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COMISIÓN DE
INVESTIGACIÓN
DE ACCIDENTES
E INCIDENTES DE
AVIACIÓN CIVIL

Report IN-027/2014

Incident involving a Boeing B737 aircraft, registration EI-EBC, operated by Ryanair, and a Boeing B737 aircraft, registration G-GDFR, operated by Jet2.com, at the Malaga-Costa del Sol Airport (Spain) on 17 September 2014

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Foreword

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

In accordance with the provisions in Article 5.4.1 of Annex 13 of the International Civil Aviation Convention; and with articles 5.5 of Regulation (UE) nº 996/2010, of the European Parliament and the Council, of 20 October 2010; Article 15 of Law 21/2003 on Air Safety and articles 1.4 and 21.2 of Regulation 389/1998, this investigation is exclusively of a technical nature, and its objective is the prevention of future civil aviation accidents and incidents by issuing, if necessary, safety recommendations to prevent from their reoccurrence. The investigation is not pointed to establish blame or liability whatsoever, and it's not prejudging the possible decision taken by the judicial authorities. Therefore, and according to above norms and regulations, the investigation was carried out using procedures not necessarily subject to the guarantees and rights usually used for the evidences in a judicial process.

Consequently, any use of this report for purposes other than that of preventing future accidents may lead to erroneous conclusions or interpretations.

This report was originally issued in Spanish. This English translation is provided for information purposes only.

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Abbreviations

AAIB	Air Accidents Investigation Branch
ACAS	Airborne Collision Avoidance System
ADI	Aerodrome control instrument rating
ADV	Aerodrome Control Visual rating
ADI/GMC	Aerodrome control instrument/Ground movement control
ADI/TWR-RAD	Aerodrome control instrument /Control tower-radar control
AENA	Spain's airport operator and air navigation services provider
AESA	Spain's National Aviation Safety Agency
AIR-RAD	Air control-Radar control
AIP	Aeronautical Information Publication
AMC	Acceptable Means of Compliance
APP	Approach control
APS	Approach control surveillance rating
APS/RAD	Approach control surveillance/Radar control
ATC	Air traffic control
ATCO	Air traffic controller
ATM	Air traffic management
ATPL(A)	Air transport pilot license (airplane)
CIAIAC	Spain's Civil Aviation Accident and Incident Investigation Commission
CLD	Clearance delivery
CVR	Cockpit Voice Recorder
DME	Distance-measuring equipment
DVOR	Doppler VHF Omnidirectional Range
EASA	European Aviation Safety Agency
EGNM	ICAO code for the Leeds Bradford International Airport
EGPF	ICAO code for the Glasgow International Airport
EU	European Union
Eurocontrol	European Organization for Air Navigation Safety
FDM	Flight data monitoring
FDR	Flight Data Recorder
Fig.	Figure
ft	Feet
GND	Aerodrome ground control post
hh:mm	Hours:Minutes
IAS	Indicated Airspeed
JAR-FCL	Joint Aviation Requirements for Flight Crew Licensing
kg	Kilos
Km/h	Kilometers per hour
kt	Knots
LCL	Aerodrome local control post
LEMG	ICAO code for the Malaga Airport
m	Meters
NM	Nautical miles
QAR	Quick access recorder
RA	Resolutionary advice
RCA	Spain's Air Traffic Regulations
RPM	Revolutions per minute
RWY	Runway
s	Seconds
SACTA	Automated System of Air Traffic Control
TCAS	Traffic alert and Collision Avoidance System
TWR	Aerodrome Control Tower
UE	European Union
UTC	Coordinated Universal Time
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VOR	VHF Omnidirectional Range

Synopsis

Owner and Operator:	Ryanair Limited	Jet2.com Limited
Aircraft:	Boeing 737-8AS	Boeing 737-8Z9
Date and time of incident:	17 September 2014 at 13:20 local time	
Site of incident:	Malaga-Costa del Sol Airport (Spain)	
Persons onboard:	6 crew and 167 passengers No injuries reported	6 crew and 184 passengers No injuries reported
Type of flight:	Commercial air transport – Scheduled – International – Passenger	Commercial air transport – Scheduled – International – Passenger
Phase of flight	Approach – Other	Passenger Takeoff – Takeoff run
Date of approval:	30 November 2016	

Summary of the event

On 17 September 2014, a Boeing B737-8AS, registration EI-EBC, was making the flight from the Leeds Bradford International Airport (EGNM), United Kingdom, to the Malaga-Costa del Sol Airport (LEMG). Its callsign was RYR57BQ. At the same time, a Boeing B737-8Z9, registration G-GDFR, was making the flight from the Malaga-Costa del Sol Airport to the Glasgow International Airport (EGPF), United Kingdom. Its callsign was EXS21PM.

The airport was in its preferred, single-runway configuration, which used RWY 13 for takeoffs and landings.

Both aircraft were in radio contact with the local controller (LCL) at the LEMG TWR. The controller decided that after the landing of another aircraft, and before the landing of aircraft RYR57BQ, aircraft EXS21PM would take off.

The LCL thus cleared EXS21PM to first enter the runway and subsequently to take off, while aircraft RYR57BQ was instructed to expect a late landing clearance.

By the time LCL cleared RYR57BQ to land, after EXS21PM had started its takeoff run, the former had already initiated a go-around maneuver.

During the course of this maneuver, the two aircraft were separated by 0.5 NM horizontally and 100 ft vertically.

After analyzing the event, this report concludes that the incident resulted from two circumstances. The first one produced by the landing clearance given to an aircraft on an occupied runway, followed by the second one during which the separation between the two aircraft might have compromised their security, as consequence of the improper management of the separation between aircraft (RYR57BQ and EXS21PM) given by the LCL controller. Contributing to the event was the fact that the departing traffic EXS21PM was taking off at a slower speed than the one expected by the controller, which evidences that the capacity of the controller to carry out his duties could have been better.

It is also considered that the procedure adopted to assess the competence of the LCL controller, due to the training processes established by the air navigation service provider during the specific training process in the unit, did not guarantee the suitability of this unit for the performance of their duties.

This report contains two Safety Recommendations, one for the air navigation services provider (ENAIRE) and other for Spain's National Aviation Safety Agency (AESA), which read as follows:

REC 38/16.
It is recommended that the air navigation services provider, ENAIRE, adopt and implement the necessary changes to its organizational procedures to use training and evaluation methods that ensure the proper proficiency level of controllers, in keeping with the characteristics of the unit and all the possible operating situations.

Such methods must be consistent with the ones indicated both in the AMC (Acceptable Means of Compliance) and in the guidelines (ATC Refresher Training Manual) referenced by the regulation, regardless of other possible authorized ones be established by the Agency.

REC 39/16.
It is recommended that Spain's National Aviation Safety Agency (AESA) inform those companies certified by the Agency that, as pertains to the initial and unit training of ATCOs, they must use those training and evaluation methods that ensure the proper proficiency level of controllers, in keeping with the characteristics of the unit and all the possible operating situations.

Such methods must be consistent with the ones indicated both in the AMC (Acceptable Means of Compliance) and in the guidelines (ATC Refresher Training Manual) referenced by the regulation, regardless of other possible authorized ones be established by the agency.

1. FACTUAL INFORMATION

1.1. History of the flight

On 17 September 2014, a Boeing B737-8AS, registration EI-EBC, was making the flight from the Leeds Bradford International Airport (EGNM) to the Malaga-Costa del Sol Airport (LEMG). Its callsign was RYR57BQ. At the same time, a Boeing B737-8Z9, registration G-GDFR, was making the flight from the Malaga-Costa del Sol Airport to the Glasgow International Airport (EGPF). Its callsign was EXS21PM.

The airport was in its preferred, single-runway configuration, which used RWY 13 for takeoffs and landings. Visual meteorological conditions (VMC) were in effect.

Aircraft EXS21PM was taxiing to the RWY 13 holding point, while RYR57BQ was number two in the approach sequence. The LEMG TWR controller manning the local (LCL) post decided that after the first aircraft in the approach sequence (THY4EG) landed, and before RYR57BQ landed, that EXS21PM would take off.

Aircraft EXS21PM was cleared by the LCL to take off at 11:18:34[1]. He then repeated the clearance, which was acknowledged by the crew of the aircraft. At 11:19:06, he informed RYR57BQ to expect a late landing clearance due to traffic rolling on the runway, and at 11:20:01, he cleared it to land. Seconds later, the LCL informed the departures controller (APP) that RYR57BQ was going around.

At 11:20:20 LCL asked to RYR57BQ to confirm if they had preceding traffic in sight, and the crew answered affirmatively.

At 11:20:31, the LCL instructed EXS21PM to turn heading north for separation from RYR57BQ. At that time the aircraft were 0.6 NM apart horizontally and 200 ft apart vertically. RYR57BQ reported it was turning left to course north. At 11:21:03, EXS21PM asked if it should also proceed on course north, and the LCL amended his previous instructor and instructed it to turn south. At 11:21:14, the LCL transferred aircraft EXS21PM to the Malaga Departures frequency, an instruction he gave to RYR57BQ a few seconds later.

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

1.2. Injuries to persons

1.2.1. Aircraft RYR57BQ

Injuries	Crew	Passengers	Total	Others
Fatal				
Serious				
Minor				
None	6	167	173	
TOTAL	6	167	173	

1.2.2. Aircraft EXS21PM

Injuries	Crew	Passengers	Total	Others
Fatal				
Serious				
Minor				
None	6	184	190	
TOTAL	6	184	190	

1.3. Damage to aircraft

There was no damage to either aircraft.

1.4. Other damage

Not applicable.

1.5. Personnel information

1.5.1. Information for the crew of aircraft RYR57BQ

The captain of RYR57BQ, a 29-year old British national, had a JAR-FCL Airline Transport Pilot License (ATPL(A)) issued by the Irish Aviation Authority and a B737 300-900 rating

that was valid until 31/12/2014. He had valid class 1 and class 2 medical certificates. He had a total of 6202 flight hours, of which 5951 had been on the type.

The first officer of RYR57BQ, a 33-year old British national, had a JAR-FCL Airline Transport Pilot License (ATPL(A)) issued by the Irish Aviation Authority and a B737 300-900 rating that was valid until 31/12/2014. He had valid class 1 and class 2 medical certificates. He had a total of 2904 flight hours, of which 2200 had been on the type.

1.5.2. Information for the crew of aircraft EXS21PM

The captain of EXS21PM, a 47-year old British national, had a JAR-FCL Airline Transport Pilot License (ATPL(A)) issued by the Aviation Authority of the United Kingdom and a B737 300-900 rating that was valid until 31/07/2015. He had valid class 1 and class 2 medical certificates. He had a total of 6370 flight hours, of which 3660 had been on the type.

The first officer of EXS21PM, a 31-year old British national, had a JAR-FCL Airline Transport Pilot License (ATPL(A)) issued by the Aviation Authority of the United Kingdom and a B737 300-900 rating that was valid until 30/11/2014. He had valid class 1 and class 2 medical certificates. He had a total of 3100 flight hours, of which 400 had been on the type.

1.5.3. Information on the air traffic control personnel

1.5.3.1. General

The controller, a Spanish national, had an Air Traffic Controller license issued by Spain's National Aviation Safety Agency (AESA) that was valid until 10/05/2015, and a medical certificate that was valid until 29/01/2015. He also had the following unit rating endorsements: ADI/AIR-RAD, ADI/GMC, ADI/TWR-RAD and APS/RAD, which were valid until 9 November 2014.

He had a total of ten years' experience in ATC. He completed the LEMG TWR training in November 2013 after taking and passing the unit training course required to obtain the rating endorsement.

His duty time on the day of the event was as follows:

START TIME (hh:mm)	DUTY TIME (hh:mm)	POST
05:33	00:25	Combined (CLD, GND,TWR)
07:02	01:52	Combined (CLD & GND)
10:02	01:22	Local (TWR)

The amount of traffic logged during these duty periods was:

Time (hh:mm)	Takeoffs	Landings	Total
05:00 ---------- 05:59	11	1	12
07:00 ---------- 07:59	9	14	23
08:00 ---------- 08:59	10	16	26
10:00 ---------- 10:59	15	14	29
11:00 ---------- 11:59	14	13	27

The total duty time from the date the controller started his activity[2] at the LEMG TWR (CLD, GND and TWR) until the event was approximately 122 hours, of which 70 hours had been at the LCL control post.

1.5.3.2. Unit training received by the controller

The controller had completed all of the tests required by the relevant regulation in order to stand watch at the various control posts at the Malaga Airport, having received the rating endorsements noted in the previous section.

As concerns the content of the theoretical and practical courses taken, the controller received on-the-job training at the LCL and GND posts by an instructor, before receiving his ADI aerodrome control rating. For his approach surveillance control (APS) rating, he took both theoretical and simulator courses. Both required him to pass the relevant assessment test.

The evaluation sheets for the courses showed that for the ADI unit endorsement, aspects such as go-arounds, communications failures, aircraft emergencies, runway incursions, and low-visibility procedures are evaluated by discussing the applicable procedure.

The same thing applied to the evaluation needed to obtain the APS unit endorsement for procedures such as ACAS/TCAS, response to an RA (resolution advisory), aircraft emergencies, system failures and low-visibility procedures.

[2] This calculation does not include his activity at the LEMG APP post.

1.6. Aircraft information

1.6.1. Aircraft RYR57BQ

Aircraft EI-EBC, a Boeing 737-8AS model with serial number 37520, had two CFMI CFM56-7B26 engines and a valid certificate of airworthiness (expiration date 01/02/2015). It had been maintained in keeping with its approved maintenance program and its last inspection, a Type A inspection, had been on 23 June 2014, with 17336 hours and 10561 cycles on the aircraft.

1.6.2. Aircraft EXS21PM

Aircraft G-GDFR, a Boeing 737-8Z9 model with serial number 30421, had two CFMI CFM56-7B26 engines and a valid certificate of airworthiness (expiration date 10/07/2015). It had been maintained in keeping with its approved maintenance program and its last inspection, a Type A inspection, had been on 10 September 2014, with 28586 hours and 12968 cycles on the aircraft.

1.7. Meteorological information

The weather conditions reported to the aircraft crews were wind from 360° at 8 knots.

1.8. Aids to navigation

1.8.1. Information taken from the SACTA system

The Malaga control station has a SACTA flight data processing system, and the area in which the aircraft were flying was within radar coverage.

Based on the data from this system, at 11:18:18 aircraft RYR57BQ was a little over 5 NM away from the runway 13 threshold and descending. At that time, the LCL had not yet cleared EXS21PM to take off from this same runway, since THY4EG was still on it following its landing maneuver.

RYR57BQ continued to approach the runway until, at 11:20:03, this aircraft was cleared to land, by which time it was already over the runway threshold within 100 ft of the ground and descending.

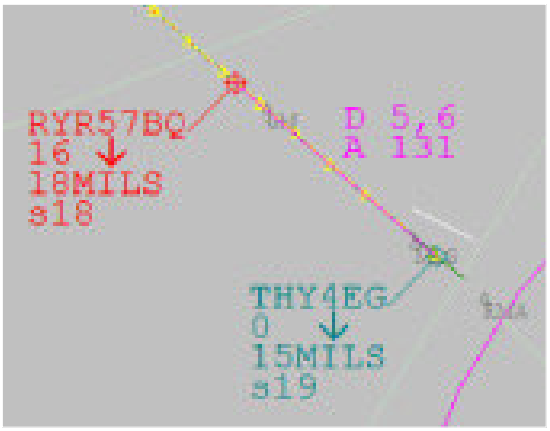


Figure 1: Position of aircraft RYR57BQ and THY4EG at 11:18:18

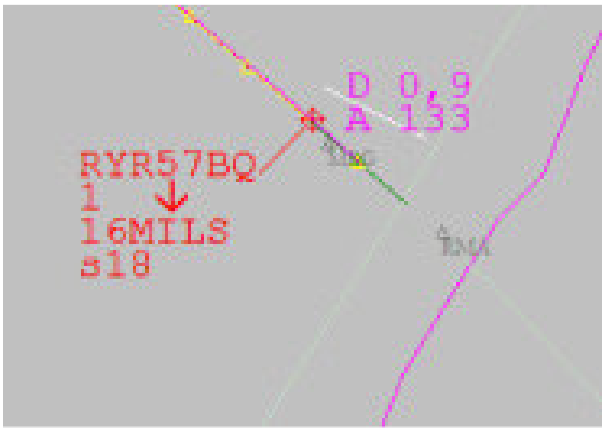


Figure 2: Position of aircraft RYR57BQ at 11:20:03

Ten seconds later, RYR57BQ was flying over the runway at 200 ft and climbing.

At 11:20:19 the first radar return from EXS21PM showed it 100 ft above the ground. At that time the two aircraft were separated by 0.8 NM horizontally and 500 ft vertically. These distances shrunk, reaching values of 0.6 NM horizontally and 200 ft vertically after the LCL instructed EXS21PM to turn heading north.

By 11:20:39 RYR57BQ had already started turning left to heading north, reducing the vertical distance between the two aircraft to 100 ft.

At 11:21:05, when EXS21PM also started turning to heading north, the horizontal separation between the two aircraft reached its minimum value of 0.5 NM. Their vertical separation at the time was 100 ft.

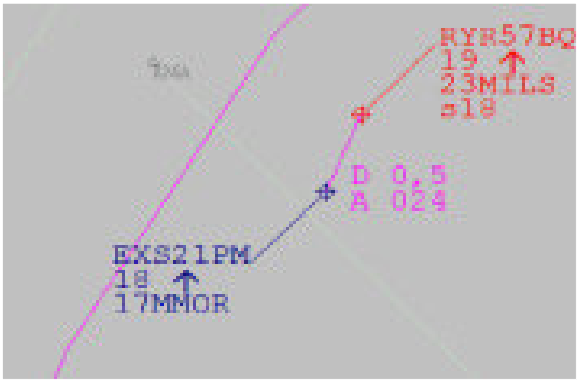


Figure 3: Position of the aircraft at 11:21:05

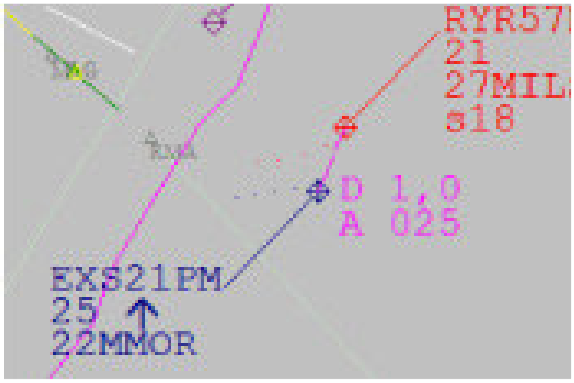


Figure 4: Position of the aircraft at 11:21:29

By 11:21:29, aircraft EXS21PM was turning to heading south, while RYR57BQ was turning to the north. By that time, the horizontal separation between them had increased to 1 NM and the vertical separation to 400 ft and the LCL had transferred RYR57BQ to the departures (APP) frequency.

1.9. Communications

The communications held with the aircraft on the local (LCL) and ground (GND) frequencies over the course of the event were available to investigators.

The controller's instruction to EXS21PM to taxi to the RWY 13 holding point was not recorded on the GND frequency, though the crew's acknowledgment ("Taxi holding point 13 EXS21PM") was.

According to the record of communications held on the LCL frequency, at 11:17:56 aircraft EXS21PM reported being fully ready. The controller then asked the crew of this aircraft if they were ready to take off, which the crew confirmed. They were then cleared to line up and wait for the takeoff clearance.

Shortly afterwards, at 11:18:26, the LCL transferred THY4EG to the ground frequency; then, at 11:18:34, he cleared EXS21PM to take off, which its crew acknowledged. The clearance was repeated eleven seconds later.

At 11:19:06, the LCL informed RYR57BQ to expect a late landing clearance because there was still an aircraft taxiing on the runway, to which its crew replied that they were continuing the approach.

Fifty-seven seconds later, the LCL cleared RYR57BQ to land, only to inform the APP controller ten seconds later that RYR57BQ was going around. There was no communication recorded on the frequency between the controller and aircraft, or vice versa, pertaining to the go-around maneuver.

At 11:20:20, the LCL asked the crew of RYR57BQ if they had visual contact with the aircraft that was taking off. The transcript of the exchange indicates that the crew of RYR57BQ replied "Affirm RYR57BQ, we are getting ready to the sea" (the complete sentence is garbled in the audio file).

At 11:20:31, the LCL instructed EXS21PM to turn heading north. Fifteen seconds later RYR57BQ reported that it was turning left heading north.

At 11:21:03, EXS21PM asked whether to proceed to the north as well, and the LCL amended his previous instruction, telling EXS21PM to turn south.

Seconds later, both aircraft were transferred to the Departures frequency (APP).

1.10. Aerodrome information

The Malaga-Costa del Sol Airport (LEMG) has two runways in 12/30 and 13/31 orientations. The airport is at an elevation of 16 m. At the time of the event it was operating in a single-runway configuration, with runway 13 being used for both landings and takeoffs. This is the preferred configuration when using a single runway.

Runway 13 is 3200 m long and 45 m wide.

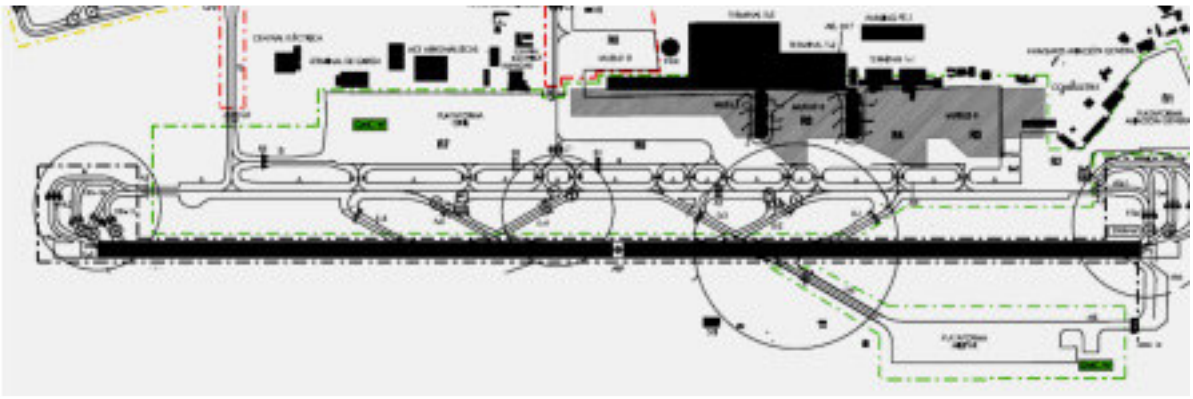


Figure 5: Runway at the LEMG airport

Unless the ground (GMC) controller specifies otherwise, access to runway 13 with a single aircraft in operation will preferentially be via HN-3. HN-1R will not be used unless instructed by GMC (information contained in the Aeronautical Information Publication (AIP)). See Figure 6.

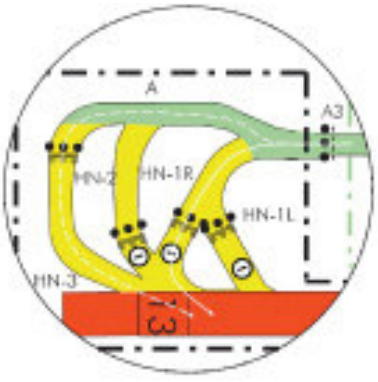


Figure 6: Access taxiways to runway 13

1.11. Flight recorders

The flight data recorder (FDR) and the quick access recorder (QAR) were synchronized using the aircraft's communications with the airport's control tower. The synchronization error was determined to be under two seconds.

1.11.1. Flight recorders on aircraft RYR57BQ

Aircraft RYR57BQ was equipped with a flight data recorder (FDR) and a cockpit voice recorder (CVR). Due to the time that elapsed between the incident and its being reported to the CIAIAC, it was not possible to recover the information from the CVR.

The FDR submitted by the operator for its reading was a Honeywell solid-state model, part number 980-4700-042. The data revealed the instant, 11:20:06, at which RYR57BQ started its go-around maneuver as it went from a descent to a climb attitude. Prior to this instant, the radio altimeter was recording descending values to an altitude of 38 ft, after which the recorded values started to increase. The airspeed also increased substantially after this time, as did the RPMs recorded by the engine tachometer.

Figure 7 shows some of the parameters it recorded. An expanded version is shown in Annex A.

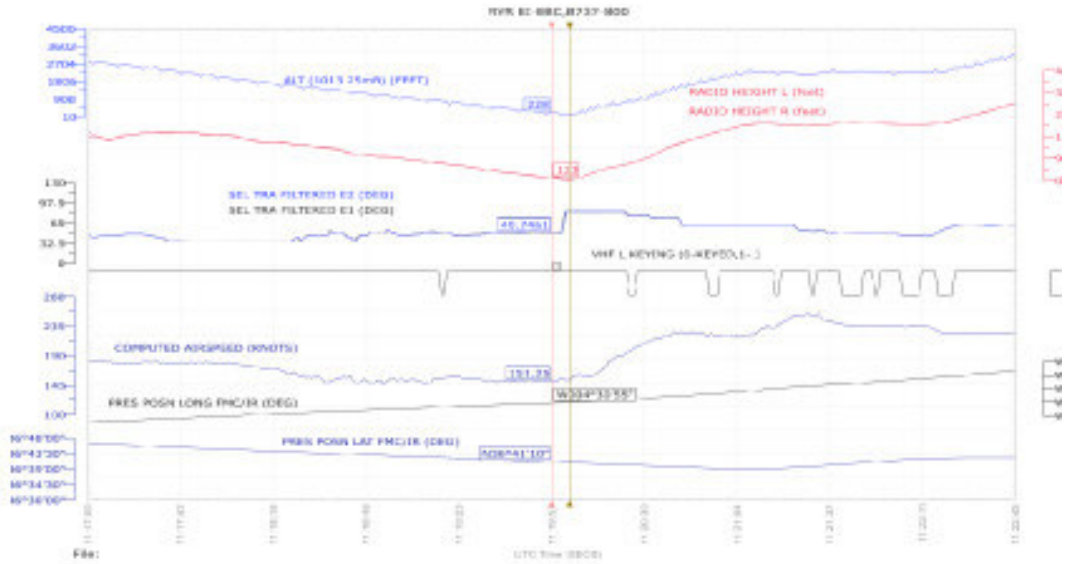


Figure 7: Data for aircraft RYR57BQ

1.11.2. Flight recorders on aircraft EXS21PM

Aircraft EXS21PM was equipped with cockpit voice and flight data recorders, as well as with a quick access recorder (QAR). Due to the time that elapsed between the incident and its being reported to the CIAIAC, it was not possible to recover the information from the CVR. The aircraft's operator did, however, provide the data from the FDR and QAR, which it obtained as part of its FDM (Flight Data Monitoring) program, to the CIAIAC through the United Kingdom's Air Accidents Investigation Branch (AAIB).

The data taken from the QAR show that the only time when pressure was applied to the brakes of EXS21PM was during a 12-second interval from 11:18:55 to 11:19:07, during which it was turning onto runway 13.

According to the data provided, at no point did the aircraft stop taxiing. The ground speed (GS) of EXS21PM was around 16 kt while it was on the taxiway. The GS then fell to 2.5 kt as the aircraft approached the holding point on taxiway HN-1R, before rising again to 8 kt and then dropping to 4 kt while turning onto the runway.

At 11:19:20, the aircraft was lined up on the runway and the engines were spooled up to start the takeoff run.

The aircraft was airborne at 11:20:10. Based on radio altimeter data, it was then that it started recording positive and increasing altitude values.

Figure 8 shows some of the parameters recorded. An expanded version is shown in Annex A.

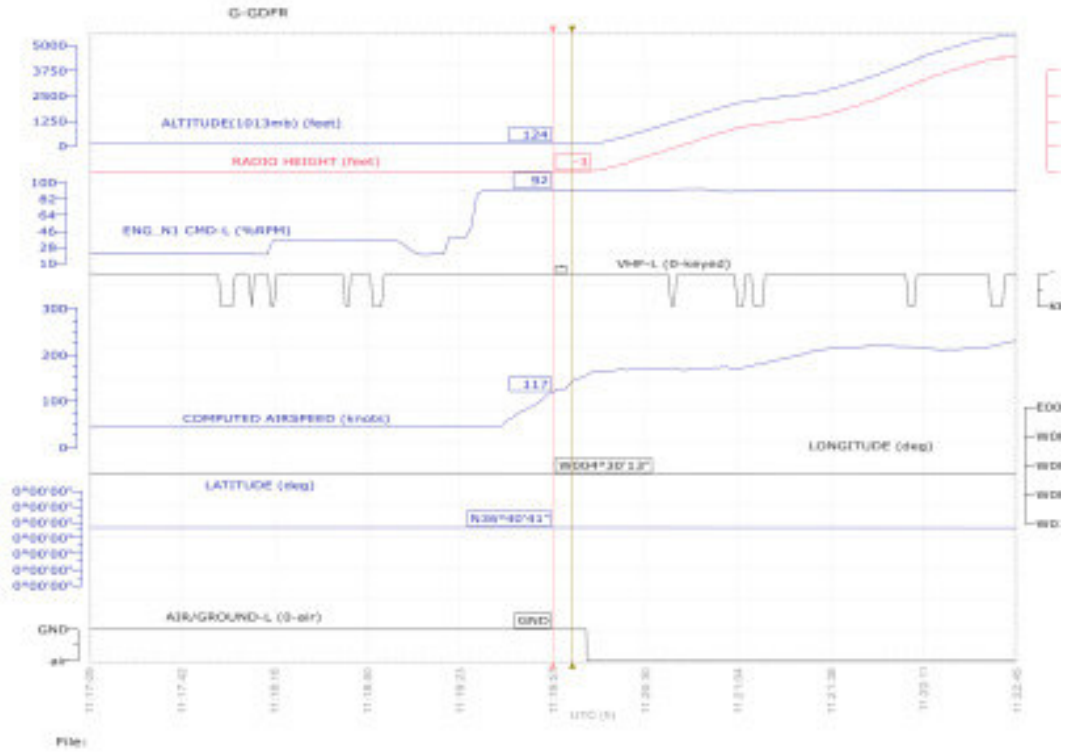


Figure 8: Data for aircraft EXS21PM

1.12. Wreckage and impact information

Not applicable.

1.13. Medical and pathological information

Not applicable.

1.14. Fire

There was no fire.

1.15. Survival aspects

Not applicable.

1.16. Tests and research

1.16.1. Reconstruction of the flight paths

The information from the surveillance radar, the FDR and QAR recorders and the ATC communications was used to reconstruct the flight paths of the two aircraft and to characterize the most significant events (Figures 9 and 10):

- When the crew of EXS21PM acknowledged the controller's instruction to line up on RWY 13 and wait, the aircraft was approximately 51 m away from the holding point for this runway on HN-1R and was traveling at 2.5 kt. Aircraft RYR57BQ was about 4.8 NM away on final and traveling at a speed of 171 kt (position 1).

- When the crew of EXS21PM acknowledged the takeoff clearance issued by the controller, they were about 73 m away from the RWY 13 threshold, on HN-1R, traveling at a speed of 7.5 kt. Aircraft RYR57BQ was about 3.6 NM away on final traveling at a speed of 156 kt (position 2).

- Aircraft EXS21PM received a second takeoff clearance. When it was acknowledged, RYR57BQ was 3.1 NM out on final, traveling at a speed of 149 kt (position 3).

- Aircraft EXS21PM did not stop at any point while turning to line up with the runway centerline, though it reduced its speed to 4 kt while turning onto the runway from HN-1R. By this time, RYR57BQ was 1.8 NM out on final and traveling at 158 kt (position 4).

- By the time aircraft RYR57BQ was over the runway threshold, at which point it started the go-around maneuver, EXS21PM was on its takeoff run, 1312 m away from the runway threshold (position 5).

- Aircraft EXS21PM rotated and took off some 1952 m away from the runway threshold, by which time RYR57BQ was already flying over the runway, and separated horizontally from EXS21PM by fewer than 0.4 NM (position 6).

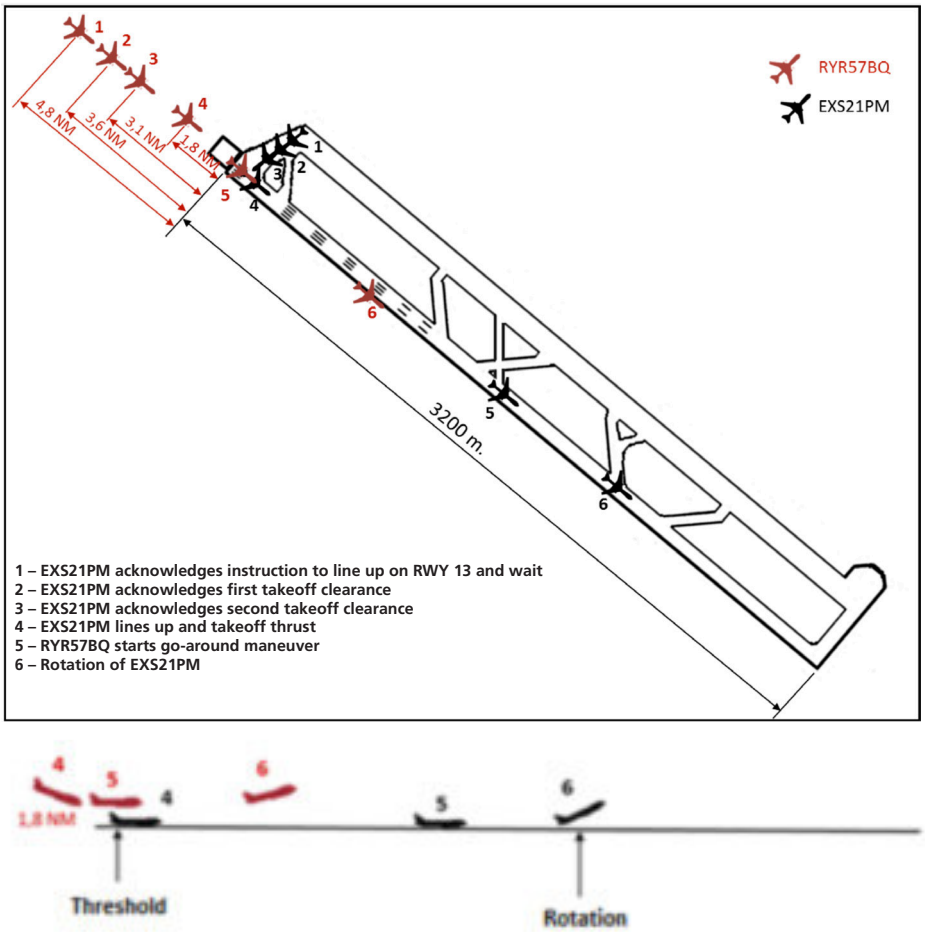


Figure 9: Positions of the two aircraft

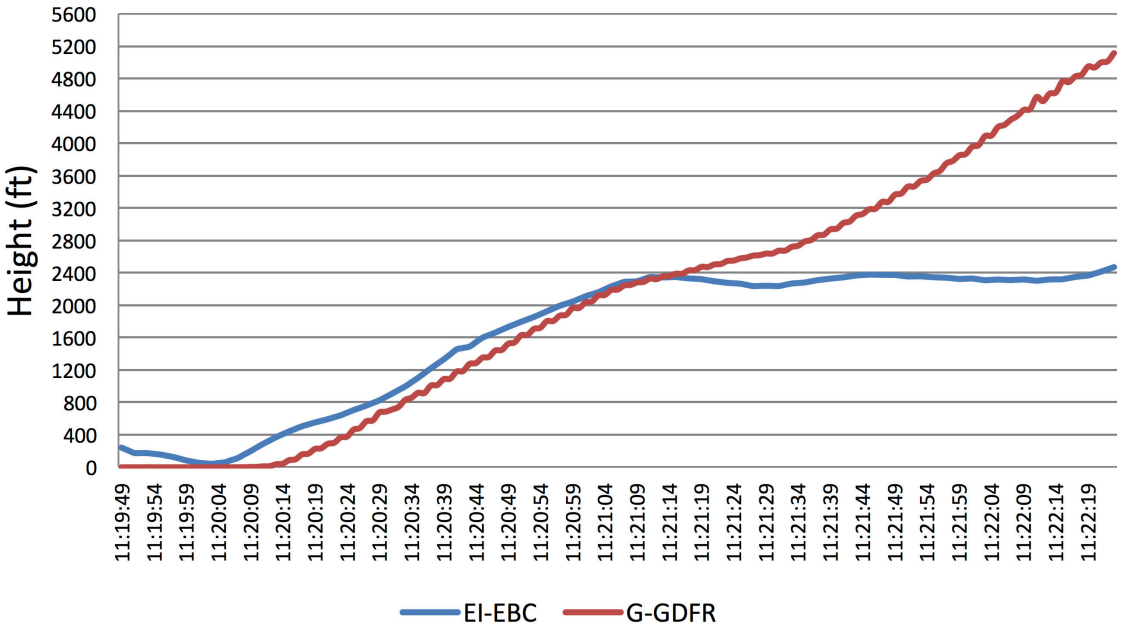


Figure 10: Vertical separations between the aircraft

1.16.2. Report from crew of aircraft RYR57BQ

The crew of aircraft RYR57BQ stated in their report that while on final, some 4 NM out, they heard the controller instruct an aircraft to line up with the runway, and cleared it to take off a short time later. The aircraft remained stopped on the runway while they continued their approach. They saw aircraft EXS21PM start its takeoff run when they were at 300 ft, and it was still on the runway when they reached 50 ft. As a result, they began a go-around maneuver. After commencing the maneuver, they were cleared by the LCL to land, while EXS21PM was still on the runway. Since both aircraft were on the same path, they decided to turn slightly to the left of the runway centerline, deviating from the published missed approach trajectory so as to maintain visual separation with the other aircraft. They were cleared by LCL to proceed on heading north, which was the same heading that EXS21PM was on, as per their assigned standard instrument departure. As a result, the distance between the two aircraft fell once more. LCL then instructed EXS21PM to turn heading south, after which the separation between the two aircraft increased.

1.16.3. Report from crew of aircraft EXS21PM

The crew of aircraft EXS21PM explained in their report that after taking off from runway 13, and while climbing as per their cleared standard instrument departure, they were instructed by LCL to turn left heading north. During this turn, the TCAS (Traffic Alert and Collision Avoidance System) showed an aircraft on the navigation display that was to their left, at the same level and climbing. They immediately disengaged the autopilot to turn right and the first officer contacted LCL, which instructed them to turn heading south, and the RYR57BQ to turn heading north. They then identified the Ryanair aircraft visually and saw it turn to its left after executing the go-around procedure for runway 13, but they did not hear any reports involving this maneuver. He also added that they did not receive any TCAS alerts.

1.16.4. Statement from ATC personnel

The executive controller at the LCL post in the LEMG TWR indicated in his report that after EXS21PM acknowledged being fully ready to take off, he cleared it to line up on the runway and take off, which the crew acknowledged. He said that at that time, RYR57BQ was 5 NM out. He informed its crew of the takeoff and told them to expect a late landing clearance. He then again cleared EXS21PM to take off, which its crew acknowledged. When this aircraft was 2200 m into its takeoff run and at the rotation speed, he cleared RYR57BQ to land, but its crew commenced a go-around. He then instructed EXS21PM to turn heading north, which its crew acknowledged. RYR57BQ reported traffic in sight and north heading turning to the right, and asked whether to turn to the left. EXS21PM

then asked if they too should turn right, so he instructed EXS21PM to proceed on heading south and RYR57BQ to continue standard and contact the Departures frequency.

The LCL stated that when he cleared EXS21PM to line up and hold on runway 13, it was stopped at the HN-1 holding point for runway 13. This holding point, according to the controller, is the one used by most aircraft when they are not instructed to use another one, as it is the closest to the runway. He also noted that EXS21PM was lined up on the runway, and that its crew reported ready for takeoff both times he cleared them to do so.

In the opinion of the LCL, as concerns a takeoff and landing involving similar aircraft, if the landing aircraft is flying at 180 kt or faster, he applies a distance greater than 5 miles on final, and always asks the crew of the departing aircraft if they are fully ready. Furthermore, to clear the aircraft to land, he ensures there is 2200 meters between the landing and departing aircraft, and that the latter is in fact moving. He does this by visually checking that the departing aircraft has passed the intersection where the Firefighting Service is located, somewhere around G-4, and is lifting its wheels.

1.16.5. Information in the AIP on the entry taxiways to runway 13

According to the information provided by the air traffic services provider, even though the Aeronautical Information Publication (AIP) indicates that entry taxiway HN3 is for takeoffs from runway 13, as noted in section 1.10 of this report, it is customary for the ground controller to instruct crews to use HN1 or, if allowed by the size of the aircraft, HN2.

As a result, the contents of the AIP will be corrected to instruct the preferred use of entry taxiway HN1.

1.16.6. Information involving similar events

This Commission studied a similar case, described in report IN-051/2011, involving two aircraft, one landing at and the other departing from the Tenerife South Airport. In that report, the CIAIAC evaluated the maneuvers carried out by the aircraft and the criterion used by the LCL to maintain the separation between the arriving and departing aircraft.

The report states that there is no written procedure to orient controllers on how to choose suitable distances for them to use as a valid reference. It also notes that even though the judgment and the references used by the controller on duty may be valid in most cases, this does not guarantee their applicability to every scenario.

The final report included one Safety Recommendation, reference REC 07/13, directed at the services provider (AENA, now ENAIRE), which stated the following:

«**REC 07/13:** It is recommended that AENA ensure that the personnel in its control towers have specific procedures and receive training on said procedures, so as to ensure proper separation when an airplane is given an immediate departure clearance with another airplane on approach, while taking the following factors, at a minimum, into consideration: type of airplane on approach, position and ground speed at the time of the clearance, position of the departing aircraft in the maneuvering area at that instant, local wind conditions and the possibility that once the clearance is issued, a situation might foreseeably arise that reduces separation below minimums.»

The response by the air traffic services provider (AENA, now ENAIRE) was evaluated and classified by this Commission as OPEN, RESPONSE NOT SATISFACTORY[3], since the documentation provided offers no evidence as to the existence of specific procedures on handling immediate departure clearances with an airplane on approach.

Subsequently, another incident, investigated in report IN-011/2014, took place at the Valencia Airport. This report details the problems facing a controller who attempted to manage the operational variables that arose when separating two aircraft, one on arrival and another departing, and how such a situation relies on the controller's own skill. In this specific case, the separation rules specified in Spain's Air Traffic Regulations were violated.

Between 2011 and 2015, this Commission opened investigations into a total of 46 accidents/incidents involving the ATC service, broken down as follows: 16 in which ATC's actions were directly related to the event, and 30 in which they contributed indirectly.

[3] NOTE: the day on which this report is being finished, this Recommendation has progressed in its course and after a new assessment based on the accompanying documentation, it has been described as CLOSED, SATISFACTORY ANSWER.

1.17. Organizational and management information

1.17.1. European regulations on air traffic controller (ATCO) training

1.17.1.1. Requirements for continuation or refresher training

The requirements for continuation training are detailed in Section 4 of Commission Regulation (EU) 2015/340 of 20 February 2015.

It states that continuation training shall be provided through refresher and conversion courses, given as per the requirements included in the unit competence scheme, pursuant to section ATCO.B.025 of the Regulation.

The goal is to review, maintain and enhance the skills needed to provide safe, orderly and fast air traffic control services, section ATCO.D.001. The training courses can include theoretical and/or practical aspects, including simulation.

The training must be part of the training plan made specifically for the ATC unit in question, which will have been established by the training organization and approved by the competent authority (AESA).

It also states that the training will be organized into modules depending on aspects such as: the duration of the unit endorsements, content, changes to procedures or equipment, occurrence of events, etc.

1.17.1.2. Content and assessment of the continuation training courses

The requirements for the continuation training courses are detailed in ATCO.D.080 of Commission Regulation (EU) 2015/340, along with the acceptable means of compliance (AMC) and guidelines published by the European Aviation Safety Agency (EASA).

As for the guidelines, it proposes the manual published by Eurocontrol titled "ATC Refresher Training Manual" to aid with the method and means of implementing these courses or plans (GM3 ATCO.D.080 Refresher training). As for the training time, and based on the structure laid out in the training plan, the Manual recommends courses distributed into 15-day training cycles at least every three years.

The content of these courses shall, at a minimum, include the following aspects (ATCO.D.080(b)):

- Training on standard practices and procedures, using approved phraseology and effective communication.

- Training on abnormal[4] and emergency[5] situations, using approved phraseology and effective communication.

- Training on human factors.

As noted in the preceding section, the content of the unit training courses is laid out in section ATCO.B.025. The guidelines accompanying the Regulation include the following recommendations in section GM3 ATCO.B.025(a)(5);(6):

- That performance and practical skills be evaluated in traffic situations in real time.

- That theoretical proficiency be examined to determine the knowledge and understanding of air traffic controllers.

- That the subjects taught during refresher training, such as standard practices and procedures training, involving abnormal and emergency situations, as well as on human factors, must be evaluated on synthetic training devices or on other means of simulation.

1.17.1.3. Information on assessing unit endorsement courses

Section ATCO.D.070(c) of the Regulation states that "Notwithstanding point (a), a synthetic training device may be used during a unit endorsement assessment to demonstrate the application of trained procedures not encountered in the operational environment during the assessment".

[4] Commission Regulation (EU) 2015/340 defines "abnormal situation" as circumstances, including degraded situations, which are neither routinely nor commonly experienced and for which an air traffic controller has not developed automatic skills.

[5] Commission Regulation (EU) 2015/340 defines "emergency situation" as a serious and dangerous situation requiring immediate actions.

1.17.2. AESA's application of the regulation to controller training

The actions carried out by Spain's National Aviation Safety Agency to adapt to the policy environment stipulated in Regulation (EU) 2015/340 include publishing guidelines intended to standardize and inform air navigation services and ATC training providers. These guidelines include the significant points for the Authority to approve the training plans and courses for air traffic controllers and that are used to obtain and maintain licenses, ratings and endorsements.

The Agency believes that the syllabus of the refresher training courses given as part of the approved unit competence schemes can consider the following: the acceptable means of compliance and the EASA guidance material referred to in Regulation (EU) 2015/340 and the ATC Refresher Training Manual published by Eurocontrol.

Likewise, as the competent authority, AESA considers using a simulator an acceptable means of training[6].

1.17.3. Information from ENAIRE, the ATC services provider at the Malaga Airport

The following documents pertaining to the training of air traffic controllers, and to the Malaga Airport in particular, were consulted:

1. General unit training plan, dated 01/07/2014

2. Specific LEMG unit training plan, dated 16/06/2014

3. Competence scheme specific to LEMG, dated 16/06/2014

4. Procedure for maintaining proficiency in the tower, dated 09/04/2014

5. 2016 annual ATC training plan

6. Safety plan for the Malaga TWR, dated 02/02/2015

This documentation is based on Commission Regulation (EU) 805/2011 of 10 August 2011 and on others prior to Regulation (EU) 2015/340. Document (6), however, is based on the stipulations of the recent Regulation.

[6] Commission Regulation (EU) 2015/340 defines "simulator" as a synthetic training device that presents the important features of the real operational environment and reproduces the operational conditions under which the person undertaking training can practice real-time tasks directly.

As pertains to the continuation training requirements for air traffic controllers, Regulation (EU) 805/2011 contained the following criterion (Annex II, Part C):

> "Continuation training shall consist of theoretical and practical courses, together with simulation. For this purpose, the training organization shall establish unit competence schemes detailing the processes, manning and timing necessary to provide for the appropriate continuation training and to demonstrate competence."

After reviewing the content of the documentation, and in particular of document (3), it was noted that simulation exercises are not used for training to maintain proficiency or to assess competence, as per the criteria of the referenced Regulations.

Document (2), on the specific unit training plan that leads to obtaining the corresponding rating endorsement, does list 20 simulator hours, but the simulation part of the program only considers references to the approach control procedural (APP) and the approach control surveillance (APS) ratings.

Document (5), in referring to LEMG, considers the points in ATCO.D.080 (b) mentioned in point 1.17.1.2 of this report. Its content, however, is interpreted as not allowing simulation to be used as a training method, in particular for the ADV (Aerodrome control Visual rating) and ADI aerodrome control ratings.

The purpose of document (6) is to establish mitigative measures involved in investigating ATM (Air Traffic Management) incidents. It identifies said incidents and rates their severity in an effort to adopt corrective measures.

1.18. Additional information

1.18.1. Information contained in Spain's Air Traffic Regulations (RCA)

The RCA contains the following information on air traffic control clearances, controlling departures and arrivals and reduced separations between aircraft on the same runway.

- Air traffic control clearances

> "2.3.6.1.1.2. If the clearance issued by air traffic control is not satisfactory to the pilot in command of an aircraft, he/she can request that it be amended and, if feasible, an amended clearance shall be issued."

- Control of departing aircraft:

  "4.5.9.5.1.1. So as to expedite traffic, an aircraft can be cleared for immediate takeoff before it enters the runway. When accepting such a clearance, the aircraft shall taxi on the taxiway to the runway and take off without stopping on the runway."

In this regard, the following is in the documentation published in the AIP for the Malaga/ Costa del Sol Airport as part of the local regulation for departures:

"ATC shall regard all aircraft arriving at the holding point as fully ready to taxi into position on the runway and start the takeoff run immediately upon receiving the relevant clearance.

Aircraft that for any reason cannot comply with this requirement shall inform ATC before reaching the holding point.

Aircraft that are not ready to initiate the takeoff run immediately upon receiving the takeoff clearance shall have said clearance cancelled and be instructed to leave the runway via the first available exit taxiway."

As for the information from aerodrome control towers to aircraft, the RCA considers:

- Essential local traffic information as:

  "4.5.5.3.1. Any information on all aircraft, vehicles or personnel in or near the maneuvering area, or operating in the vicinity of the aerodrome, that may pose a hazard to the aircraft in question shall be regarded as essential traffic information."

  "4.5.5.3.2. Information shall be provided on essential local traffic, either directly or through the unit that provides the approach control service when, in the aerodrome controller's opinion, said information is necessary for safety reasons or when it is requested by the aircraft."

- And on runway incursions or a runway with obstacles:

  "4.5.5.4.1. If the aerodrome controller, after issuing a takeoff or landing clearance, notices an actual or imminent runway incursion or the presence of any obstacle in or near the runway that could jeopardize the safe takeoff or landing of an aircraft, the following suitable measures shall be taken:

a) Cancel the takeoff clearance for a departing aircraft;

b) Instruct the landing aircraft to initiate a go-around or missed approach maneuver;

c) In any event, inform the aircraft of the runway incursion or of the obstacle and of its position in relation to the runway."

As a general rule, the RCA prohibits aircraft from flying over the threshold of an occupied runway:

- Control of arriving aircraft:

  "4.5.10.1.1. Except as specified in 4.5.11 and 4.5.15, a landing aircraft shall generally not be allowed to cross a runway threshold during final approach until the preceding aircraft has crossed the other end of the runway in use (B), started a turn (C) or until all aircraft that have just landed (D) clear the runway (see Fig. 4-35 A)."

An early landing clearance may be issued, however, as long as adequate separation is ensured when the threshold is crossed:

"4.5.10.1.1.1. An aircraft can be issued a landing clearance if it can be reasonably assured that the separation shown in 4.5.10.1.1, or that stipulated as per 4.5.11, will exist when the aircraft crosses the runway threshold, as long as the landing clearance is not issued until the preceding aircraft in the landing sequence has crossed said threshold. To decrease the likelihood of a misunderstanding, the landing clearance shall include the designator of the landing runway."

This regulation also considers the requirement to publish the requirements associated with the application of reduced separation minimums on the runway:

- Reduced separation minimums between aircraft using the same runway:

  "4.5.11.2 All procedures pertaining to the application of reduced separation minimums on the runway shall be published in the Aeronautical Information Publication and in the local air traffic control instructions. Controllers shall receive appropriate and sufficient training on the use of these procedures."

Pursuant to this, these procedures are contained in the documentation published in this airport's AIP:

"No aircraft on final approach shall be allowed to cross the end of the runway until the following minimum separation exists, as appropriate:

A) Aircraft weighing 5670 kg or more.

Landing after takeoff: The departing aircraft that precedes it has taken off and is at least 2000 m away from the threshold."

When a landing clearance is issued pursuant to this procedure, the following phraseology shall be used:

"... (Callsign) BEHIND THE (aircraft type) LANDING/TAKING OFF,

CLEARED TO LAND RUNWAY (number)".

The RCA allows the controller to request expediting the taxi maneuver:

- Bilingual phraseology:

"4.10.3.4.8. Taxi procedures

ACELERE RODAJE [motivo]; EXPEDITE TAXI [reason]; "

Reducing the speed of aircraft on approach is also permitted, though the following are not allowed during the final approach phase:

- Instructions to control horizontal speed:

"4.2.21.3.6. Only adjustments not exceeding 40 km/h (20 kt) IAS higher or lower are allowed for aircraft on intermediate and final approach."

"4.2.21.3.7 No speed controls shall be applied to an aircraft after it crosses the 7-km (4-NM) point inbound on final approach."

1.18.2. Missed approach to runway 13 at the Malaga Airport

In the AIP Spain, the standard missed approach to runway 13 at LEMG instructs the aircraft to fly runway heading to D2.4 MLG, and then turn left to intercept and follow the 103 radial of the MLG DVOR/DME and hold at a maximum altitude of 2200 ft. See Figure 11.

Figure 11: Missed approach to runway 13

1.19. Useful or effective investigation techniques

Not applicable.

2. ANALYSIS

2.1. Progress of the flight and handling of air traffic by the LEMG TWR

2.1.1. Analysis of the approach of RYR57BQ and the takeoff of EXS21PM

Aircraft RYR57BQ was in radio contact with the LCL post at the LEMG TWR, and was number two in the approach sequence to RWY 13, behind THY4EG.

At the airport, EXS21PM was proceeding to the RWY 13 holding point.

At 11:17:56, the crew of EXS21PM informed the LCL they were fully ready for takeoff. LCL then cleared EXS21PM to enter runway 13 and line up. At that time the aircraft was, based on data taken from the QAR, 51 m away from the holding point on taxiway HN-1R and reducing its speed to 2.5 in the area near the holding point, before increasing its speed to 8 kt. RYR57BQ was 4.8 NM out on final and had a ground speed of 171 kt. THY4EG, which was ahead of RYR57BQ, had just landed and was still on the runway.

According to the statement made by the LEMG TWR LCL, an aircraft that is completely ready for takeoff may be issued a takeoff clearance as long as the next aircraft in the approach sequence is at least 5 NM out and traveling at 180 kt or less. In this case, RYR57BQ was within 5 NM and THY4EG had not yet cleared the runway. These measures are adopted by the controller, there being no written procedure at the unit.

At 11:18:26, after exiting the runway, THY4EG was transferred by the controller to the ground frequency, after which the controller cleared EXS21PM to take off from runway 13 at LEMG. At that time the aircraft was on taxiway HN-1R, some 73 m away from the runway threshold, while RYR57BQ was 3.6 NM out on final. EXS21PM did not stop at any time between being cleared to line up and starting its takeoff run. As it traveled on taxiway HN-1R, the aircraft was taxiing at 7 kt, slowing to a relatively slow 4 kt to turn onto the runway.

In this situation, the LCL did not instruct EXS21PM to expedite taxi, an instruction that could have been issued as per the applicable regulation, "EXPEDITE TAXI [REASON]", and indicating that there was traffic on final approach.

The LCL also did not instruct RYR57BQ to alter its speed, which could have gained a few seconds. Such speed controls can only be used before mile 4, as per Spain's Air Traffic Regulations.

Based on FDR data, the aircraft used taxiway HN-1R to enter the runway. The AIP states that this taxiway can only be used with permission from the GMC controller and that HN-3 is the preferred taxiway. It was not possible to determine whether such permission was given since it was not recorded on the audio tapes of the GND frequency. The aircraft's crew acknowledged "taxi holding point 13". In this regard, the controller indicated that holding point HN-1 is the most used by crews when another point is not given, since it is the closest to the runway. By the time EXS21PM was cleared to enter the runway and line up, it had already turned toward taxiway HN-1, though it had not reached the holding point. The aircraft was verified to have accessed the runway via HN-1R. It is not known which taxiway it was instructed to use.

At 11:19:06, the LCL notified RYR57BQ to expect a late landing clearance. At 11:19:20, EXS21PM was lined up on the runway and increasing engine thrust to start its takeoff run. RYR57BQ was 1.8 NM out on final. Until that moment the LCL could have changed the sequence by stopping EXS21PM from taking off and instructing RYR57BQ to go-around.

As EXS21PM was on its takeoff run, the LCL cleared RYR57BQ to land, but it had already started a go-around maneuver since the pilot thought that landing with EXS21PM still on the runway could compromise the operation. RYR57BQ started the go-around maneuver when it was over the runway threshold at an altitude of about 38 ft.

The crew of RYR57BQ could have requested that the clearance issued by air traffic control be amended in light of the proximity between the two aircraft. This would have helped identify the conflict a few seconds earlier.

Definitely, in the very moment that RYR57BQ was initiating a go-around maneuver, aircraft EXS21PM was still on the runway.

At 11:20:10, EXS21PM rotated and went airborne, some 1952 m away from the runway threshold. At that time, RYR57BQ was within 0.4 NM (740.8 m) of EXS21PM; that is, it had already passed the runway threshold, meaning that in case RYR57BQ had landed the minimum separation distances specified in the regulation would not have been complied with.

As the controller stated, when clearing an aircraft to land, he ensures there is 2200 m between the departing and landing aircraft and that the former is rotating. He does so by checking that the departing aircraft is past the intersection of the Firefighting Service, somewhere around G-4, and is lifting its wheels.

The QAR, FDR and radar data available show that the condition described by the controller was not met.

Finally, it is calculated that EXS21PM took 1 minute and 55 seconds from the time it was cleared to line up (it was 51 m away from the holding point), and 1 minute and 25 seconds from the time it was cleared to take off, until it rotated and became airborne. During that time, RYR57BQ traveled about 5 NM, equivalent to having an average speed of 160 kt, which is considered a normal approach speed.

2.1.2. Analysis of the go-around maneuver by RYR57BQ and the initial climb by EXS21PM

Figure 12 shows the paths taken by the two aircraft, with that of RYR57BQ indicated in red and that of EXS21PM in blue. The first path diverges to the left from the runway heading and continues north. The second aircraft started to fly the assigned standard departure, which also included a turn to the right, but was disturbed by the wrong instruction given by the LCL.

The crew of RYR57BQ took their action without informing ATC of their intentions as they were focused in flying the aircraft and in maintaining the horizontal separation with the other traffic at sight, this way deviating gently leftwards of runway 13. . On the other hand, the LCL also instructed EXS21PM to turn heading north, to its left, and a new reduction in the separation was produced

The radar data from that instant show that RYR57BQ was at 2200 ft, the altitude specified in the standard missed approach maneuver.

When the crew of EXS21PM noticed that the maneuver of RYR57BQ, and resulting from the instruction given to them by the LCL, put RYR57BQ in conflict with EXS21PM, they disengaged the autopilot and turned right to avoid the other aircraft. They then verified the direction of their turn with the LCL, who amended his instruction from turn north to turn south. At that time, the distance between the two aircraft was reduced to 0.5 NM and 100 ft.

Figure 12: Aircraft flight paths

2.2. Actions omitted by the LCL at the LEMG TWR

The aerodrome controller is the person who orders the movement of aircraft within his area of responsibility for the essential purpose of avoiding collisions between aircraft, vehicles, obstacles, and so on. To achieve this, the controller provides information and issues clearances pursuant to established procedures. These procedures are contained in the RCA, in traffic stipulations specified by the ATS authority, in the control tower's operating manuals, in the aeronautical information services, etc.

Section 1.18 lists the various rules of relevance to this event. Most of them are applicable directly to the controller, and others involve the cooperation of flight crews. A list of the chain of events that led first to the air traffic incident described herein, and then to an AIRPROX[7], is provided below:

- The location of EXS21PM, at least during the segment traveled before entering the runway, was not properly known by the LCL.

[7] Situation in which, in the opinion of a pilot or air traffic services personnel, the distance between aircraft as well as their relative positions and speed have been such that the safety of the aircraft involved may have been compromised.

- The assessment of the distance from RYR57BQ to runway 13 was not adequate.
- The controller did not apply his own references to ensure separation during the takeoff-landing operation.
- The controller did not employ the measures at his own power such as controlling the approach speed of RYR57BQ, cancelling the takeoff clearance or expediting the taxi of EXS21PM, or instructing RYR57BQ to go-around.
- He cleared RYR57BQ to land while the runway was occupied.
- He did not report either aircraft's situation to the other.
- He gave the aircraft headings instead of information.
- He had to amend a turn instruction while the two aircraft were climbing.

2.3. Aspects involving air traffic controller training

The combination of two aircraft, one taking off and the other going around, leads to a hazardous situation since both aircraft are on the same heading. Typically, this scenario stems from a previous misjudgment by either crew or by an unforeseen circumstance. Obviously, the frequency of events involving air traffic management will be reduced if the controller's ability to carry out this task is increased. One of the methods for doing this is to improve the training they receive.

The instructions contained in the RCA can be rendered ineffective if an unexpected situation or any unforeseen variable arises. When this happens, control of the situation is transferred to controllers, who will take action commensurate with the experience, knowledge and skills that they have acquired. As a result, aircraft safety relies on the controller's ability to respond to procedures that are not routine and that have not been learned.

The investigation into this event compared the regulations pertaining to specific unit training and refresher training with the methods proposed by the air navigation services provider to carry out said training. The key finding concerns the procedure used to evaluate the proficiency of controllers at their working positions, either to obtain the unit rating endorsement or to maintain their proficiency (renew the endorsement).

Without undertaking an evaluation of the syllabus for each training plan, it was noted that the method proposed for evaluating the proficiency of controllers in the two situations described above seems inadequate. As concerns the training given to obtain the ADI rating endorsement at the unit, the method of having the controller verbally describe the procedures to be used during emergency situations, a runway incursion, low visibility and so on, is deemed insufficient to evaluate the controller's proficiency.

The same method is used to evaluate the controller's response to an ACAS/TCAS advisory, a degraded system, etc. This is probably because these circumstances are not present during the training period. It is also understood that the factors involved in a real situation, such as stress and fatigue[8], are not comparable to those present during a verbal presentation of the procedures to be used.

Similarly, the way that a unit endorsement is maintained, by calculating the duty hours and giving an annual course on emergency and "special situations", without a method to examine the level of knowledge gained and the skills acquired through whatever simulation exercises are deemed necessary, is regarded as insufficient since the current methods are not enough to maintain and enhance the controller's skills.

Identifying and analyzing risk situations as a method for defining the safety actions needed at each unit is deemed insufficient if this is not accompanied by objectively evaluated theoretical and practical instruction for controllers, who are the ones who must handle the operational variables as they arise.

The event in question would not have progressed to the point that it did, with a simultaneous takeoff and go-around, if the skill in handling the situations leading up to it had been more appropriate. Specifically, while the controller demonstrated theoretical knowledge after the fact of the procedures and common practices in terms of separation between arriving and departing aircraft, in a situation like the one described herein, in which an aircraft is taxiing slower than expected, i.e. an abnormal situation, the controller did not know how to react effectively and did not make use of all the tools within his reach to avoid a situation that jeopardized the safety of the aircraft. If the controller had been exposed to more simulation exercises involving analogous situations (traffic taxiing slower than usual, aircraft landing with a tailwind, failure by pilots to carry out instructions, etc.), he would have been able to react more properly to the unexpected situation.

A comparison with the training methods used by other groups involved in air operations, be they on the ground or in the air, reveals that these groups receive and require training that evaluates their ability to handle infrequent or highly complex situations. For example, flight crews are required to be evaluated for their skills at solving emergency situations

[8] See the paper "Is refresher training of air traffic controllers adequate to meet the challenges of emergencies and abnormal situations?", by Stathis Malakis, of the Hellenic Civil Aviation Authority, and Tom Kontogiannis, of the Department of Production Engineering & Management, Technical University of Crete.

and for how they apply normal flight procedures. It is not strange, therefore, to consider creating similar procedures that enhance (improve) controllers' ability to handle infrequent situations, given their role as joint participants with flight crews in commercial air operations.

Since the safety of both aircraft was jeopardized in the event analyzed herein, since the frequency of events in which the role of air traffic control is significant enough, and in order to ensure that controllers' proficiency is in keeping with the demands placed on them by the nature of their activity, it is deemed necessary to issue the Safety Recommendations contained in Section 4 of this report.

The main goal of these recommendations is to maintain the on-the-job proficiency and practical skills of air traffic controllers through the use of training plans that contain evaluation methods that ensure the theoretical and practical knowledge gained during unit-specific training and then during continuation or refresher training.

To this end, Commission Regulation (EU) 2015/340, the acceptable means of compliance it contains and the guidelines (Eurocontrol document "ATM Refresher Training", Edition 1.0, dated 06/03/2015) specify suitable methods, including the simulated practice of real situations. The foregoing is without prejudice to any other evaluation methods proposed and that are accepted by the competent authority.

It should be noted that references on establishing simulation exercises in unit competence schemes already existed in Commission Regulation (EU) 805/2011, which was repealed by the current regulation.

2.4. Findings from previous accidents

Point 1.16.6 refers specifically to two events. The first determined the need to establish procedures and training on how to apply the separation criteria contained in the RCA, considering the variables specific to each control unit, such that the controllers' actions follow a single criterion and not each controller's individual interpretation of the regulation.

The second acknowledged the skill of the control personnel in dealing with the operational variables that arose when it came time to establish separation between two aircraft.

The number of events studied demonstrates the effect that instructions involving the controller, either directly or indirectly, can have[9].

[9] This figure includes route, approach and tower ATC personnel.

3. CONCLUSIONS

3.1. Findings

A. Pertaining to aircraft RYR57BQ:

i. The crew were qualified for the flight in question.

ii. The aircraft had a valid certificate of airworthiness.

iii. The crew were informed to expect a late landing clearance.

iv. The crew executed a go-around shortly before they were cleared to land when the aircraft was over the runway 13 threshold..

v. During said maneuver it deviated gently turning north (left) to separate from and maintain visual contact with the departing aircraft.

B. Pertaining to aircraft EXS21PM:

i. The crew were qualified for the flight in question.

ii. The aircraft had a valid certificate of airworthiness.

iii. They were cleared to taxi to the runway 13 holding point.

iv. It was not possible to verify which access taxiway they had been directed to use.

v. The crew informed LCL he ready to take off.

vi. They were cleared to take off twice, which they acknowledged twice.

vii. At no time did the aircraft stop while taxiing.

viii. After being cleared to take off, it took 35 s to increase thrust for takeoff.

ix. The standard departure they were flying required a turn to the south (right).

x. They noticed the presence of another aircraft on the TCAS, and they turned south (right), informing the LCL that his turn instruction matched the intentions of RYR57BQ.

xi. They executed the turn instruction as amended by the LCL.

C. Pertaining to the LCL

i. The controller had the license and unit endorsement required for the control task he was engaged in.

ii. The references used by the controller to ensure landing-takeoff separation were inadequate or were not used.

iii. He cleared RYR57BQ to land while the runway was occupied.

iv. He did not provide traffic information to EXS21PM to expedite or stop the takeoff.

v. He provided headings to the aircraft instead of information.

vi. He had to amend his turn to the left instruction to EXS21PM while both aircraft were climbing, as he was warned by the crew

D. Pertaining to the ATS provider at LEMG

vii. It has a specific unit training plan approved by the authority that allows issuing the ADI and APS unit rating endorsement for LEMG to its air traffic controllers.

viii. It has a unit competence scheme approved by the authority for maintaining the ADI and APS unit endorsement of its air traffic controllers.

ix. The unit training plan (D.i) does not envisage the use of a simulator to obtain the ADI rating endorsement for the unit; it only allows the use of simulation for the APS rating endorsement.

x. In the unit competence scheme (D.ii), the parameters used to maintain the unit endorsement are the number of duty hours and theoretical training on "emergencies and special situations".

xi. The unit has a safety plan to define mitigate measures as part of investigations into ATM (Air Traffic Management) incidents.

xii. The structure of the unit's 2016 ATC Annual Training Plan conforms to the guidelines in section ATCO.D.080(b), but it does not identify the use of simulation during instruction or to assess proficiency.

xiii. The methods used to assess proficiency in emergency and abnormal situations do not guarantee the controller's proficiency.

xiv. The subjects taught during annual training, such as standard practices and procedures, abnormal and emergency situations, and human factors, do not consider the use of simulation methods.

E. Pertaining to Spain's National Aviation Safety Agency

xv. The Agency is in the midst of phasing in the new Regulation (EU) 2015/340.

F. Previous incidents

xvi. There have been events with similar characteristics in the past where the need was identified to improve traffic management based on the characteristics specific to aerodromes. These events have resulted in a renewed call to improve the procedures used and controller training.

3.2. Causes/Contributing factors

The incident was the result of two situations. The initial one produced by the decision to issue an aircraft a clearance to land on an occupied runway, followed by the second one during which the distance between the two aircraft jeopardized their safety. This latter situation was a consequence of the improper handling of the separation between the two aircraft (RYR57BQ and EXS21PM) by the LCL.

Contributing to the event was the fact that the departing traffic EXS21PM was taking off at a slower speed than the one expected by the controller, which evidences that the capacity of the controller to carry out his duties could have been better.

It is also considered that the procedure adopted to assess the competence of the LCL controller, due to the training processes established by the air navigation service provider during the specific training process in the unit, did not guarantee the suitability of this unit for the performance of their duties.

4. SAFETY RECOMMENDATIONS

Investigation is intended to affirm that the management carried out by the LCL could have been better and safer.

As described in paragraph 2.3., it has been detected that during the training and evaluation of the air traffic controllers competence made by the air navigation services provider, there are situations specially hard to train and exercise viewing their rare occurrence.

Similarly the services provider, within the regulations scope, has a method approved by the authority both to obtain the rating for the pertinent unit and for the refreshing courses. However, data collected during investigation show that in sections related to emergency situations and those assessed as "special", the used method does not guarantee that the competence of the controller be the adequate one.

Regardless of the date of the event, and of the regulations applied, it is considered that this issue can be improved.

As a result of the investigation into the event, the following safety recommendations are issued:

REC 38/16. It is recommended that the air navigation services provider, ENAIRE, adopt and implement the necessary changes to its organizational procedures to use training and evaluation methods that ensure the proper proficiency level of controllers, in keeping with the characteristics of the unit and all the possible operating situations.

Such methods must be consistent with the ones indicated both in the AMC (Acceptable Means of Compliance) and in the guidelines (ATC Refresher Training Manual) referenced by the regulation, regardless of other possible authorized ones be established by the agency.

REC 39/16. It is recommended that Spain's National Aviation Safety Agency (AESA) inform those companies certified by the Agency that, as pertains to the initial and unit training of ATCOs, they must use those training and evaluation methods that ensure the proper proficiency level of controllers, in keeping with the characteristics of the unit and all the possible operating situations.

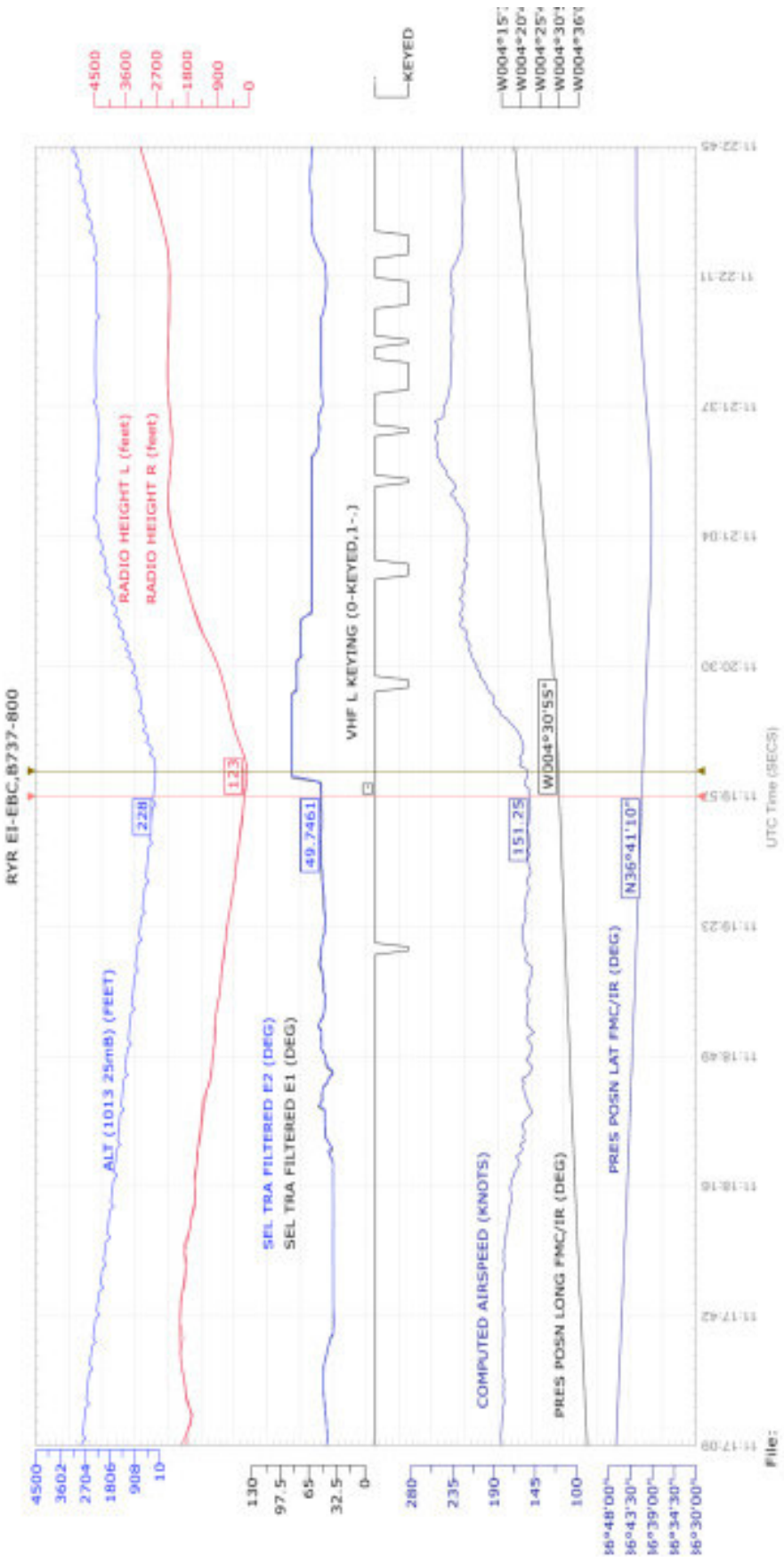
Such methods must be consistent with the ones indicated both in the AMC (Acceptable Means of Compliance) and in the guidelines (ATC Refresher Training Manual) referenced by the regulation, regardless of other possible authorized ones be established by the agency.

5. APPENDICES

ANNEX A: Graphs of the parameters recorded by the FDR on RYR57BQ and the QAR on EXS21PM.

ANNEX A

Graphs of the parameters recorded by the FDR on RYR57BQ and the QAR on EXS21PM


RYR EI-EBC,B737-800
ALT (1013.25mB) (FEET)
RADIO HEIGHT L (feet)
RADIO HEIGHT R (feet)
SEL TRA FILTERED E2 (DEG)
SEL TRA FILTERED E1 (DEG)
VHF L KEYING (0-KEYED,1-.)
COMPUTED AIRSPEED (KNOTS)
PRES POSN LONG FMC/IR (DEG)
PRES POSN LAT FMC/IR (DEG)
KEYED
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123
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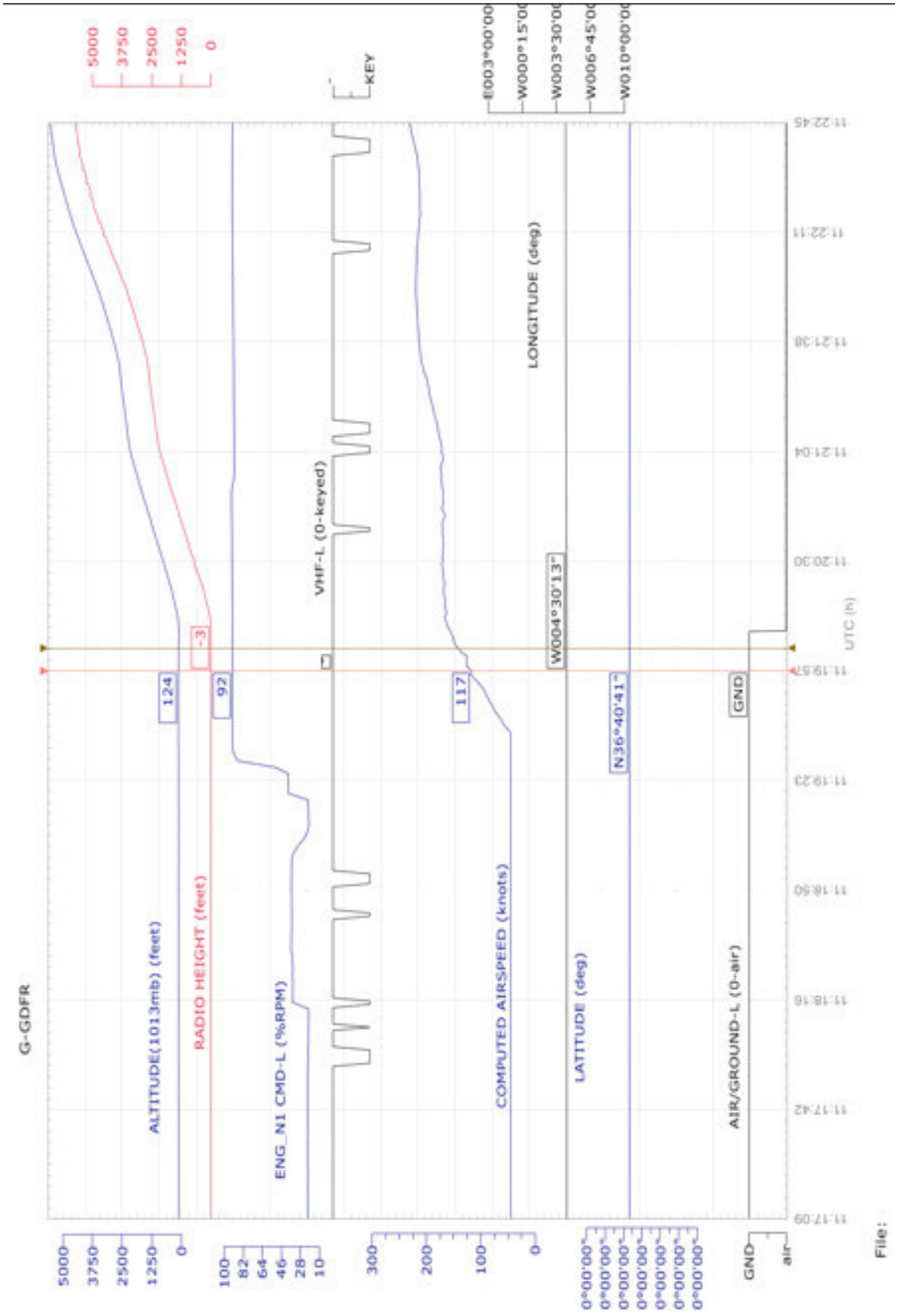
151.25
W004°30'55"
N36°41'10"
UTC Time (SECS)
File:


G-GDFR
ALTITUDE(1013mb) (feet)
RADIO HEIGHT (feet)
ENG_N1 CMD-L (%RPM)
VHF-L (0-keyed)
LONGITUDE (deg)
COMPUTED AIRSPEED (knots)
LATITUDE (deg)
AIR/GROUND-L (0-air)
KEY
UTC (h)
File:
124
92
-3
117
W004°30'13"
N36°40'41"
GND
air