, and receiving a reply that it is 5 NM out on final, they decide that it will be number one in the approach, followed by ENT1237.



states that EC-GCF is compatible with



Figure 10. Traffic SELZU transferred to D1E (09:01:08)

09:01:01 Sector T4E transfers aircraft SELZU to sector D1E.

09:01:40 Sector TGR transfers ENT1237 to the Girona TWR. This aircraft is over point OKETA, as shown in Figure 11.

09:01:45 The Girona TWR cancels the IFR flight plan of EC-GGF, clearing it to proceed to point W to leave the CTR.



Figure 11. ENT1237 transferred to LEGE TWR (09:01:40)

09:02:27 ENT1237 communicates with the Girona TWR and is cleared to continue its VOR/DME approach to RWY02.

ENT: Girona ENT1237 buenos días, follow in the arc approach for RWY02

TWR: ENT 1237 muy buenas, continue with the VOR/DME approach RWY02, QNH 1030, descend according the profile VOR 02, report 7 miles on final.

ENT: We report 7 miles on final follow the profile, VOR 02 ENT1237

TWR: ENT 1237, please confirm your position now, are you on the arc?

ENT: Yes, on the arc 15 miles, ENT 1237, 5000 ft

TWR: Copied, thank you

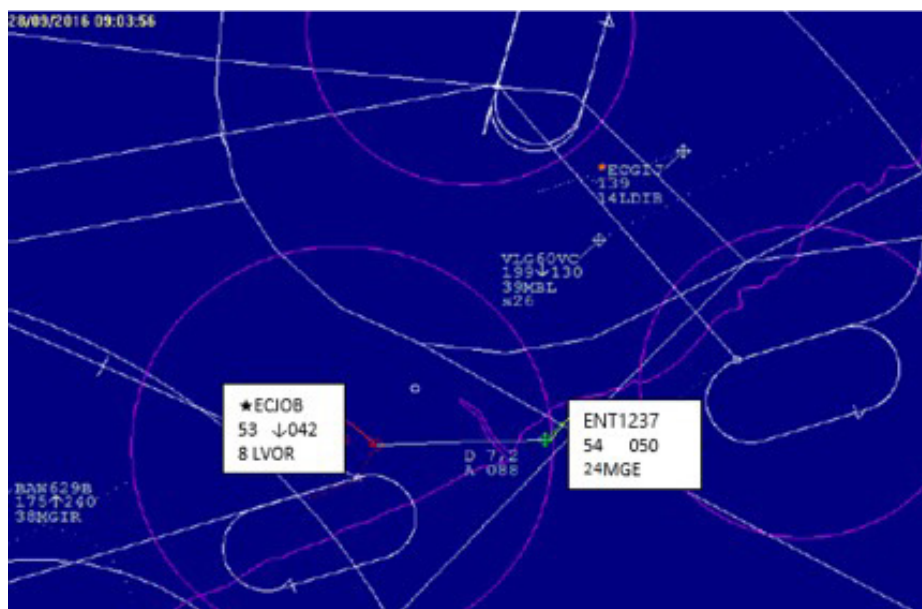


Figura 12. EC-JOB en aproximación a LEGE (09:03:56)

09:03:56 The D1E sector ATCO transfers EC-JOB to Girona. The traffic is 3 NM away from TISGO.

09:04:20 ECJOB communicates with Girona TWR

EC-JOB: from CLE, descending to 4200 ft as cleared EC-JOB.

TWR: ECJOB confirm?

EC-JOB: Affirm ECJOB

TWR: ECJOB, please repeat your last.

EC-JOB: Inbound from CLE descending to 4200 ft as cleared ECJOB.

TWR: ECJOB, roger, continue as cleared, QNH 1030 and report 7 miles on final. Report your current position and altitude.

EC-JOB: QNH 1030, will report 7 miles on final. We are 15 miles from the Girona VOR right now, 4500 ft ECJOB.

TWR: ECJOB 4500 ft at 15 miles. Copy, report established on final.

EC-JOB: Will report established on final ECJOB.



Figura 13. Pérdida de separación entre ECJOB y ENT1237 (09:04:54)

09:04:54 Separation lost between the two aircraft proceeding to TISGO.

09:05:28 The ATC at the Girona TWR asks ENT1237 to confirm its position. Once reported, he instructs the aircraft to continue on approach as number one.

TWR: ENT1237 report position and altitude please.

ENT: ... a traffic at TCAS and visual contact with aircraft who is near, too near to us.

TWR: ENT 1237 roger, my screen is not working and there is another traffic that ... just reported 15 miles on final at 4500 ft. It's a light traffic, Cessna 172 so I don't know which... the turn, you which the first one.

ENT: Near behind us, we are 4200 ft at 13.2 DME.

TWE: ENT 1237 roger then you are number one, continue approach.

ENT: Continue approach as number one ENT1237



Figure 14. Approach between the two aircraft (09:05:28)

09:05:29 The TGR sector planner contacts Girona TWR to inform it of the presence of EC-JOB very close to ENT1237.

TGR: Do you have a visual there at CLE, 4300 ft, like ENT. Are you tracking it?

TWR: Where are you calling from? Barcelona, I suppose.

TGR: Barcelona, yes.

TWR: We don't have SACTA.

TGR: No, I'm seeing on my screen... very close to 4000 ft, ENT and ECJOB, a visual.

TWR: No, ECJOB is under IFR.

TGR: IFR? We have them there together.

TWR: The JOB, where is it and at what altitude?

TGR: At 4100 ft next to ENT according to the display.

TWR: Next to ENT, but established on final in the arc.

TGR: No, it's right next to it, less than one mile.

TWR: OK.

TGR: Is it on your frequency? It has to be with you. Call him and find out.

TWR: Yes, this one is a mile away from that one.

TGR: It's within a mile, right nearby.

TWR: Thanks.

TGR: Now it's above and ENT is below.

TWR: Thanks.

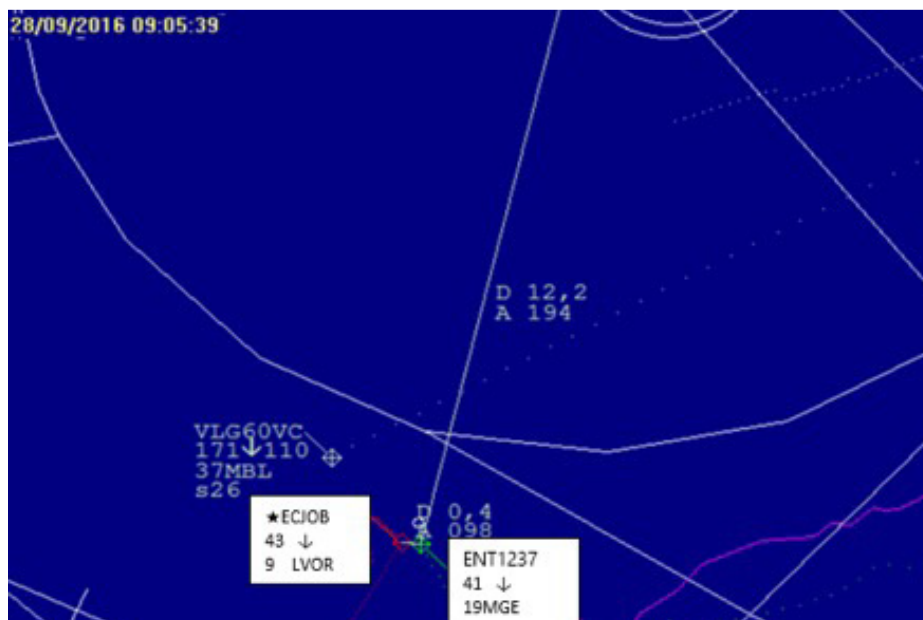


Figure 15. Minimum distance between the two aircraft (09:05:39)

09:05:39 The aircraft reach their closest point of approach.

09:06:19 The TWR ATC informs EC-JOB of the position of ENT1237. EC-JOB replies that it is cleared as number one in the approach and that they have ENT1237 in sight. TWR replies that the Barcelona ACC cleared ENT as number 1 and them as number 2, instructs it to maintain separation with the traffic and apologizes, stating that they are having problems with the radar.

1.10. Aerodrome information

The Girona Airport (LEGE) is located 12.5 km southwest of the city of Girona. It is at an elevation of 469 ft and has one 2,400-meter long runway in a 02/20 orientation. The 02 threshold has a VOR approach.

1.11. Flight recorders

The operator provided the incident report included in section 1.16.1 based on the data obtained from the QAR on aircraft SP-ENA.

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. Report from Enter Air

The crew were conducting a VOR/DME approach to Girona from the 16 DME arc at GIR. It was using Lateral Navigation (LNAV) mode.

At 09:03:11, they started a descent from 5000 ft using vertical speed mode (V/S Engage) on an approximate heading of 270°. During the descent, they changed course to approximately 280° to follow the arc. The aircraft passed through 4200 ft (required until TISGO D14 GIR according to the charts) at 09:04:01. At 09:04:03, at 4156 ft, they started a right turn to intercept the final approach course and lowered the flaps to position 5.

At 09:04:27, the auto-flight system changed from Vertical Speed to Acquisition Altitude (ALTACQ) mode. The turn was stopped temporarily at about 340°. At 09:04:37, the aircraft changed from LNAV to VOR/Localizer (VORLOC) mode. At the same time, the aircraft continued turning right to 340° to intercept the final approach course. At 09:04:44, they changed from ALTACQ to Altitude Hold (ALTHLD) at 3740 ft. At that point the TCAS RA was activated, and it cleared at 09:05:00. While the TCAS RA was activated, the autopilot was not disengaged and the aircraft descended in ALT HOLD from 3740 ft to 3728 ft, then climbed to 3736 ft, where the TCAS RA cleared. During the RA, the turn to the final approach course continued. The RA lasted 16 s, with AP2 and ALT HOLD engaged the whole time. At 09:05:23, 23 seconds after the RA cleared, the auto-flight system changed from ALTHOLD to V/S engage and continued the descent, with the aircraft in a landing configuration.

1.16.2. Report from the crew of EC-JOB

On the morning of 28-09-2016, at approximately 11:00 local time, the aircraft with registration EC-JOB, owned by the Aeroclub Barcelona-Sabadell, was on a training flight for the student onboard to obtain his IR(A) rating.

The flight departed from LELL under VFR and transitioned to IFR above the same airport at 4000 ft AMSL. When in contact with Barcelona control (131.125 MHz), the aircraft was cleared to climb to 6000 ft. In contact with the ground, it was also cleared to fly direct to the CLE VOR. As it reached the CLE VOR, it was cleared to start the VOR approach to RWY02 at Girona, while still on the Barcelona control frequency. The aircraft maintained 6000 ft and started its descent above CLE, turning to intercept the 032° outbound radial en route to TISGO.

Barcelona then transferred the aircraft to Girona on 120.9, and the crew contacted Girona, which repeated its clearance to the RWY02 VOR as number 1. After intercepting the 032 radial and while descending to 4200 ft, the student prepared to intercept the inbound route for the VOR approach. As they neared TISGO, they saw a Boeing aircraft to their right at the same altitude and some 2 miles away from them laterally. They then heard the aircraft contact Girona. With the traffic in sight, and after hearing how the other aircraft was cleared as number 1, the crew of EC-JOB were cleared to continue as number 2. They decided to do a 360 to separate from the aircraft, and they then proceeded to continue the approach.

They noted that it was easy to see the traffic due to the excellent weather conditions that prevailed at the time. During an IMC approach, it would have been completely impossible to detect the presence of another aircraft, since they had no TCAS onboard. In the crew's opinion, the situation could have had serious consequences, either due to a possible collision or to having entered the wake turbulence of an airplane of the characteristics of a Boeing in a light aircraft.

1.16.3. Report from the executive controller in sector T1E

There were several aircraft in sector T1 doing photographic work: a CARTO that was blocking FL080 to FL090 very close to the runway 25 localizer, another aircraft holding at FL180 and that was flying north to south and back again, reaching the localizer for RWY25 before turning north, and another that was flying from west to east at FL180 right at the border between sectors D1 and TGR.

There were three Z aircraft from LELL, two en route to LEGE (runway 02 in use) and another going to France. The controller transferred the first inbound aircraft (KLM under IFR) arriving through KANIG, then the first zulu, which was inbound from Sabadell to CLE TISGO.

A wind change required a configuration change in Barcelona, which went from WRL to ELR. The CARTO became conflicting traffic with all departures from T1 and with all inbound traffic. The photographic aircraft at FL180 also became conflicting traffic (primarily with arrivals, but also with departures).

They decided to open sector TGR to offload T1 and XAL. Before opening the sector, the controller tried to call Girona to confirm that he would be transferring the second zulu traffic, but communications with Girona were not working. Seeing that there was sufficient distance, he transferred the second zulu (EC-JOB).

The controller transferred the aircraft on 125.25 to himself on 131.125. He notified the supervisor to see if they should cancel the CARTO's photographic work. They proceeded to open sector TGR, and he stayed with D1E. He informed sector TGR of the two photographic aircraft at FL180, which were conflicting with arrivals, since TGR was transferring arrivals to him at FL130. Since EC-JOB had not been transferred to Girona, and since it was in Girona's airspace and altitude, he did not inform TGR of the presence of this traffic. The RASTER at Girona was also not working, which prevented him from seeing low-level aircraft.

The ENTERAIR entered in sector TGR en route to Girona via MAMES. The assistant at TGR called Girona to coordinate the hand-off of this IFR traffic, and Girona reported that they could not clear it yet because it was number two. The controller assumed that number

one referred to E-OB, which had been on his frequency for a few minutes, and that Girona had all its traffic under control.

Minutes later Girona called the TGR to say that the approach of ENT could be authorized. Shortly thereafter, the BGR radar returned to operation, and they saw on the screen that E-OB and ENT1237 were practically in the same point, just a few feet apart. The TGR planner immediately called Girona to inform them, but the Girona controller replied that that was not possible. The T1E controller could not confirm this, but apparently the Girona controller was not aware that EC-JOB was under IFR making an instrument approach, thinking instead it was under VFR and in contact with TGR.

Sector T1E was then informed that ENT1237 had reported a TA.

1.16.4. Report from the executive controller in sector TGR

At the same time as the volume of sector Tigre was being divided, he was informed that the BGS radar was out of service and that communications with the LEGE TWR were also not working. The assistant called LEGE to make sure that the instrument arrival to LEGE of ENT1237 was clear for the approach. LEGE informed that they still had a preceding traffic 7 miles out (not visible on the screen due to the radar failure), and that ENT1237 was number 2 on the approach. He thus asked LEGE to inform him when this first traffic completed its approach before clearing ENT1237, and gave them his emergency contact number. The assistant again called and confirmed the first traffic to clear ENT1237 to make the VOR approach to LEGE, which he transferred to LEGE. By the time ENT1237 was past TISGO, they saw another traffic on the radar (by then the BGS radar was starting to work) at 4000 ft, ECJOB, which was already on the LEGE frequency (it had come from sector T1 and had already been transferred to LEGE in a previous exchange). The Tigre sector had no information on ECJOB. As soon as the situation was detected on the radar, the assistant called LEGE on the hotline to inform them.

1.16.5. Report from the executive controller at the Girona Airport tower

VMC conditions prevailed with excellent visibility reported by several aircraft throughout the morning. Runway 02 was in use due to the wind, from the north at 10 kt, gusting to 14 kt. In these conditions, approach (VOR/DME) is authorized by LECB (LEGE provides tower services),

The BEGUES radar (PSR and MSSR/S) had been out of service due to a malfunction (lightning strike) since 27/09/16.

At 08:44 UTC, an electrical problem at the airport (Telefónica border crossing) caused a drop in REDAN communications that resulted in SACTA going offline at LEGE (raster display empty, no processing of flight plans) and in the loss of SCV communications with the ACC. It also affected data transmissions from the Girona radar.

When the fault occurred, there were four strips from ARR to LEGE with estimates: RYR39SW (TISGO 0844, B738, EHEH to LEGE), ECGGF (TISGO 0846, PA27, LELL to LEGE), ENT1237 (TISGO 0901, B734, EPWA to LEGE) and ECJOB (TISGO 0900, C172, LELL to LEGE). The estimates for traffic from LELL tend to be highly variable. There was a single controller in the control room (with paired frequencies 121.7 and 120.9). The other (on break) had stepped out for a moment.

The following are some of the communications that took place on the frequency or telephone between 08:52 and 09:18, involving the controller:

- Called ECGGF (LELL to LEGE) on CLE at 08:52 (delayed some 9 minutes with respect to the estimate on the strip), cleared to VOR and instructed it to continue and report 8 NM on final.
- RYR39SW landed at 08:53, instructed to follow the follow-me car to the apron.
- Falconer cleared to go near runway to turn off a noise cannon. Falconer requested to enter the runway to the N and turn off other cannons, controller instructed him to wait.
- RYR72NC (LEGE to EGGW) with CTOT 0914 called for clearance and to confirm its slot. He tried calling the Teoista personnel on the phone, but they did not answer.
- Barcelona maintenance called to see if he was aware of the problem. He said that LEGE maintenance personnel were working on it.
- The TGR sector called on the phone to talk about ENT1237. He described the situation, with no radar or SACTA. He asked about the position of ENT with respect to ECGGF, which reported 8 NM. TGR did not have it on the screen, and the TGR controller then told him to inform him when the approach was complete. He asked if ENT would go before ECJOB, and the TGR controller replied that he did not know anything about ECJOB. He explained that ECGGF would fly low and go to point W. The TGR controller told the executive controller at the Girona tower that he would make ENT hold over OKETA. The tower controller then asked for his phone number, to which the TGR controller replied that he would call him back.

- A short time later TGR called on the phone to give him their phone number. The tower controller told him that ECGGF was completing its approach and that he could see it on short final.
- ECGGF made a low pass at 09:00 and turned left to the W. He checked with CECO (SCV call) and saw that he had another flight plan departing from LEGE, which they confirmed. He told the traffic that the IFR FP was canceled, and could not give it a SSR code because the SACTA was down.
- ENT1237 called at 09:02 and the controller confirmed that it should continue its VOR/DME02 approach and asked for its position. It was at 5000 ft on the 15 DME arc.
- He cleared the falconer to enter the runway, which he reported clearing later.
- RYR72NC called for start-up at 09:03. The controller asked his colleague, who had just arrived, to call Teoista personnel on the phone to verify the CTOT (he was also unable to contact them).
- He called ECJOB to confirm its clearance, position and altitude. The crew reply that they are cleared for the VOR approach and that they are 15 NM out on final at 4200 ft. He gave them traffic information (the last exchange with ENT1237), and the pilot said that they had it in sight ahead of them, but that they were cleared as number one.
- He called ENT, which reported they had a TCAS with traffic in sight. They were at 13.2 NM and 4200 ft.
- He told ECJOB to be careful with the medium wake from the B734, to which they replied they would do a 360.
- While speaking to the two aircraft, a colleague at LEGE (on the telephone with LECB) informed him that there are two aircraft very close to one another.
- At 09:10 the SACTA screen display came back, and they saw ECJOB doing a 360 on final and ENT1237 on short final.
- ENT1237 landed at 09:12.
- Controller turnover at LEGE.
- ECJOB made a low pass at 09:18 and went SW.

ENT1237 reported a TCAS RA on 121.7, and that the point of closest approach, 2 NM at the same altitude, had been 14 NM away from the VOR. They had had the aircraft in sight for

7.5 NM, but did not know what the other traffic's clearance was, since the communications had been in Spanish. He requested that all communications be made in English to avoid incidents. He said he circled once at OKETA and was then cleared for the VOR.

ECJOB called LEGE on the telephone. They had mode S but not TCAS. He reported that at the time of the near miss, they were at the same altitude and some 2 NM away. There was good visibility and they saw ENT perfectly. They were conducting an IFR test.

The power to the REDAN network was restored at 09:10. They only lost the strips that would have had to be printed during that period.

1.16.6. *Change in operating configuration*

Figure 16 shows the checklist for separating sectors included in the LECB Operations Manual.

<u>B. SECTOR SEPARATION</u>
B.1 Inform ATCOs of sector to open and sector to divide of configuration change.
B.2 Inform collateral sectors affected by frequency change (Route).
B.3 Verify that executive and planning controllers in sector to divide have turned over to executive and planning controllers in opening sector.
B.4 Configure the SACTA sectors in the PSSO:
B.4.1 Left click on "SECTORIZATION" tab
B.4.2 Left click on "IN EFFECT: CURRENT" option
In right half:
B.4.3 Left click on "SECTOR/VOLUME" to be transferred (change to reverse video)
B.4.4 Left click on "POST" (UCS no.) to transfer to
B.4.5 Left click on "EXECUTE" and left click on OK.
B.5 Check on affected UCS that the re-sectorization was completed correctly and that the executive and planning controllers in opening sector are on the right UCS
B.6 Check that the opening sector has the correct frequencies selected and the ATCO plugged in
B.7 Check that the sector to be divided no longer has the frequencies of the opening sector
B.8 Check that the GENIUS cards are correctly inserted in the new open sector
B.9 End of SECTOR SEPARATION checklist

Figure 16. Sector separation procedure

1.16.7. *Loss of air navigation data network*

The REDAN network is a communications network specifically for air navigation that is used to transmit essential aviation data. It also includes voice communications.

According to the information provided, the network went offline from 08:44 UTC until 09:10 UTC when a thermal-magnetic breaker opened at a telephone station in the Girona Airport, and when the associated batteries were depleted. Although an alarm was triggered when the breaker opened, the airport's technicians were offsite when it happened and they were unable to restore the network before the batteries ran out.

The main consequences of this were the loss of the Girona radar signal, which registers aircraft below 3200 ft, the loss of communications between LEGE and the Barcelona ACC, and the loss of the SACTA system at LEGE.

As a result of this incident, telephone lines had to be used to communicate between LEGE and the ACC, the radar display for the aforementioned targets at both centers were lost, and flight plans were not updated at LEGE.

To avoid a future recurrence of this event, it was agreed to replace the differential breaker with one that resets automatically, as well as to install an aural alarm.

1.17. Organizational and management information

Not applicable.

1.18. Additional information

1.18.1. *Usage time for sectors, runways at LEGE and route SLL1K*

Information was obtained on the usage time for the sectors at the Barcelona TMA and the runways at LEGE in 2014, 2015 and 2016.

The time that the sectors in the TMA were opened, prior to the incident, were:

	2014	2015	2016
T1E	1039.93	848.53	637.25
TGR	147.33	288.87	229.58
D1E	47	81.77	80.23
T1W	3823.67	3029	2446.45

The usage time for the runways at the Girona Airport up to 17 November 2016 were:

	2014	2015	2016
LEGE A02	798	906.84	669.66
LEGE A20	8044.73	7772.13	6967.47

In addition, route SLL1K, in the direction SLL-CLE-TISGO-RWY02LEGE, was used by 11 aircraft in 2015 and by 8 in 2016 until the date of the incident.

1.18.2. Actions taken by ENAIRE

On 14 November 2016, a meeting was held at the CIAIAC offices, where ENAIRE stated that it had addressed, through its Safety Committee (COSEGO), which had met on 13 October 2016, the incidents that had occurred between April and September 2016 in the Barcelona operating environment, and had drafted a Plan of Action for LECB ROUTE that had been expanded to include the TMA.

On 15 November 2016, ENAIRE was sent a written notice informing of the decision made at a plenary session of the CIAIAC to issue an urgent safety recommendation to ENAIRE involving the loss of separation events in the Barcelona area, requesting a reply from ENAIRE within 90 days:

REC 49/16: It is recommended that ENAIRE identify the hazards and assess the risks associated with the recent events at the Barcelona TMA involving a loss of separation, and propose mitigation measures in coordination with AESA.

On 16 February 2016, ENAIRE responded to CIAIAC safety recommendation 49/16, stating that after coordinating with AESA, it had drafted an LECB Plan of Action to identify hazards and assess the risks associated with the recent events at the Barcelona TMA involving a loss of separation, and to propose mitigation measures.

It describes the various plans of action that are being implemented at the Barcelona TMA, as well as future plans, intended to reduce possible incidents. The most relevant of these plans include:

- The addition of new instrument departure maneuvers to the right for the East configuration at LEBL in order to avoid sector T1E.
- Implementation of operating procedures to reduce the number of IAFs from 4 to 2.
- Operational use of Mode-S radar data.
- Analysis of the configuration changes and opening/closing of sectors at the TMA in an effort to improve the decision-making processes used by supervisors.
- Improve the analysis and tracking of operations and traffic flow control measures by control room supervisors and ATCOs: weather conditions, presence of traffic in the wake of H or L traffic, takeoffs from the non-preferred runway, etc.

1.18.3. Actions taken by AESA

On 15 November 2016, AESA was notified in writing of the decision made at a plenary session of the CIAIAC to issue an urgent safety recommendation to AESA involving the loss of separation events in the Barcelona area, requesting a reply from AESA within 90 days:

REC 50/16: It is recommended that AESA review the hazard identification and assessment of risks associated with recent loss of separation events in the Barcelona TMA, as well as the proposed mitigation measures that ENAIRE was recommended to undertake in REC 49/16.

On 22 February 2016, AESA responded to safety recommendation REC 50/16, stating that in order to comply with urgent recommendations REC 49/16 and 50/16 issued by the CIAIAC, four coordination meetings were held between AESA/ENAIRE that were attended by personnel from both organizations with experience in the operational environment at the Barcelona Control Center. These meetings were intended to review the content of the ENAIRE report that identified hazards and assessed the risks associated with recent loss of separation events en route and at the Barcelona TMA, and to check the mitigation measures put in place by the provider.

AESA also indicated that inspections had been conducted at ENAIRE's East Regional Office in October 2016. These activities have served to identify and correct several deficiencies pertaining to the provider's technical and operational skills and abilities, safety requirements, operations manual, and to mitigate change-related risks.

1.19. Useful or effective investigation techniques

Not applicable.

2. ANALYSIS

2.1. Loss of separation between aircraft EC-JOB and SP-ENA

On 20 September 2016, a Boeing 737-400 aircraft, registration SP-ENA and callsign ENT1237, was flying from the Warsaw-Chopin Airport to the Girona Airport. At the same time, a Cessna 172, registration EC-JOB and callsign ECJOB, was flying from the Sabadell Airport to the Girona Airport.

The first aircraft was following standard terminal arrival route BGR1L, while the second was on route SLL1K. Both aircraft were in radio contact with the sector T1W controller in the Barcelona ACC.

Based on the information provided, at 08:44 the REDAN network went offline, which resulted in the loss of communications between Girona TWR and the Barcelona ACC. The SACTA system was also lost, along with the information from the Girona radar, meaning that traffic below 3200 ft was not displayed on the radar screen.

At 08:50, the configuration of the TMA was changed for weather reasons. As a result, to avoid overloading the sector T1E ATCOs, sectors TGR and D1E were opened at the TMA, with the ATCOs for sector T1 being placed in charge of D1E and two new ATCOs going on duty to handle sector TGR. In this configuration, both SP-ENA and EC-JOB should have been under the control of sector TGR.

At 08:59:23, the executive controller in sector D1E cleared aircraft EC-JOB to make the approach to runway 02 at the Girona Airport without informing sector TGR.

Under these conditions, it is sector TGR that handles approaches to runway 02 at Girona. When this sector was opened, its controllers were not informed about the aircraft flying from Sabadell to Girona (ECGGF, ECJOB and ECGIJ), and thus they were initially unaware of said traffic. Although the Girona tower controller checked with sector TGR about flight ECJOB at 08:55:42, he did not receive a reply since the ATCO at said sector was unaware of the existence of ECJOB. This traffic was visible on the display, but the sector's ATCO was focused on finding out the position of ECGGF, which had been transferred to the Girona TWR at 08:50:45 by sector T1E and was completing its approach without being visible on the radar due to the loss of the network. The last radar blip for this traffic had been at 08:54:37, when it descended below 3200 ft, as shown in Figure 8.

Following this, at 09:00, the TGR sector ATCO, not knowing that aircraft EC-JOB had been cleared to make its approach by sector D1E, also instructed aircraft SP-ENA to complete the approach from point OKETA to runway 02 at Girona. Both aircraft converged near point TISGO, resulting in a loss of separation and the TCAS advisory being issued at approximately 09:05. The minimum distance recorded was 0.4 NM and 200 ft, as shown

in Figure 15. Weather conditions allowed the crews of both aircraft to remain in visual contact at all times. The crew of aircraft EC-JOB decided to turn left to separate from SP-ENA, while the latter continued its approach without disengaging the autopilot, eventually landing on runway 02.

Thus, a series of factors occurred simultaneously (change in TMA configuration, opening of sectors, loss of the REDAN network and use of infrequent routes) that contributed to the lack of proper coordination between the ATCOs in sectors D1E and TGR, who practically simultaneously cleared the two aircraft to make the approach to runway 02 at the Girona Airport.

2.2. Configuration change and opening of sectors

At 08:50, the configuration of the TMA was changed from West to East, and sectors D1E and TGR were opened, which played a role in the loss of situational awareness of the ATCOs in sector D1E. Of note is the large number of aircraft being handled, which were competing for the attention of the ATCOs. As shown in Figure 1, there were a total of 10 aircraft in sector 2: two doing aerial work (ICC01 and SFS80), three that had departed from Sabadell (ECGGF, ECGIJ and ECJOB), and a further five IFR flights (VLG6208, MAC338, RYR61LB, VLGB0KY and DRF01R). According to the information supplied, when the TMA was changed to the East configuration, this created a high workload that required the D1E controller to focus on handling the separations between arrivals and departures at the Barcelona Airport and the aerial work aircraft present in the sector. This contributed to sector TGR not being informed about aircraft EC-JOB, which had been cleared by sector D1E to make the approach to runway 02 at LEGE.

2.3. Loss of the REDAN network

Due to the loss of the air navigation data network at 08:44, which lasted 26 minutes, communications between Barcelona ACC and LEGE had to be conducted via contingency telephone. Also lost was the display of radar targets from the Girona radar, which records aircraft below an altitude of 3200 ft. The first inbound traffic to LEGE that was cleared by sector T1E, EC-GGF, thus disappeared from the screen when it dropped below said altitude. When the sectors were opened, the TGR sector ATCOs went on duty and established communications with the LEGE tower in an effort to determine the position of this aircraft, since ENT1237 was waiting to be cleared for the approach. This resulted in other aircraft originating in Sabadell being ignored, especially EC-JOB, which had been instructed by sector D1E to complete the approach to LEGE.

Although the communications between the ATCO make reference to the fact that EC-GGF could not be seen on the display at 08:55:42 due to problems with the Begas radar, this was actually caused by the loss of the REDAN data network.

2.4. Use of sectors TGR and D1E, RWY 02 LEGE and route SLL1K

Based on the information in section 1.18.1 on the time that elapsed between when the sectors were opened and the incident, it appears that the use of sectors TGR and D1E was very low compared to sector T1 in both the T1E and T1W configurations.

As for the use of runway 02 at the Girona Airport, it was in use 9% and 10.4% of the total operational time in 2014 and 2015, respectively.

Based on the above, and also considering the low number of aircraft that regularly use route SLL1K, the combination of these circumstances resulted in an unusual situation that contributed to the incident.

3. CONCLUSIONS

3.1. Findings

- The documentation for aircraft SP-ENA and EC-JOB was valid at the time of the incident.
- The crews had valid licenses and medical certificates.
- ATC personnel also had valid licenses and medical certificates.
- At 08:44, the REDAN communications network went offline at LEGE for about 26 minutes, which resulted in the loss of the Girona radar signal, the communications between LEGE TWR and the Barcelona ACC, and the SACTA system at LEGE.
- At 08:50:00, there was a configuration change at the Barcelona TMA, going from WLR to ELR.
- At 08:53:24, sectors D1E and TGR were opened.
- There were several aircraft doing aerial work that required the attention of the controllers in sector D1E.
- At 08:59:23, sector D1E instructed aircraft EC-JOB to complete its approach to runway 02 at LEGE without relaying this information to sector TGR. Said aircraft should have been cleared by sector TGR.
- At 09:00:02, sector TGR also instructed aircraft SP-ENA to complete its approach to runway 02 at LEGE.
- Both aircraft proceeded to intermediate approach fix TISGO.
- At approximately 09:04:44, the TCAS system on aircraft SP-ENA issued TA and RA advisories.
- Both aircraft were in visual contact at all times. Aircraft EC-JOB made a 360° turn to its left, and aircraft SP-ENA continued its approach, after which it landed without further incident.

3.2. Causes/contributing factors

The main cause of the incident was the loss of situation awareness of the controllers in sectors D1E and TGR after the sectors were opened. Aircraft EC-JOB, which was inbound

from the Calella VOR and should have been under the control of sector TGR, was cleared by sector D1E to complete its approach to runway 02 at the Girona Airport. After this, sector TGR instructed aircraft SP-ENA to also approach inbound from OKETA, which caused a loss of separation between the two aircraft in the vicinity of the intermediate approach fix TISGO.

The following factors contributed to the incident:

- Sectors were opened at a time when there was a high workload for the controllers in sector T1E.
- There were several aircraft doing aerial work, and when the TMA configuration change occurred, these aircraft conflicted with operations at LEBL, which forced the controllers in sector D1E to focus their attention on managing these aircraft, a task that was not properly coordinated with the newly-opened sector TGR.
- The temporary outage of the air navigation data network, which caused the radar display for traffic below 3200 ft to be lost, along with the updated flight plans and communications between LEGE and the Barcelona ACC, requiring the use of telephone communications. All of this contributed to having the sector TGR controllers focus their attention on determining the position of aircraft EC-GGF, inbound to LEGE. This, combined with the loss of coordination with sector D1E, made them become unaware of other traffic affecting them.

4. SAFETY RECOMMENDATIONS

4.1. Safety recommendations issued during the investigation

Two preliminary safety recommendations were issued, to ENAIRE and AESA, contained in sections 1.18.2 and 1.18.3, respectively.

4.2. New safety recommendations issued with this report

No new recommendations are issued.