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Report IN-031/2020

Incident involving a BOEING B737-800 aircraft operated by RYANAIR, registration EI-EFJ, and lighting vehicle 'Balizamiento 3' operated by AENA, on runway 24R at Palma de Mallorca Airport, on 19 July 2020

GOBIERNO DE ESPAÑA

MINISTERIO DE TRANSPORTES, MOVILIDAD Y AGENDA URBANA

Edita: Centro de Publicaciones
Secretaría General Técnica
Ministerio de Transportes, Movilidad y Agenda Urbana ©

NIPO: 796-21-139-6

Diseño, maquetación e impresión: Centro de Publicaciones

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Notice

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

In accordance with the provisions in Article 5.4.1 of Annex 13 of the International Civil Aviation Convention; and with Articles 5.5 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, 4 and 21.2 of RD 389/1998, this investigation is exclusively of a technical nature, and its objective is the prevention of future aviation accidents and incidents by issuing, if necessary, safety recommendations to prevent their recurrence. The investigation is not intended to attribute any blame or liability, nor to prejudge any decisions that may be taken by the judicial authorities. Therefore, and according to the laws detailed above, the investigation was carried out using procedures not necessarily subject to the guarantees and rights by which evidence should be governed in a judicial process.

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

Contents

Abbreviations

° ' "	Sexagesimal degrees, minutes and seconds
AEMET	Spain's State Meteorological Agency
AENA	Spanish Airports and Air Navigation
AESA	Spain's National Aviation Safety Agency
APP	Approach
ARR	Arrival
ATPL(A)	Airline Transport Pilot License (aircraft)
ATC	Air traffic control
ATS	Air traffic service
A-SMGCS	Advanced-Surface Movement Guidance & Control System
BBPP	Stop bars
CAVOK	Visibility, cloud and present weather better than prescribed values or conditions (clouds and visibility OK)
CLD	Clearance delivery
CLR	Clearance referral
CPL(A)	Commercial Aircraft Pilot License
ATC	Air traffic controller
DEP	Departures
DME	Distance measuring equipment
EAPPRI	European Aviation Plan for the Prevention of Runway Incursions
ft	Feet
h	Time
GMC	Ground movement control
GS	Ground speed
IAA	Irish Aviation Authority
IFR	Instrumental fight rules
JOA	VOR/DME designation for Palma de Mallorca Airport
km	Kilometre
kt	Knot
LEPA	ICAO location indicator for Palma de Mallorca Airport
m	Metre
METAR	Aviation routine weather report (in aeronautical meteorological code)
MHz	Megahertz
NM	Nautical mile
ICAO	International Civil Aviation Organisation
OR	Object of responsibility
PCP	Airside driving permit
QAR	Quick access recorder
RCA	Spanish Air Traffic Regulation
RD	Royal Decree
SACTA	Automated air traffic control system
SERA	Standardised European rules of the air
SID	Standard instrument departure
SMP	Lighting control system console and display
SMR	Surface movement radar
SOP	Standard operating procedure
SUP	Supervisor
TWR	Control tower
U/S	Unserviceable
UTC	Coordinated universal time
VHF	Very high frequency
VOR	VHF omnidirectional radio range

Synopsis

	Aircraft	Lighting vehicle
Operator:	Ryanair	AENA
Aircraft:	Boeing B737-800 registration EI-EFJ	---
Persons on board:	6 +145, unharmed	1, unharmed
Type of operation:	Commercial air transport–Scheduled – Domestic – Passengers	Runway inspection
Phase of flight:	Take-off - take-off run	
Flight rules:	IFR	
Date and time of incident:	Sunday, 19 July 2020; 20:51[1] UTC	
Site of incident:	Runway 24R at Palma de Mallorca Airport	
Date of approval:	28 April 2021	

Summary of incident

At 20:51 on Sunday, 19 July 2020, a Boeing 737-800 aircraft operated by Ryanair, registration EI-EFJ, was cleared to take off from runway 24R at Palma de Mallorca Airport while an airport vehicle was positioned at the opposite threshold of the same runway.

The airport vehicle had been cleared to enter the runway to carry out maintenance work on the lighting. On hearing the control tower clear the EI-EFJ aircraft for take-off, the vehicle's driver notified his presence and vacated the runway. The tower immediately instructed the EI-EFJ aircraft to abort its take-off, and it stopped shortly after commencing the take-off run. The distance between the vehicle and the aircraft was at no time less than 1.6 NM. After the incident, the aircraft was cleared to take off again and completed its flight without further incident.

There were no personal or material damages of any kind.

The investigation has determined the runway incursion was caused by the local controller's (TWR) failure to adhere to the procedures set out in the unit's *Operating Manua*l and the provisions of the Spanish Air Traffic Regulation in regard to the use of phraseology, active listening and surveillance of the airport manoeuvring area.

Two safety recommendations are issued, one to the air navigation service provider (ENAIRE) and one to the Spanish airport service provider (AENA).

[1] All times used in this report are UTC. The local time can be calculated by adding two hours.

1. FACTUAL INFORMATION

1.1. History of the flight

On 19 July 2020, the Boeing B737-800 aircraft with registration EI-EFJ, operated by Ryanair, was making a scheduled flight with callsign[2] RYR81SN from Palma de Mallorca Airport to Madrid-Barajas Adolfo Suárez Airport. For its part, the airport vehicle with callsign 'Balizamiento 3', had been cleared by the ground movement controller (GMC) at the Palma de Mallorca control tower to taxi from gate F on the north taxiway.

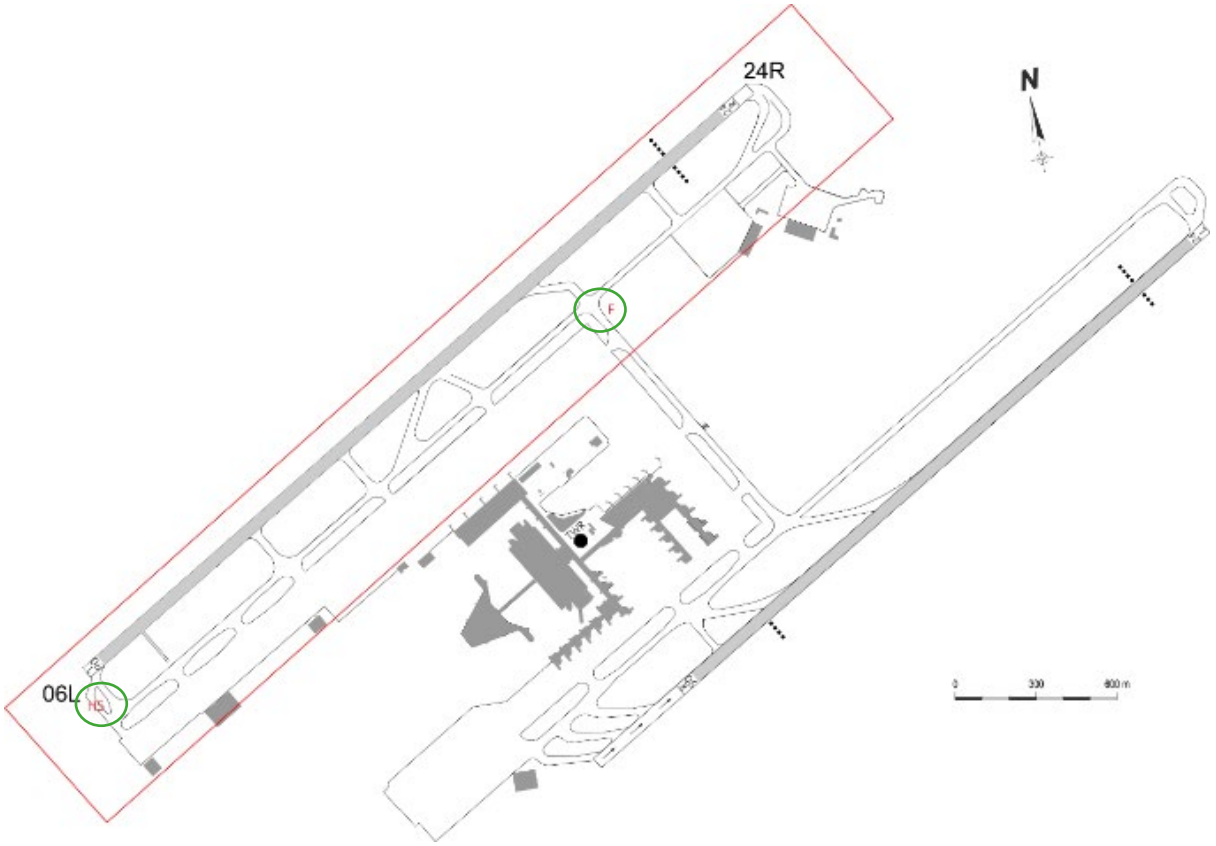


Fig. 1. Layout of Palma de Mallorca Airport.
The manoeuvring area where the incident took place is highlighted in red
and holding point H5 and gate F are highlighted in green

The ground movement controller (GMC) at the Palma de Mallorca control tower instructed the RYR81SN aircraft to taxi via gate F to the holding point on runway 24R. It then requested the aircraft make contact on the Palma de Mallorca local control frequency (TWR) when ready.

This was followed by a staff shift change, which meant the Palma de Mallorca local controller (TWR) also took over the functions of the ground movement controller (GMC).

[2] Hereinafter, the aircraft will be referred to by its callsign.

The driver of the Balizamiento 3 vehicle called the local controller (TWR) to report that he was at holding point H5 (the holding point for the runway located to the north - runway 06L/24R), however, he mistakenly requested *permission to occupy the south* runway (runway 06R/24L), and the local controller replied, *approved*.

The driver of the Balizamiento 3 vehicle then requested the local controller (TWR) to switch off the stop bars at holding point H5 so that he could enter the runway. The controller responded, instructing the driver to go over the lit stop bars, to which the driver replied, *with permission to pass lit stop bars, north runway occupied by Balizamiento 3, listening on frequency 118.305* (control tower's local frequency). The local controller (TWR) didn't reply.

The RYR81SN aircraft established radio contact on the local frequency (TWR) and reported that they were completely ready for departure. The local controller (TWR) cleared the aircraft for take-off from runway 24R, informing the crew that there was an aircraft eight miles away.

Both the RYR81SN aircraft and the lighting maintenance vehicle, Balizamiento 3, were on the local frequency (TWR) of the Palma de Mallorca control tower.

The closest the aircraft and vehicle came to one another during the incident was 1.6 NM at 20:51:49.

1.2. Injuries to persons

1.2.1. Aircraft RYR81SN (EI- EFJ)

Injuries	Crew	Passengers	Total	Others
Fatal				
Serious				
Minor				
None	6	145	151	
TOTAL	6	145	151	

1.2.2. Lighting vehicle

Injuries	Crew	Passengers	Total	Others
Fatal				
Serious				
Minor				
None	1		1	
TOTAL	1		1	

1.3. Damage to the aircraft

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

1.4. Other damage

There was no other damage.

1.5. Personnel information

1.5.1. Information about the crew of aircraft RYR81SN (EI- EFJ)

The 43-year-old Spanish captain had an airline transport pilot license for aircraft (ATPL(A)) issued by the Irish Aviation Authority (IAA), with B737 and instrument type ratings valid until 31 December 2020. He also had a class 1 medical certificate, valid until 18 January 2021. He had 12161 h of flight experience, of which 10951 h were in the type of aircraft involved in the incident.

The 28-year-old Spanish first officer had a CPL(A) license issued by the IAA with B737 and instrument type ratings valid until 31 December 2020. He also had a class 1 medical certificate, valid until 11 September 2020. He had 2080 h of flight experience, of which 1846 h were in the type of aircraft involved in the incident.

1.5.2. Information about the personnel in the Balizamiento 3 vehicle

The Spanish driver of the vehicle had an airside driving permit (PCP) valid from 16 June 2015 until 11 November 2023. He had been employed by the company for eight years.

1.5.3. Information about the control tower personnel

At the time of the incident, the air traffic control service was being provided by a local controller (TWR), a ground movement controller (GMC) and a tower supervisor (SUP).

The local controller (TWR) was a 32-year-old Spanish national who had an air traffic controller license issued by AESA (Spain's National Aviation Safety Agency) on 13 May 2013. He also had a class 3 medical certificate valid and in force until 3 March 2021. He had worked at the unit for eleven months. He had unit endorsements with the aerodrome control rating valid and in force until 16 August 2021.

The ground movement controller (GMC) was a 25-year-old Spanish national who had an air traffic controller license issued by AESA on 18 September 2018. He also had a class 3 medical certificate valid and in force until 18 December 2021. He had worked at the unit for ten months. He had unit endorsements with the aerodrome control rating valid and in force until 11 September 2020.

The supervisor (SUP) was a 48-year-old Spanish national who had an air traffic controller license issued by AESA on 10 December 2003. He also had a class 3 medical certificate valid and in force until 30 June 2021. He had worked at the unit for sixteen years. He had unit endorsements with the aerodrome control rating valid and in force until 9 March 2021.

1.6. Aircraft information

The aircraft with registration EI-EFJ was a BOEING B737-800 with serial number 37536. It had an airworthiness certificate issued on 21 May 2020 by the IAA, which was valid and in force until 15 June 2021. It was operated by the company Ryanair, whose air operator certificate (number IE 07/94) had been issued by the IAA on 29 June 2020. The aircraft had accrued 35536 flight hours and 19234 cycles.

1.7. Meteorological information

According to the information provided by the State Meteorological Agency (AEMET), the remote sensing images and the aerodrome reports indicate that at the time and place of the incident, there was no significant storm activity, convective cloudiness or reduced visibility and the low-level forecast in the area was for light southeasterly wind.

The METAR for Palma de Mallorca Airport around the time of the incident were as follows:

METAR LEPA 192030Z 22003KT CAVOK 26/21 Q1016 NOSIG=

METAR LEPA 192100Z 15002KT CAVOK 26/20 Q1016 NOSIG=

1.8. Aids to navigation

All the navigation systems were functioning correctly.

1.9. Communications

We have been provided with the records of the verbal communications between ATC, the aircraft and the vehicle. We have also been able to obtain the radar data from the Palestra system[3]. In order to better understand the succession of events, data from both these sources has been included in this section: communications and radar data.

It should be noted that runway 06R/24L (located to the south) was closed for maintenance work, and all take-off and landing operations were being carried out on a single runway, 06L/24R (located to the north).

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

At 20:33:10, the crew of the RYR81SN aircraft called ground movement control (GMC), which issued it with a standard instrumental departure for its flight to Madrid-Barajas Adolfo Suárez Airport. We have omitted the start-up and push-back procedures of the RYR81SN aircraft due to their lack of relevance to the investigation.

At the same time, the driver of the Balizamiento 3 lighting maintenance vehicle contacted the ground movement controller (GMC) at the Palma de Mallorca control tower and requested him not to turn off the visual aids on the south runway so that he could inspect them. The ground movement controller responded by accepting his request.

At 20:36:30, the driver of another vehicle (Balizamiento 5), which was not involved in this incident, called the ground movement controller (GMC) to inform him that he was at gate Q[4]. The ground movement controller (GMC) responded, and the driver of the vehicle immediately requested permission to drive on the south taxiway. The ground movement controller (GMC) cleared him to do so, and the driver read-back the clearance correctly.

At 20:38:03, the driver of Balizamiento 3 contacted the Palma de Mallorca control tower on the ground movement frequency to report being at gate F and request clearance to drive on the north taxiway. The controller cleared the manoeuvre, and the driver read-back the clearance.

At 20:47:08, the crew of the RYR81SN aircraft notified control that it was ready to taxi. The ground movement controller (GMC) instructed them to taxi, via F, to the holding point for runway 24R. The crew of the RYR81SN aircraft read-back the instruction correctly.

At 20:48:53, the ground movement controller (GMC) instructed the RYR81SN aircraft to contact the Palma de Mallorca control tower frequency (TWR) when it was ready. The crew read-back the instruction correctly. At the same time, the controllers began to make preparations for integrating the ground movement position (GMC) with the local position (TWR). (the integration of the frequencies and the hand-over took place at 20:50:12).

At 20:50:00, the driver of the Balizamiento 3 vehicle, having established initial contact with the local frequency (TWR) of the Palma de Mallorca control tower, indicated the following: *Good evening, at H5. Permission to occupy the south runway when possible.* The Palma de Mallorca control tower local controller (TWR) replied: *Approved*.

At 20:50:10, the driver of the Balizamiento 3 vehicle asked the Palma de Mallorca control tower local controller (TWR) the following: *Can you switch off the stop bars at H5, please?*. The local controller (TWR) in the Palma de Mallorca control tower replied: *Balizamiento 3 go over the stop bars*, to which the driver of the Balizamiento 3 vehicle responded, *Copied, with permission to pass lit stop bars at H5, north runway occupied*

[4] Gate Q is located on the south taxiway, which runs parallel to runway 06R/24L and provides access to the 06R threshold

by Balizamiento 3, listening on frequency 118.3…. 118.305, sorry. There was no reply from the local controller (TWR).

At 20:50:12, the ground movement controller (GMC) ended his shift and the frequencies were integrated so that, from that moment on, the local controller (TWR) was also responsible for the surface movements in the manoeuvring area of Palma de Mallorca Airport.

At 20:50:43, the RYR81SN aircraft established initial contact on the local controller frequency (TWR) of the Palma de Mallorca control tower and indicated that it was ready to depart. The Palma de Mallorca control tower local controller (TWR) replied: *RYR81SN good evening, wind 210º, 5 knots, runway 24R, cleared for take-off, traffic on final 8 miles out.* The crew of the aircraft read-back the instruction correctly. At this point, the radar shows the RYR81SN aircraft taxiing to the holding point on runway 24R and an uncorrelated label on the threshold of runway 06L, which corresponds to the Balizamiento 3 vehicle.

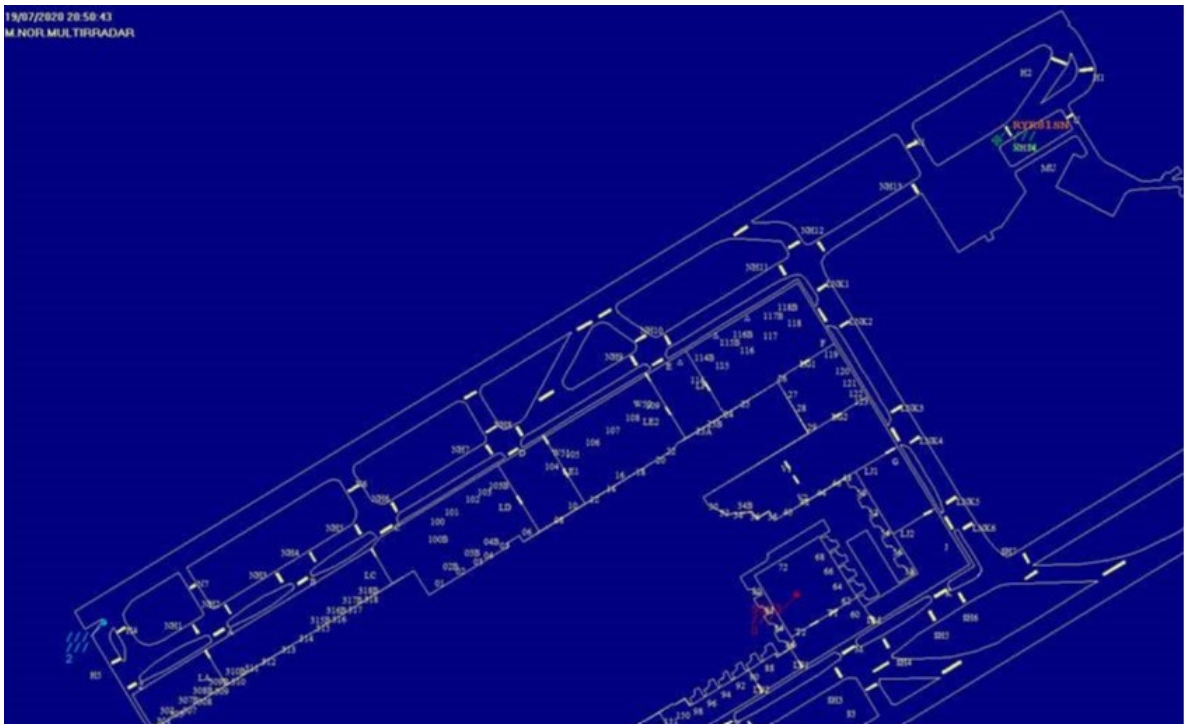


Fig. 2: Palestra image corresponding to 20:50:43

At 20:51:18, aircraft AEA6103, which was not involved in the incident, established initial contact with the Palma de Mallorca control tower local controller (TWR). The local controller (TWR) responded by identifying the aforementioned aircraft on final for runway 24R and instructing the crew to continue the approach. He also notified them that there was departing traffic (aircraft RYR81SN) and that he would inform them when the runway was clear. The crew of aircraft AEA6103 acknowledged the communication.

At 20:51:32, the driver of the Balizamiento 3 vehicle contacted the Palma de Mallorca control tower and reported the following: *tower from Balizamiento 3, I'm on the north runway, you cleared me to enter, exiting immediately*. The radar trace at that point in time shows aircraft RYR81SN aligned on runway 24R and travelling at a ground speed (GS) of 10 kt, while an uncorrelated label corresponding to the Balizamiento 3 vehicle (a duplication of the radar echo is visible) can also be seen at the opposite end of the runway, abeam on taxiway N7.

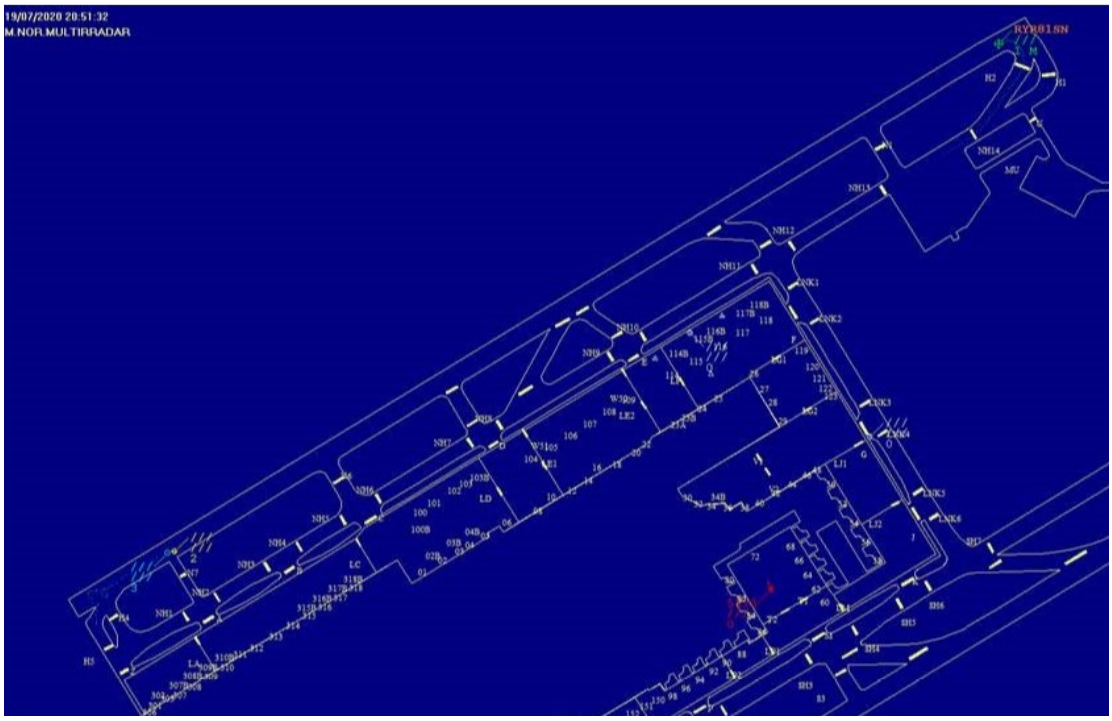


Fig. 3: Palestra image corresponding to 20:51:32

At 20:51:37, the local controller (TWR) replied: *Balizamiento 3, you told me you were on the south runway; vacate the runway immediately. Break, break. (20:51:39) RYR81SN hold position; I say again hold position.* The crew of the aircraft read-back *stopping RYR81SN.* At this point, the radar shows the RYR81SN aircraft aligned on runway 24R and travelling at a ground speed (GS) of 10 kt, while an uncorrelated label corresponding to the Balizamiento 3 vehicle (a duplication of the radar echo is visible) can be seen at the opposite end of the runway, abeam on taxiway N7.

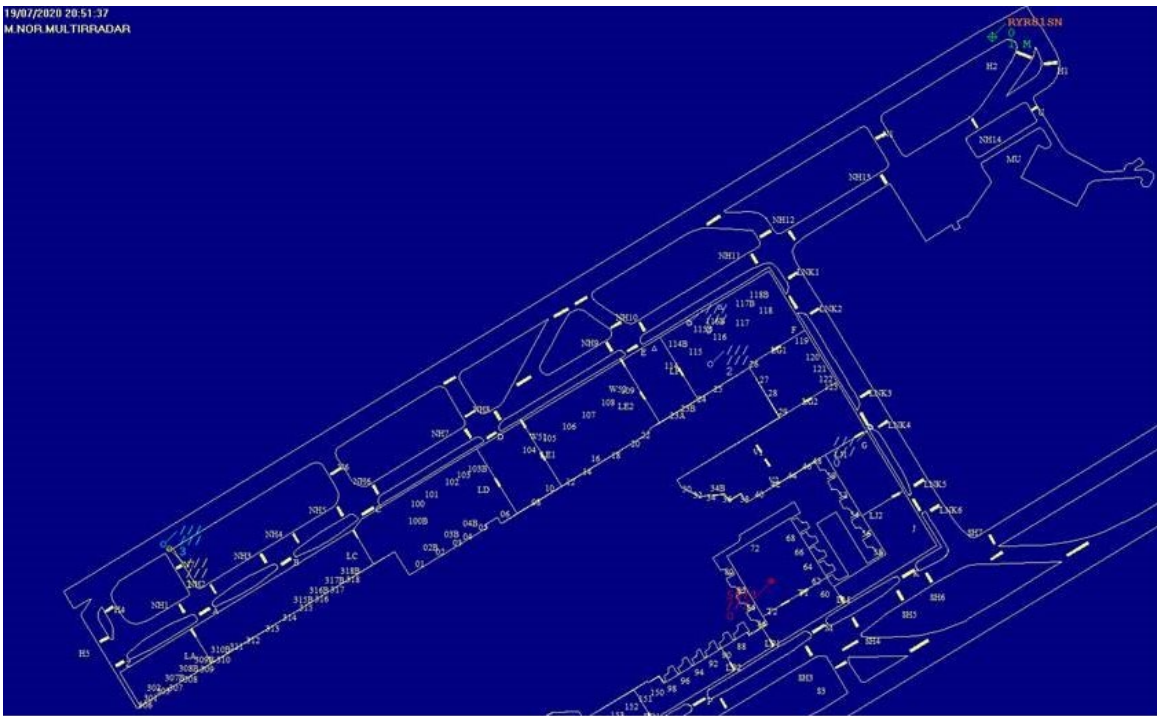


Fig. 4: Palestra image corresponding to 20:51:37

At 20:51:49, the radar shows the RYR81SN aircraft beginning its take-off roll on 24R at a ground speed (GS) of 30 kt, while an uncorrelated label corresponding to the Balizamiento 3 vehicle can be seen at the opposite end of the runway, close to exiting via H4. This was the point at which the distance between the aircraft and the vehicle was the shortest: 1.6 NM.

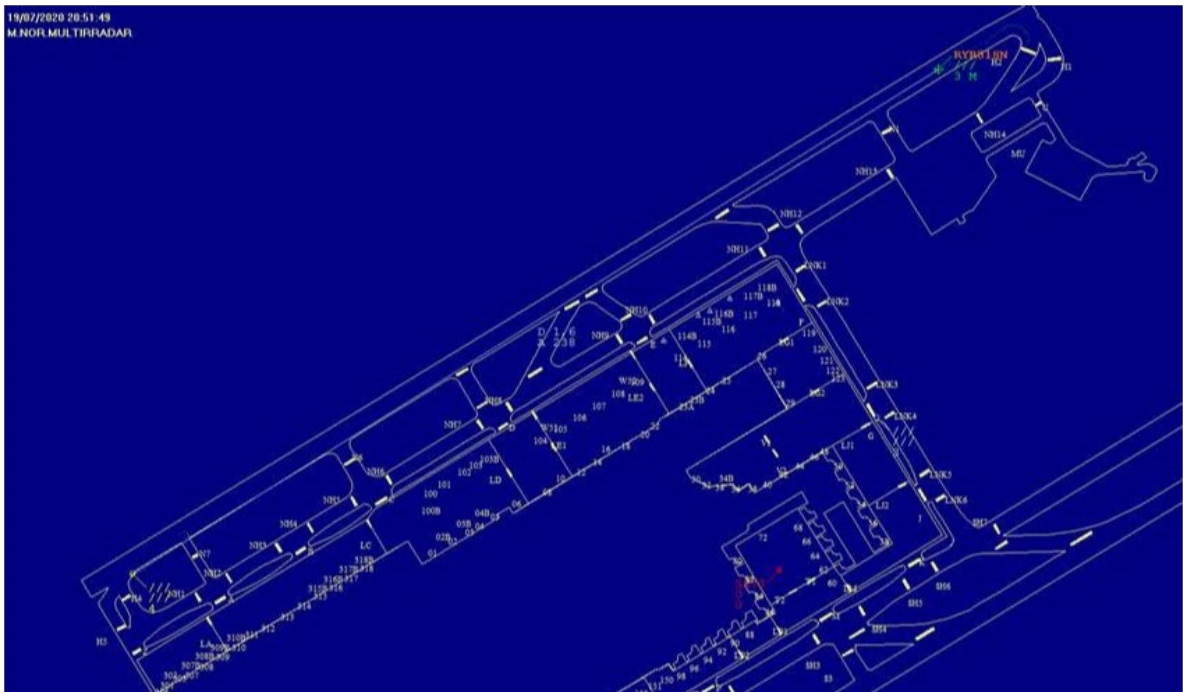


Fig. 5: Palestra image corresponding to 20:51:49

At 20:51:54, the Balizamiento 3 vehicle informed the local controller (TWR) that the north runway was vacated and he was just short of taxiway H4. The local controller (TWR) acknowledged the communication.

At 20:51:58, the local controller (TWR) asked aircraft RYR81SN if it could take off from intersection N1. The crew replied that they would prefer to return to holding point H1. The controller acknowledged and instructed them to leave the runway via taxiway N1 and notify him when it was clear. The crew acknowledged the instruction correctly.

At 20:52:57, the local controller (TWR) cleared aircraft AEA6103 to land on runway 24R, and the crew read-back the communication.

At 20:53:09, the crew of the RYR81SN aircraft reported that the runway was vacated and requested to remain at N1 for a few minutes in order to carry out some checks. The controller approved their request.

At 20:55:25, the crew of aircraft RYR81SN requested to return to holding point H1, and the local controller (TWR) cleared them to do so. The local controller (TWR) was then hand-over by the night-shift controller.

At 21:15:00, aircraft RYR81SN took off from runway 24R without incident.

The following image shows the positions of the Balizamiento 3 vehicle (in red) and aircraft RYR81SN (in blue) at 20:50:43, 20:51:32, 20:51:37 and 20:51:49.

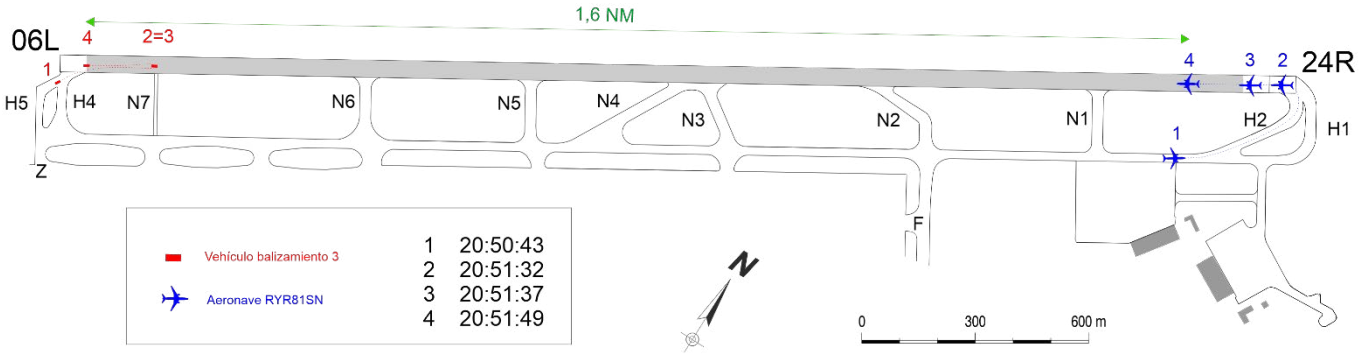


Fig. 6: Combined portrayal of the 4 previous images

1.10. Aerodrome information

Palma de Mallorca Airport (LEPA) is located 8 km to the east of the city. It has an elevation of 27 ft (8 m) and two parallel asphalt runways designated as 06L - 24R and 06R - 24L. The runways are 3270 m long by 45 m wide and 3000 m long by 45 m wide, respectively.

It is a controlled airport using the following frequencies:

- APP 118.955 MHz
- TWR (ARR) 118.305 MHz
- TWR (DEP) 118.455 MHz
- GMC (North) 121.905 MHz
- GMC (South) 121.705 MHz
- CLR 123.880 MHz

The control tower at Palma de Mallorca Airport has a level 1 advanced surface movement guidance and control system (A-SMGCS), the operation of which is included in the unit's *Operating Manual* (Annex B page B12).

The controllers can use this system to identify and observe the position of vehicles and aircraft[5] equipped with a Mode S transponder and see the position of other radar echoes coming from those without that type of transponder to provide the aerodrome control service safely and move the airport traffic in an orderly manner.

1.11. Flight recorders

We were unable to analyse the flight data recorders because they no longer contained the data recorded during the incident flight when the investigation began.

However, we were able to access the flight parameter records recorded in the QAR and the audio recordings of the communications with the control centre. We were also given access to the radar traces. All this information was analysed, and any relevant content was included in the previous section.

1.12. Aircraft wreckage and impact information

Not applicable.

1.13.Medical and pathological information

Not applicable.

1.14. Fire

There was no fire.

[5] Vehicles and aircraft taxiing in the different areas of the airport's manoeuvring area

1.15. Survival aspects

Not applicable.

1.16. Tests and research

1.16.1. Statement from the captain of aircraft RYR81SN (EI- EFJ)

The following information has been extracted from the report written by the captain of the RYR81SN aircraft after the incident:

They were cleared to line up and take off from runway 24R from the H2 intersection. After performing all the checks, they initiated the take-off roll. When they had reached about 35 or 40 kt, the tower advised them that a vehicle was on the runway, and they aborted the take-off. Subsequently, the vehicle left the runway, and the controller asked them if they could take off from N1, which was where they had stopped.

The crew informed control that they needed to leave the runway and perform some checks before they could take off again. The crew contacted operations, maintenance and their company's service pilot and were authorised to continue with their planned flight operation. They were carrying more fuel than they needed for the flight to Madrid. Once all the pre-take-off checks had been completed again, they took off without further incident.

1.16.2. Statement from the first officer of aircraft RYR81SN (EI- EFJ)

The following information has been extracted from the report written by the first officer of the RYR81SN aircraft after the incident:

As they were approaching holding point H2 on runway 24R, he heard communications between an airport vehicle and the tower, requesting access to the south runway (he refers to 06R/24L). The control tower authorises the vehicle to proceed. Once they were ready for departure, they notified the tower, and the controller cleared them to enter and take off from runway 24R. As they were aligning, there were conversations between the control tower and the vehicle, and just as they started the take-off roll, the vehicle clarified that it was on the north runway (he refers to 06L/24R), not the south. The control tower immediately advised them to abort the take-off. They executed the abort take-off manoeuvre when they were rolling at a speed of approximately 35 kt, with no problems. They vacated the runway normally and went through all the checks. They informed operations, maintenance and their company's service pilot and subsequently took off without incident.

1.16.3. Statement from the driver of the Balizamiento 3 lighting vehicle

The following information has been extracted from the report written by the driver of the Balizamiento 3 lighting vehicle:

The driver of the Balizamiento 3 vehicle requested clearance from the ground movement controller to travel on the north taxiway from gate F in order to perform an inspection of the north runway (he refers to 06L/24R). He also recalls that another colleague, whose vehicle callsign was Balizamiento 5, was inspecting the south runway (he refers to 06R/24L). Once he approached holding point H5 (which provides access to threshold 06L), he requested clearance from the local controller (TWR) to occupy the north runway. However, he said "south runway" by mistake. He wasn't aware of his mistake at any point during the incident; if he had realised, he would have informed the controller immediately.

The driver of the Balizamiento 3 vehicle added that the fact he wasn't aware of his error doesn't mean he denies it, nor does he doubt that he made a mistake when transmitting his message or that the mistake may have confused the controller in the Palma de Mallorca control tower. He added that the tower would have been able to identify and follow his position via the transponder in his vehicle.

Regarding his communications with the controller in the Palma de Mallorca control tower, during which he reported that he was at the H5 holding point and requested permission to occupy the runway, he claims the controller either replied *proceed* or *go ahead*, but he couldn't say for certain which it was. Subsequently, he contacted the controller again to request he switch off the H5 stop bars, and the controller authorised him to pass them while they were lit. The driver of the Balizamiento 3 vehicle acknowledged the clearance: *copied, with permission to pass lit stop bars at H5, north runway occupied by Balizamiento 3, listening on frequency 118.305*, and proceeded to enter the runway via taxiway H5, heading towards runway threshold 06L.

A few seconds after entering the runway, he noticed the lights of an aircraft that was on hold at one of the 24R head-end exits. At the same time, he was waiting for a message to confirm his north runway occupancy message but could only hear distortion on the frequency. With no clear response from the control tower, he tried to contact it again but was unable to do so immediately as the frequency was busy. Listening to the conversation that was taking place, he realised that it was a communication between a traffic and the controller, in which the latter cleared the aircraft to take off from runway 24R.

Everything happened in a matter of seconds. Once the frequency was free, the driver of the Balizamiento 3 vehicle reminded the controller that his vehicle was on the north runway, as he had previously authorised (passing the H5 hold point stop bars). He then immediately exited the runway via H4 and notified control when he was vacated.

The controller responded that he had cleared him to occupy the south runway, and then he heard him instructing the traffic to stop, among other instructions. After the driver of the vehicle confirmed that he had vacated the runway, he reported that he was waiting just short of the H4 taxiway, intending to continue the runway inspection if possible or access the north taxiway to carry out an inspection there.

1.16.4. Statement from the Palma de Mallorca control tower local controller (TWR)

*Ten minutes before the end of the afternoon shift, a lighting car asked for permission to enter the runway to carry out an inspection. He was referring to the north runway, but I understood the south and cleared him to enter, passing the stop bars (to switch off the bars, you have to get up, go to the screen, and wait for it to work because despite being a touchscreen it often doesn't detect your finger and wastes a lot of time, which, given that there was only one runway in use, was something I didn't have a lot of). The south runway was closed for maintenance work, and the Balizamiento 5 lighting car had previously made a couple of requests, if I remember rightly, to enter the south runway and carry out its work. I don't remember if Lighting specified, on this occasion, which runway it wanted to inspect. I was focusing on getting one aircraft to take-off in its slot (*referring to the RYR81SN aircraft) *before another one, on final approach, arrived (*referring to the AEA6103 aircraft). *I cleared RYR81SN to take off, under the impression at all times that Lighting was on the south runway. I couldn't see the vehicle because it was night-time, nor was I looking at the surface radar screen because I was looking out of the window concentrating on the imminent departure and arrival. As soon as I cleared RYR81SN for take-off, Lighting advised me that he was on the runway and in the process of vacating it.*

I cancelled RYR81SN's take-off clearance and asked if he could take off from the N1 intersection so I wouldn't have to take him off the runway and he could keep his slot, but he told me he would prefer to clear the runway. When both Lighting and RYR81SN notified that they had cleared the runway, I cleared the traffic on final to land and then handed over because my shift had ended.

1.16.5. Statement from the ground movement controller (GMC) at Palma de Mallorca control tower

The following information has been extracted from the report written by the ground movement controller (GMC) after the incident:

The only communication he had with the lighting vehicle was at 20:38 when it requested entry to the north taxiway. He didn't transfer the vehicle across because at 20:50, they unified the positions[6] in the control position (PICT3), and he was relieved, ending his afternoon shift. With regard to coordinating with the local controller, he said they followed the usual procedure for unifying positions. After being relieved at the end of his shift, he left.

[6] Unifying positions means that the local controller took charge of the local frequency as well as any movements the ground controller was managing at that time.

1.16.6. Statement from the Palma de Mallorca control tower supervisor (SUP)

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

He was on the afternoon shift. At 20:50, just as he was handing over to the incoming night-shift supervisor, he turned to the local controller (TWR) and the incoming supervisor to warn them that a lighting vehicle was on the north runway (referring to 06L/24R) instead of the south runway (referring to runway 06R/ 24L). However, as it was the point of handover, he wasn't aware at the time that what had happened was a runway incursion. Therefore, he didn't notify the incident in the Edina (the electronic ATC News Diary). He later heard what had happened.

1.16.7. Information about the controllers' rest and activity periods

For the local controller (TWR) of the Palma de Mallorca control tower, it was his second consecutive day of activity, following one day on standby and 3 days off. On the day of the incident, his shift began at 13:58:25 and involved covering different positions in the Palma de Mallorca control tower. He took over as the local controller (TWR) at 18:58:51 and remained in that post during the hours leading up to the incident. At 20:50:12, the local position was unified with the ground movement position (GMC), and he managed both functions and frequencies until 20:56:03 when he was relieved, and his shift ended.

For the Palma de Mallorca control tower ground movement controller (GMC), it was his second day of activity after one day on standby and four days off. On the day of the incident, his shift began at 13:30:13 and involved covering different positions in the Palma de Mallorca control tower. He took over as ground movement controller (GMC) at 19:58:09 and remained in that post until 20:50:11 when he was relieved, and they unified the GMC position with the local controller (TWR) position.

For the Supervisor (SUP) of the Palma de Mallorca control tower, it was his second consecutive day of activity, following one day on standby and six days off. With regard to his shift on the day of the incident, he had been performing the duties of the supervisor all afternoon.

1.17. Organisational and management information

- The *LEPA Operating Manual. Annex B: Specific unit procedures*, establishes in point 5.4.1.1 (page B51) a series of recommendations that controllers should follow to prevent runway incursions (two of which have been outlined in yellow):

A continuación, se proporcionan recomendaciones para el CTA que permiten mejorar la seguridad de las operaciones en pista en lo relacionado con las citadas incursiones:

a) Recomendaciones relacionadas con las comunicaciones:

- Todas las comunicaciones asociadas a la operación de cada pista (vehículos, aeronaves que cruzan, etc.), deberían realizarse en la misma frecuencia utilizada para el despegue y aterrizaje de las aeronaves y manteniendo contacto radio en dicha frecuencia.
- Se incluirá el designador de pista en toda comunicación relacionada con dicha pista, incluyendo las pistas que no estén en uso.
- Sólo se utilizarán distintivos de llamada de aeronaves abreviados a iniciativa del CTA, tras haberse establecido comunicación satisfactoria y si no es probable que pueda haber confusiones con otros distintivos.
- Utilizar mensajes cortos y claros empleando la fraseología normalizada y el distintivo de llamada completo de la aeronave, salvo lo dispuesto en RCA 10.5.2.1.6.2.2.
- Utilizar el idioma inglés cuando sea necesario para mejorar la conciencia situacional de los involucrados en las operaciones en pista.
- Comprobar la correcta colación (SERA 8015 e)) de las autorizaciones emitidas, especialmente cuando se trate de autorizaciones condicionales.
- Se utilizará fraseología standard para el movimiento de vehículos que no sean tractores de remolque en el área de maniobras, con la excepción de la instrucción "RUEDE"/"TAXI", que será sustituida por "PROCEDA" o "SIGA" /"PROCEED" en dichas comunicaciones. (Doc 4444 12.2.6).
- Emitir la autorización ATC de ruta antes de que la aeronave inicie el rodaje, y en caso de tener que revisarla, hacerlo preferentemente cuando la aeronave esté parada.
- Emitir instrucciones de rodaje incluyendo un límite de autorización. Si se considera oportuno, se proporcionarán instrucciones de rodaje de forma progresiva para reducir la carga de trabajo del piloto y la probabilidad de confusión por su parte.
- Utilizar en lo posible rutas estándar de rodaje, para minimizar posibles confusiones en la pista o en su entorno.
- Cuando una aeronave se encuentra en el punto de espera de una pista, antes de revisar su autorización, ATC usará la frase: "MANTENGA POSICIÓN" / "HOLD POSITION" para reducir la probabilidad de malentendido por parte del piloto.
- No instruir a cruzar barras de parada iluminadas, excepto cuando es necesario adoptar medidas de contingencia (ver apartado "Utilización de barras de parada" de este anexo).

- The *LEPA Operating Manual. Annex B: Specific unit procedures*, establishes in point 5.3 on Flight Progress Strips and their usage:

Utilización de los colores en las fichas de obstáculo

- FICHAS ROJAS

El color rojo se utilizará únicamente para resaltar toda la información relacionada con la OCUPACIÓN de la PISTA (ej.: Revisión Pista, Señalero, Balizamiento en Pista, Desbrozadora en Pista...) o Pista fuera de servicio.

- FICHAS AMARILLAS

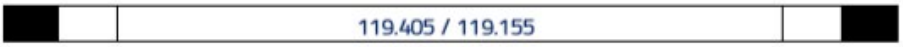
El color amarillo se utilizará para cualquier situación que afecte a la operativa normal (ej.: JOA U/S, SID contingencia...).

- FICHAS AZULES

EL color azul se utilizará para toda aquella información que sea relevante en el área de maniobras (Ej.: Balizamiento Rodadura Norte, Coche Halcón Rodadura Sur, Desbrozadora Link...).

- FICHAS BLANCAS

El color blanco se utilizará como fijo de bahía (frecuencias de transferencia, Push-Back...).



- The *LEPA Operating Manual. Annex E: Checklist*, establishes on page E3 *ATC relief checklist*:

ENAIRE

Código del MO LEPA: S41-06-MAN-062-10.0

CHECKLIST RELEVO CTA

METEO
- ✓ FENÓMENOS METEOROLÓGICOS: VIENTO, RVR, IMC/VMC, CBs, ACCIÓN DE FRENADO...
- ✓ LVP (PREVISIÓN-FASES).

INCIDENCIAS
- ✓ EN ÁREA DE MANIOBRAS Y ENTORNO: CIERRE DE RWY/TWY
- ✓ EN RADIOAYUDAS, AYUDAS VISUALES/NO VISUALES, METEO Y MEDIOS TÉCNICOS
- ✓ DESVÍOS, REGULACIONES Y PROCEDIMIENTOS NO USUALES EN APLICACIÓN

LCL
- ✓ CONDICIONES DEL ÁREA DE MANIOBRAS
- ✓ AERONAVES, VEHÍCULOS Y OBSTÁCULOS RELEVANTES
- ✓ ACTUACIONES SOBRE EL SMP

GMC
- ✓ CONDICIONES DEL ÁREA DE MOVIMIENTO
- ✓ AERONAVES, VEHÍCULOS Y OBSTÁCULOS RELEVANTES
- ✓ ACTUACIONES SOBRE EL SMP

CLD
- ✓ TRÁFICOS AUTORIZADOS Y REGULADOS
- ✓ RESTRICCIONES A LA PUESTA EN MARCHA
- ✓ RESTRICCIONES TÉCNICAS PARA A-CDM
- ✓ INTERCAMBIO DE INFORMACIÓN CON NMOC
- ✓ RESOLUCION DE INCIDENCIAS

TRÁFICO / RWY
- ✓ PISTAS EN USO
- ✓ PLANIFICACIÓN Y BAHÍA (VFVE)
- ✓ COORDINACIONES EN VIGOR

GENIUS
- ✓ ACEPTACIÓN DE TRÁFICO: CAMBIO DE TARJETAS GENIUS
- ✓ SALIENTE VERIFICA QUE LA TARJETA DEL ENTRANTE SE REGISTRA CORRECTAMENTE

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Formato empleado: 524-13-PL-007-6.0

- The *LEPA Operating Manual. Annex E: Checklist*, establishes on page E7 *New control position checklist*: for the closure of the ground movement control position/handover of clearances and unifying the frequencies in the local position.

Código del MO LEPA: S41-06-MAN-062-10.0

CHECKLIST NUEVA POSICIÓN DE CONTROL

APERTURA

ACCIONES PREVIAS

- ✓ ACTIVAR Y CONFIGURAR NUEVA POSICION DE TRABAJO (PICT, SCV, IMPRESORA)
- ✓ DISPONER DE LAS FICHAS QUE AFECTEN A LA NUEVA POSICIÓN
- ✓ CTA DE POSICIÓN AGRUPADA TRANSMITE A CTA NUEVA POSICIÓN LA INFORMACIÓN OPERACIONAL RELEVANTE PARA EL SERVICIO

ACTUACIONES DE APERTURA

- ✓ CTA ENTRANTE, UNA VEZ SELECCIONADA LA FRECUENCIA ASIGNADA, NOTIFICA A CTA DE POSICIÓN AGRUPADA LISTO PARA INICIAR OPERACIÓN.
- ✓ CTA DE POSICIÓN AGRUPADA NOTIFICA A CTA ENTRANTE LISTO PARA DESDOBLAR
- ✓ COORDINAR EL PRIMER TRÁFICO A TRANSFERIR A LA NUEVA POSICIÓN
- ✓ CTA DE POSICIÓN AGRUPADA INICIA TRANSFERENCIA EN FRECUENCIA LOS TRÁFICOS

SUPERVISOR O CTA DESIGNADO (SEGÚN PROCEDA)

- ✓ IMPLANTAR EL CAMBIO DE CONFIGURACIÓN EN LA PSI
- ✓ MODIFICAR PARÁMETROS DE AERÓDROMO EN SACTA,
- ✓ REGISTRAR EN EDINA LA INFORMACIÓN Y SI PROCEDE, MODIFICAR ATIS

CIERRE

ACCIONES PREVIAS

- ✓ CONFIGURAR NUEVA POSICION DE TRABAJO AGRUPADA (PICT, SCV, IMPRESORA.
- ✓ DISPONER DE LAS FICHAS QUE AFECTEN A LA NUEVA POSICIÓN
- ✓ CTA DE POSICIÓN DESDOBLADA TRANSMITE A CTA DE POSICIÓN AGRUPADA LA INFORMACIÓN OPERACIONAL RELEVANTE PARA EL SERVICIO

ACTUACIONES DE CIERRE

- ✓ CTA DE POSICIÓN AGRUPADA NOTIFICA A CTA ENTRANTE LISTO PARA DESDOBLAR
- ✓ CTA ENTRANTE, UNA VEZ SELECCIONADA LA FRECUENCIA ASIGNADA, NOTIFICA A CTA DE POSICIÓN AGRUPADA LISTO PARA INICIAR OPERACIÓN.
- ✓ COORDINAR EL PRIMER TRÁFICO A TRANSFERIR A LA POSICIÓN AGRUPADA
- ✓ CTA DE POSICIÓN DESDOBLADA INICIA TRANSFERENCIA EN FRECUENCIA LOS TRÁFICOS

SUPERVISOR O CTA DESIGNADO (SEGÚN PROCEDA)

- ✓ IMPLANTAR EL CAMBIO DE CONFIGURACIÓN EN LA PSI
- ✓ MODIFICAR PARÁMETROS DE AERÓDROMO EN SACTA,
- ✓ REGISTRAR EN EDINA LA INFORMACIÓN Y SI PROCEDE, MODIFICAR ATIS

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Formato empleado: S24-13-PL-007-6.0

- Section 4.5.1.3 of the *Air Traffic Regulation* (RD 57/2002) establishes the following with regard to the constant surveillance of all operations in the aerodrome:

4.5.1.3. The aerodrome controllers will keep all flight operations at the aerodrome or in its vicinity and all the vehicles and personnel in the manoeuvring area under constant surveillance. This surveillance will be carried out by visual observation assisted, especially in low visibility conditions, by an ATS surveillance system if available.

- Accordingly, EUROCONTROL's *European Action Plan for the Prevention of Runway Incursions*, EAPPRI 3.0, provides (in appendix E) several best practices for controllers regarding visually scanning the entire runway[7]:

  e. *Visual scanning techniques: in more than half of the analysed Sudden High Energy Runway Conflict (SHERC) events in the EUROCONTROL Operational Safety Study, ATC did not visually detect the potential conflict prior to the runway incursion: the best practice of a proper and systematic visual scan of the entire runway and approach area, in both directions, can be one of the most effective safety barriers to stop an event.*
  Anyone can "look", but scanning is more than just looking. Scanning is the skill of seeing by looking in a methodical way.

- Section 4.5.5.4 of the *Spanish Air Traffic Regulation* establishes the following regarding runway incursions involving obstacles:

  4.5.5.4.1. Should the aerodrome controller, after clearing an aircraft to take-off or land, notice an existing or imminent runway incursion or the presence of any obstacle on the runway or in its proximity that could jeopardise the safety of an aircraft's take-off or landing, they should take the following appropriate measures:

  a) if the aircraft is departing, cancel the take-off clearance;

  b) if the aircraft is approaching to land, instruct it to initiate a go-around or missed approach procedure;

  c) in both cases, notify the aircraft of the runway incursion or obstacle and its position in relation to the runway.

- Sections 4.6.10.2.2.1 and 4.6.10.2.2.2 of the *Spanish Air Traffic Regulation* establish the following regarding the functions and usage of surface movement radar SMR:

  4.6.10.2.2.1. SMR should be used to enhance the visual observation of traffic in the manoeuvring area and to provide traffic surveillance in those parts of the manoeuvring area that cannot be seen visually.

  4.6.10.2.2.2. The information displayed on the SMR screen can be used to assist with the following:

  a) Surveillance of aircraft and vehicles in the manoeuvring area to ensure their compliance with clearances and instructions;

  b) to determine if a runway is clear of traffic prior to a landing or take-off;

[7] On page 86 of the *European Action Plan for the Prevention of Runway Incursions*, EAPPRI V3.0

c) to provide information on essential local traffic in or near the manoeuvring area;

d) to determine the location of aircraft and vehicles in the manoeuvring area;

e) to give directions to taxiing aircraft when requested by the pilot or deemed necessary by the controller. Information should not be issued in the form of specific heading instructions except in exceptional circumstances, e.g. emergencies; and

f) to provide assistance and advice to emergency vehicles.

- Section 1.4.12 g) of the *Air Traffic Regulation*[8] establishes the phraseology that must be used by controllers when stopping a take-off after the aircraft has initiated the take-off run (bordered in yellow):

1.4.12. Autorización de despegue.

a) (distintivo de llamada de la aeronave) PISTA (número) AUTORIZADO A DESPEGAR [NOTIFIQUE EN EL AIRE];	a) (aircraft call sign) RUNWAY (number) CLEARED FOR TAKE-OFF [REPORT AIRBORNE];
...cuando se utiliza separación en la pista reducida	
b) (distintivo de llamada de la aeronave) (información de tránsito) PISTA (número) AUTORIZADO A DESPEGAR;	b) (aircraft call sign) (traffic information) RUNWAY (number) CLEARED FOR TAKE-OFF;
...cuando no se ha cumplido con la autorización de despegue	
c) (distintivo de llamada de la aeronave) DESPEGUE INMEDIATO O ABANDONE PISTA [(instrucciones)];	c) (aircraft call sign) TAKE OFF IMMEDIATELY OR VACATE RUNWAY [(instructions)];
d) (distintivo de llamada de la aeronave) DESPEGUE INMEDIATO O MANTENGA FUERA (o MANTENGA CORTO) DE PISTA;	d) (aircraft call sign) TAKE OFF IMMEDIATELY OR HOLD SHORT OF RUNWAY;
... para cancelar autorización de despegue:	
e) (distintivo de llamada de la aeronave) MANTENGA POSICIÓN, CANCELE DESPEGUE REPITO CANCELE DESPEGUE (motivo);	e) (aircraft call sign) HOLD POSITION, CANCEL TAKE-OFF I SAY AGAIN CANCEL TAKE-OFF (reasons);
*f) (distintivo de llamada de la aeronave) MANTENGO POSICIÓN;	*f) (aircraft call sign) HOLDING;
... para detener un despegue después que la aeronave ha iniciado el recorrido de despegue	
g) (distintivo de llamada de la aeronave) ABORTE DESPEGUE [(se repite el distintivo de llamada de la aeronave) ABORTE DESPEGUE];	g) (aircraft call sign) STOP IMMEDIATELY [(repeat aircraft call sign) STOP IMMEDIATELY];
*h) (distintivo de llamada de la aeronave) ABORTANDO;	*h) (aircraft call sign) STOPPING;
... para operaciones de helicópteros	
i) (distintivo de llamada de la aeronave) AUTORIZADO A DESPEGAR [DE (emplazamiento)] (posición actual, calle de rodaje, área de aproximación final y de despegue, pista, número);	i) (aircraft call sign) CLEARED FOR TAKE-OFF [FROM (location)] (present position, taxiway, final approach and take-off area, runway and number);
*j) (distintivo de llamada de la aeronave) SOLICITO INSTRUCCIONES DE SALIDA;	*j) (aircraft call sign) REQUEST DEPARTURE INSTRUCTIONS;

[8] RD 1180/2018 of 21 September, which modifies RD 57/2002 of 18 January approving the implementation of the Air Traffic Regulation

- The *Basic Manual for the airport maneuvering area, EXA43, of AENA, in Unit 2, in point 1.1 on Procedure for access to the runway, in section 1.1.1 on General considerations, indicates:*

  "Any runway crossing permit will be issued by the controller explicitly, clearly and unequivocally, and must be accurately read-back".

  In the same sense, said manual and that same unit, in point 4.3 on Configuration of the airfield / runway incursion, adds the following reminder for vehicle drivers:

  "Read-back the permits to enter the runway or to cross it".

- The *Basic Manual for the airport maneuvering area, EXA43, of AENA,* in unit 3 regarding Communications, in point 4.1 on Guidelines for establishing communication, in section 4.1.2 development of communication, the examples that provide indicate the runway number:

DEP.	TRANSMISIÓN	TRANSMISSION	OBJETO
VEH	P-2 en L-4. Solicito permiso para cruzar pista	P-2 on L-4, request cross RWY (RWY num.)	Una vez que el vehículo llega al punto de espera en L-4, vuelve a contactar con GMC para informar que ha llegado al límite del permiso e indicar intenciones.
GMC	P-2 pase a frecuencia de TWR XXX,XXX	P-2 contact TWR XXX,XXX	GMC transfiere a la frecuencia de TWR que es la que tiene responsabilidad sobre la pista.
VEH	Tenerife TWR, de P-2	Tenerife TWR, P-2	Se solicita contacto con la nueva dependencia y se espera respuesta.
TWR	P-2, de Tenerife TWR	P-2, Tenerife TWR	
VEH.	P-2 en punto de espera L-4. **Solicito permiso para** cruzar pista (núm. Pista).	P-2 on holding point L-4. Request permission to cross RWY (RWY num)	El vehículo en L-4 solicita permiso a TWR para entrar en pista para cruzarla. Informará de posición e intenciones.
TWR	P-2, Cruce pista (núm. pista). Notifique pista libre.	P-2 cross runway. Report when RWY vacated.	
VEH.	P-2 permitido cruce de pista (núm. Pista). Cruzando pista (núm. Pista) Notificaré pista libre.	P-2 Permitted to cross RWY (RWY num). Crossing runway (RWY num) I will report RWY vacated.	Cruzar una pista es la parte más crítica de cualquier recorrido por el Área de Maniobras, se debe repetir el mensaje, para confirmar su correcta recepción.

- The *European Regulation of rules of the air (SERA), Regulation (EU) nº 923/2012*, on precept 8015 e) 3) on the Authorizations of the control of air traffic indicates (bordered in yellow):

(e) Read-back of clearances and safety-related information

(1) The flight crew shall read back to the air traffic controller safety-related parts of ATC clearances and instructions which are transmitted by voice. The following items shall always be read back:

(i) ATC route clearances;

(ii) clearances and instructions to enter, land on, take off from, hold short of, cross, taxi and backtrack on any runway; and

(iii) runway-in-use, altimeter settings, SSR codes, newly assigned communication channels, level instructions, heading and speed instructions; and

(iv) transition levels, whether issued by the controller or contained in ATIS broadcasts.

(2) Other clearances or instructions, including conditional clearances and taxi instructions, shall be read back or acknowledged in a manner to clearly indicate that they have been understood and will be complied with.

(3) The controller shall listen to the read-back to ascertain that the clearance or instruction has been correctly acknowledged by the flight crew and shall take immediate action to correct any discrepancies revealed by the read-back.

(4) Voice read-back of CPDLC messages shall not be required, unless otherwise specified by the ANSP.

1.18. Additional information

The navigation service provider, ENAIRE, carried out an internal investigation into the event and made the following internal recommendations:

- Send the investigation report to the unit and the Training and Evaluation Department to extend knowledge of the factors that contributed to the event.
- Include the analysis and conclusions of the investigation in the 2020 safety incident module, reinforcing the need to:
  - Ensure the stop bars are switched off before authorising entry to a runway, or, in the event of a malfunction, use the applicable contingency procedure as per the unit's *Operating Manual*.
  - Use standardised phraseology to instruct a take-off abort, according to RD 1180-2018, which implements the RCA and SERA.

- Consider the opening and closing of tower positions as a normal handover that requires precise verbal communication from the outgoing ATC to the incoming one about any movement of traffic, vehicles, potential conflicts or circumstances that the incoming ATC should be aware of before assuming responsibility for the new OR[9].
- Draft a reminder of the need to vacate the runway immediately in case of conflict (this recommendation was addressed to the airport service provider (AENA)).

The airport service provider, AENA, carried out an internal investigation into the event and made the following internal recommendation:

- The Head of the Department of Electrical Energy and Lighting should issue a notice to the Lighting personnel on the importance of notifying safety occurrences.

1.19. Useful or effective investigation techniques

Not applicable.

[9] Object of Responsibility. An ATC may cover three positions in the control tower: CLD, GMC or TWR

2. ANALYSIS

2.1. General considerations

On 19 July 2020, the Boeing B737-800 aircraft with registration EI-EFJ, operated by Ryanair, was making a scheduled flight (callsign RYR81SN) from Palma de Mallorca Airport to Madrid-Barajas Adolfo Suárez Airport. Aircraft RYR81SN was instructed to taxi to the 24R holding point and then take off on runway 24R.

The lighting vehicle, Balizamiento 3, was conducting a runway inspection from the threshold of runway 06L towards the threshold of runway 24R, having previously been cleared to do so.

Both the vehicle and the aircraft were on the local controller frequency (TWR) when they found themselves on runway 06L/24R at the same time.

The crew of the aircraft had the required licenses and medical certificates for the flight.

The aircraft's documentation was in order.

The driver of the lighting vehicle had the required licenses to carry out his work.

The local controller (TWR) and the ground movement controller (GMC) had valid licenses, unit endorsements and medical certificates. Furthermore, their activity prior to the incident flight is considered to be compliant with normal standards.

The meteorology at the time was in no way limiting and did not have any bearing on the incident.

2.2. Cause of the conflict

At 20:48:53, preparations began for the integration of the ground movement position (GMC) with the local position (TWR) (the frequency unification and handover would occur at 20:50:12). Therefore, during the period between 20:48:53 and 20:50:12, the ground movement controller (GMC) should have made use of the checklists (according to the *LEPA Operating Manual. Annex E: ATC handover checklist and Annex E: New control position checklist*) and the electronic strips to prepare to close the ground movement control position (GMC), hand over the clearances, and unify both frequencies in the local position (TWR).

If the handover had taken place according to the established procedures, the local controller (TWR) would have been made aware, at that point, of the location and intentions of the Balizamiento 3 vehicle.

There is no documentary evidence to show that, during the handover, the outgoing ground movement controller (GMC) informed the local controller (TWR) that he had a vehicle circulating on the north taxiway or that he had made an electronic strip for the movement of that vehicle, as established in Annex B, section 5.3 of the LEPA *Operating Manual* and as recommended as a best practice in Appendix M of the EAPPRI 3.0 Plan. However, based on what happened next and the local controller's (TWR) own statement, it's clear he was not aware of the exact position and intentions of the Balizamiento 3 vehicle.

At 20:50:00, the driver of the Balizamiento 3 vehicle established initial contact on the local controller frequency (TWR), reported that he was *at H5* and requested clearance to *occupy the south runway*. This communication was mistaken on two counts:

- Firstly, because by not using the runway designator when making the occupancy request, he used a phraseology not in accordance with the provisions of the *Basic Manual for the airport manoeuvring area* EXA43 of AENA, section 4.1, and
- secondly, because his position at H5 meant the only runway he could access was the north, not the south. Therefore, the message from the driver of the lighting vehicle was incoherent from a spatial point of view because either the vehicle wasn't at H5, or it was, and he requested access to the north runway rather than the south. Upon hearing the contradictory message, the local controller (TWR) should have asked for some sort of clarification to ensure he understood the driver's intentions, but he didn't.

Despite the phrasal and spatial errors in the communication, the local controller (TWR) replied, *approved*. This laconic response also failed to comply with the provisions of the LEPA *Operational Manual* by not using the designator of the runway for which the occupation permit was granted.

His approval lead to the Balizamiento 3 vehicle entering runway 06L/24R through threshold 06L. Previously, at 20:47:08, the ground movement controller (GMC) had cleared the RYR81SN aircraft to taxi to the 24R holding point.

The local controller (TWR) failed to visually identify the vehicle, as stipulated in section 4.5.1.3 of the RCA, claiming in his statement that he couldn't because it was night-time. Furthermore, he didn't use the A-SMGCS display to check its exact position. According to section 4.6.10.2.2.1 of the RCA, the SMR surface radar should be used to enhance the visual observation of traffic in the manoeuvring area and provide traffic surveillance in those parts of the manoeuvring area that cannot be observed visually.

Had he carried out either of these two actions, he would have undoubtedly noticed the position of the Balizamiento 3 vehicle. According to the local controller's statement (TWR), he didn't carry out either of the two actions.

At 20:50:10, the driver of the Balizamiento 3 vehicle requested the local controller (TWR), *Can you switch off the stop bars at H5, please?*. The controller responded: *Balizamiento 3 go over the stop bars*, to which the driver of the Balizamiento 3 vehicle responded, *Copied, with permission to pass lit stop bars at H5, north runway occupied by Balizamiento 3, listening on frequency 118.3…. 118.305, sorry*.

There was no reply from the controller.

Once again, this communication was erroneous for several reasons, and a decisive factor in the conflict that later occurred on the runway:

- The driver's request to switch off the stop bars was in accordance with the provisions of the LEPA *Operating Manual*, which states that illuminated stop bars should not be exceeded. However, the controller instructed the Balizamiento 3 vehicle to pass the illuminated stop bars without any contingency circumstances, in a clear breach of the provisions of the LEPA *Operating Manual*.
- In his acknowledgement, the driver of the Balizamiento 3 vehicle again failed to use the runway designator for the runway he was requesting permission to enter, although this time he said *north runway*, unlike the previous communication in which he said *south runway*. Now, at least, the driver's message was coherent from a spatial point of view because he stated he was entering the *north runway* from H5. However, the controller did not respond to the driver.
- At this point (and as stated later by the local controller (TWR)), the controller thought the Balizamiento 3 vehicle was on the south runway and that he was authorising entry onto a non-operational runway. Despite the aforementioned spatial discrepancy between the two previous communications from the driver of the vehicle, the controller did not request any clarification. It follows, therefore, that his listening was not as active as it should have been because, although he was clear (mistakenly) that the vehicle was in the south zone, the driver had clearly said he was at H5 (which is in the north zone) and that he was entering the *north runway*.

At 20:50:12, the ground movement controller (GMC) finished his shift and left. The local controller position (TWR) had already assumed the handover and integration of both frequencies, which included management of the surface movements at Palma de Mallorca Airport.

At 20:50:43, the RYR81SN aircraft established initial contact on the Palma de Mallorca control tower local controller frequency (TWR) and indicated that it was ready to depart. The controller at the Palma de Mallorca control tower replied: *RYR81SN good evening, wind 210º, 5 knots, runway 24R, cleared for take-off, traffic on final 8 miles out*. The crew of the aircraft read-back the communication correctly.

2.3. Resolution of the conflict

This take-off clearance should not have been issued because the runway was occupied by the Balizamiento 3 vehicle. It led to the inappropriate presence of the aircraft on the runway and the runway incursion that is the subject of this investigation. It should be noted that, at the time the clearance was given, the A-SMGCS screen already showed the Balizamiento 3 vehicle at the opposite end of runway 24R. Again, the controller failed to visually verify that the runway was clear and didn't use the A-SMGCS screen. If he had done so, he would have noticed the presence of the lighting vehicle on the runway on which he was authorising an aircraft to take off.

The investigation has determined the runway incursion was caused by the local controller's (TWR) failure to adhere to the procedures set out in the unit's *Operating Manual* and the provisions of the Air Traffic Regulation in regard to the use of phraseology, active listening and surveillance of the airport manoeuvring area.

At 20:51:32, the driver of the Balizamiento 3 vehicle, who was listening on the TWR frequency, heard the clearance given to the RYR81SN aircraft and notified the local controller, saying, *I'm on the north runway, you cleared me to enter, exiting immediately*.

At that moment, the Balizamiento 3 vehicle was abeam on level with the N7 taxiway and proceeded to vacate the runway via the H4 taxiway.

At 20:51:37, the local controller (TWR) replied to the driver of the vehicle, *Balizamiento 3, you told me you were on the south runway; vacate the runway immediately. Break, break.*

This last communication clearly demonstrates that the controller had mistakenly thought the lighting vehicle was on the south runway, under the impression that he had previously cleared it to enter the south runway, and not the north, despite the fact that the vehicle entered from H5, which is in the north zone of the airport.

And at 20:51:39, the local controller (TWR) contacted the aircraft: *RYR81SN hold position, I say again hold position*. The crew of the aircraft acknowledged *Stopping RYR81SN*.

According to section 1.4.12 g) of the RCA, this phraseology was also incorrect. Furthermore, the controller did not comply with the provisions of precept 4.5.5.4 of the aforementioned standard, which indicates that when a controller notifies an aircraft of a runway incursion after clearing it for take-off, they must inform the aircraft involved about the nature of the incursion and the position of the obstacle in relation to the runway. Something the controller failed to do.

Finally, the driver of the Balizamiento 3 vehicle notified runway free via H4, and the controller asked aircraft RYR81SN if it could take off from its position abeam on taxiway N1. The crew responded negatively, advising that they would prefer to carry out some

checks and return to holding point H1. Thus, the controller instructed the aircraft to leave the runway via N1 and advise when the runway was clear. Which it subsequently did.

According to the radar data, the minimum distance reached between the aircraft and the vehicle was 1.6 NM at 20:51:49.

2.4. Relevant factors in respect of the procedures/regulations

The following factors are considered to have been relevant and decisive in producing the conflict:

On the part of the driver of the Balizamiento 3 vehicle:

- The phraseology he used to name the runway he wanted access to was not the phraseology stipulated in the *Basic Manual for the airport manoeuvring area* EXA43 of AENA, section 4.1 because he did not use the runway designator.
- A spatial error made in his first communication, once at H5, requesting access to the south runway (06R/24L), which he did not have access to from H5.

On the part of the local controller (TWR):

- Not detecting the inconsistency in the communication from the driver of Balizamiento 3 when he requested permission to enter the south runway (06R/24L), which he could not access from H5.
- The phraseology he used to approve access to the requested runway was not the phraseology stipulated in the LEPA *Operating Manual* because he did not use the runway designator.
- He did not perform a direct visual scanning of the position of the Balizamiento 3 vehicle, nor did he use the A-SMGCS display for the same purpose. Accordingly, he did not comply with the provisions of sections 4.5.1.3 and 4.6.10.2.2.1 of the RCA.
- He should not have instructed the Balizamiento 3 vehicle to pass the illuminated stop bars without any contingency circumstances to justify the action and, therefore, did not comply with the stipulations in the LEPA *Operating Manual*.
- The phraseology he used with the aircraft after warning it of the runway incursion was incorrect, according to section 1.4.12 g) of the RCA.
- He did not comply with the provisions of precept 4.5.5.4 of the RCA, which indicates that when a controller notifies an aircraft of a runway incursion after clearing it for take-off, they must inform the aircraft involved about the nature of the incursion and the position of the obstacle in relation to the runway.

2.5. Assessment of the actions taken by ENAIRE and AENA

ENAIRE

The internal recommendations issued by ENAIRE in its internal investigation report are focused on not repeating the factors that led to the runway incursion and its improvable resolution. However, none of them focus on performing a visual scanning and using the A-SMGCS screen to verify the position of vehicles and/or aircraft in the manoeuvring area to prevent events like this from reoccurring in the future. For this reason, a Safety Recommendation is issued to ENAIRE to reinforce its tower controllers' training in visual observation and the use of the surface radar at Palma de Mallorca Airport.

AENA

The internal recommendation issued by AENA in its internal investigation report to remind lighting personnel of the importance of reporting safety occurrences is considered insufficient to prevent events like this from reoccurring in the future. For this reason, a Safety Recommendation is issued to AENA to reinforce the training of its airside drivers in using standard phraseology for communications at Palma de Mallorca Airport.

3. CONCLUSIONS

3.1. Findings

- The crew of the RYR81SN aircraft had the required licenses and medical certificates for the flight.
- The RYR81SN aircraft had the necessary documentation for the flight.
- The driver of the Balizamiento 3 lighting vehicle had the required licenses to carry out his work.
- The meteorology at the time was in no way limiting and did not have any bearing on the incident.
- Both the local controller (TWR) and the ground movement controller (GMC) at the Palma de Mallorca control tower had valid licenses, unit endorsements and medical certificates. Furthermore, their activity prior to the incident flight is considered to be compliant with normal standards.
- Aircraft RYR81SN was instructed to taxi to the holding point for runway 24R.
- The Balizamiento 3 vehicle was conducting an inspection of the runway from threshold 06L to threshold 24R, having previously been cleared to do so by the local controller.
- The communications made by the driver of the Balizamiento 3 vehicle to the local controller (TWR), with regard to his position and intentions, were contradictory. However, the controller did not request any clarifications.
- The phraseology used by the driver of the Balizamiento 3 vehicle was contrary to the stipulations in the LEPA *Operating Manual*.
- The local controller (TWR) authorised the Balizamiento 3 vehicle to pass the H5 stop bars without any justification for doing so.
- The local controller (TWR) mistakenly believed he had cleared the Balizamiento 3 vehicle to occupy runway 06R/24L, which was not operational at the time.
- The local controller (TWR) cleared aircraft RYR81SN to take off from runway 24R, which was occupied by the Balizamiento 3 vehicle.
- The local controller (TWR) did not check the physical location of the Balizamiento 3 vehicle during the incident, neither by direct visual observation nor by making use of the available surface radar.
- Both the Balizamiento 3 vehicle and the RYR81SN aircraft were on the local controller frequency (TWR) when they found themselves on runway 06L/24R at the same time.
- The driver of the Balizamiento 3 vehicle was the one who detected the conflict and notified the controller while proceeding to vacate the runway.
- The local controller (TWR) cancelled the take-off clearance of aircraft RYR81SN using incorrect phraseology.
- According to the radar data, the minimum distance reached between the aircraft and the vehicle was 1.6 NM at 20:51:49.
- After the incident, the aircraft resumed its flight with no further issues.

3.2. Causes/contributing factors

The investigation has determined the runway incursion was caused by the local controller's (TWR) failure to adhere to the procedures set out in the unit's *Operating Manual* and the provisions of the Air Traffic Regulation in regard to the use of phraseology, active listening and surveillance of the airport manoeuvring area.

Furthermore, the following factors are considered to have contributed:

- The phraseology used by Balizamiento 3 driver when naming the runway he wanted to access, given that it was contrary to the stipulations in the LEPA *Operating Manual* because he failed to use the runway designator.
- A spatial error made by the Balizamiento 3 vehicle driver in his first communication once established at H5, in that he requested entry to a runway he could not access from H5.

4. OPERATIONAL SAFETY RECOMMENDATIONS

REC 20/21: It is recommended that ENAIRE, as the navigation service provider, should reinforce its tower controllers' training in visual observation and the use of the surface radar at Palma de Mallorca Airport.

REC 21/21: It is recommended that AENA, as the airport service provider, should reinforce the training of its airside drivers in using standard phraseology for communications at Palma de Mallorca Airport.