

# **TECHNICAL REPORT**

## **IN-033/2022**

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**Incident on 4 June 2022 involving a  
BOEING 737-800 aircraft operated by  
Ryanair, on registration EI-GJS, and an  
AIRBUS A-300 aircraft operated by DHL,  
on registration D-AEAO, at Josep  
Tarradellas Barcelona - El Prat Airport  
(Barcelona, Spain)**

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 that is the object of the investigation, its probable causes, and its consequences.

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

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

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## **ABBREVIATIONS**

° ‘ “	Degrees, minutes, seconds
°	Sexagesimal degrees
AIP	Aeronautical Information Publication
APP LECB	Approach clearance position at Barcelona Control Centre
ATC	Air traffic control
ATPL(A)	Air transport pilot licence (aircraft)
CB	Circuit breaker
CLD	Clearance delivery
CPL(A)	Commercial pilot license (aircraft)
CVR	Cockpit voice recorder
CWY	Clearway
DME	Distance measuring equipment
E	East
EDDP	ICAO code for Leipzig / Halle Airport (Germany)
ENAIRE	Air Navigation Manager in Spain
ft	Feet
GMC	Ground movement control position
h	Hour
IAA	Irish Aviation Authority
IAS	Indicated airspeed
ILS	Instrument landing system
IFR	Instrument flight rules
IR(A)	Instrument rating (aircraft)
kg	Kilogram
km	Kilometre
Kt	Knot
L	Left
LBA	German Civil Aviation Authority (Luftfahrt-Bundesamt)
LEBL	ICAO code for Barcelona Airport
LCL	Local clearance
LDA	Landing distance available
LIME	ICAO code for Bergamo Airport (Italy)
m	Metre
MHz	Megahertz
N	North
NM	Nautical mile
ICAO	International Civil Aviation Organisation
QAR	Quick access recorder
R	Right
RADAR	Radio detection and ranging
RESA	Runway end safety area
SID	Standard instrument departure
TCAS	Traffic and collision avoidance system
TDZ	Touchdown zone
THR	Threshold
TWR	Control tower
TWR LCL	Tower local clearance
WLL	West configuration using a single runway at Barcelona Airport

# TECHNICAL REPORT

## IN-033/2022

### AIRCRAFT 1

**Owner and Operator:** RYANAIR

**Aircraft:** Boeing 737-800, registration number EI-GJS.

**Persons on board:** One hundred and ninety-three (193). Six (6) crew members and one hundred and eighty-seven (187) passengers.

**Flight rules:** IFR.

**Type of flight:** Commercial air transport - International - Passengers

### AIRCRAFT 2

**Owner and Operator:** DHL

**Aircraft:** AIRBUS A-300, with registration D-AEAO

**Persons on board:** Five (5). Two (2) crew members and three (3) passengers.

**Flight rules:** IFR.

**Type of flight:** Commercial air transport - International - Cargo

**Date and time of the incident:** 4 June 2022, at 06:33:06 h (local time).

**Location of the incident:** Josep Tarradellas Barcelona – El Prat Airport / LEBL (Barcelona)

**Date of approval:** 2022, September, 28

## SYNOPSIS

### **Summary:**

On Monday, 4 June 2022, at 6:32:28 h (local time), a BOEING 737-800 aircraft on registration EI-GJS took off from runway 24 L at Barcelona airport (LEBL).

During its initial climb, it lost regulatory separation with an AIRBUS A-300 aircraft executing a missed approach manoeuvre, on registration D-AEAO.

Both aircraft manoeuvred to separate as per the instructions received from their respective TCAS systems and continued their flights normally.

There were no personal or material injuries or damages.

The investigation has found that the cause of the incident was the non-compliance with procedures on the part of the control services, together with the fact that the AIRBUS A – 300-600 crew failed to immediately notify their intention to execute a missed approach.

## 1. FACTUAL INFORMATION

### 1.1. History of the flight

On Monday, 4 June 2022, the BOEING 737-800 aircraft, on registration EI-GJS and flight code RYR6353, operated by RYANAIR, was cleared to take off from runway 24 L at Barcelona Airport (LEBL) at 6:31:33 h (local time), bound for Bergamo - LIME airport (Italy).

As the clearance was given, an AIRBUS A 300-600 operated by DHL, on registration D-AEAO and flight code BCS31M, was approaching the same runway at a distance of 2.3 NM, coming from Leipzig / Halle - EDDP Airport (Germany).

The BOEING took off at 06:32:28 h and followed the standard departure procedure, turning to its left when it reached 500 ft of altitude.

As the BOEING was initiating its take-off run, the AIRBUS crew was at 800 ft of altitude and, having received several error warnings about the position of the aircraft's flaps and slats, decided to execute a missed approach and began to climb, overflying the runway at 1,500 ft.

Both aircraft received warnings (TCAS RA) from their respective collision warning systems because of a loss of separation.

On receiving the TCAS RA warning the AIRBUS descended to 1,200 ft and turned left, following the guidance, and the BOEING, which was ahead and at 700 ft, continued with the established standard departure, completing its turn to the left on a heading of 162° and continuing to climb.

Once the conflict was resolved, the AIRBUS was instructed by the control services to make a new approach and the BOEING continued its flight normally.

### 1.2. Injuries to persons

Injuries	Crew		Passengers		Total in the aircraft		Others	
Aircraft	BOEING	AIRBUS	BOEING	AIRBUS	BOEING	AIRBUS		
Fatal	0	0	0	0	0	0	0	0
Serious	0	0	0	0	0	0	0	0
Minor	0	0	0	0	0	0	0	0
Unharmmed	6	2	187	3	193	5	0	0
TOTAL	6	2	187	3	193	5	0	0

### 1.3. Damage to the aircraft

N/A

### 1.4. Other damage

N/A

### 1.5. Information about the personnel

#### 1.5.1. Crew of the BOEING 737- 800 aircraft

##### 1.5.1.1. Captain

The captain was 42 years old. He had a commercial airline transport pilot licence, ATPL(A), issued by the Irish Civil Aviation Authority (IAA) on 12 June 2016, as well as the necessary instrument IR(A) and BOEING 737 300-800 ratings. His English proficiency level was six (6). His licence and corresponding Class 1 medical certificate were valid.

He had a cumulative flight experience of 13,957 h, of which 4,908 in type.

#### **1.5.1.2. Co-pilot**

The 26-year-old co-pilot had a commercial airline pilot licence, CPL(A), issued by the Irish Civil Aviation Authority (IAA) on 8 February 2022, as well as the necessary instrument IR(A) and BOEING 737 300-800 ratings. His English proficiency level was six (6). His licence and corresponding Class 1 medical certificate were valid.

He had a cumulative flight experience of 187 h.

#### **1.5.2. Crew of the AIRBUS A 300 - 600 aircraft**

##### **1.5.2.1. Captain**

The 58-year-old captain had a commercial airline transport pilot licence, ATPL(A), issued by the German Civil Aviation Authority (LBA) on 12 June 2016, as well as the instrument IR(A), AIRBUS A 310 / 300-600 and flight instructor ratings (TRI) for the aircraft. His language proficiency levels were six (6) in German and five (5) in English. His licence and corresponding Class 1 medical certificate were valid.

He had a cumulative flight experience of 15,700 h, of which 2,896:23 were in type.

##### **1.5.2.2. Co-pilot**

The 33-year-old co-pilot had a commercial airline pilot licence, CPL(A), issued by the German Civil Aviation Authority (LBA) on 31 October 2019, as well as the instrument flight rating IR(A) for the AIRBUS 310 300-600 aircraft. His language proficiency levels were six (6) in German and five (5) in English. His licence and corresponding Class 1 medical certificate were valid.

He had a cumulative flight experience of 1,816 h, of which 1,487:32 h were in type as co-pilot.

#### **1.5.3. Local controller for runway 24 L**

The 49-year-old controller had a community air traffic controller license issued by Spain's National Aviation Safety Agency on 3 December 2003 and the required ratings for the role. His licence, ratings and medical examinations were in force.

He had been stationed at the airport tower since May 2007, and this was the fifth day of his duty cycle. As he had been occupied with training-related duties on the four (4) preceding days, this was his first operational night duty covering the Local (LCL) position from 6:00 h.

### **1.6. Information about the aircraft**

#### **1.6.1. BOEING 737 - 800 aircraft**

The Boeing B-737-800 is a transport aircraft with a wingspan of 34,3 m, a length of 39,5 m and a total height of 12,57 m. It was fitted with two CFM56-7B26E engines. Its unladen weight is 62,731 kg, and its maximum take-off weight is 79,015 kg. The model involved in the incident had registration number EI-GJS, was manufactured in 2018 with the serial number 44836 and had a valid airworthiness certificate issued by the Irish Civil Aviation Authority (IAA).

#### **1.6.2. AIRBUS A 300 - 600 aircraft**

The AIRBUS A 300 F4-622 RF is a transport aircraft with a wingspan of 44.84 m, a length of 54.08 m and a total height of 16.66 m. It was equipped with two PRATT & WHITNEY PW4158-3A engines. Its unladen weight is 136,500 kg and its maximum take-off weight is 168,000 kg. The model involved in the incident had registration number D-AEAO, was manufactured in 1993 with the serial

number 711 and had a valid airworthiness certificate issued by the German Civil Aviation Authority (LBA).

### 1.7. Meteorological information

The cloud base was at 500 ft and visibility was 7,000 m, with instrument meteorological conditions (IMC) and LVP in Phase 2 (when visibility is  $\leq 2,000$  m or the cloud ceiling is  $\leq 800$  ft, as it was in this case), which is the preparation and standby phase prior to a potential implementation of LVP at Barcelona-El Prat Airport.

### 1.8. Aids to navigation

To properly establish the sequence of events, the positions of the two aircraft involved in the loss of separation, as captured by the RADAR<sup>1</sup> and also by another aircraft not involved in the event, are described in chronological order below.

At 6:27:46 h, an aircraft with call sign AAL66<sup>2</sup> (not involved in the incident) was making the ILS Z RWY 24L approach with no aircraft ahead and cleared to land.

At 6:29:02 h, the crew of the BOEING 737-800 with registration number EI-GJS and call sign RYR6FK informed the tower (TWR LCL 24L) that they were ready for departure. At 6:30:13 h, TWR LCL 24L asked if they had sight of the aircraft with call sign AAL66 on short final and the reply from the BOEING crew was affirmative.

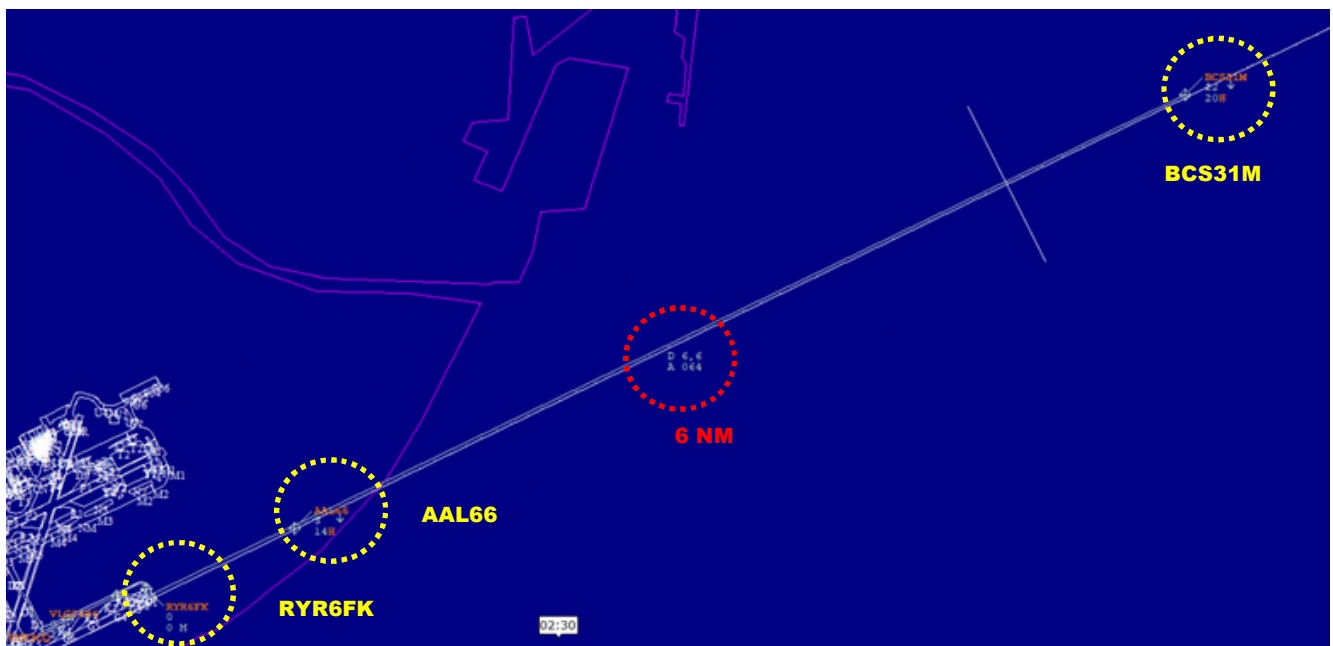


Figure 1. Positions of the aircraft at 6:30:13 h

At this point, the next aircraft on approach, the AIRBUS A-300-600 aircraft with registration D-AEAO and call sign BCS31M, was on final at 6.6 NM, behind the AAL66 aircraft and descending through 2,200 ft.

At 6:30:46 h, the RADAR trace shows the RYR6FK aircraft lined up on the runway and the BCS31M aircraft at 4.9 NM on final for the same runway and descending through 1,600 ft.

<sup>1</sup> The RADAR information is provided for reference only; the QAR offers more accurate data.

<sup>2</sup> AAL66 is the callsign of an AMERICAN AIRLINES flight from New York.

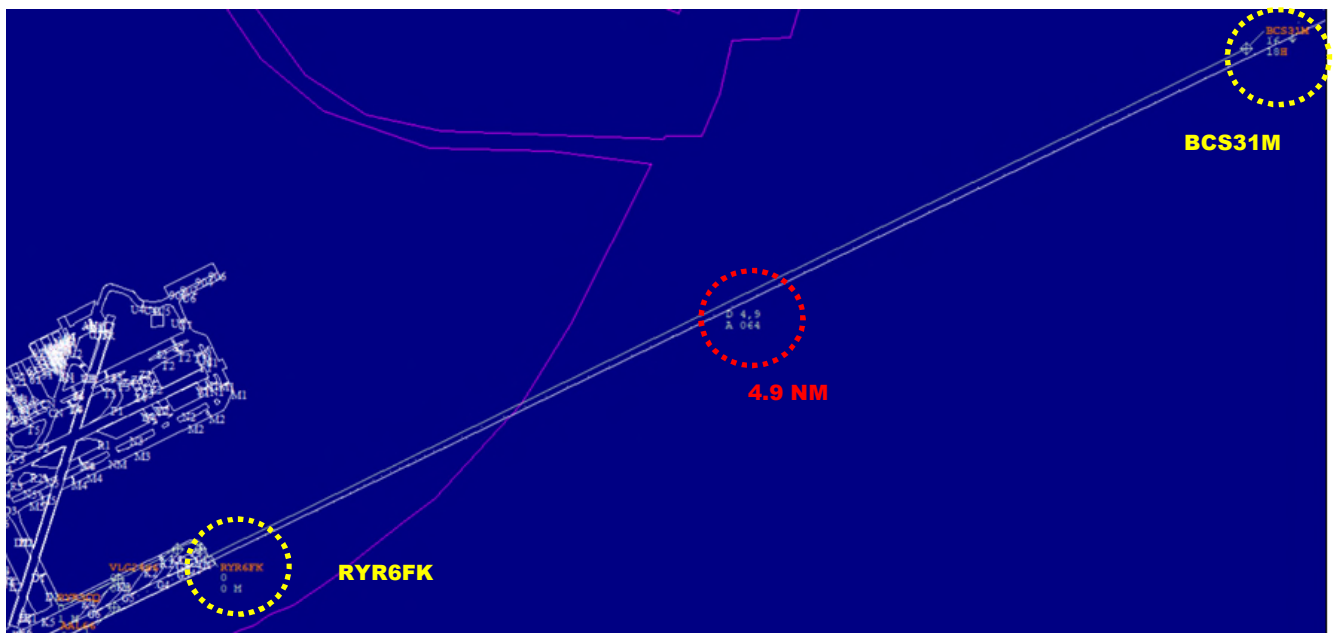


Figure 2. Positions of the aircraft at 6:30:46 h

At 6:31:44 h, the RYR6FK aircraft lined up on runway 24L was cleared for take-off while the BCS31M aircraft had reached 2.3 NM on final and was descending through 800 ft, its minimum altitude during its approach.

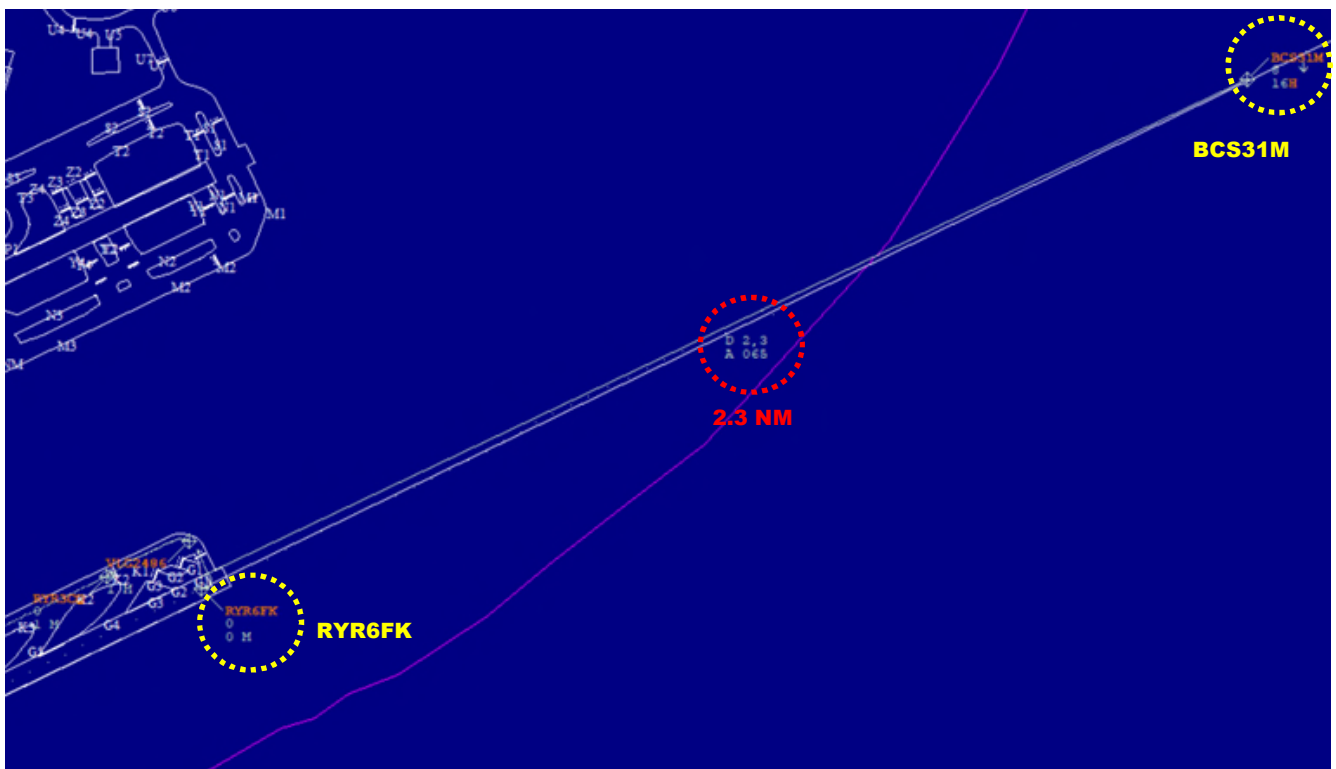


Figure 3. Positions of the aircraft at 6:31:44 h

At 6:31:47 h, the tower instructed the crew of the BCS21M aircraft to wait for late landing clearance, and they replied that they were going around. After 2 s, at 2.2 NM from the runway, they started to climb from 800 ft, and another 10 s later (6:31:59 h), the crew specified that they had discontinued their approach due to minor technical issues and would fly a standard missed approach.

At 6:31:58 h, the BOEING aircraft with call sign RYR6FK commenced its take-off run. The aircraft executing the missed approach was 1.5 NM behind the threshold, climbing through 1,400 ft.

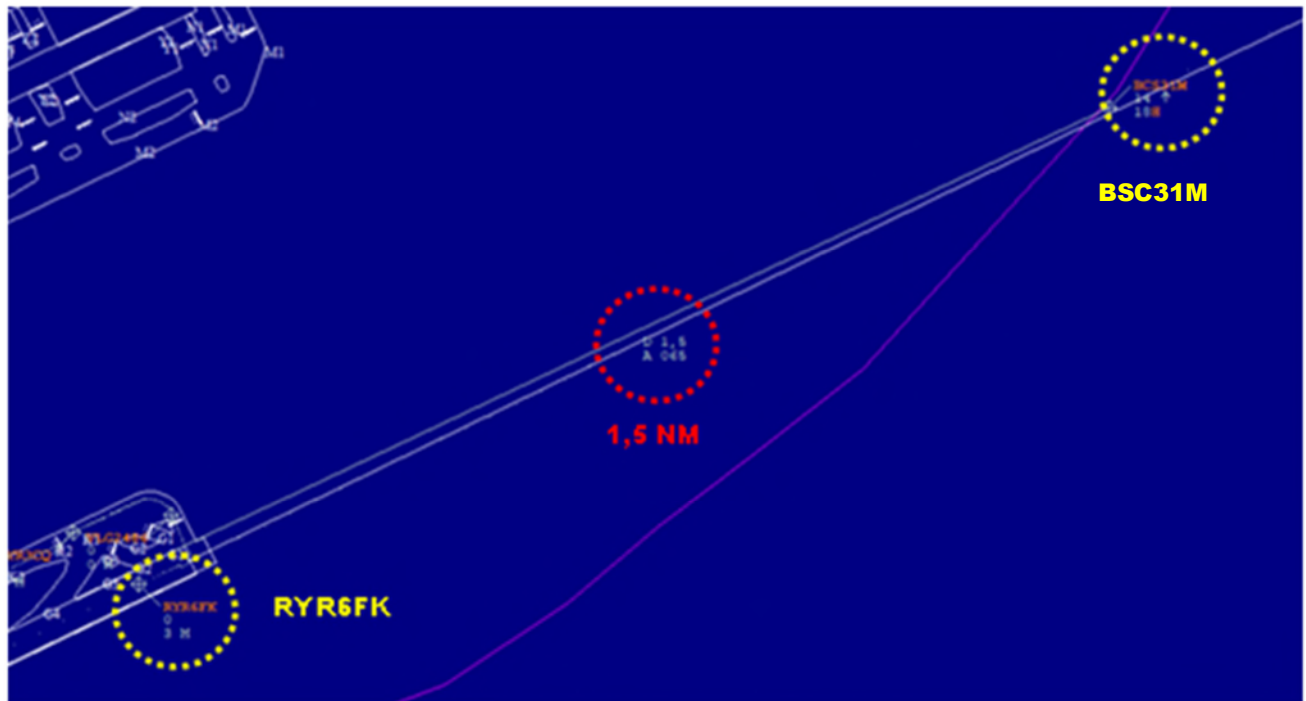


Figure 4. Positions of the aircraft at 6:31:59 h

At 6:32:06 h, the RADAR trace shows the BCS31M aircraft reaching 1,500 ft at 1 NM from the end of runway 24L, which is the standard altitude in this missed approach zone.

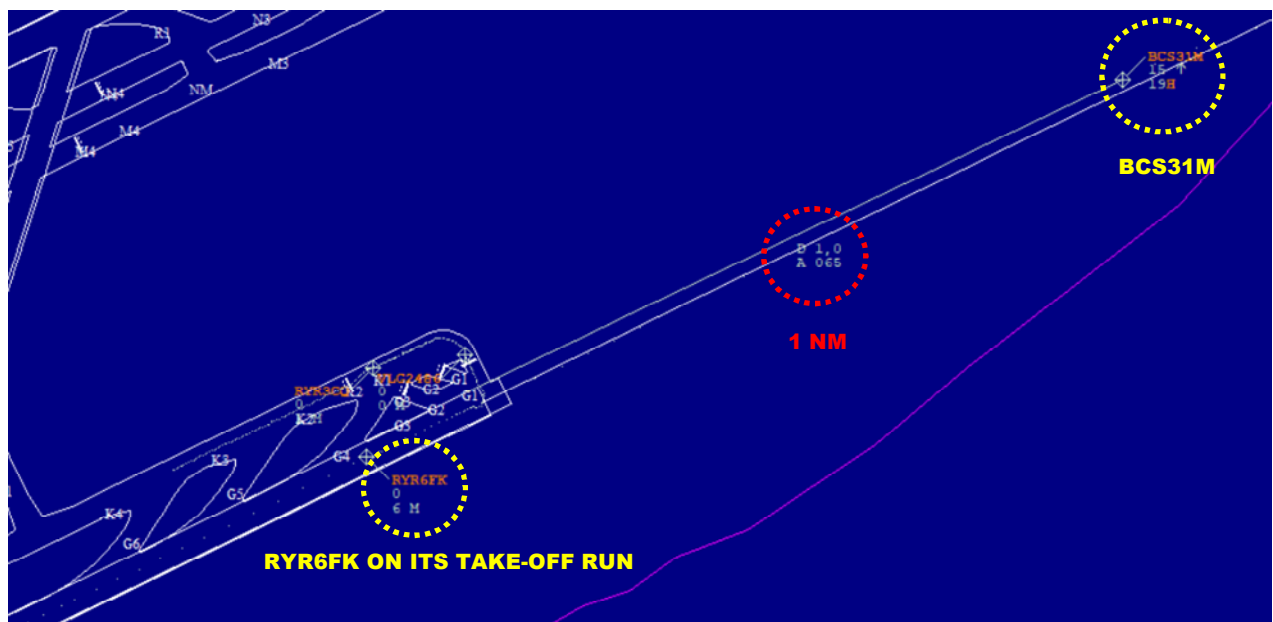


Figure 5. Positions of the aircraft at 6:32:06 h

At 6:32:20 h, the local Tower controller (TWR LCL 24L) informed the approach controller (APP LECB) that the aircraft with call sign BSC31M was executing a missed approach manoeuvre and that he was going to halt the climb of the aircraft on take-off with call sign RYR6FK at 2,000 ft. 16 s later he instructed them to maintain their altitude on reaching at 2,000 ft.

At 6:32:36 h, the RADAR trace shows the aircraft with call sign RYR6FK climbing through 100 ft and the aircraft with call sign BCS31M flying over runway 24L, maintaining 1,500 ft.

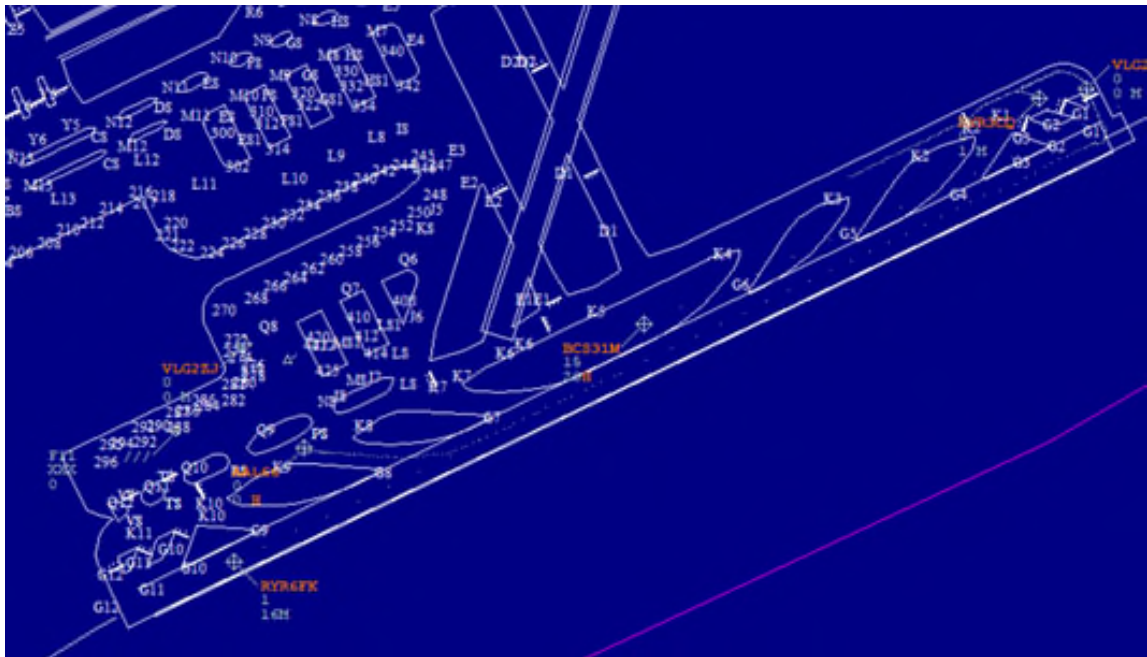


Figure 6. Positions of the aircraft at 6:32:36 h

At 6:32:51 h, the RADAR trace shows the RYR6FK aircraft climbing through 700 ft and the BCS31M aircraft behind it maintaining 1,500 ft.

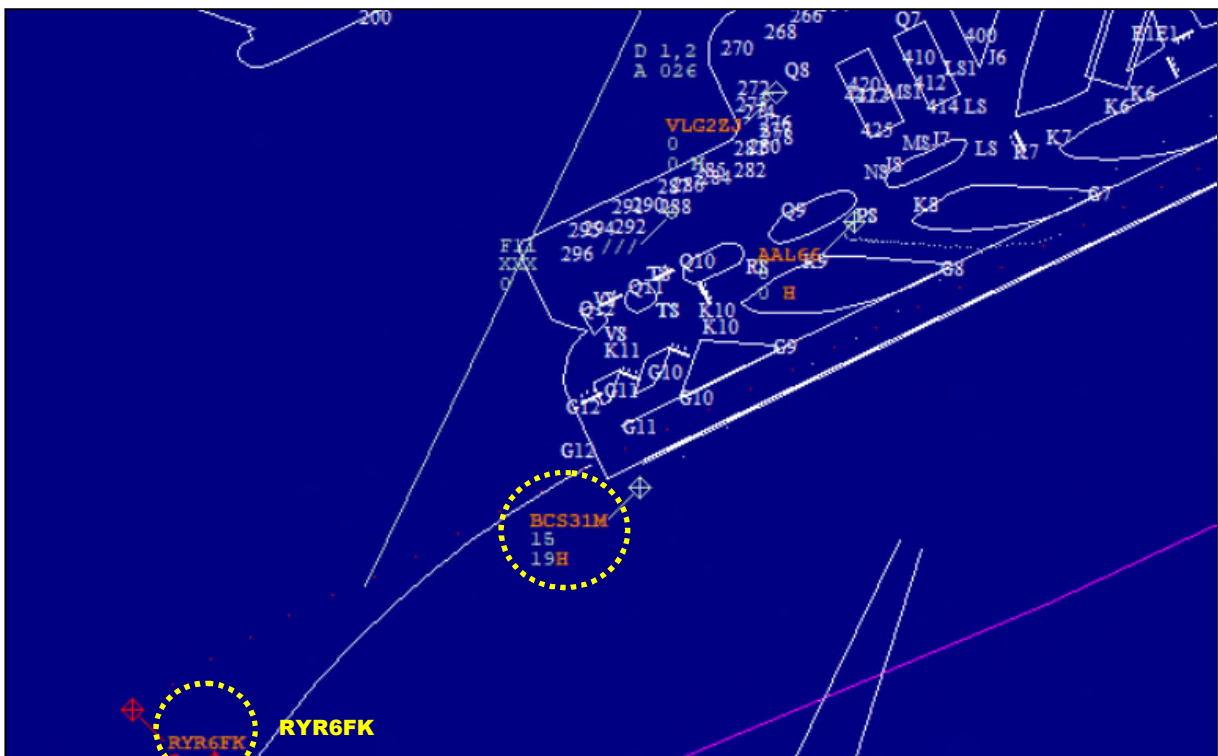


Figure 7. Positions of the aircraft at 6:32:51 h

At 6:33:06 h, the controller on the local frequency (TWR LCL 24L) transferred the aircraft with call sign RYR6FK to the approach controller (APP LECB), and the RADAR trace shows it climbing through 1,200 ft cleared to 2,000 ft. The BCS21M aircraft is shown maintaining 1,500 ft. Five (5) s later (6:33:11 h), the aircraft with call sign RYR6FK was climbing through 1,400 ft and cleared to 2,000 ft, and the aircraft with call sign BCS31M was still holding at 1,500 ft. This was when the two aircraft were closest, separated by 0.3 NM horizontally and 200 ft vertically, triggering their TCAS RA warnings.

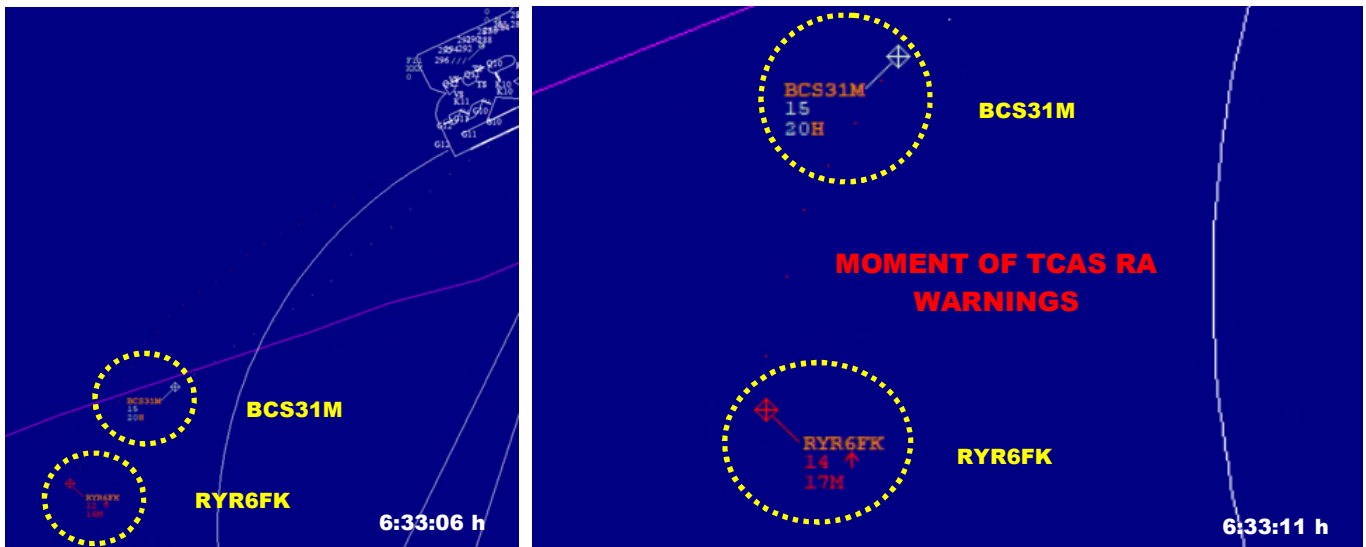


Figure 8. Positions of the aircraft at 6:33:06 h and 6:33:11 h

At 6:33:14 h, the RADAR trace shows the aircraft with call sign RYR6FK climbing through 1,400 ft and the aircraft with call sign BCS31M at 1,400 ft, having already descended 100 ft. By that point, the two aircraft were already on divergent headings.

At 6:33:30 h, the aircraft with call sign BCS31M notified TWR LCL 24L that it had received a TCAS RA warning, and after a request for confirmation by TWR LCL 24L, that they were climbing to 3,000 ft flying the standard missed approach procedure. The RADAR trace shows the aircraft with call sign RYR6FK climbing through 1,500 ft and the aircraft with call sign BCS31M descending through 1,200 ft.

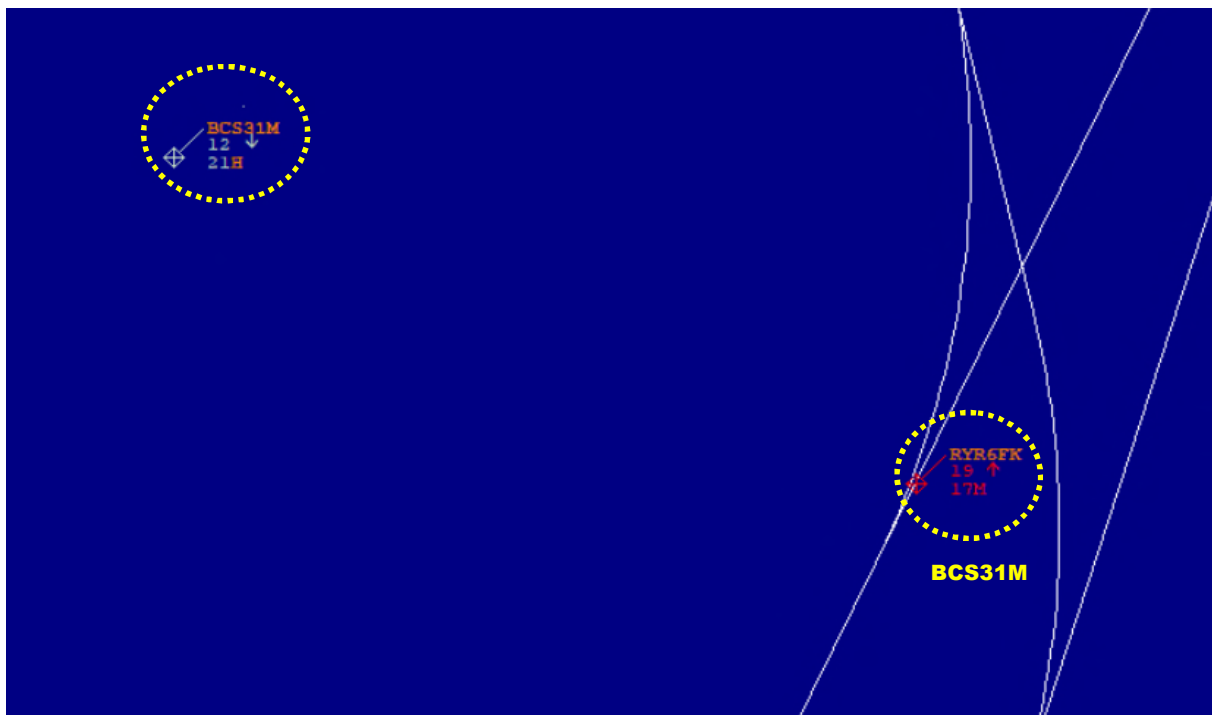


Figure 9. Positions of the aircraft at 06:33:30 h

## 1.9. Communications

The communications most relevant to the event are summarised below:

At 6:27:46 h, the crew of an aircraft with call sign AAL66<sup>3</sup> (not involved in the incident) contacted the tower local frequency controller (118.105 MHz - TWR LCL 24L) while on the ILS Z RWY 24L approach and was informed that they were first in the approach sequence and cleared to land.

At 6:29:02 h, the crew of the BOEING 737-800 with registration EI-GJS and call sign RYR6FK contacted TWR LCL 24L to advise that they were ready for departure.

At 6:30:13 h, TWR LCL 24L asked the crew of the aircraft with call sign RYR6FK if they had the aircraft with the call sign AAL66<sup>4</sup> (not involved in the incident) in sight, to which they replied in the affirmative. They were then informed that the next aircraft was at 6 NM on final and asked if they were ready for immediate take-off behind the aircraft that was on short final, to which they again replied in the affirmative, so they were cleared to "enter and hold" behind aircraft AAL66 (6:30:34 h).

At 6:30:46 h, the crew of the AIRBUS A-300-600 aircraft with registration D-AEAO and call sign BCS31M contacted TWR LCL 24L and informed them that they were established on the ILS for RWY 24L. The TWR LCL 24L controller told them that the preceding traffic was on the runway and that there would be a departure prior to their arrival, instructing them to continue the approach to runway 24L.

At 6:31:11 h, the TWR LCL 24L controller instructed the aircraft with call sign AAL66, which had just landed, to exit the runway to its right and asked what the height of the cloud ceiling was, to which the aircraft replied that the cloud ceiling was at 500 ft.

At 6:31:33 h, the TWR LCL 24L controller cleared the aircraft with call sign RYR6FK for take-off, indicating that the wind was 3 kt from a 70° direction, which the crew acknowledged.

At 6:31:45 h, the TWR LCL 24L controller told the crew of the aircraft with call sign BCS31M to wait for late landing clearance. The crew replied 4 s later that they intended to go-around.

At 6:31:58 h, the TWR LCL 24L controller asked for confirmation that they intended to discontinue the landing. The crew's answer was affirmative, explaining that it was due to minor technical issues, and the controller acknowledged their reply.

At 6:32:11 h, the TWR LCL 24L controller called the approach controller (APP LEBC - Sector T4W) and informed him that the aircraft with call sign BCS21M was executing a missed approach and that they were going to ascend aircraft RYR6FK to 2,000 ft.

At 6:32:36 h, the TWR LCL 24L controller told the crew of the aircraft with call sign RYR6FK to maintain 2,000 ft and informed them that there was traffic flying a missed approach manoeuvre, and the crew acknowledged correctly.

At 6:32:47 h, the TWR LCL 24L controller called the APP LECB controller to confirm that he had received the information and 4 s later transferred the aircraft with call sign BCS21M to the APP LECB (127.7 MHz) approach frequency in a somewhat confusing manner, prompting the crew receiving the information to ask for confirmation of the frequency. In response, the TWR LCL 24L

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<sup>3</sup> The callsign AAL66 corresponds to an AMERICAN AIRLINES flight from New York.

controller repeated the frequency and asked them if they were climbing to 3,000 ft. This time, the crew acknowledged as if the controller had instructed them to climb to 3,000 ft but did not acknowledge the frequency.

At 6:33:06 h, the TWR LCL 24L controller transferred the aircraft with call sign RYR6FK to the approach frequency, and they acknowledged correctly.

At 6:33:30 h, the aircraft with call sign BCS31M notified TWR LCL 24L that they had received a TCAS RA warning and were climbing to 3,000 ft flying the standard missed approach procedure. They also asked again about the approach frequency, and the controller replied that once they notified a missed approach, they had to climb to 3,000 ft and could not stay at 1,500 ft. He then repeated the approach frequency (127.7 MHz). The crew acknowledged and again informed the controller that they had received a TCAS RA warning.

At 6:33:59 h, the approach controller called the tower controller to query the reason for the missed approach, and during the conversation, the tower controller told him that it had initially stayed at 1,500 ft but was now climbing to 3,000 ft.

## 1.10. Information about the aerodrome

### 1.10.1. General information

Barcelona Airport is located 10 km southwest of the city and is classified as a category 4E<sup>5</sup> airport by the ICAO. Its reference point coordinates are 41° 17' 49" N – 02° 04' 42" E, and its elevation is 4 m (14 ft).

It has three runways, designated 02/20, 06R/24L and 06L/24R, respectively, which, depending on which are in use, provide six (6) different configurations.

### 1.10.2. Runway 06R / 24L

Runway 06R/24L, on which both aircraft were operating, measures 2,660 m x 60 m. The coordinates for the threshold (THR) at the head of 24L are 41° 17' 31" N – 02° 06' 11" E, and it lies at an altitude of 2.4 m (8 ft). The altitude of its touchdown zone (TDZ) is 3.3 m (11 ft). It is a category II/III ILS precision approach.

According to ENAIRE's AIP (Aeronautical Information Publication), this runway has an available landing distance (LDA) of 2,660 m. The size of the clearway (CWY) is 60 m. The runway strip measures 2,780 m x 300 m, and the runway end safety area (RESA) measures 125 m x 150 m. Figure 10 shows the profile of runway 24L / 06R.

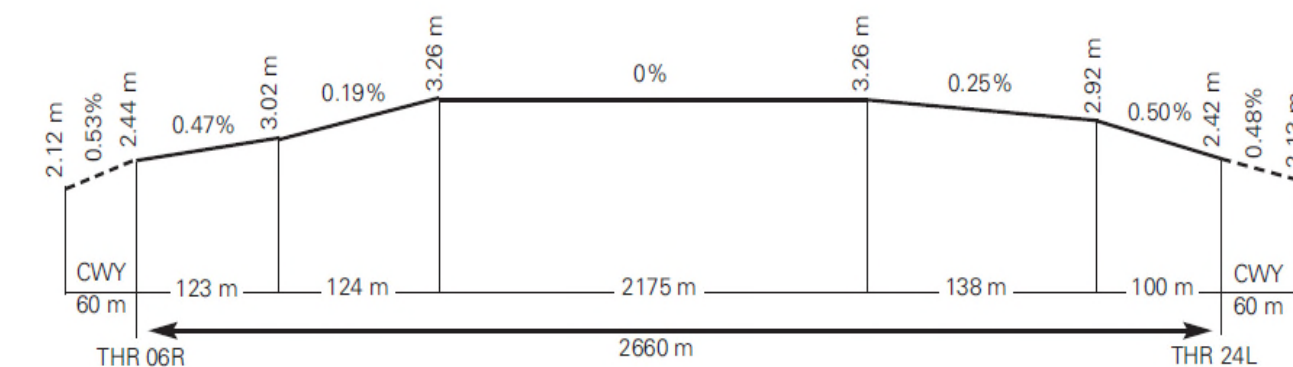


Figure 10. Profile of runway 06R / 24L

<sup>5</sup> The number 4 indicates a minimum reference field length of 1,800 m, while the letter E indicates that aircraft must have a wingspan of between 52 m and 65 m, and a maximum outer main landing gear wheel span of between 9 m and 14 m, in order to use the airport.

## PROCEDURES

Under the procedures set out in the AIP, using the west single runway configuration with 24L (WLL) for both departures and arrivals at night (23:00 h to 7:00 h) is not the preferential configuration.

For take-offs, on receipt of line-up clearance, pilots should ensure that they are able to taxi and line up on the runway as soon as the preceding aircraft has commenced either its take-off run or landing roll and start their take-off run immediately after receiving clearance.

In order to avoid excessive noises at the runway centreline extension 24L and except for safety reasons, the initial turn prescribed in the SID shall begin no later than reaching 500 ft altitude.

In regard to arriving aircraft, the landing clearance shall be issued when ILS sensitive areas are free, usually before the approaching aircraft is at 2 NM from the touchdown point. However, the landing clearance issue might be delayed until the aircraft is 1 NM from the touchdown point if the pilot has been advised that they will receive a late clearance.

The information at the foot of the instrument approach chart to runway 24L (document LE\_AD\_2\_LEBL\_IAC\_19\_en) specifies that, in the event of a missed approach, aircraft should perform the following manoeuvres: Climb on the runway heading to 500 ft then turn left (max. IAS 185 kt) to follow R - 236° PRA to 8,8 NM DME PRA. Next, turn left to intercept and follow magnetic track 118° VNV. Maintain 1,500 ft to cross R - 190° PRA and then climb to 3,000 ft and await ATC instructions.

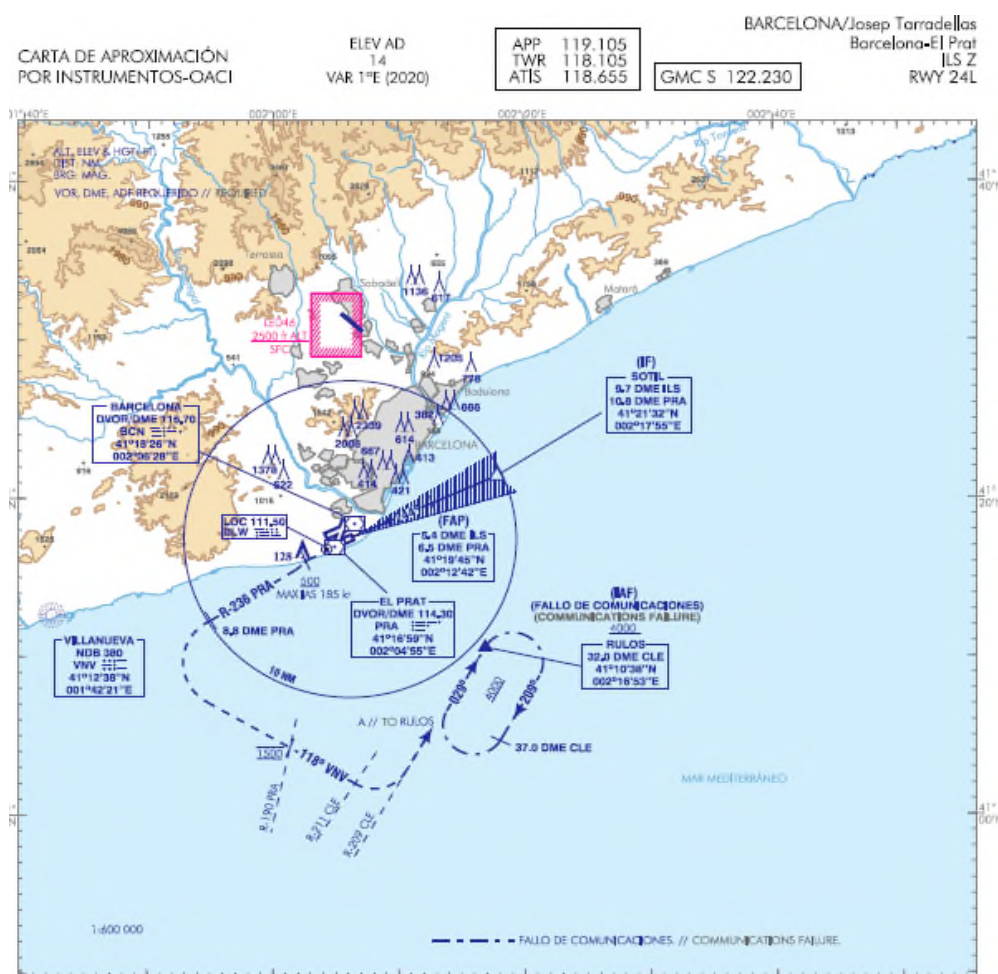


Figure 11. LEBL ILS Z RWY 24L approach chart

### 1.11. Flight recorders

By the time the CIAIAC became aware of the event and opened an investigation, it was no longer possible to recover the recorders of either aircraft because more than twenty days had passed (20).

However, copies of the QAR (quick access recorder) in both aircraft were available, from which it was possible to extract the recorded information and establish the relative positions of the two aircraft and their exact locations when they received the TCAS warnings.

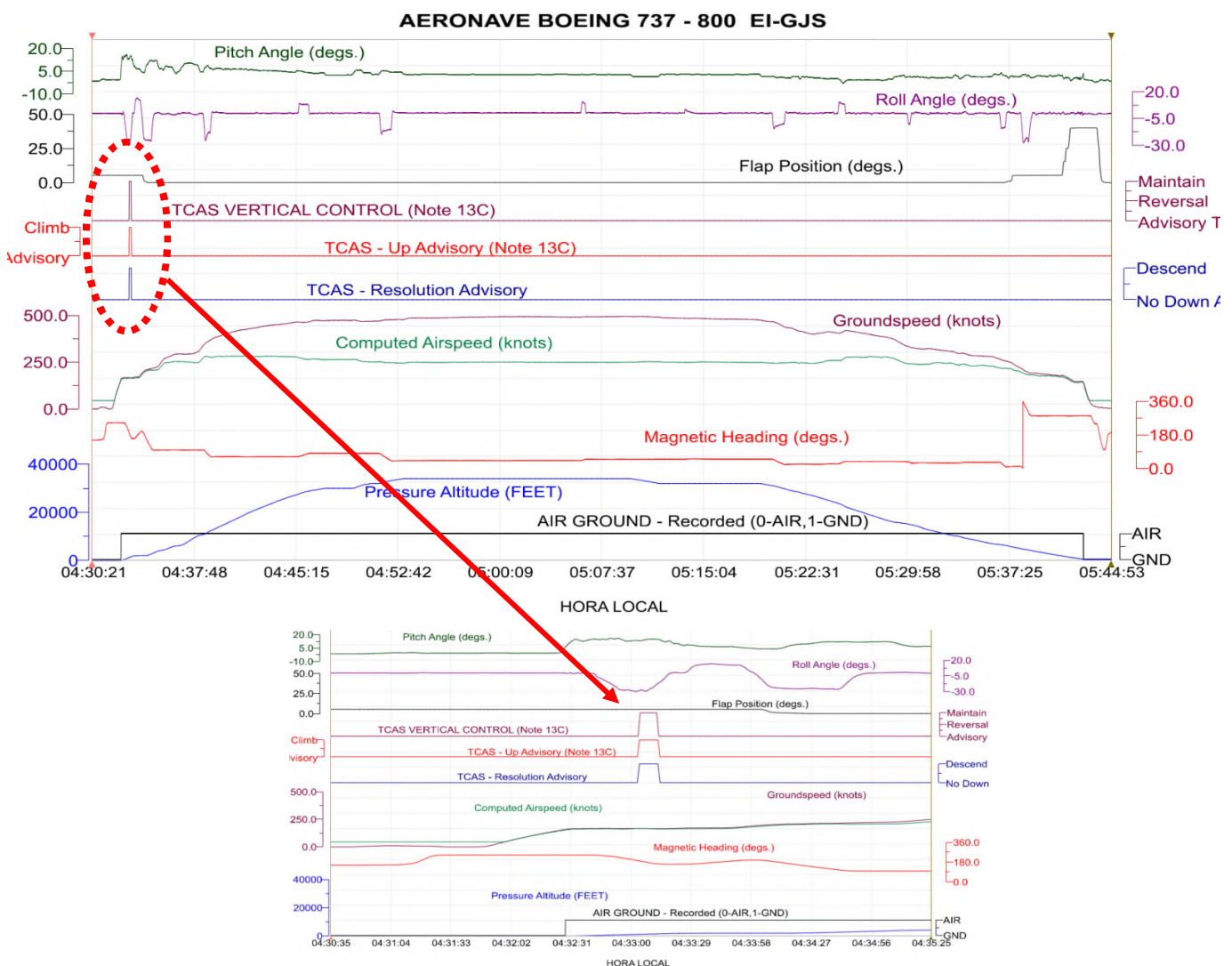
The most relevant information is summarised below.

#### 1.11.1. BOEING 737 - 800 aircraft<sup>6</sup>

The TCAS RA warning, with a climb resolution, occurred at precisely 6:33:04 h and lasted until 6:33:13 h, i.e. 9 s. At that moment, the aircraft was flying at an altitude of 1,234 ft, with an indicated airspeed of 165.2 kt and a ground speed of 167.5 kt.

It was on a magnetic heading of 190.9 °, which varied to 164.85 ° during the 9 s that the warning remained in force.

The flaps were deployed at an angle of 5.3 °, varying the pitch angle between 13 ° and 14.5 °, while the roll angle ranged between -26.5 ° and -16 ° (to the left).



**Figure 12. Flight parameters recorded on the BOEING 737- 800 aircraft**

<sup>6</sup> The times that appear in figures 12 and 13 are UTC.

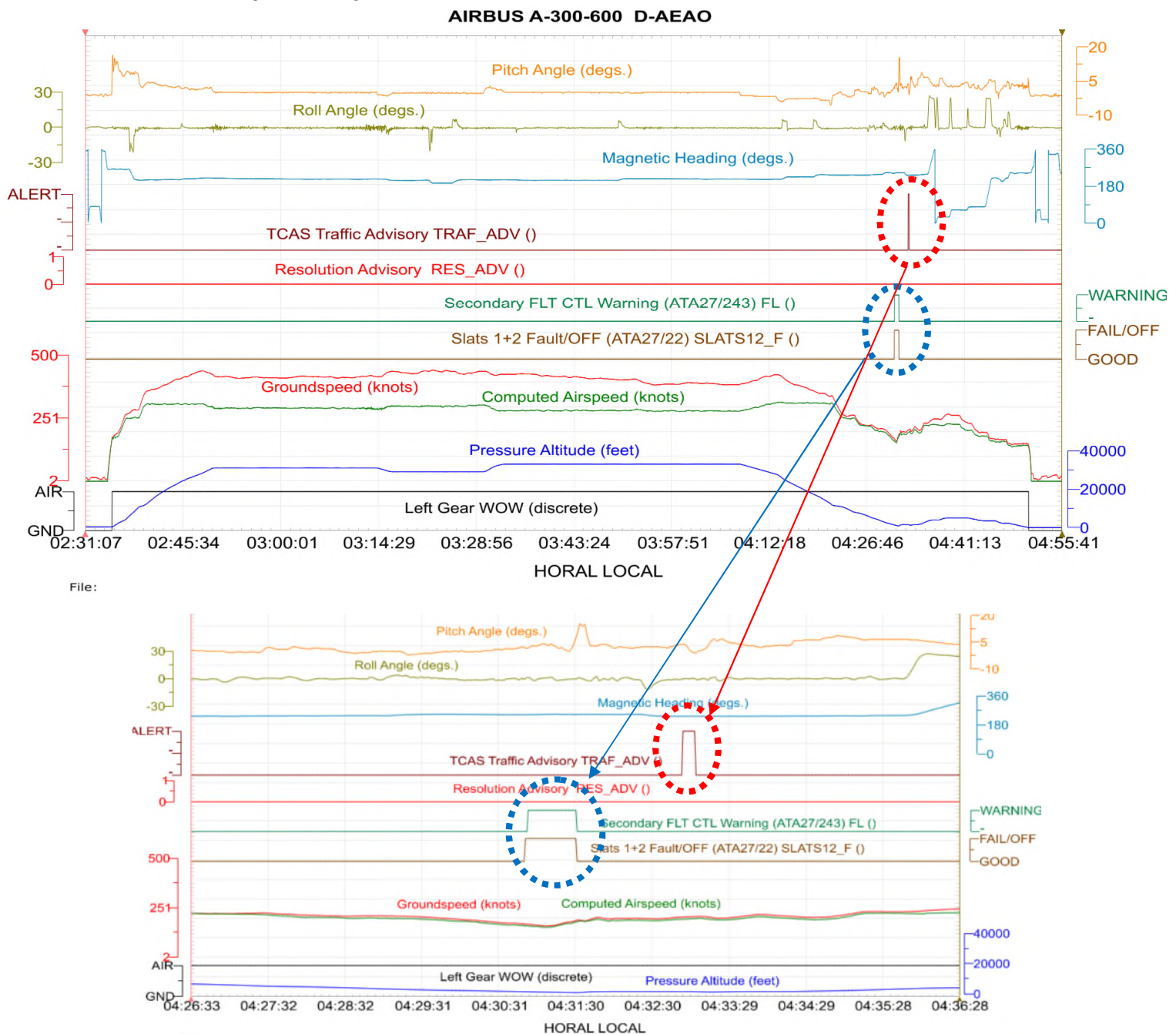
### 1.11.2. AIRBUS A 300 - 600 aircraft

The AIRBUS received a flaps and slats malfunction warning at 6:30:53 h, which lasted until 6:31:30 h. When it aborted the landing, it was 6:31:47 h, and it was flying at an altitude of 1,379 ft with an indicated airspeed of 192 kt and a ground speed of 201 kt.

The TCAS TA warning occurred at 6:32:53 h and lasted until 6:33:06 h, i.e. 13 seconds. At that time, it was flying at an altitude of 1,451 ft, with an indicated speed of 170 kt and a ground speed of 175 kt. No TCAS resolution advisory was recorded.

It was on a magnetic heading of 233 °, which it maintained for the duration of the warning, and the flaps were not deployed. The pitch angle was 4 °, and it was level, i.e. not rolling.

The aircraft maintained an altitude of 1,500 ft along the length of the runway centreline and began turning left.



**Figure 13. Flight parameters recorded on the AIRBUS A 300-600 aircraft**

## 1.12. Aircraft wreckage and impact information

N/A

## 1.13. Medical and pathological information

We have found no evidence to suggest that the flight crew on board either aircraft were affected by any physiological or disabling factors.

## 1.14. Fire

No fire broke out.

## 1.15. Survival aspects

N/A

## 1.16. Tests and research

ENAIRE conducted an internal investigation into the event, during which they arrived at the following conclusions:

- The airport was operating in phase 2 of the reduced visibility procedure (cloud base 500 ft and 7,000 m visibility), and the crew of the BOEING 737-800 (RYP61FK) were cleared for take-off between two heavy turbulent wake aircraft (one had just landed and the other was at 2.4 NM). When the AIRBUS A 300-600 (BCS31M) reached 1.9 NM on final, its crew were instructed to wait for a late clearance, and it was during this communication that the controller was advised the aircraft was executing a missed approach. At that point, the BOEING 737-800 (RYP61FK) had yet to cross G3 and was taxiing at just 20 kt. It took a few moments to request confirmation of the missed approach from the AIRBUS A 300-600 (BCS31M). When their reply was received, the BOEING 737-800 (RYP61FK) was passing G5 at a speed of 60 kt, and its take-off was allowed to proceed. Given the unusual situation, this was not an appropriate decision; therefore, the planning is considered to have been inadequate.

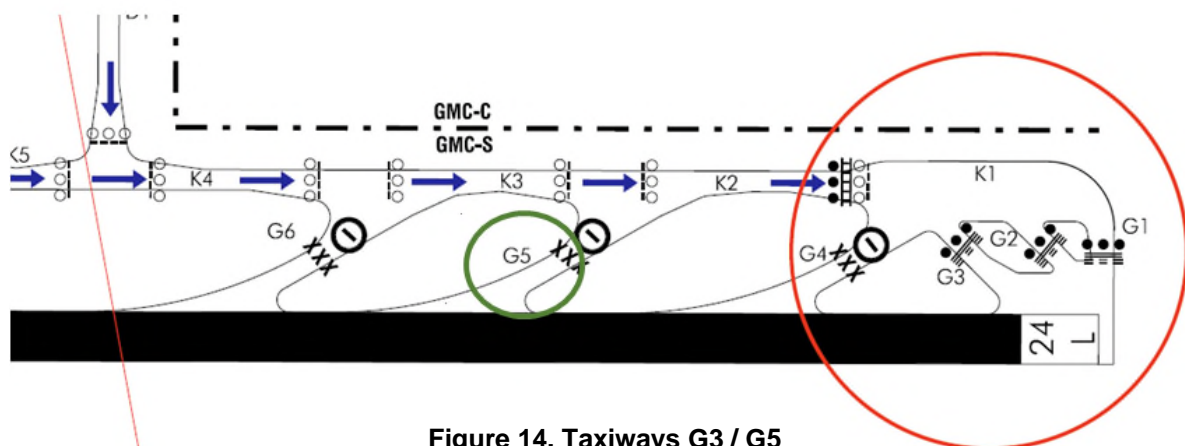


Figure 14. Taxiways G3 / G5

- After the BOEING 737-800 (RYP61FK) aircraft took off, control failed to provide traffic information to the AIRBUS A 300-600 (BCS31M) crew, which, given that the minimum separation reference used in single-runway operations is the length of the runway, was essential for them to ensure the appropriate separation in their trajectory.

- The AIRBUS A 300-600 (BCS31M) crew were instructed to climb to 3,000 ft, while the BOEING 737-800 (RYP61FK) crew were instructed to stop climbing at 2,000 ft. Later, when the crew of the AIRBUS A 300-600 (BCS31M) were called to tell them to contact the approach frequency (127.7 MHz), the controller could see that it was still maintaining 1,500 ft with an indicated airspeed of 185 IAS (as published) and they were instructed to climb to 3,000 ft. This occurred more than one (1) minute after the crew of the AIRBUS had notified control of the missed approach. TCAS warnings then commenced on both aircraft, and they began to separate as their crews followed the resolutions provided by their respective systems. The facts outlined above indicate a poor understanding of the visual information and a delay in processing the available data. The so-called “startling effect” also seems to have played a role.<sup>7</sup>.
- The controller assumed that the aircraft executing the missed approach to runway 24L (ILS-Z RWY24L) would climb to 3,000 ft, as stipulated in the other configurations. Furthermore, given that the aircraft initially stayed at 1,500 ft and did not start climbing to 3,000 ft until it crossed R-190 PRA and that the controller involved was the unit instructor, it's possible that similar situations could arise in the future. Therefore, ENAIRE concluded that inadequate training and excessively complex or inappropriate operating procedures that could lead to a failure to remember (or misremembering) a piece of information might be at fault.
- On this occasion, the historically sufficient 6 NM of separation between arrivals was compromised by the early missed approach of the AIRBUS A 300-600 (BCS31M) aircraft and its consequent increase in speed, resulting in an undesirable situation that could not be reversed.

As a possible recommendation, the internal investigation identified the sending of the report to different internal departments for inclusion in the annual incident training, further study of the missed approach procedure and dissemination of the lessons learned.

### 1.17 Organisational and management information

ENAIRE has a specific procedure for managing the control tower at Barcelona Airport, which uses the SACTA operating system (Automated System of Air Traffic Control).

The document specifies that there are ten (10) different types of configurations depending on which runways are operational. The WLL configuration was in force during the event in question, which specifies single-runway operations on 24 L between 23:00 h and 7:00 h.

In this configuration, the control tower cab has one (1) southerly coordination post, COOR S, one (1) for clearances, CLD, one (1) for ground movement, GMC (GN1 + GN2), one (1) for southerly ground movements, GS (movements from Terminal 2), one (1) for easterly coordination, COOR E, and one (1) for LCL Local (24L/06R, 24R/06L, 02/20, DEP, LA RR).

The procedure clearly establishes the functions of the controllers stationed at the clearance (CLD), ground movement (GMC) and Local (LCL) positions.

The default location of each of these control positions in the control tower cab is shown in figure 15 below:

<sup>7</sup> According to the FAA Advisory Circular 120-111 dated 4/14/15 - Upset Prevention and Recovery Training, Startling Effect can be defined as an uncontrollable, automatic muscle reflex elicited by exposure to a sudden, intense event that violates a person's expectations.

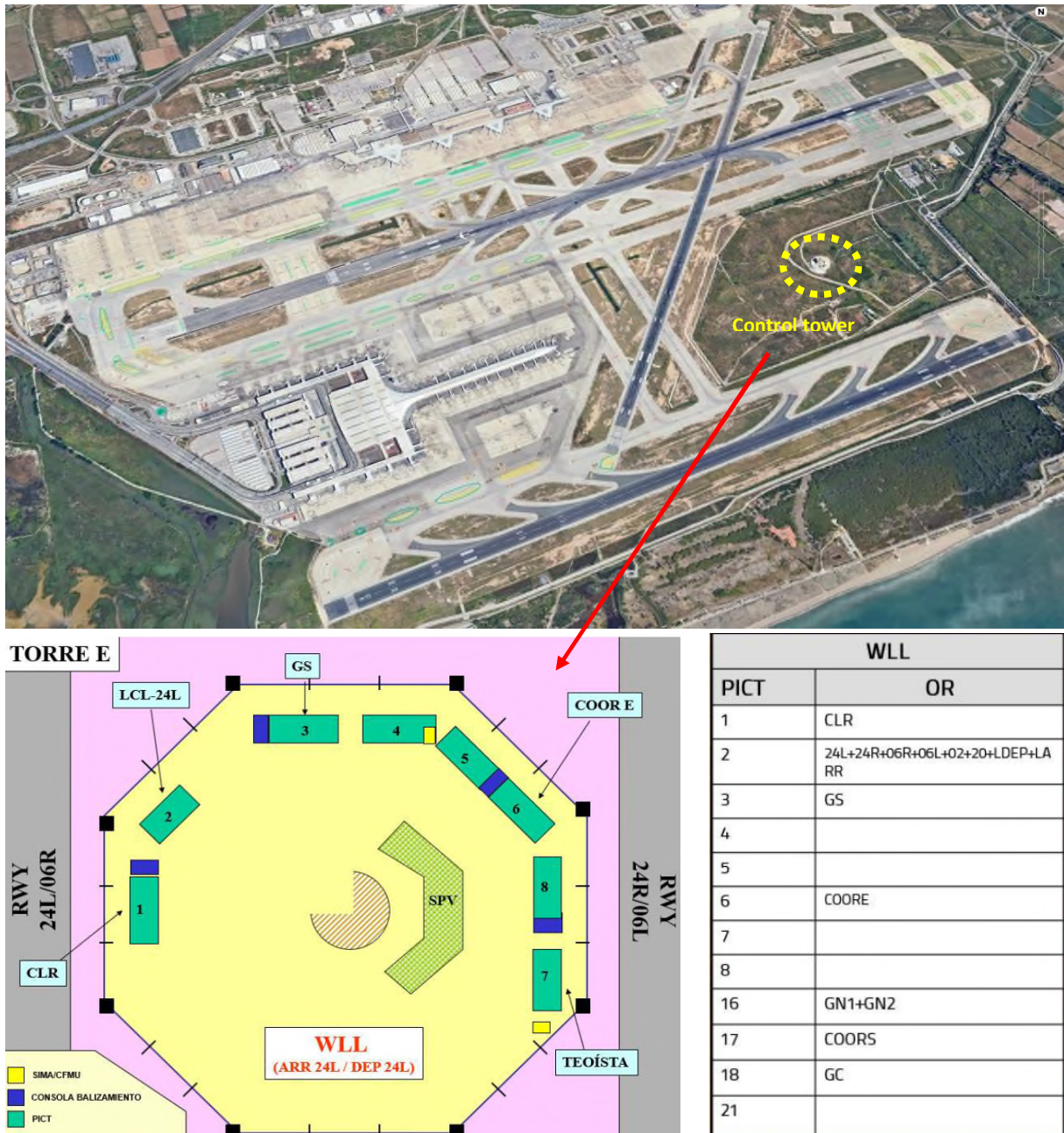


Figure 15. Positions in the Barcelona Airport control tower cab

### 1.18. Additional information

RYANAIR, the BOEING 737-800 (RZR61FK) aircraft operator, carried out an analysis of the incident and provided a series of specific data to the investigation, which is summarised in the following paragraphs.

When the Ryanair crew received clearance to take off, the AIRBUS A 300-600 (BCS31M) was behind them at 6 NM on final. By the time the AIRBUS crew informed the control services that they

were executing a missed approach due to a technical problem, the Ryanair crew had already begun the take-off run.

The TCAS TA warning was received during the initial turn to 162 ° at an altitude of 700 ft. The TCAS RA audible warning to climb occurred when they were above 1,000 ft. Subsequently, the tower also gave them a climb restriction requesting they level off at 2,000 ft instead of the 6,000 ft stipulated in the standard departure (SID).

They complied with this request because the TCAS RA resolution had disappeared, but they did not receive a “conflict-free” alert.

They were then instructed to contact the approach controller on frequency 127.7 MHz, which cleared them to continue the climb.

During take-off, the rate of climb was 2,000 ft/min, and during the TCAS RA warning, they continued to turn left with an average rate of climb of 2,300 ft/min.

Following its analysis of the event, RYANAIR reached the following conclusions:

- The crew had been well rested, had no Flight Time Limitation (FTL) issues, their level of alertness was normal, and no evidence of time pressure was found to have influenced the event.
- Operating a single-runway configuration using runway 24L is a standard and commonplace configuration at Barcelona airport between 23:00 h and 7:00 h (local time).
- The ground movement controller (GMC ATC) was performing separate functions from the local controller (ATC LCL), who was handling both take-offs and landings.
- There were few ground movements in the holding area for 24L and low traffic intensity. Furthermore, the standard procedures were correctly followed.
- The meteorological information indicated low visibility, which means the final approach could not be seen by the crews taking off.
- When Barcelona Airport operates in the runway configuration that was in force at the time (WLL), it is standard practice to give runway clearance before take-off when there is an aircraft on final approach at 6 NM.
- The crew of the RYANAIR BOEING 737-800 aircraft knew that an aircraft was executing a missed approach but were not aware of its position.
- Given the information available to the crew, they were mentally prepared to abort the take-off if they received an instruction to do so from control.
- There was an illegible transmission during the take-off run that the crew could not understand.
- The co-pilot was at the controls during the take-off, which followed the published departure procedure, turning to the left and away from any missed approach trajectory.
- The controller quickly realised that this was a potentially dangerous situation involving a reduced separation between the two aircraft and promptly issued a new clearance to level off at 2,000 ft.
- The crew executed the actions stipulated by the TCAS RA warning but didn't communicate the existence of the warning to Control because it was short in duration and the captain didn't want to add to the controller's already high workload.
- The vertical separation between the two aircraft was approximately 90 m, and while the exact horizontal separation is not known, there is evidence to suggest that the regulatory separation

between the two aircraft was violated due to the design of the ATC procedures/instructions and that, therefore, safety was compromised.

- The TCAS systems of both aircraft functioned correctly, and their guidance was well followed, preventing a potentially dangerous situation from arising.
- The crew of the RYANAIR BOEING 737-800 aircraft failed to follow the correct procedure in that, after an event of this type, they should have disconnected the cockpit voice recorder circuit breaker (CVR CB) on landing and notified the maintenance service. The recoding time was 01:28 h, which means the communications could have been recovered. This was due to a lack of knowledge on the part of the crew.

For its part, DHL, the operator of the AIRBUS A 300-600 (BCS31M) aircraft, either did not conduct or did not disclose any internal investigation into the event.

The information provided in relation to the incident was extremely brief, stating only that a missed approach was executed due to a failure in the flaps and slats system and that the crew followed procedure by maintaining an altitude of 1,500 ft over the runway until they received the TCAS RA warning, at which time they also followed the guidance issued by the system.

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

N/A

## 2. ANALYSIS

This event requires an analysis of whether the crews of the two aircraft and the control services acted in accordance with the established procedures.

Having analysed the performance of the BOEING 737-800 aircraft crew, it appears they complied at all times with the requirements of the control services and carried out a normal take-off in accordance with the procedures.

They were cleared for take-off at 6:31:33 h and started the run at 6:31:47 h, i.e. 14 s later, a time interval that complies with procedures.

They executed the actions stipulated by the TCAS RA warning correctly, aided by the fact that the RA told them to climb, which meant they weren't required to do anything other than continue as they were.

Their decision not to inform the control services that they had received a resolution advisory warning from the TCAS system because it only lasted for 9 seconds and, as inferred in RYANAIR's internal report, because they didn't want to interfere with the controller's workload, seems to have been the correct judgement.

The aforementioned internal investigation by the operator also detected that, given that an event of this nature would have required it, the crew failed to follow procedure by not disconnecting the cockpit voice recorder circuit breaker (CVR CB) on landing. Furthermore, it established that as the recording time was 1:28 h, the cockpit communications during the event could have been recovered.

With regard to the performance of the AIRBUS A – 300-600 crew, it should be noted that on deciding to execute a missed approach, they followed the procedures set out in the AIP for the runway configuration in force, maintaining an altitude of 1,500 ft. Moreover, when they received the TCAS warning, they descended to 1,200 ft, thus separating themselves from the other aircraft.

Instead of expressly contacting control to advise them of their decision to execute a missed approach, they did so on the back of another communication from the control services, informing them that they would receive a late clearance to land.

They received the warning that they had a problem with the secondary flight control configuration at 6:30:53 h, and control's late-clearance message (during which they took the opportunity to report the missed approach) came at 6:31:47 h. This means that 54 s elapsed, which should have been sufficient time for them to take the initiative and inform control that they would be executing a missed approach. They should have been the ones to inform the control services at the earliest opportunity.

Between the AIRBUS A - 300-600 crew receiving the secondary flight control configuration warning and the BOEING 737-800 crew being cleared for take-off, 40 s passed. As a result, if the AIRBUS crew had notified the missed approach immediately, the controller could have held the BOEING 737-800 aircraft and not cleared it to take off.

Regarding the performance of the control services, the controller authorised the BOEING aircraft to take off when the AIRBUS aircraft was at a distance of 2.8 NM on final.

When he detected the conflict, he made the decision to resolve it by increasing the vertical separation between the aircraft, the only other possible option being to stop the take-off of the BOEING aircraft, which was still taxiing at low speed.

This was a decision that was not his to make because it falls within the scope of the APP LECB approach controller rather than the local controller. Having authorised the BOEING 737-800 to take off, he should have transferred both aircraft as soon as possible so that APP LECB could separate them as it saw fit.

When he assumed the control of the aircraft to try to ensure their separation, his resolution of the conflict was flawed because he stopped the climb of the BOEING 737-800 aircraft immediately after take-off and instructed the crew to remain at 2,000 ft, thinking that the AIRBUS aircraft would climb to 3,000 ft and not taking into account that the procedure for that runway configuration stipulates that they should remain at 1,500 ft when executing a missed approach. Therefore, there was insufficient understanding of the visual information received, and the processing of the available information was delayed.

ENAIRE reacted proactively, accepting the fact that the training planning may be inadequate and that overly complex procedures or flawed operating procedures could have led to information not being remembered (or being misremembered) and initiating an in-depth analysis of the incident to study whether the 6 NM separation between arrivals, which has historically been considered sufficient, should be changed.

### **3. CONCLUSIONS**

#### **3.1. Findings**

- At 6:30:53 h, the crew of the AIRBUS A -300-600 aircraft with call sign BCS31M received a flaps and slats failure warning during their approach to runway 24L at Barcelona Airport, which lasted until 6:31:30 h.

- At 6:31:33 h, the TWR LCL 24L controller cleared the BOEING 737-800 aircraft with call sign RYR6FK to take off from 24L.

- At 6:31:45 h, the TWR LCL 24L controller told the crew of the AIRBUS A -300-600 aircraft with call sign BCS31M to wait for late landing clearance, and the crew replied 4 s later that they intended to go-around.

- At 6:32:36 h, the TWR LCL 24L controller instructed the BOEING 737-800 aircraft with call sign RYR6FK to maintain 2,000 ft.

- The crew of the BOEING 737-800 aircraft received a TCAS RA warning with a climb resolution at 6:33:04 h, which lasted until 6:33:13 h.

- The crew of the AIRBUS A 300 - 600 aircraft received a TCAS TA warning at 6:32:53 h, which lasted until 6:33:06 h. They notified a TCAS RA warning to ATC at 06:33:30 h.

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

The investigation has found that the cause of the incident was the non-compliance with procedures on the part of the control services, together with the fact that the AIRBUS A – 300-600 crew failed to immediately notify their intention to execute a missed approach.

#### **4. RECOMMENDATIONS**

None.

## ANNEXE 1. RELATIVE POSITIONS OF THE AIRCRAFT DURING THE TCAS WARNING



## ANNEXE 2. PERSPECTIVE OF THE AIRCRAFT DURING THE TCAS WARNING



## ANNEXE 3. PERSPECTIVE OF THE AIRCRAFT FROM THE TOWER

