DATA SUMMARY

LOCATION

Date and time	**Sunday, 27 May 2012; 05:00 UTC[1]**
Site	**Barcelona-El Prat Airport (LEBL) (Spain)**

AIRCRAFT

Registration	**F-GJVG**	**EI-EBN**
Type and model	**AIRBUS A320**	**BOEING B737-800**
Operator	**Air France**	**Ryanair**

Engines

Type and model	**CFM 56-5 A1**	**CFM 56-7**
Number	**2**	**2**

CREW

	Captain	First officer	Captain	First officer
Age	**42**	**47**	**53**	**32**
Licence	**ATPL(A)**	**ATPL(A)**	**ATPL(A)**	**ATPL(A)**
Total flight hours	**7,962 h**	**3,662 h**	**15,485 h**	**1,030 h**
Flight hours on the type	**3,403 h**	**781 h**	**6,270 h**	**880 h**

INJURIES

	Fatal	Serious	Minor/None	Fatal	Serious	Minor/None
Crew			**6**			**6**
Passengers			**142**			**23**
Third persons						

DAMAGE

Aircraft	**None**	**None**
Third parties	**None**	**None**

FLIGHT DATA

Operation	**Commercial Air Transport – Scheduled – International – Passenger**	**Commercial Air Transport – Scheduled – International – Passenger**
Phase of flight	**Taxi for departure**	**Approach**

REPORT

Date of approval	**26 June 2013**

[1] All times in this report are in UTC unless otherwise specified. To obtain local time, add two hours to UTC.

1. FACTUAL INFORMATION

1.1. Description of the event

A B737 aircraft, with callsign RYR6363, was making an ILS approach to runway 02 at the Barcelona/El Prat Airport. The crew was in radio contact with the Barcelona tower on the local frequency for runway 02 (LCL). It was the last aircraft in the sequence for that runway before the change in configuration from nighttime preferred to daytime preferred, a transition that had been decided a few minutes earlier[2].

Also at that time an A320 aircraft, callsign AFR2349, was taxiing from stand 13 on the parking apron while in radio contact with the ground frequency on the Barcelona tower (SS ground[3]), which had cleared it to proceed to the runway 25L holding point via taxiway K and crossing runway 02. Shortly thereafter, aircraft RYR6363 was cleared to land on that runway.

On realizing the imminent runway incursion by AFR2349, the local controller alerted the ground controller, who instructed the aircraft to stop, which it did but only after crossing the holding point on taxiway K7 that controls access to runway 02. In light of its position, the controller urged the aircraft to continue taxiing, while the LCL controller instructed RYR6363 to go around.

After completing the go-around procedure, aircraft RYR6363 was cleared to make a new approach and landed without further incident. Aircraft AFR2349 continued taxiing and managed to take off uneventfully.

1.2. ATC personnel information

The ground controller had over seven years of experience as a tower controller (three as an instructor and 2 as tower chief). According to his statement, he had 500 hours as an executive controller at the Barcelona tower.

He joined the Barcelona tower staff in August 2011 and obtained the unit endorsement in February 2012 after completing the associated training, the theory phase of which ended in October 2011 and the practical phase in January 2012. This training included refresher sessions in the simulator.

[2] As shown in the AIP, the preferred nighttime configuration (from 23:00 to 07:00 local time) is the so-called ENR (runway 02 used for landings and runway 07R used for takeoffs), while the preferred daytime configuration is referred to as WRL (runway 25R used for landings and runway 25L used for takeoffs). See figure 1.

[3] Every operational configuration at the Barcelona Airport features four mutually independent areas of taxi responsibility. The SS controller (GSS) is responsible for ground movements in the area furthest south and controls traffic entering and exiting runway 25L/07R, as well as ramp movements south of Terminal 1 (Figure 2).

Runway 02/20 had been closed during his entire training period for construction work, meaning he had not practiced using the ENR configuration with real operations.

According to the training department, the special circumstances involved in not having received instruction on a preferred configuration were accounted for through three specific measures:

- The simulator refresher sessions were expanded from the usual three days to five.
- During the first few days working in an ENR configuration, the plan was to have a supervisor work with the controller. The runway work was delayed, however, and the shift schedules could not be changed, meaning the necessary personnel was unavailable to carry out the plan.
- As an additional safeguard, the controller would not work as the local controller (LCL) in an ENR configuration until he received practical training on that configuration.

In May he had worked the night shift on three occasions, the last two with runway 02/20 once again in service. Both nights the ENR configuration was temporarily in use for five hours and one hour, respectively. It wasn't possible to accurately determine the activities performed or the posts occupied by the controller during those shifts.

On the day of the incident he went on duty at 20:00. At 21:00 the configuration was changed as usual to the nighttime preferred ENR, which stayed in use until 22:00. After some time in another configuration the ENR configuration was reestablished at 03:24 during a break in the controller's shift. He went back to work and relieved another controller at the GSS position with the ENR configuration once more in use, shortly before the standard change was made to the daytime (WRL) configuration. As it is normally the case early in the morning, movements in the airport mainly involved departing flights, with only one landing having taken place in the time between the controller's return to duty and the incident.

1.3. Meteorological information

The METAR issued at 05:00 listed a visibility of 8,000 m with no significant weather phenomena.

1.4. Aerodrome information

The Barcelona/El Prat Airport has three asphalt runways, two of them parallel (07L/25R and 07R/25L), and a runway in a 02/20 orientation that crosses runway 07L/25R. Runway 02/20 is also crossed by mutually parallel taxiways D and E and by taxiway K, which runs parallel to runway 07R/25L (Figure 1).

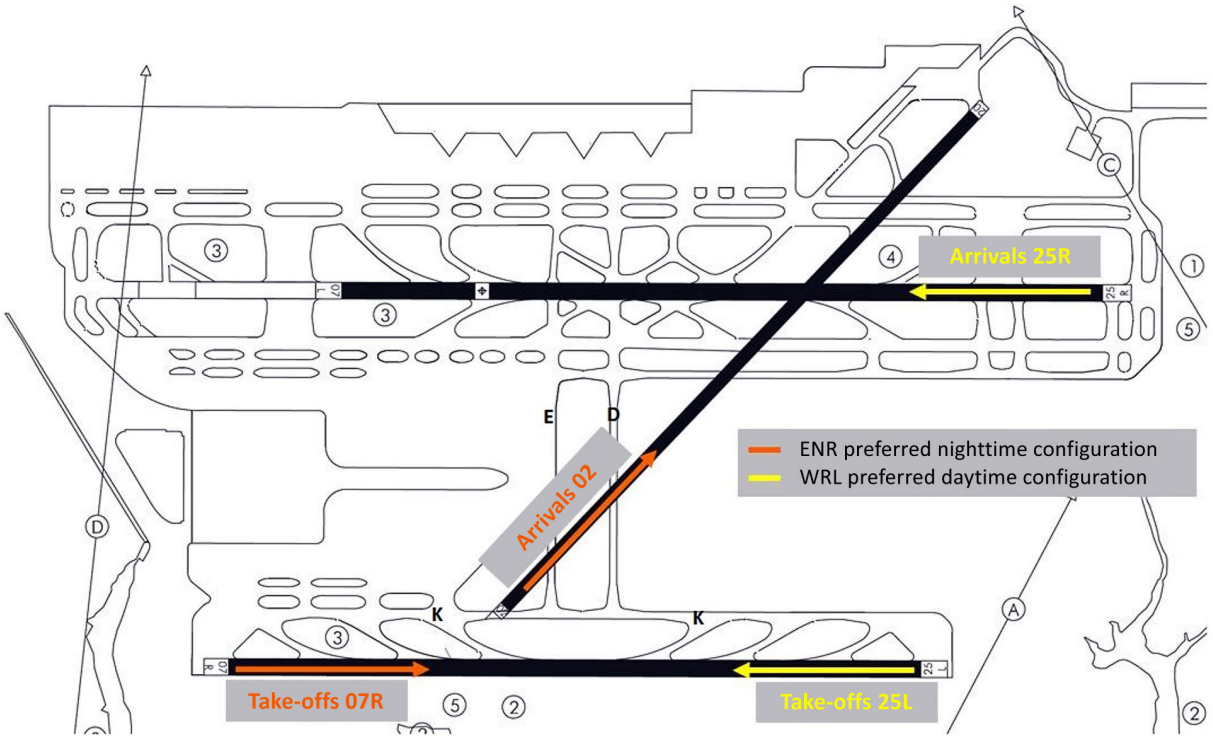

Figure 1. ENR and WRL configurations at LEBL

At the time of the event the configuration was in the process of being changed from nighttime to daytime, an operation that is typically started daily between 20 minutes and half an hour before 07:00 local time[4]. The change was made from the nighttime preferred configuration (ENR), in which runway 02 is used for landings, to the daytime preferred configuration (WRL), in which runway 02 is inactive and departing traffic must taxi to the runway 25L threshold by crossing 02 via taxiways D, E or K, depending on the parking apron of origin.

The ENR configuration became inoperative on 22 September 2011 due to work needed to repair patches of pavement along the runway, the centerline pavement and the shoulders of RWY 02/20. The runway was returned to service on 2 May 2012[5].

1.5. Communications

At 04:57:48 the SS controller cleared aircraft AFR2349 to taxi via LS, turn left onto taxiway K, cross runway 02 and taxi to the runway 25L holding point, an instruction that the crew acknowledged.

[4] This is done to ensure that the configuration change is complete by 07:00 local time (05:00 UTC on the day in question), as per the AIP.

[5] According to AIP Supplement 25/11, the work was scheduled to be completed on 30 April. A NOTAM (B3162/12) informed of a delay in the completion date until 2 May.

Approximately one minute later, at 04:58:47, the LCL controller cleared aircraft RYR6363 to land on runway 02, which its crew also acknowledged.

At 04:59:58, with no prior requirement from ground control, aircraft AFR2349 initiated a communication where only "2349 we cross" was heard through the interference.

The ground frequency was then busy with two other aircraft, the first informing the controller of its position, to which the controller replied by giving instructions to taxi on E to the intersection with runway 02, and the second reporting it was ready to taxi.

Without answering the second aircraft, the GSS controller, at 05:00:30, instructed aircraft AFR2349 to "hold position" before almost immediately directing it to "continue now, continue please continue to holding point."

The LCL controller then instructed aircraft RYR6363 to initiate a go-around.

The recording of the communications between the SS controller and aircraft AFR2349 did not reveal any mention of the stop bar situated on taxiway K7, which protects the intersection of the taxiway and runway 02 (Figure 2).

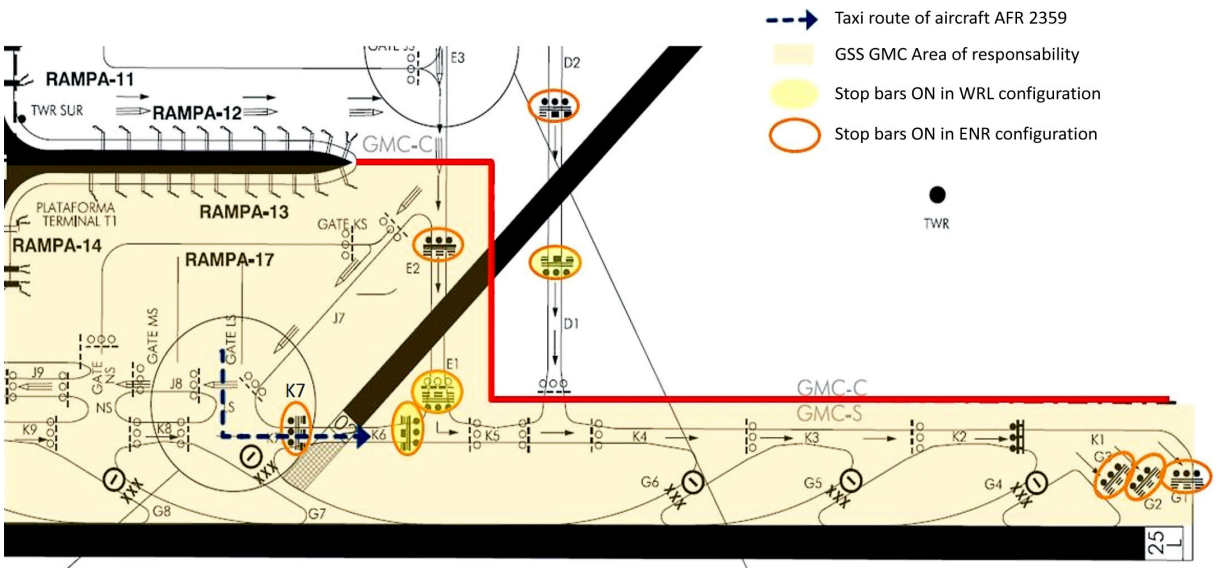

Figure 2. Taxi route of aircraft AFR2349

1.6. Eyewitness statements

1.6.1. *Statement fom the GSS controller*

He stated it was his first time working at that position in an ENR configuration and that when he relieved the offgoing controller, he was surprised to see an aircraft landing

"from the sea" on 02, since he was not used to seeing aircraft land on that runway during his time working in tower E.

He clearly recalled hearing the supervisor's instruction that RYR6363 would be the last aircraft to land on runway 02.

He noted that aircraft AFR2349 was the first aircraft to taxi from the south stand to runway 25L during his shift. He stated that it was normal for the vast majority of traffic handled by the GSS controller to originate from taxiway D, having already crossed runway 02 before entering his area of responsibility (see Figure 2), and that only in certain cases (like AFR2349 that night), when required by the location of their parking stand, do aircraft have to cross runway 02 within the GSS controller's area of responsibility.

He underscored that the taxi pattern for the airplane (which was going to take off from 25L) was the typical one for the WRL configuration, with which he was familiar and in which there are no landings on runway 02.

The stop bar on K7 was turned on and he turned it off so that traffic could continue taxiing, believing it had been left on after the change in configuration without really being needed.

The LCL controller asked him about aircraft AFR2349 and prompted him to require it to stop. He could not immediately relay the instruction since another aircraft was on the frequency at that instant. When he finally contacted aircraft AFR2349, it stopped very close to runway 02, as a result of which the LCL controller asked it to expedite the crossing.

His perception of the incident is that it took place as a consequence of his working in an environment with which he was not familiar (the ENR configuration) and for which he had not been trained.

1.6.2. *Statement from the LCL controller*

After clearing RYR6363 to land, he noted that aircraft AFR2349 was crossing past the K7 holding point and warned the GSS controller, whose post is alongside his. Despite seeing aircraft AFR2349 stop, he did not hesitate to order aircraft RYR6363 to go around.

He did not notice if the K7 stop bar was off. His position is next to the light stand from which the lights are turned on and off.

1.6.3. *Supervisor's statement*

The on-duty supervisor stated that, as happens every night starting at 04:40, they started to coordinate with the Barcelona Control Center to prepare the configuration

change from ENR to WRL. They agreed that the last arrival via runway 02 would be RYR2349 and that as soon as it landed, they would start routing traffic to runway 25L for takeoff.

As the supervisor he was charged with notifying all controllers of the last arriving aircraft, changing the airport configuration lights, requesting the placement into service of the new ILS, changing the ATIS message, changing the aerodrome parameters in the SACTA system and coordinating the first departure via the new runway with the control center.

Having finished the aforementioned tasks, he first noticed the incursion by the taxiing aircraft AFR2349 onto runway 02 when the LCL controller asked out loud about the airplane that did not appear to be holding short of runway 02 on taxiway K.

1.6.4. *Crews' statements*

The crew of AFR2349 detected the other airplane on its TCAS screen (some 1,200 ft above) and estimated it would reach the runway in about two minutes. The first officer confirmed the presence of the aircraft visually through the window and expressed his concerns to the captain regarding the margin of safety for crossing, as a result of which they reduced their speed a little and requested confirmation to cross the runway, which they received, according to the crew. At no time did either of them remember having seen the stop bar lit. Just before crossing the runway the controller instructed them to stop and then to continue. The aircraft on short final had to abort its approach since it was very close to runway 02.

The crew of aircraft RYR6363 noted that they were instructed to go around due to a runway incursion by another aircraft when they were at an altitude of 400 ft. They carried out the maneuver and received vectors for a second approach, which they completed uneventfully.

1.7. Organizational and management information

1.7.1. *Air France taxi procedures*

The operations manual requires the coordination between the pilot flying (PF) and the pilot monitoring (PM) who must also pay permanent attention during taxi operations in order to guarantee:

- An adequate situational awareness that includes geographical location, proximity to runway and the presence of other traffics.
- To carry out tasks exclusively compatible with the taxi and the accomplishment of the normal procedures at the right time.

- A continuous trajectory supervision by the use of all available means (airport charts, panels, markings, beaconing, RAAS[6] ...).
- The pilot flying informs about his intentions to the pilot monitoring at all times while taxiing.
- The explicit identification of the taxiway and the runway by the pilot flying. This information must be cross-checked by the pilot monitoring.
- If any doubt arises, the taxi must be interrupted and the position/clearance must be verified.

The manual also develops the "sterile cockpit" concept that ensures that during the taxi the crew must only carry out essential flight related tasks. Conversations or distractions not directly related to the operation are not authorized.

1.7.2. *Training of tower controllers*

The Training Plan for the Barcelona tower[7] contains the program to be followed by candidates wishing to obtain the unit endorsement[8], which is required to carry out the duties of executive controller at the various posts in the Barcelona tower.

The program consists of two main phases: theory (transition part) and practical (on-the-job training).

1. *Transition part:* In turn broken down into two separate parts:

    a) General theory, where the topics covered in the student's initial training are reviewed and serve as the basis for the aerodrome control instrument (ADI) rating.
    b) Specific theory, the goal of this phase being to provide the applicant with training on topics specific to the unit, that is, on the operational and technical environment in which he will work.

2. *On-the-job training*. In this phase the applicant provides ATC services in an actual operational environment under the supervision of an instructor. The minimum duration is 90 hours or one month (whichever is greater). If the candidate comes from an ATC station whose unit endorsement contains the same ratings, the hours may be reduced by 25%.

[6] Air France aircrafts are equiped with an RAAS system (Runway Awareness Advisory System) that warns about runway proximity entering a runway.
[7] Training plan for LEBL A331A-10-PES-030-2.0.
[8] Authorization added to the license, of which it is a part and which lists the ICAO location identifier and the sectors and/or station posts where the license holder is qualified to stand watch. In the case of the Barcelona tower, these annotations do not indicate a specific post (LCL, Area GMC) or the applicable operating configurations.

While not explicitly envisaged in the training plan, the practical phase concludes with three days of simulator sessions where the focus is on training on non-preferred, and thus less typical, airport configurations.

The training plan does not specify that the controller must receive on-the-job training on each of the airport's operational configurations, or even on the preferred ones. Changes in configuration are covered on a theoretical level but the plan does not explicitly require a minimum amount of practical training on this aspect.

For its part, the Competence Scheme[9] is intended to ensure that the controller maintains the operational skills associated with the ratings and unit endorsements he possesses.

It specifies that a controller must be on duty for 80 hours a year as an executive controller in order to maintain his unit endorsements. In addition he must also stand one watch every six months at every post.

This scheme does not require a minimum number of hours for each operational or preferred configuration either, nor a minimum on-duty period during configuration changes.

The Competence Scheme includes the both the theoretical and practical training to be received annually. This training includes a course on emergencies and special situations that covers, among other topics, non-preferred configurations. In general, six hours of training on emergencies and special situations is given annually.

1.7.3. *Airport lighting and the stop bars*

The Barcelona Airport tower has a lighting control and indicating system (SMP in Spanish) consisting of consoles that provide information on the status of the light system and can be used to make changes to it[10].

The SMP allows for preset changes to be made to the lights by selecting a configuration (for the runways, taxiways or overall) and its exceptions. Changes can also be made individually to each of the components that comprise the lighting system.

Each lighting configuration was designed based on the taxi routes established for each of the airport's operational configurations. For each lighting configuration, a condition (on/off) is specified for all of the stop bars at the airport.

[9] Competence Scheme LEBL **A331C-10-PES-029-2.0.**

[10] A description and diagram of the lighting arrangement that is programmed for each of the configurations is described in the document **CONFIGURACIONES OPERATIVAS DE BALIZAMIENTO (SMP) EN EL AEROPUERTO DE BARCELONA – EL PRAT (OPERATIONAL LIGHTING CONFIGURATIONS (SMP) AT THE BARCELONA/EL PRAT AIRPORT)** ***DORE-09-INF-014-1.4.***

One of the positions of the light stand is next to the LCL and GSS positions.

When the airport configuration is changed, the stop bars for the two configurations remain on until the last aircraft reaches its assigned apron. In the case of a configuration change from ENR to WRL, the K7 bar, which protects runway 02 in an ENR configuration, must be on.

1.7.4. *Procedure for crossing runways*

The LCL controller is responsible for active runways. When operating in a parallel runway configuration, there are two local controllers, one in charge of the preferred runway for arrivals and the other of the preferred runway for departures. When in a cross-runway or single runway configuration, a single controller is responsible for arrivals and departures.

All runways must be crossed in keeping with the procedure put in place for this purpose[11].

In general terms the procedure states that:

- The local controller is responsible for explicitly authorizing the crossing of an active runway under his control.
- Ground controllers shall authorize those movements of aircraft, vehicles or people that involve crossing an inactive runway within his area of responsibility.
- The standard lighting configurations are programmed such that all of the stop bars protecting the active runways in the configuration are on, as are the stop bars protecting inactive runways that may be crossed as part of a non standard taxi route. The stop bars protecting inactive runways that are crossed as part of a standard taxi route are off.
- When traffic is authorized to cross, the clearance shall be given verbally on the radio frequency and the stop bar must be turned off in the SMP. Once the runway is crossed, the stop bar must be reenergized.

The steps involved in crossing a runway differ depending on whether it is active or not. In the case of an active runway:

- Ground controllers shall coordinate the crossing of a runway with the local controller (LCL) who is responsible for it so as to inform him of the request and provide him with all the relevant information.
- Once coordinated, the ground controller shall send the traffic to the corresponding holding point, ensuring that the stop bar (if any) is on, and shall transfer

[11] PROCEDIMIENTO DE CRUCE DE PISTAS EN EL AEROPUERTO DE BARCELONA – EL PRAT (PROCEDURE FOR CROSSING RUNWAYS AT THE BARCELONA/EL PRAT AIRPORT). *S41-10-DTC-003-1.1*

communications to the LCL controller, reminding the traffic to hold short of the runway.
- Before authorizing the crossing, the LCL controller shall notify the ground controller of which taxiway the traffic will use after crossing so as to coordinate the clearance limit.
- The LCL controller shall determine the best time to carry out the crossing, turn off the stop bar and issue the crossing clearance.
- Once the traffic confirms the crossing, the LCL controller shall transfer it to the corresponding ground frequency.

An inactive runway shall be crossed as follows:

- The relevant ground controller is responsible for authorizing the crossing.
- Any instruction involving the crossing of a runway, even if it is inactive, must expressly include the clearance to cross it.
- When a runway crossing is not part of a standard taxi route for the configuration in use, the stop bar shall be on. In this case, the ground controller must turn it off as the crossing clearance is issued and turn it on once the crossing is complete.

1.8. Tests and research

1.8.1. *Reconstruction of the paths*

The information obtained from the surface monitoring system allowed investigators to reconstruct the paths of both aircraft and to corroborate the statements from the crews and controllers.

- At 05:00, when aircraft AFR2349 contacted ground with the expression "we cross", it had barely completed the turn to line up with taxiway K and it was some 50 m from the stop bar on taxiway K7.
- About 25 s later it reached the holding point just as the approaching aircraft was at an altitude of 600 ft and within 2 NM on final approach to runway 02.
- Aircraft AFR2349 stopped taxiing for a few seconds between 05:00:33 and 05:00:45 when it was instructed to hold, and then resumed taxiing. It had already crossed over the K7 holding point.
- According to the radar, aircraft RYR6363 reached a minimum altitude of 300 ft during its go-around maneuver.

2. ANALYSIS

2.1. General

Aircraft RYR6363 was on final approach to runway 02, used for landings in the preferred nighttime configuration (ENR).

It was the last aircraft of the few that had landed on that runway in the time frame before the configuration change to daytime preferred (WLR), in which takeoffs are conducted on runway 25L and landings on 25R. In keeping with the applicable procedure, this action had been coordinated with the control center and reported to all of the controllers on watch in the tower.

Aircraft AFR2349 was parked in the south apron and contacted GSS on the ground frequency to request taxi. Since it would take off using the new configuration, it would taxi to the runway 25L holding point, which required it to use taxiways LS and K and then cross runway 02, which would remain active until the final aircraft of the ENR configuration landed. This meant that, according to the runway crossing procedure, only the local controller (LCL) could authorize its crossing. Despite this, the ground controller cleared AFR2349 to taxi to the holding point and explicitly included the crossing of runway 02 in the clearance, as if the runway were inactive, as he had done multiple times when runway 02/20 had always been inactive due to construction work.

As is normal during a configuration change, the stop bar for runway 02 on taxiway K7 was still on, so the ground controller turned it off so as to allow the aircraft to continue, believing the runway was now inactive and that it was thus no longer required to be on.

According to the sterile cockpit philosophy, while taxiing the crew must pay due attention avoiding distractions and monitoring the movements of other traffics. In this case the crew of AFR2349 noticed the aircraft on final approach, both as a result of the TCAS warning and of the direct visual observation well before reaching the holding point. The procedure states that, if any doubt arises, the crew must interrupt the taxi and verify the clearance. As a precautionary mean, the crew only reduced speed and asked ATC for confirmation, but did not detent the aircraft. Probably due to interferences, their hesitation was not clearly reflected in the communications with the controller, where only a confusing "2349 we cross" is heard, with no explicit reference to the arriving aircraft, which would probably have given the controller enough time to amend the runway crossing clearance.

This scenario once more underscores the importance of clarity, brevity and discipline in communications, deficiencies in which are present as contributing factors in a large number of runway incursion events[12].

It was the local controller (LCL) who, after clearing RYR6363 to land, noticed the imminent incursion of the other aircraft and notified the ground controller, who

[12] "A breakdown in communications between controllers and pilots or airside vehicle drivers is a common factor in runway incursions". **ICAO Doc 9870. Manual on the prevention of runway incursions.**
"From studies of investigation reports, and from surveys regarding runway safety occurrences, it is apparent that communications issues are frequently a causal or contributory factor". **European Action Plan for the Prevention of Runway Incursions Edition 2.0.**

immediately tried to stop the traffic but the frequency was being used at that time by another aircraft. This prevented a sufficiently fast reaction and inevitably caused AFR2349 to invade the runway protection zone, which forced the local controller to instruct RYR6363 to go around.

2.2. Training considerations

The unit training plan specifies standing a minimum number of hours as executive controller under instruction, but it does not specify the applicable configurations nor the minimum requirements with regard to configuration changes. Under normal circumstances, it is expected that the controllers will stand watch in all of the preferred configurations and under changing configurations during their training period (90 hrs or one month). However, as it is written, the training plan does not ensure minimum watch periods in each preferred configuration when, due to exceptional circumstances, such as construction in this case, a given configuration is not used over a relatively long period of time. This was the case of the ground controller responsible for AFR2349, who, due to the inactive status of runway 02/20 throughout his entire instructional period, had not received training in a real situation involving the active configuration at the time of the incident.

The measures taken by the training department to address this situation could not be carried out due to the unexpected delay in the construction work and to the unavailability of backup personnel to supervise the controller during his first few hours in an ENR configuration. While his eligibility to work as local controller was restricted, the measures taken did not prevent the controller from working as the ground controller in a configuration to which he was unaccustomed and on which he had not received specific practical training. It thus seems justified to issue a safety recommendation that this training plan be amended such that a written procedure be put in place that prevents a similar situation from reoccurring. Another recommendation is issued along these same lines so that the competence scheme provide a guarantee that controllers will remain proficient in all of the preferred configurations at the airport where they work.

3. CONCLUSIONS AND CAUSES

3.1. Findings

- The tower supervisor had started the procedure to change the configuration and had informed the controllers in the tower that aircraft RYR6363 would be the last to land on runway 02. The ground controller heard this information.
- The ground controller cleared aircraft AFR2349 to taxi to the runway 25L holding point by crossing runway 02.

- The ground controller turned off the stop bar on taxiway K7 that limited access to runway 02, which was active at the time, so as to allow aircraft AFR2349 to taxi to the runway 25L holding point. He did not coordinate this action with the LCL controller.
- Aircraft RYR6363 was cleared to land on runway 02 by the LCL controller.
- The ground controller ordered aircraft AFR2349 to hold its position after being warned by the LCL controller, though by then aircraft AFR2349 had already crossed the runway 02 holding point.
- In keeping with the LCL controller's instructions, aircraft RYR6363 aborted the approach and initiated a go-around. Aircraft AFR2349 was authorized to continue taxiing.
- The ground controller had not received on the job training on that post while in an ENR configuration.
- Neither the training plan nor the Barcelona tower competence scheme list requirements for the minimum duty periods to be spent in each airport configuration.

3.2. Causes

The incident occurred as a result of aircraft AFR2349 entering the runway after being cleared to do so by the ground controller, who did not coordinate this activity with the local controller responsible for clearing landings and crossings of the runway, which was still active pending completion of the configuration change. The controller's unfamiliarity with the conditions on that day, due to not having received practical training on that configuration, affected his handling of the situation and caused him to act in keeping with the configuration most familiar to him, one in which runway 02 is not used for landings, especially during a time period with few arriving aircraft.

4. SAFETY RECOMMENDATIONS

REC 29/13. It is recommended that AENA modify the Training Plan for the Barcelona tower so as to guarantee that a minimum amount of time is spent during the practical training periods in each and all of the preferred airport configurations as well as in changing configurations, before a controller receives the unit endorsement.

REC 30/13. It is recommended that AENA modify the Barcelona tower Competence Scheme so as to guarantee that a minimum amount of on-duty time is spent in each of the preferred airport configurations, as well as in changing configurations as a requirement for tower controllers to maintain their operational proficiency.