# Technical report IN-034/2022

Incident on 2 July 2022 involving an Airbus A-330-323X aircraft operated by Delta Airlines, registration N803NW, and a Boeing 737-8AS aircraft operated by Ryanair, registration El-DYO, at Barcelona Airport

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.



MINISTERIO DE TRANSPORTES Y MOVILIDAD SOSTENIBLE SUBSECRETARÍA

COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

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

Consequently, the use of this report for any purpose other than the prevention of 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

o ' "	Sexagesimal degrees, minutes and seconds
°C	Degrees Celsius
ADI	Aerodrome control instrument rating
AENA	Spanish Airports and Air Navigation (airport management)
AESA	Spain's National Aviation Safety Agency
AMEL	Aircraft multi-engine land rating
APP	Approach control service
Art.	Article
ATC	Air traffic control
ARR	Arrivals
ATPL	Airline transport pilot license
С	Central
CAVOK	Visibility, cloud and present weather better than prescribed values or conditions (clouds and visibility OK)
CWY	Clearway
DEP	Departures
E	East
FAA	United States Federal Aviation Administration
ft	Feet
GMC	Ground movement control
GMS	Ground movement surveillance
GS	Ground speed
h	Hours
IAA	Irish Aviation Authority
IFR	Instrument flight rules
ILS	Instrument landing system
kg	Kilograms
km	Kilometres
kt	Knots
LCL	Local controller
LECB	ICAO code for the Barcelona area control centre
LEBL	ICAO code for 'Josep Tarradellas Barcelona-El Prat Airport'
m	Metres
METAR	Aviation routine weather report (in aeronautical meteorological code)
МТОМ	Maximum take-off mass
MSN	Manufacturer serial number
No.	Number
Ν	North
ICAO	International Civil Aviation Organisation
RAD	Aerodrome radar control rating

RD	Royal Decree
RWY	Runway
S	South
SEP	Single-engine piston aircraft
SMGCS	Surface movement guidance and control system
SMP	Lighting control and indicating system
TWR	Control tower
EU	European Union
UTC	Coordinated universal time
WRL	West configuration at Barcelona Airport

#### SYNOPSIS

Aircraft no.1:		
Operator:	Delta Airlines, Inc.	
Aircraft:	Airbus A-330-323X, with registration N803NW and flight callsign DAL169	
Persons on board:	13 crew members and 293 passengers, unharmed	
Type of flight:	Commercial air transport - Scheduled - International - Passengers	
Phase of flight:	Take-off – initial climb	
Type of operation:	IFR	
Aircraft no. 2:		
Operator:	Ryanair	
Aircraft:	Boeing 737-8AS, with registration EI-DYO and flight callsign RYR18NN	
Persons on board:	6 crew members and 166 passengers, unharmed	
Type of flight:	Commercial air transport - Scheduled - International - Passengers	
Phase of flight:	Taxi to runway	
Type of operation:	IFR	
Date and time of the incide Site of incident: Date of approval:	ent: 2 July 2022, 14:08 UTC <sup>1</sup> Josep Tarradellas Barcelona- El Prat Airport ( LEBL) 29 november 2023	

#### Summary of the incident:

On Saturday, 2 July 2022, the Boeing 737-8AS aircraft, registration EI-DYO, was taxiing towards runway 24L at Barcelona EI Prat airport. The route it was instructed to take by the ground movement controller involved crossing the extension of runway 24R using taxiway S14. When they reached this taxiway, the stop bar lights were off, so the crew continued to taxi across the runway. However, after a few seconds, the north ground movement controller requested they stop and hold, as the Airbus A-330 aircraft (registration N-803NW) was taking off from the same runway. The Boeing aircraft stopped and remained on the extension of runway 24R. A few seconds later, at 14:08:11, the A-330 aircraft overflew the Boeing at about 700 feet.

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

The crew and passengers of the aircraft did not sustain any injuries.

<sup>&</sup>lt;sup>1</sup> All times used in this report are UTC. To calculate the local time add 2 hours.

The investigation has established that the incident was caused by a failure to adhere to procedures on the part of the local arrivals controller, who neglected to stop the flow of traffic across the S14 bypass taxiway.

The following factors are thought to have contributed to the incident:

- The design of the non-preferential runway take-off checklist.
- The ergonomics of the lighting control and indicating system

A safety recommendation has been issued to ENAIRE:

REC 25/23: It is recommended that AENA, in collaboration with ENAIRE, improve the lighting control and monitoring system at Josep Tarradellas Barcelona-El Prat Airport so that it can be monitored from the controller's main working position.

REC 26/23: It is recommended that ENAIRE, in collaboration with AENA, improve the lighting control and monitoring system at Josep Tarradellas Barcelona-El Prat Airport so that it can be monitored from the controller's main working position.

## 1. FACTUAL INFORMATION

#### 1.1. Summary of the incident

On Saturday, 2 July 2022, at approximately 13:54 UTC, Barcelona Airport changed configuration from east to west (WRL configuration). This meant that runway 24R would be used for arrivals and runway 24L for take-offs. The local arrivals controller (LCL ARR) coordinated with the Barcelona Final Sector 06 approach controller (Final Sector 24 after the change of configuration) to arrange the non-preferential<sup>2</sup> take-off of an A330 aircraft with registration N803NW and flight callsign DAL169, which would be the first to take off on runway 24R after the change of configuration. The approach controller informed him that he had clearance for the take-off.

The LCL ARR controller then contacted the north ground movement controller (GMC N) to advise him that the DAL169 aircraft would take off as soon as it arrived at the runway holding point. Less than a minute later, he contacted him again to assume control of the runway bypass,<sup>3</sup> turning on the stop bar (at 13:56:00). Shortly afterwards, he contacted aircraft DAL169 and was informed they would be ready in one minute. This was communicated to the approach controller, who tried to gain time by slowing down the first aircraft to land. However, when the DAL169 aircraft was finally ready to take off (at 14:00:00), the arrivals controller judged that the slot was no longer sufficient and requested a new one from Approach. The new slot provided was behind an aircraft operated by ITA Airways, which would be the third to land on the runway after the change of configuration. As the non-preferential take-off was delayed by a few minutes, the LCL ARR controller called the GMC N controller (at 14:01:30) to release the bypass and advise him that the non-preferential take-off would take place after the third landing on that runway.

<sup>&</sup>lt;sup>2</sup> A non-preferential take-off is when an aircraft takes off on the runway normally used for arrivals.

<sup>&</sup>lt;sup>3</sup> 'Bypass' is the name given to the taxiways that cross the 24R runway extension. When it is taken over by the arrivals controller, the controller turns on the stop bars to prevent aircraft from crossing it while aircraft are taking off from the non-preferential runway.



Image 1: Trajectories and relevant time points of the aircraft

Meanwhile, at 13:57:50, the crew of the Ryanair aircraft (with registration EI-DYO and flight callsign RYR18NN) contacted the GMC N controller to request a towed pushback from its stand, which was authorised by the latter. Five minutes later, the crew requested clearance to taxi, and the controller authorised them to so, immediately providing a complete route to follow from the parking stand to the boundary between the GMC N area of responsibility and the central ground movement controller's area of responsibility (GMC C). This instruction implied taxiing around runway 24R and crossing its extension on the S taxiway bypass (See Image 1).

Additionally, at 14:00:19, a medical transport aircraft with the callsign ADN16D requested permission to taxi. The GMC N controller instructed it to taxi to point GN, with the intention that it would cross runway 24R on taxiway E after the ITA Airways aircraft had landed and before the take-off of the DAL169 aircraft (the non-preferential take-off). However, in the end, the second aircraft to land on runway 24R (operated by EasyJet with callsign

EZY75MZ) used runway exit P5 (at 14:05:40). This meant it blocked the path of aircraft ADN16D, causing its taxi to take longer than anticipated and leaving it unable to cross the runway when it was scheduled to do so. As a result, it was decided that the plan would be changed again and that the non-preferential take-off would take place before the runway crossing, and the GMC N controller asked the EZY75MZ aircraft to speed up its taxi (at 14:06:00).

Following these changes to the plan, the LCL ARR controller cleared aircraft DAL169 for take-off at 14:06:44. At the time of issuing the clearance, he had not re-coordinated the bypass release with GMC N nor had he turned on the S14 stop bar, which the RYR18NN aircraft was approaching, just few metres away. The controller subsequently stated that, when it was time to clear the take-off, the gap for it do so before the next landing was tight.



Image 2: Detail of the paths of the ADN16D and EZY75MZ aircraft until 14:06:44

At 14:07:13, the GMC N controller, who at the time was giving instructions to another aircraft, was alerted by the GMC C controller that the DAL169 aircraft had started its take-off run and the RYR18NN aircraft was crossing the bypass stop bar. Upon realising this, the GMC N controller told the aircraft to stop immediately without giving a reason. It took a few seconds for the aircraft to acknowledge and brake, which meant that by the time it had stopped, it was on the runway extension. According to the controller's statement, once stopped, it didn't appear to him to be encroaching on the runway extension. Immediately afterwards, the controller commented to his supervisor that he had not been advised of the change in the use of the bypass. The supervisor replied at 14:08:01 saying that the stop bar was already on but that there had been an oversight in communicating this (according to AENA records, the stop bar was turned back on at 14:07:44). The GMC N controller later stated that he was not expecting aircraft DAL169 to take off until aircraft ADN16D had crossed the runway.

Aircraft DAL169 took off and flew over aircraft RYR18NN at a vertical distance of about 700 ft at 14:08:11. Thereafter, operations continued without further relevant events.

## 1.2. Injuries to persons

## 1.2.1. Injuries to persons on board the Delta Airlines aircraft

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal				
Serious				
Minor				
Unharmed	13 <sup>4</sup>	293	306	
TOTAL	13	293	306	

## 1.2.2. Injuries to persons on board the Ryanair aircraft

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal				
Serious				
Minor				
Unharmed	6 <sup>5</sup>	166	172	
TOTAL	6	166	172	

## **1.3.** Damage to the aircraft

Neither aircraft sustained damage as a result of the incident.

### 1.4. Other damages

There was no further damage of any kind.

### **1.5.** Information about the personnel

## 1.5.1. Delta Airlines aircraft

Captain:

- At the time of the incident, the captain was the pilot monitoring.
- Age: 59 years
- License: Airline pilot (ATPL) issued by the FAA and renewed in May 2022, in force.

 $<sup>^{\</sup>rm 4}$  3 flight crew and 10 cabin crew

<sup>&</sup>lt;sup>5</sup> 2 flight crew and 4 cabin crew

- Relevant ratings:
  - Aircraft multi-engine land (AMEL)
  - A-330
- Medical certificate:
  - Class 1 valid until January 2023
- Periodic capacity check completed in June 2022
- Flight hours:
  - Total: 18178 h
  - In type: 91 h
  - In the last 24 h: 5

## First Officer:

- At the time of the incident, the co-pilot was the pilot at the controls.
- Age: 57 years
- License: Airline pilot (ATPL) renewed in October 2021 and in force.
- Relevant ratings:
  - Aircraft multi-engine land (AMEL)
  - A-330
- Medical certificate:
  - Class 1 renewed in May 2022
- Periodic capacity check completed in March 2021
- Flight hours:
  - Total: 13957 h
  - In type: 724 h
  - In the last 24 h: 5 h

## 1.5.2. Ryanair aircraft

Captain:

- At the time of the incident, the captain was the pilot flying.
- Age: 36 years
- License: Airline pilot (ATPL) issued in January 2019 by the Irish Aviation Authority (IAA)
- Relevant ratings:
  - Single-engine piston aircraft (SEP) valid until August 2022
  - Boeing 737-900 valid until November 2022
- Medical certificate:
  - Class 1 valid until October 2022
- Flight hours:
  - Total: 6200 h
  - In type: 4400 h

First Officer:

- At the time of the incident, the first officer was the pilot monitoring.
- Age: 37 years
- License: Airline pilot (ATPL) issued in August 2019 by the IAA
- Relevant ratings:
  - Boeing 737-900 valid until January 2023
- Medical certificate:

- Class 1 valid until June 2023
- Flight hours:
  - Total: 2500 h
  - In type: 2300 h

## 1.5.3. Information about the controllers in the Barcelona tower

Ground movement controller north (GMC N):

- Age: 28 years
- License: Air traffic controller issued in June 2022 by Spain's National Aviation Safety Agency (AESA)
  - Endorsements for the LEBL unit: ADI/TWR/GMS/RAD (all valid until June 2023).
- Medical certificate:
  - Class 3 valid until July 2023
- Experience at the unit: less than a month

Local arrivals controller (LCL ARR):

- Age: 30 years
- License: Air traffic controller issued in November 2021 by Spain's National Aviation Safety Agency (AESA)
  - Endorsements for the LEBL unit: ADI/TWR/GMS/RAD (all valid until October 2022).
- Medical certificate:
  - Class 3 valid until February 2023
- Experience at the unit: 8 months

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

### 1.6.1. Information about the DAL169 aircraft (N803NW)

The Airbus A-330-323X aircraft, with registration N803NW and manufacturer serial number (MSN) 542, was built in 2003 and registered with the FAA on 31 December 2009 to Delta Airlines inc. It has two Pratt & Whitney engines, model PW4168AI. At the time of the incident, the aircraft had 82726 h of flight time. Its maximum take-off mass (MTOM) is 233000 kg.

At the time of the incident, it had a valid airworthiness certificate issued by the FAA.

## 1.6.2. Information about the RYR18NN aircraft (EI-DYO)

The Boeing 737-8AS aircraft, with registration EI-DYO and serial number 33636, was built in 2008 and registered with the Irish aircraft registry on 10 September 2008. It has two CFMI engines, model CFM56-7B26. Its maximum take-off mass (MTOM) is 66990 kg.

At the time of the incident, it had a valid airworthiness certificate issued by the Irish Aviation Authority (IAA) in 2008 and an airworthiness review certificate valid until 5 August 2022.

## 1.7. Meteorological information

The two METARs closest to the time of the incident were as follows:

## 14:00-> METAR LEBL 021400Z 15008KT 110V190 9999 FEW015 24/16 Q1019 NOSIG= 14:30-> METAR LEBL 021430Z 14007KT 100V190 CAVOK 25/17 Q1019 NOSIG=

According to the METARs, between 14:00 and 14:30 UTC at Barcelona Airport, the average wind was about 7 - 8 kt from a south-southwesterly direction. Visibility was very good, with little cloud cover, and the temperature was 24-25°C.

## 1.8. Aids to navigation

Barcelona Airport has a surface radar, used by controllers to monitor and give instructions to aircraft. The following radar data was extracted from the Surface Movement Guidance and Control System (SMGCS) Level 2<sup>6</sup>:

At 14:06:49 h, the radar image shows aircraft DAL169 entering runway 24R to commence its take-off and aircraft RYR18NN taxiing along taxiway S and reaching gate RN. See Image 3. It also shows the EasyJet aircraft, callsign EZY75MZ, blocking the medical transport aircraft's (ADN16D) planned route across the runway after the landing of the ITA Airways aircraft (ITY076).



Image 3: Positions of the aircraft at 14:06:49 h

At 14:07:16 h, the radar image shows aircraft DAL169 initiating its take-off run at 20 kt (GS) and aircraft RYR18NN just passing over the S14 stop bar. See Image 4.

<sup>&</sup>lt;sup>6</sup> The surface radar predicts and alerts ATC personnel to conflicts



Image 4: Positions of the aircraft at 14:07:16 h

At 14:07:23 h, the radar image shows aircraft DAL169 on its take-off run at 60 kt (GS) and aircraft RYR18NN having passed the S14 stop bar. See Image 5.



Image 5: Positions of the aircraft at 14:07:23 h

At 14:07:39 h, the radar image shows aircraft DAL169 on its take-off run at 120 kt (GS) while aircraft RYR18NN is stationary on the extension of 24R having passed the S14 stop bar. See Image 6.



Image 6: Positions of the aircraft at 14:07:39 h

At 14:07:44 h, the radar image shows aircraft DAL169 on its take-off run at 150 kt (GS) while aircraft RYR18NN is stationary on the extension of 24R having passed the S14 stop bar. According to the information sent by AENA, it was at this moment that the S14 stop bar was activated in the tower's lighting system. See Image 7.



Image 7: Positions of the aircraft at 14:07:44 h

At 14:08:11 h, the radar image shows aircraft DAL169 on its initial climb at 170 kt (GS) and an altitude of 700 ft overflying aircraft RYR18NN, which was continuing to hold on the extension of 24R. See Image 8.



Image 8: Positions of the aircraft at 14:08:11 h

### 1.9. Communications

The most relevant verbal communications between the ATC personnel and the two aircraft involved in the incident are included below:

At approximately 13:54 UTC, the west configuration (WRL) was introduced, i.e. the runway for arrivals was going to be 24R and the runway for take-offs 24L. Subsequently, the local 24R arrival controller informed APP Barcelona Final Sector 06 that the last arrival on the old runway 06L was on the ground and the ILS on 24R was in the air, which meant they could now commence instrument approaches for runway 24R.

The local arrival controller (LCL ARR) then informed his APP counterpart that he would have a non-preferential departure from runway 24R, as requested by the crew.

At 13:56:00, the LCL ARR controller coordinated with the north ground movement controller (GMC N) to arrange the departure of the non-preferential traffic from runway 24R, which meant that no one could cross the S14 taxiway bypass located on the extension of that runway. Next, the LCL ARR controller coordinated with central ground movement (GMC C) to arrange the transfer of aircraft DAL169 to him as soon as possible.

Approximately one minute later, the LCL ARR controller established contact with the crew of aircraft DAL169. They told him they would be at M1 (holding point for take-off) in about three minutes. The controller replied that there were no problems and confirmed a standard departure (LOBAR6D) and that the initial altitude would be 4000 ft. The crew acknowledged the instruction correctly.

The controller then asked the crew if they would be ready for an immediate take-off when they reached the holding point; the crew reported that they would need one minute. The controller replied, requesting they advise him when fully ready (at that time, it was 13:58:01). During this communication, the aircraft stopped on the taxiway.

At approximately the same time, aircraft RYR18NN requested a towed pushback from its parking stand, which the north ground movement controller approved.

At 13:58:10, the Approach controller, Final Sector 24, asked the LCL ARR controller if aircraft DAL169 would be departing immediately from runway 24R. The latter replied that it needed one minute, so the Approach controller suggested reducing the speed of the traffic on final so that it would have more time to take off. The LCL ARR controller agreed. At 13:58:43, the crew on DAL169 reported that they were fully ready, and the LCL ARR controller instructed them to continue taxiing to M1. After acknowledging, the crew did as instructed, although it took 20 seconds for the aircraft to start moving again.

At 14:00:00, the LCL ARR controller asked aircraft DAL169 again if it was completely ready for an immediate departure. The crew's response was affirmative.

At 14:01:00, the LCL ARR controller informed his Final 24 counterpart that it would not depart and to make a new slot for him between approaches; they decided it would depart behind an ITA Airways aircraft. He then informed aircraft DAL169 that there would be three arrivals before their departure. Approximately half a minute later, he informed the GMC N controller that the traffic on runway 24R was going to take off behind the ITA Airways aircraft, so for the time being, he would turn off the stop bars on taxiway S14, and he could continue moving aircraft along the bypass.

Two minutes later, aircraft RYR18NN requested taxi instructions, and the GMC N controller instructed it to taxi via HN, then S, then M to hold short of DS. The crew of this aircraft acknowledged correctly.

At 14:05:46, the LCL ARR controller asked aircraft DAL169 if they had the traffic on short final in sight. The crew responded in the affirmative and were instructed to enter and line up on runway 24R behind that traffic.

At 14:06:44, the LCL ARR controller cleared aircraft DAL169 to take off from runway 24R. The crew of this aircraft acknowledged correctly.

At 14:07:15, the LCL ARR controller informed his APP counterpart that the traffic on runway 24R was on its take-off run.

At 14:07:13, the GMC N controller instructed the RYR18NN aircraft to hold position after being alerted by GMC C that the DAL169 aircraft was taking off on the runway.

At 14:07:22, the GMC N controller informed the supervisor that he had not been advised to stop the flow of traffic taxiing on the S14 bypass. The supervisor replied that he would tell

the LCL ARR controller. At 14:07:50, the supervisor replied that he had not been told but that the stop bar was on.

Subsequently, the local arrivals controller transferred aircraft DAL169 to the APP departures frequency, sector T4W.

The GMC N controller then instructed the crew of aircraft RYR18NN to continue taxiing. Shortly afterwards, the Ryanair crew informed them that they would be reporting the incident as they believed an irregularity had been committed.

## 1.10. Information about the aerodrome

Josep Tarradellas Barcelona-El Prat Airport is located 10 km to the southwest of the city of Barcelona. Its reference point coordinates are 41° 17' 49" N 2° 04' 42" E, with an elevation of 4 m (14 ft).

The airport has three runways. Two are parallel, designated RWY 24R/06L (used preferably for arrivals) and RWY 24L/06R (used preferably for departures). The third runway crosses the other two and is designated RWY 02/20 (used preferably for arrivals). It also has two control towers: TWR east and TWR south.



Image 9: Plan of Barcelona-El Prat aerodrome.

#### 1.10.1. Information about obstacle limitation surfaces

Taxiways S/M and T/N, which cross the extension of runway 24R outside the strip, are 350 and 280 m from the end of the clearway (CWY), respectively. After the clearway, there is a take-off climb obstacle limitation surface, with a gradient of 2%. In the West configuration, this obstacle limitation surface would be breached if an aircraft with a height of more than 7m crosses the runway extension using the S/M taxiway. For this reason, the airport's procedures do not allow aircraft to cross these taxiways while another aircraft is taking off from the runway (see Image 10).



Image 10: Detail of the end of runway 24R and the S/M & T/N taxiway bypasses

### 1.10.2. Configuration at the time of the incident

At the time of the incident, the runway was operating in its WRL configuration (West Configuration). When the airport operates in this configuration, runway 24R is used for arrivals, while runway 24L is generally used for take-offs. In certain circumstances, due to performance, weight and balance considerations, aircraft crews may ask air traffic control to use runway 24R for take-off, as it has longer declared distances than the other runway. This was the case for aircraft DAL169. This is known as a 'non-preferential' take-off, a common procedure sometimes carried out more than 10 times in a day.

Traffic control at Barcelona-El Prat Airport is basically divided into several positions:

- a) There are 3 clearly defined ground movement control areas, each operated by a different controller (called GMC north, centre and south). GMC north and GMC centre are are based in TWR south, whereas GMC south is based in TWR east.
- b) For the aircraft on the runways (or those that are on short final or have just taken off but haven't yet been transferred to the relevant approach sector), the local arrival controller (LCL ARR) is normally responsible for runway 24R, and the local



departures controller (DEP) is responsible for runway 24L, in this configuration. Both these positions are based in TWR east.

Image 11: Areas of responsibility and frequencies of the ground movement controllers

## 1.11. Flight recorders

The aircraft involved in this incident had flight recorders. However, we were unable to extract any data relevant to the analysis of the incident from them.

## 1.12. Aircraft wreckage and impact information

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

#### 1.13. Medical and pathological information

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

#### 1.14. Fire

No fire broke out in the aircraft or the surroundings.

#### 1.15. Survival aspects

N/A.

## 1.16. Tests and research

### 1.16.1. Operation of the stop bars

A report on the operation of the S14 stop bar was requested (see extract in Image 12). The report confirmed that no electrical faults were found in its installation, that it had been switched off at 14:01:46 and that it had not been switched on again until 14:07:44. At this moment, aircraft DAL169 was on its take-off run, passing taxiway P3 with a GS of 150 kt, i.e. it had already covered more than half of the runway. Meanwhile, aircraft RYR18NN was on the extension of the runway axis (having crossed the stop bar at 14:07:15).

Fecha/Hora 🔍	Incidencia
02/07/2022 14:10:15	Telemando a barra de parada S14 por BCNSMPTORRE05 a 0 desde BCN505SMP17 satisfactorio.
02/07/2022 14:10:14	Enviando telemando a barra de parada S14 por BCNSMPTORRE05 desde BCN505SMP17.
02/07/2022 14:09:24	Cambio a Configuración WRL (TODO) por BCNSMPTORRE05 desde BCN505SMP17.
02/07/2022 14:09:17	Telemando a barra de parada M1 por BCNSMPTORRE05 a 1 desde BCN505SMP17 satisfactorio.
02/07/2022 14:09:17	Telemando a barra de parada M16 por BCNSMPTORRE05 a 0 desde BCN505SMP17 satisfactorio.
02/07/2022 14:09:17	Telemando a barra de parada N16 por BCNSMPTORRE05 a 0 desde BCN505SMP17 satisfactorio.
02/07/2022 14:09:17	Telemando a barra de parada T14 por BCNSMPTORRE05 a 0 desde BCN505SMP17 satisfactorio.
02/07/2022 14:09:16	Enviando telemando a barra de parada M1 por BCNSMPTORRE05 desde BCN505SMP17.
02/07/2022 14:09:16	Enviando telemando a barra de parada M16 por BCNSMPTORRE05 desde BCN505SMP17.
02/07/2022 14:09:16	Enviando telemando a barra de parada N16 por BCNSMPTORRE05 desde BCN505SMP17.
02/07/2022 14:09:16	Enviando telemando a barra de parada T14 por BCNSMPTORRE05 desde BCN505SMP17.
02/07/2022 14:08:42	Telemando a barra de parada E7 por BCNSMPTORRE05 a 1 desde BCN505SMP17 satisfactorio.
02/07/2022 14:08:41	Enviando telemando a barra de parada E7 por BCNSMPTORRE05 desde BCN505SMP17.
02/07/2022 14:07:55	Telemando a barra de parada E7 por BCNSMPTORRE05 a 0 desde BCN505SMP17 satisfactorio.
02/07/2022 14:07:54	Enviando telemando a barra de parada E7 por BCNSMPTORRE05 desde BCN505SMP17.
02/07/2022 14:07:45	Telemando a barra de parada S14 por BCNSMPTORRE05 a 1 desde BCN505SMP17 satisfactorio.
02/07/2022 14:07:44	Enviando telemando a barra de parada S14 por BCNSMPTORRE05 desde BCN505SMP17.
02/07/2022 14:06:08	Telemando a barra de parada M1 por BCNSMPTORRE05 a 0 desde BCN505SMP17 satisfactorio.
02/07/2022 14:06:07	Enviando telemando a barra de parada M1 por BCNSMPTORRE05 desde BCN505SMP17.
02/07/2022 14:01:46	Telemando a barra de parada S14 por BCNSMPTORRE05 a 0 desde BCN505SMP17 satisfactorio.
02/07/2022 14:01:45	Enviando telemando a barra de parada S14 por BCNSMPTORRE05 desde BCN505SMP17.
02/07/2022 14:00:42	Telemando a barra de parada M1 por BCNSMPTORRE05 a 1 desde BCN505SMP17 satisfactorio.
02/07/2022 14:00:41	Enviando telemando a barra de parada M1 por BCNSMPTORRE05 desde BCN505SMP17.
02/07/2022 13:57:02	Telemando a barra de parada M1 por BCNSMPTORRE05 a 0 desde BCN505SMP17 satisfactorio.
02/07/2022 13:57:01	Enviando telemando a barra de parada M1 por BCNSMPTORRE05 desde BCN505SMP17.
02/07/2022 13:55:54	Cambio a Configuración WRL (TODO) + DEP 24R NO PREF por BCNSMPTORRE05 desde BCN505SMP17.
02/07/2022 13:55:48	Telemando a barra de parada M16 por BCNSMPTORRE05 a 1 desde BCN505SMP17 satisfactorio.
02/07/2022 13:55:48	Telemando a barra de parada N16 por BCNSMPTORRE05 a 1 desde BCN505SMP17 satisfactorio.

Image 12: Stop bar usage records requested from AENA

## 1.17. Organisational and management information

### 1.17.1. Information about the control services

The following ENAIRE procedures are relevant to this report:

The Barcelona-EI Prat Tower Operating Manual, Annex B, Section 5.4.9 (page B37), establishes the procedure for using non-preferential runway 07L/25R (at the time of the incident 06L/24R):

#### a. Runway already active due to configuration

In this case, the LCL is responsible for runway 07L/25R at all times.

The runway lighting must be on (when necessary for visibility), as must the stop bars. Furthermore, the supervisor or the local controller, having been delegated by the supervisor, must update the runway usage in line with the type of non-preferential operation (departure or arrival).

[...]

## LCL ARR will:

- Assess when take-off can take place as per the "Letter of Agreement between LECB and LEBL" (S41-08-CAC-016).
- If take-off is on 25R<sup>7</sup>, it must notify GMC N so that it can halt any aircraft due to taxi across the bypass, indicating when the take-off is expected to take place.
- Remind traffic of the altitude restriction and SID, as per the "Letter of Agreement between LECB and LEBL" (S41-08-CAC-016) and paragraph 5.29 "Departure Instruction Amendment Coordination Procedure".
- Confirm that the traffic will be ready to depart.
- Advise LCL DEP by hotline of the non-preferential take-off, its SID and the " slot" in the sequence of ARRs in which it is scheduled to depart.
- Coordinate the departure with the appropriate approach sector, as per the "Letter of Agreement between LECB and LEBL" (S41-08-CAC-016).
- <u>Switch on any stop bars that are switched off due to the configuration, including</u> <u>those of the bypass, if necessary.</u> To do this, the controller uses the "Nonpreferential take-off XXX (07L or 25R, whichever is applicable)" button in the "Exceptions" menu of the "Configurations" page.
- Switch off the stop bar at the holding point where the aircraft is located and give the aircraft clearance to align and take off.
- <u>Clear the take-off.</u>
- After the take-off, reset the lighting to its appropriate settings, including the stop bars.
- Notify the supervisor of the take-off so they can record it in the eDina.

### Lighting Control and Indicating System:

The stop bars are monitored and operated from the Lighting Control and Indicating System (SMP) control panel, which also has other functions. It is located approximately 1 metre to the right of the controller's position (see Image 13) and oriented almost horizontally, which means that it can only be seen properly if the controller is straight in front of it. It works as follows: the controller has to approach the screen, select the configuration wanted, and press twice on the screen to accept the change, also called "double-check". They then wait a few seconds to see if the system has acted accordingly (changing the depiction of the bar to red when it is activated).

Other airports have different methods, such as 'tablets' for lighting control or SMP functions integrated into the SMGCS display.

<sup>&</sup>lt;sup>7</sup> Runways sometimes get renamed due to time variations in the Earth's magnetic field, so although it is now called 24R, it is referred to as 25R in the manual.



Image 13: Position of the local arrivals controller (the SMP control panel is on the right).

- In the Barcelona-El Prat Tower Operating Manual, Annex E provides a checklist for the local arrivals controller, containing the procedures to be carried out before the take-off of non-preferential traffic. This checklist is comprised of 10 points to complete before the non preferential take off. Each point is comprised of a phrase with a mean of fourteen words, and five of them highlighted in red.
- The annexes to the October 2020 Document on Ground Movement Procedure at Josep Tarradellas Barcelona-El Prat Airport contain the ground movement plans with runway 25L for take-offs (in red), runway 25R for arrivals (in blue) and in exceptional cases for some non-preferential departures on 25R (in black):



Image 14: Ground movement procedure for arrivals and departures in WRL configuration

## 1.18. Additional information

ENAIRE produced a report on the incident, as a result of which internal recommendations were issued, including the following:

- Reinforce on-the-job training, particularly in relation to the responsibilities of each control position and the use of checklists.
- Reinforce the use of checklists in the continuous training for assessors.
- Revise the wording and format of the non-preferential take-off checklist to simplify it and make it easier to see items that may have been missed (also applicable to other checklists).

Following the revision of the checklists to make them more efficient, ENAIRE decided to modify the one for non-preferential runway take offs to shorten it and make it easier to follow. Even though it is not published yet, it was possible to examine it. It comprises five points before the take off, and four afterwards, containing each of them a phrase of no more than three words.

### 1.19. Special investigation techniques

None required.

## 2. ANALYSIS

According to Annex B of the Barcelona-El Prat Tower Operating Manual, the local arrivals controller (LCL ARR) is responsible for runway 24R when it is used for non-preferential landings and take-offs. If a non-preferential landing or take-off is requested, the controller must notify the north ground movement controller (GMC N) before they expect it to take place. Later, just before the take-off, they must switch on the bypass stop bar. We were able to confirm, through the AENA stop bar usage records, that the stop bar was not illuminated until aircraft DAL169 was already accelerating along the runway (at 14:07:44), some time after the take-off clearance for the non-preferential aircraft (which was issued at 14:06:44). No error was detected in the lighting system; therefore, the LCL ARR controller did not switch on the bar when he should have done so, probably due to an oversight.

The factors that may have contributed to this oversight will be examined below, together with an analysis of the actions of the north ground movement controller and those taken by ENAIRE after the incident.

## 2.1. Actions taken by the local arrivals controller

Several factors led to the controller having to manage a backlog of tasks simultaneously before the incident. One of these was the management of a non-preferential take-off. The procedure for a non-preferential runway take-off requires multiple steps to be followed and additional coordination by the local arrivals controller (LCL ARR) with the north ground movement (GMC N) and approach (APP) controllers.

In addition, two changes to the initial plan were made at short notice, as detailed below:

- The initial sequence had aircraft DAL169 taking off on runway 24R as the first traffic after the configuration change. The controller carried out the first steps of the non-preferential take-off checklist correctly, advising the GMC N controller at 13:55:21. However, due to the DAL169 aircraft taking slightly longer than expected, when it was finally ready, the controller judged the take-off slot to be insufficient. He therefore decided to look for a new slot, causing the first change of plan, due to the unfulfilled expectation that the aircraft would be ready on arrival at the holding point.
- The new plan was for DAL169 to take off after an ITA Airways aircraft had taken off and a medical transport aircraft (with callsign ADN16D) had crossed the runway. He also advised GMC N of this and turned off the S14 stop bar (at 14:01:37). However, the aircraft before the ITA aircraft left the runway through an exit that blocked the movement of aircraft ADN16D, which was then unable to get to the runway holding point in time.
- As a result, a second plan had to be made, with the LCL ARR controller clearing aircraft DAL169 for take-off before aircraft ADN16D crossed the runway. The controller stated that the slot for DAL169 to take off was tight, which may have placed him under pressure and played a role in the oversight.

In conclusion, the increase in simultaneous tasks resulting from the non-preferential takeoff, combined with two successive changes of plan, the last of which took place two minutes before the take-off was cleared, may explain why the controller had to concentrate on several different things in a brief period of time, and it was under these circumstances that the oversight occurred. That said, the workload was not excessive, and these types of changes in plan are not uncommon in the daily workload of a controller.

## 2.2. Non-preferential take-off checklist

Due to the multiple steps to be followed prior to a non-preferential take-off, there was a specific checklist for the procedure (shown in point 1.17.1).

The local arrivals controller started going through the checklist items correctly, following the initial plan. However, after the take-off of aircraft DAL169 was postponed, and then the runway crossing of ADN16D was delayed, the controller did not restart the checklist from the beginning (or skipped a few steps) because he failed to re-coordinate the take-off with the GMC N controller (second item on the checklist) and did not activate the stop bar (seventh item on the checklist) nor advise his colleagues.

After analysing the checklist, we have concluded that the text for each item is too long, and there are too many words highlighted in red, which makes it harder to follow than it needs to be, especially when the checklist takes a long time to complete or has to be restarted from the beginning. We feel that a more concise checklist would help controllers complete it more efficiently and make it less likely that they would skip items or neglect to restart it when necessary.

Following the incident, ENAIRE is undergoing a revision and update of the non-preferential runway take-off checklist to make it more concise and efficient.

## 2.3. Ergonomics of the SMP (Lighting Control and Indicating System)

As noted in point 1.17.1, the SMP is approximately one metre away from the controller's normal position, and its orientation prevents it from being seen unless the controller is in front of it. This means that to modify or check the status of the stop bars, the controller has to move from their principal position in front of the radar screens. Consequently, if the controller forgets to change the status of a stop bar, there would be no visible warning to alert them of the oversight whilst in their normal position.

Furthermore, because of the way the system works, once the process of changing the status of a bar is done, you have to double-click on a button on the SMP screen and wait a few seconds for a confirmation of the status change. It is entirely conceivable that a controller could double-click and return to their main position without waiting to check whether the change has been made correctly.

As more modern and efficient methods already exist in other airports, such as lighting control 'tablets' or the integration of SMP functions in the SMGCS screen, we feel that it would be advisable for Josep Tarradellas Barcelona-El Prat Airport to improve the ergonomics of its SMP. Therefore, a recommendation will be made in this regard.

#### 2.4. Actions taken by the north ground movement controller

The north ground movement controller (GMC N) provided aircraft RYR18NN with full instructions to taxi from its parking stand to the boundary that divides his area of responsibility with that of the central ground movement controller (GMC C). While these instructions comply with established procedures, we have concluded that, in this case, the controller could have acted more appropriately for the following reasons:

- a) The controller was aware that there was an impending take-off from a nonpreferential runway in the next few minutes. Therefore, it would have been wiser to taxi the aircraft to the S14 stop bar and, once near it, re-assess and decide whether to cross it via the bypass or hold.
- b) The controller relied on his local arrivals colleague to advise him to stop the flow of traffic through the bypass and also to switch on the stop bar in time, disregarding and overlooking the potential for his colleague to make an error.
- c) The controller failed to use the SMGCS radar efficiently by not checking the position of the aircraft that was about to take off, and it fell to the GMC C controller to alert him to what was happening.

In terms of the measures taken, as a result of being surprised by the undesirable circumstances, the controller chose to stop the aircraft when it had already passed the stop bar without informing the crew of the reasons for this decision. By the time the crew stopped the aircraft, it was sitting on the extension of the runway, which made the situation even worse. By contrast, had he instructed the crew to accelerate, or even if he hadn't communicated anything at all, the aircraft would have been clear of the runway extension when the DAL169 aircraft flew over it.

### 2.5. Assessment of the actions taken by ENAIRE

The air navigation service provider, ENAIRE, conducted an internal investigation into the event and, as a result, put forward three recommendations.

The actions taken by ENAIRE to prevent similar incidents in the future are considered satisfactory. In particular, the revision of the checklists. By simplifying them and making them quicker to follow, controllers will be less likely to follow them incorrectly in the future.

## 3. CONCLUSIONS

## 3.1. Findings

- The north ground movement controller instructed aircraft RYR18NN to taxi from the parking stand to taxiway M and hold short of DS, which was the boundary of his area of responsibility. This involved using the bypass that crosses the runway extension of 24R.
- The local arrivals controller coordinated with the Approach controller, sector Final 06, to create a slot between approaches for the take-off of aircraft DAL169 on runway 24R.
- Two changes of plan were made in regard to the slot in which the non-preferential aircraft DAL169 was to take off. Initially, it was to be the first to take off after the change of configuration. Later, it was to take off after three landings and a runway crossing by a medical transport aircraft. Eventually, it took off before the medical transport aircraft crossed.
- The local arrivals controller cleared aircraft DAL169 for take-off on runway 24R at 14:06:44 h without having coordinated with the north ground movement controller to stop aircraft taxiing across the bypass.
- The local arrivals controller turned on the S14 stop bar at 14:07:44 h, after aircraft RYR18NN had already passed it and was on the bypass section of the runway extension. At that point, aircraft DAL169 was accelerating along the runway to take off.
- The north ground movement controller instructed aircraft RYR18NN to hold when it had already passed the stop bar. By the time it had acknowledged and stopped, it was on the extension of runway 24R.
- The DAL169 aircraft flew over the position occupied by the RYR18NN aircraft with a vertical separation of about 700 ft.

## 3.2. Causes/contributing factors

The investigation has established that the incident was caused by a failure to adhere to procedures on the part of the local arrivals controller, who neglected to stop the flow of traffic across the S14 bypass taxiway.

The following factors are thought to have contributed to the incident:

- The design of the non-preferential runway take-off checklist.
- The ergonomics of the lighting control and indicating system

## 4. OPERATIONAL SAFETY RECOMMENDATIONS

Despite finding the design of the non-preferential take-off checklist to be inefficient, no safety recommendation is issued in this regard because ENAIRE is in the process of modifying it.

Based on the findings concerning the poor ergonomics of the Lighting Control and Indicating System, which means controllers cannot use or check it without moving from their principal working position, the following recommendation is issued:

REC 25/23: It is recommended that AENA, in collaboration with ENAIRE, improve the lighting control and monitoring system at Josep Tarradellas Barcelona-El Prat Airport so that it can be monitored from the controller's principal working position.

REC 26/23: It is recommended that ENAIRE, in collaboration with AENA, improve the lighting control and monitoring system at Josep Tarradellas Barcelona-El Prat Airport so that it can be monitored from the controller's main working position.