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AVIACIÓN **C**IVIL

Report IN-005/2016

Incident involving a Boeing 737-700, registration D-ABLB, operated by Germania Fluggesellschaft mbH, at runway 03R of the Gran Canaria airport (Canary Islands, Spain) on 7 January 2016

GOBIERNO DE ESPAÑA
MINISTERIO DE FOMENTO

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COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

Edita: Centro de Publicaciones
Secretaría General Técnica
Ministerio de Fomento ©

NIPO: 161-16-350-1

Diseño, maquetación e impresión: Centro de Publicaciones

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Notice

This report is a technical document that reflects the point of view of the Civil Aviation Accident and Incident Investigation Commission (CIAIAC) regarding the circumstances of the serious incident 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 is 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

ACC	Area Control Center
AENA	Aeropuertos Españoles y Navegación Aérea
AESA	National Aviation Safety Agency
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATIS	Automatic Terminal Information Service
ATPL	Airline Transport Pilot License
ATS	Air Traffic Service
CIAIAC	Comisión de Investigación de Accidentes e Incidentes de Aviación Civil (Spanish AIB)
CPL(A)	Commercial Pilot License (Airplane)
CVR	Cabin Voice Recorder
EAPPRI	European Action Plan for the Prevention of Runway Incursions
EASA	European Aviation Safety Agency
FDR	Flight Data Recorder
ft	Feet
GCLP	ICAO identifier for the Gran Canaria Airport
GMC	Ground Movement Control
GNC	Ground Navigation Control
GS	Ground Speed
ICAO	International Civil Aviation Organization
Part-FCL	Flight Crew Licenses
Km	Kilometer
Kt	Knots
LCL	Local ATC position
LRSC	Local Runway Safety Committee
METAR	Airport weather report
N/A	Not applicable
NOTAM	Notice to Airmen
NPA	Notice of Proposed Amendment
QAR	Quick Access Recorder
RWY	Runway
SN	Serial Number
TWR	Control tower
UTC	Universal coordinated time

Synopsis

Owner and Operator:	Germania Fluggesellschaft mbH
Aircraft:	Boeing 737-700, registration D-ABLB
Date and time of incident:	Thursday, 07 January 2016 at 14:46[1]
Site of incident:	Runway 03R at the Gran Canaria Airport
Persons onboard the aircraft:	2 flight crew, 3 flight attendants and 135 passengers, none injured
Type of operation:	Commercial air transport - Scheduled - International - Passenger
Date of approval:	31st May, 2016

Summary of the incident:

On 7 January 2016, a Boeing 737-700, registration D-ABLB and callsign GMI6129, operated by Germania Fluggesellschaft mbH, was preparing to make a flight from the Gran Canaria airport (GCLP) to the Friedrichshafen airport (Germany).

The aircraft was cleared by the local controller (LCL) in the GCLP TWR to cross runway 03L and line up and wait on 03R. The aircraft's crew reported that the red lights on the stop bar located at S4 were turned on. The LCL controller again cleared the crew to line up and wait, and then to take off.

At that moment there was surveying work being conducted on runway 03R/21L, and there was a vehicle on the strip of this runway. As a result, once GMI6129 started its takeoff run on runway 03R, the LCL controller instructed it to cancel the takeoff.

The investigation concluded that the most probable cause was the controller's loss of situational awareness, as he mistakenly instructed the crew of GMI6129 to enter and then take off from runway 03R, despite knowing it was closed. This loss of situational awareness seems to have been caused by having his attention focused on another aircraft that had taken off previously, and to the entry into effect of a complex helicopter recovery procedure that required considerable coordination.

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

The following contributing factors were also identified:

- The controller did not notice his mistake despite having visual aids in the tower indicating that the runway was closed. He also did not visually detect the presence of the car in the runway 03R strip, though this may have been caused by the fact that, in keeping with the account of the crew of GMI6129 and the controller himself, it did not have its flashing lights on.

- The controller only partially heard a report from the crew informing that the stop bar was active, but he did not ask the crew to repeat the report, instead instructing the crew once more to line up and wait on runway 03R.

- The crew crossed an active stop bar without asking ATC to turn it off and without having information on contingency measures in place that prevented its deactivation. The fact that the regulation on stop bars and its associated manuals are not clear and specific could have contributed to this.

- The crew of the aircraft started the takeoff run despite having visual contact with the car, which was stopped on the runway strip.

- The mitigation measure of placing cones at the threshold of the temporarily closed runway was not in effect, since the minutes of the Local Runway Safety Committee meeting, where this measure had been proposed, were not approved.

As a result of the investigation, two safety recommendations are issued to the airport manager, ENAIRE, and to the ICAO.

1. FACTUAL INFORMATION

1.1. History of the flight

On 7 January 2016, a Boeing 737-700, registration D-ABLB and callsign GMI6129, was preparing to make a flight from the Gran Canaria airport (GCLP) to the Friedrichshafen airport (Germany).

The airport was in a single-runway configuration since runway 03R was temporarily closed due to surveying work. The runway closing had been reported by publishing a NOTAM.

At 14:33:04 there was a shift change involving the executive controller in the Local (LCL) position. Both the controller and the crew of GMI6129 knew that runway 03R was closed.

The controller correctly cleared VKG5636 to line up and wait and then to take off from runway 03L. A few seconds later, and after contacting GMI6129 on the LCL frequency, he cleared it to cross runway 03L and line up and wait on runway 03R, not realizing that the runway was closed.

After GMI6129 reached taxiway S4 to enter runway 03R, the crew reported that the stop bar was on and they stopped the aircraft. The controller then re-authorized the crew to line up and wait on runway 03R. Two minutes later, the controller cleared GMI6129 to take off. The crew started the takeoff run, but were instructed to cancel after traveling about 270 meters.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal				
Serious				
Minor				N/A
None	2 + 3	135		N/A
TOTAL	**5**	**135**		

1.3. Damage to aircraft

The aircraft was undamaged and was able to make its flight normally.

1.4. Other damage

There was no other damage.

1.5. Personnel information

1.5.1. Information on the crew of GMI6129

The captain of GMI6129, a 36-year old German national, had a Part-FCL Airline Transport Pilot License (ATPL(A)) with a B737 300-900 rating that was valid until 29 February 2016. He also had a class-1 medical certificate that was valid until 24 September 2016, and a class-2 certificate that was valid until 24 September 2020. He had a total of 6550 flight hours, of which 6030 had been on the type and 1550 as the captain.

The first officer of GMI6129, a 26-year old Dutch national, had a Part-FCL Commercial Pilot License (CPL(A)) with a B737 300-900 rating that was valid until 31 March 2016. He also had class-1 and 2 medical certificates that were valid until 10 March 2016. He had a total of 1000 flight hours, of which 650 had been on the type.

1.5.2. Information on ATC personnel

The executive controller, a 38-year old Spanish national, had an air traffic controller license, issued in 2008, and had been an air controller at GCLP since 2010. He had the required ratings and unit endorsements, which were valid until 6 October 2016. His English proficiency rating was 5 and was valid until 29 June 2017. He had a class-3 medical certificate that was valid until 26 March 2015.

He had previously been a traffic controller at the El Hierro control tower, from 2008 to 2010. He had been a supervisor since January 2013 and a supervisory instructor at GCLP since September 2014.

The controller took and passed three training courses in 2015:

- Six-hour theory course whose content included changes made to the phraseology to use with taxiing aircraft due to incidents, as well as changes to the ATS Contingency Plan.
- Theory (2 hours) and simulator (2 hours) course on emergencies and special situations on the apron, and changes to the ATS Contingency Plan.
- Four-hour theory course whose content included an analysis of safety incidents and the EAPPRI (European Action Plan for the Prevention of Runway Incursions).

On the day of the incident, the controller worked the afternoon shift and was in the LCL position at the start of the shift. Based on information supplied by the services provider, this was at 14:33:04. In the two days before the incident he had also worked the afternoon shift, carrying out the supervisor's tasks on one of those days.

1.6. Aircraft information

1.6.1. General information on aircraft D-ABLB

The aircraft with registration D-ABLB is a Boeing 737-700 with serial number 36115. It is outfitted with two CFM56 -7B22 engines (SN 896699 and SN 896700). The aircraft had valid registration and airworthiness certificates.

1.6.1.1 Maintenance records for aircraft D-ABLB

The last inspection of the aircraft before the incident had been on 17 November 2015, at which time the aircraft had 18,358 flight hours and 12,325 cycles.

1.7. Meteorological information

According to the 14:30 METAR, visibility conditions were good. There was a 5 kt wind from the east (090º), variable between 040º and 130º, and scattered clouds at 2500 ft. No significant changes were expected.

1.8. Aids to navigation

Not applicable.

1.9. Communications

Based on the transcript of the communications supplied by the ATS provider (ENAIRE), GMI6129 was instructed by the GMC controller to proceed to the runway 03L holding point and contact the LCL frequency.

At 14:39:51, the executive controller at LCL cleared one aircraft (VKG5636) to line up on runway 03L, and at 14:41:32 he cleared it to take off. Then, at 14:41:40, the controller instructed GMI6129 to cross runway 03L and line up and hold on runway 03R. The crew of the aircraft did not reply, so the controller repeated the instruction, which the crew acknowledged this time.

At 14:42:54, the LCL controller twice instructed VKG5636 to contact the takeoff frequency without receiving a reply from the crew.

At 14:43:21, the crew of GMI6129 noticed the presence of an illuminated stop bar at S4. According to the communications transcript supplied by ENAIRE, the comment was heard on the LCL frequency; however, on the controller's channel, the report heard was from VKG5636, "Departure, good morning, VKG5636 heavy BIMBO5A".

At 14:43:33, the LCL controller against instructed GMI6129 to line up and wait on runway 03R, which was acknowledged by the crew.

At 14:45:40, the LCL controller cleared GMI6129 to take off on runway 03R. After 28 seconds, at 14:46:08, the LCL controller instructed GMI6129 to hold its position and cancel the takeoff.

1.10. Aerodrome information

The Gran Canaria Airport, ICAO identifier GCLP, is 19 km south of the city of Las Palmas de Gran Canaria. The airport has two parallel runways, 03L/21R and 03R/21L, both of them 3100 meters long and 45 meters wide.

The airport was operating in the north configuration, which is preferred and normally uses runway 03L for landings and 03R for takeoffs. On the day of the incident, survey work was being carried out on the 03R/21L runway strip, which required closing the runway, leaving 03L/21R as the only runway in use.

The closing of runway 03R/21L was reported via the publication of NOTAM number B9738/15.

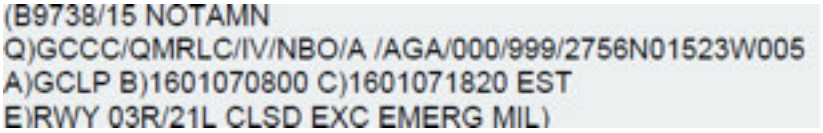
(B9738/15 NOTAMN
Q)GCCC/QMRLC/IV/NBO/A /AGA/000/999/2756N01523W005
A)GCLP B)1601070800 C)1601071820 EST
E)RWY 03R/21L CLSD EXC EMERG MIL)

Figure 1. NOTAM informing of RWY 03R/21L closure

The work had been started on 4 January 2016. An Operational Safety Monitoring Plan was in effect, approved by the contractor and by the airport manager. This plan detailed the work to be carried out and the affected movement areas. On 5 January, two days before the incident, the nature of the work forced the temporary closure of the other runway, 03L/21R.

Departing aircraft usually enter runway 03R via taxiway S4, which features a stop bar.

1.11. Flight recorders

Due to the time that elapsed between the incident and when it was reported to the CIAIAC, it was not possible to preserve the flight recorders (FDR and CVR). However, the operator of GMI6129 did provide data taken from the QAR. These data were verified to be synchronized to within one second of the verbal communications.

The QAR data reveal that the aircraft stopped at the stop bar on taxiway S4 for nine seconds before continuing to taxi and lining up on runway 03R.

At 14:45:45, the crew acknowledged the takeoff clearance and at 14:46:01 they started the takeoff run. The crew canceled the takeoff at 14:46:16, by which time the aircraft had reached a ground speed (GS) of 61.5 kt and traveled a distance of about 270 meters. The aircraft completely stopped at 14:46:57 after traveling about 740 meters.

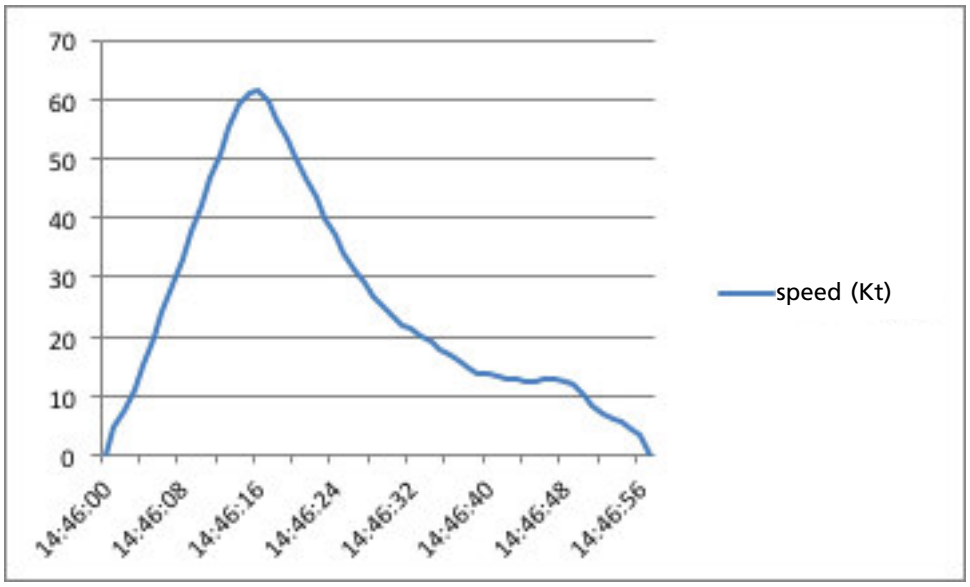

Figure 2. Graphic of the GMI6129 aircraft speeds during take-off run

The QAR data were used to make an approximate reconstruction of the path followed by the aircraft. The graph includes the approximate position of the vehicle based on the version of the events provided by the personnel inside said vehicle.

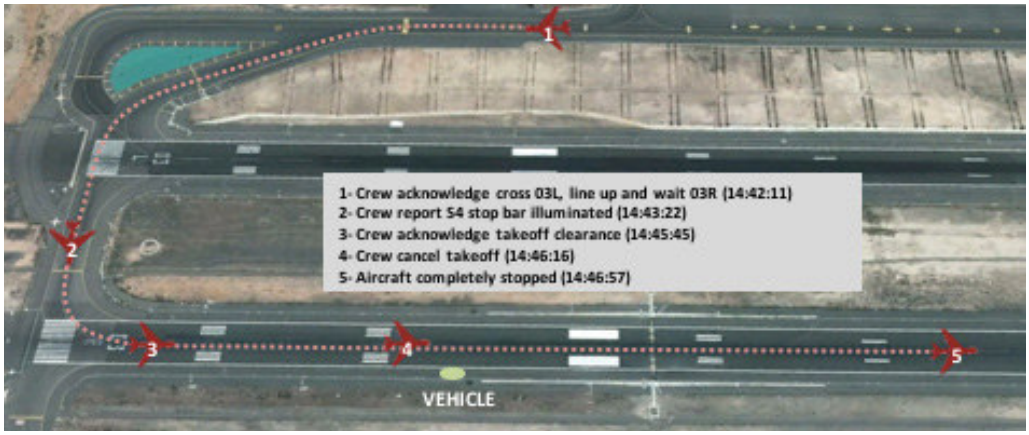

Figure 3. Approximate path of GMI6129

1.12. Wreckage and impact information

The incident aircraft did not sustain any damage.

1.13. Medical and pathological information

There were no indications that the actions of the flight crew or the controllers were affected by any physiological factors or that they were in any way impaired.

1.14. Fire

There was no sign of a fire during the flight.

1.15. Survival aspects

No search and rescue activities resulted from this incident since the aircraft continued on its flight without further incident.

1.16. Tests and research

The air navigation services provider (ENAIRE) and the airport manager (AENA) each conducted internal investigations as a result of the incident, the findings of which were sent to the CIAIAC.

The airport manager was also asked to provide security camera footage from the time of the incident that showed runway 03R in order to ascertain the conditions in which the vehicle was working, its position and the movement of the aircraft, but AENA stated that such footage was not available.

1.16.1. Analysis conducted by the air traffic services provider (ENAIRE)

The air navigation services provider (ENAIRE) made a series of recommendations during its internal analysis, several of them directed at the air navigation services provider:

- It is recommended that the unit evaluate the use of relief checklists, as is the practice in the ACC.
- Review the effectiveness of the measures currently in place in the GCLP TWR control room to alert/remind ATCOs of runway closings.
- Review the investigation report with the ATCO involved by way of an interview.
- If a frequency other than the one for the sector being serviced is monitored, and the controller becomes aware that traffic called during that period, ask said traffic to repeat its message to avoid misunderstandings or faulty expectations/interpretations.

Recommendations were also issued for the airport manager:

- Review the procedures for implementing measures agreed to by the LRSC, specifically the use of lighted cones at thresholds during runway closings.
- It is recommended that the airport require companies that have access to the maneuvering area to rent easily visible vehicles (e.g. white).
- It is recommended that the airport provide rotating portable lights to non-airport vehicles that have to access the maneuvering area.

ENAIRE stated that the checklist procedure had been in place since 2015, though its use was not obligatory. On the day of the incident there was no updated copy of the checklist at the LCL positions in use, as it had likely been misplaced. The use of this checklist has been mandatory since February 2016.

Figure 4. Relief checklist at the LCL post

As for the review of the visual aids in the control room to indicate that the runway was closed, the unit has decided to place an additional strip on the wind speed indicator. This way, when the controller obtains the wind information required to be provided in the message authorizing the landing/takeoff of an aircraft, he can see that the runway is occupied.

Figure 5 shows the visual aids that indicate the runway is closed. Runway 03L/21R was closed for a period in excess of 15 minutes, while runway 03R/21L was temporarily occupied by a vehicle doing a runway inspection (yellow strip in the horizontal position).

Figure 5. Visual aids at the GCLP LCL post to indicate a runway is closed

1.16.2. Analysis conducted by the airport manage (AENA)

According to the AENA report, the vehicle involved was a passenger vehicle with its documentation in order and with the necessary equipment installed to access and operate in the maneuvering area. It was authorized to carry rotating lights, which were used during the work.

AENA, in its Apron Safety Regulations, specifies that in order to enter the maneuvering area, runway end safety areas and runway strips and taxiways, or any other place determined by the airport operator, the vehicle must have flashing (rotating) lights which have to remain on, even when the vehicle is stopped.

According to the operational safety records provided by the company, the driver of the vehicle had a valid license to drive in the maneuvering area, and had received all of the relevant local information.

The report states that all of the measures agreed to at the coordination and risk analysis meeting were implemented. As for placing cones, it states that the documentation resulting from the LRSC was being reviewed and pending approval by its members, and that none of those involved proposed analyzing and using this measure during the meeting to coordinate and analyze the risk of the survey work.

The report includes two recommendations:

- Systematic use of cones at the threshold when closing a runway. The airport manager stated that this measure was already implemented.
- As pertains to the above and for closures of runway 03R/21L involving the possibility of removing people and machinery if required for an emergency military procedure that requires installing the brake cable, the use of the runway in that situation with the cones in place should be analyzed and agreed to with the air base expressly for each case.

Figure 6. View from threshold of the vehicle's position with the cones in place

1.17. Organizational and management information

1.17.1. Local Runway Safety Committee

Royal Decree 862/2009 requires creating local runway safety committees (LRSC) at airports. They shall be run by the airport manager and its members shall include representatives from the airlines and the air navigation services provider, as well as the supervisor of the airport's operational safety management system. This committee shall be responsible for advising the airport manager on anything related to operational safety at the airport.

AESA Specific Technical Instruction CSA-15-IT-031-1.0, on Operational Safety on Runways, lays out technical standards to improve operational safety on runways. It specifies the tasks for which the LRSC is responsible:

- Identify potential safety problems on runways.
- Develop and carry out local awareness campaigns.
- Track the number, type and severity of runway incursions and excursions.
- Ensure that communications between controllers and other groups involved are correct.
- Evaluate the suitability of runway access routes and visual aids.
- Analyze operational problems and recommend improvements.
- Lead the initial, refresher and familiarization training programs for all relevant personnel to prevent runway incursions and excursions.
- Provide recommendations before implementing changes in the airport, practices or procedures that identify the likelihood of runway incursions or excursions.
- Periodically evaluate the effectiveness of any operational solutions implemented.
- Ensure that the recommendations included in the EAPPRI are implemented.
- Check the airport to ensure that it is in compliance with ICAO rules and recommendations.
- Periodically gauge the efficiency of any operational measures taken.

As for meeting frequency, the aforementioned technical instruction states that they are to be held regularly or extraordinarily when the timeline or the urgency does not allow waiting until the next regular meeting. Their content is to be reflected in the minutes, which must be sent to the interested parties within two weeks. The parties will then have at least a further two weeks to make comments or request changes to the minutes.

The technical instruction notes the need to conduct both internal and external audits. The latter are to be conducted by the competent authority or by an outside organization at least annually.

The LRSC at Gran Canaria held a regular meeting in 1 December 2015. The survey work that was going to be done was not discussed, but work on the apron was. Also presented and discussed were incidents/accidents that had been categorized as runway incursions or excursions.

During the meeting, the placement of lighted cones at the thresholds of runways closed for short periods of time was proposed to avoid runway incursions, a measure that, according to the minutes, would be immediately implemented.

The minutes were approved on 15 January 2016, eight days after the incident in question.

Some time after the LRSC meeting, on 21 December 2015, a meeting was held to coordinate the survey work that was going take place at the airport. This meeting was attended by representatives of the air navigation services provider, the airport manager, the air base and the contractor doing the work. It was not considered a meeting of the LRSC, meaning all of the members of this committee did not attend. It was agreed that the contractor would take measures to avoid risks when carrying out its work. No other measures to be taken by the other parties involved (airport manager or ATS provider) were discussed. Neither was the topic of placing cones temporarily while the runway was closed, which had been considered during the LRSC meeting held on 1 December.

The European Action Plan for the Prevention of Runway Incursions notes that changes to operational modes and to maneuvering area procedures, including planned work, should take into account the operational safety on the runway, which could require consulting with the local runway safety team. An adequate risk assessment should be the basis for procedural and/or infrastructural changes in the maneuvering area.

1.17.2. Operations Manual of the Air Navigation Services Provider

1.17.2.1 Controller turnovers

Section 6.3 in Annex B, "Specific Unit Procedures", of ENAIRE's GCLP Operations Manual states that turnovers are to be conducted correctly so as to ensure that the oncoming controller is fully aware of the situation. A series of requirements are to be drafted and updated for each operations post that contains, by way of a checklist, all of the essential points that must be considered when relaying information to the oncoming controller.

The checklist for the LCL post is shown below.

CHECKLIST TURNOVER TWR/LCL		
AIRCRAFT/RWY	RUNWAY IN USE	
	RUNWAY SIGNIFICANT CONDITIONS	
	AIRCRAFT IN RADIO CONTACT: IDENTIFICATION AND POSITION	
	PERSONNEL/VEHICLES ON RUNWAY OR EXPECTING CLEARANCE TO ENTER	
	FLIGHT PROGRESS STRIP: POSITION IN STRIP HOLDER AND STRIP MARKING	
	IDENTIFICATION OF POTENTIAL CONFLICTS	
	ARR/DEP INTENDED SEQUENCE	
	IDENTIFICATION OF AIRCRAFT TAXIING TO HP/EXITING RUNWAY	
	TRAFFIC DIVERSION FROM/TO OTHER AERODROMES	
	ACTIVITIES AND AERIAL WORK	
	WORKS IN PROGRESS IN THE RUNWAY VICINITY	
	NON STANDARD PROCEDURES IN PROGRESS	
	REMAINING TASKS	
METEO	SIGNIFICANT WIND. GUSTS. WINDSHEAR. TURBULENCE	
	VISIBILITY. CLOUD CEILING	
	STORMS: FORECASTS - WARNINGS - PHASE OF ACTUATION	
	OTHER CURRENT OR PREDICTED SIGNIFICANT METEOROLOGICAL PHENOMENA	
	LVP APPLICATION/PPOAM: PREVISION - PHASES	
INCIDENCES	FLIGHT PLAN INCIDENCES	
	NOTAM IN FORCE	
	METEOROLOGICAL INFORMATION PRESENTATION SYSTEM STATUS	
	RADIO NAVIGATON AIDS STATUS	
	STATUS AND SELECTION OF FREQUENCIES AIR-GROUND IN SCV	
	COMUNICATION STATUS T/T (HOT AND DEDICATED LINES)	
	ATS SURVEILLANCE SYSTEM STATUS	
	ATIS STATUS	

Figure 7. LCL turnover checklist

Similarly, before going on watch, controllers receive a document with operational information relevant to ATS, published NOTAMs in effect, events of interest, notifications, scheduled traffic and military aircraft movements. On the day of the incident, the controller involved in the incident signed the sheet to indicate he had received the operational information, which included the NOTAM informing of the closure of runway 03R/21L.

1.17.2.2 Closed runway procedure

Point 6.7.2 in Annex B, "Specific Unit Procedures", of ENAIRE's GCLP Operations Manual lays out the procedure to follow if the runway in use is temporarily occupied (more than 15 minutes), specifying the following measures:

- Indicate that the runway is occupied by an obstacle, aircraft or vehicle by placing a strip on the strip holder that specifies the nature of the obstacle. In addition, the strip holder is to be placed across the bay.
- Pay special attention to crew acknowledgments regarding the runway on which they are cleared to operate.
- Visually check, and verify using radar if needed, that the cleared aircraft is proceeding to the runway in use.
- A closed runway shall remain under the control of GMC, meaning its use does not have to be coordinated with LCL.

1.18. Additional information

1.18.1. Statement from crew of GMI6129

The crew stated that before the flight, they received the NOTAM and heard on the ATIS that runway 03R/21L was closed, so they planned to take off from runway 03L. After being transferred by GMC to the LCL frequency, they were cleared to cross runway 03L and line up on runway 03R. This instruction confused them, and they requested confirmation that they were really supposed to line up on runway 03R, which they received from the controller.

As they approached entrance S4, they saw the red lights were on in the stop bar, so they again asked the LCL controller, and they were again cleared to line up on runway 03R.

As they lined up, both pilots saw the vehicle on the right edge of the runway, on the grass, and thought there was no collision danger, so after receiving the clearance, they started the takeoff run. After travelling 300 meters, they were instructed to stop and cancel the takeoff.

The crew stated that if there were flashing lights on the vehicle, which they could not say for certain, they were not on.

1.18.2. Statement from the vehicle's driver

The driver of the vehicle stated that he was inside it on the right shoulder of runway 03R. At one point he was instructed to exit the runway temporarily, which he did, leaving the runway and going to the perimeter road, where he remained until he was cleared to enter the runway again and continue with the survey work.

Figure 8. Vehicle's position based on the driver's account

1.18.3. Statement from the executive controller in the LCL post at the GCLP TWR

The executive controller stated that with runway 03R closed but without any kind of signage, he incorrectly lined up GMI6129 on runway 03R. The stop bar was turned on at intensity 3, when it should have been at 5, with control of the lights turned over to the electrical department for maintenance purposes.

The controller stated knowing that runway 03R was closed, since the offgoing controller had told him this during their turnover and he had read it on the operational information prior to going on watch.

The fact that he overlooked the fact that runway 03R was closed when he lined up GMI6129 and cleared it to take off could have been caused by many factors:

- Recent turnover.
- Expectation of normal operations.
- Increased workload due to recovering a helicopter and the entry into effect of a new helicopter recovery procedure, which imposed a high stress level due to having to coordinate a large number of actions. According to the interview with the controller, he stated that he had attended classroom training on this procedure a few months before it went into effect.
- Focusing his attention on the outbound traffic (VKG5636) and having to monitor the takeoff frequency due to its crew's non-acknowledgment.

The controller stated that the visual aids indicating the closure of runway 03R were in place, and that the runway and approach lights were off, as required by the procedure. He heard part of the message from the crew of GMI6129 when they were at S4 since he was monitoring the takeoff frequency, and he assumed that the crew had made the

typical report that they were ready for departure. He added that his attention was focused on monitoring the recovery of a helicopter.

He stated that the vehicle was beyond the first third of the runway, on the paved shoulder of the strip, and that he was not in visual contact with it, either because its lights were off or they not visible from the tower, and its color blended in with the runway's, making it hard to make out without knowing its exact location.

Finally, he stated that he became aware of the situation at the same time as his colleague in the ground position, when the aircraft started its takeoff run. After he noticed the presence of an object on the runway strip, he immediately canceled the takeoff clearance.

1.18.4. Statement from the control tower supervisor at GCLP

The tower supervisor at GCLP stated that the change to the helicopter recovery procedure was due to the need to certify the Gran Canaria airport to adapt it to applicable regulations. He also confirmed that the new procedure was complex and required a great deal of coordination with the GMC position, the previous procedure being simpler and easier to follow. As a result of this complexity, the procedure was changed after the date of the incident.

He also stated that controllers at the unit were not trained on the simulator before the new procedure went into effect. They had a classroom session, given well in advance of the procedure going into effect, in which they were explained its operation.

The unit has a simulator for training, which is used to provide training on emergencies and on changes to the ATS contingency plan.

1.18.5. Report from the Energy and Maintenance Service manager

According to the report written by the head of the Energy and Maintenance Service Department, at 12:16:15 the power plant activated configuration "03L DAY" at the request of the control tower. This configuration includes having the S4 stop bar at brightness level 3, though the brightness of the bars can be controlled individually by the person at the controls.

The service report states that at 12:33:22, the tags on the visual aids were cleared, with control being returned to the control tower following completion of the maintenance work. It also shows that at 14:53:52, control over the visual aids was turned over to the tower, with the brightness of the S4 stop bar being raised to level 5 a few seconds later.

1.18.6. Regulation and documentation applicable to stop bars

1.18.6.1 OACI regulations

Point 3.2.2.7.3 states of ICAO Annex 2 states that:
"An aircraft taxiing on the maneuvering area shall stop and hold at all lighted stop bars and may proceed further when the lights are switched off."

Point 7.15.7 of ICAO Document 4444 states that:
"Stop bars shall be switched on to indicate that all traffic shall stop and switched off to indicate that traffic may proceed."

Point 5.2 of ICAO Document 9870, "Manual on the Prevention of Runway Incursions", further expands on the point above by stating that:
"As such, a controller should never issue a clearance to cross a stop bar without first switching off the stop bar. The only exception to this should be when contingency measures are required due to unserviceability. An example of a contingency measure is the use of a follow-me vehicle."

In point 4.4.1 it states that_
"Pilots should never cross illuminated red stop bars when lining up on, or crossing, a runway unless contingency procedures are in use that specifically allow this."

Similarly, point 6.3.3 says:
"Red stop bars should never be crossed when lining up on or crossing a runway unless, in exceptional cases, the stop bars, lights or controls are reported to be unserviceable, and contingency measures, such as using follow-me vehicles, are in force. In these circumstances, whenever possible, alternative routes should be used."

1.18.6.2 European and national regulations

Commission Implementing Regulation (SERA) no. 923/2012 specifies, in paragraphs 2 and 3 of section d) of point SERA.3210 that:

"2) At a controlled aerodrome an aircraft taxiing on the maneuvering area shall stop and hold at all runway-holding positions unless an explicit clearance to enter or cross the runway has been issued by the aerodrome control tower."

"3) An aircraft taxiing on the maneuvering area shall stop and hold at all lighted stop bars and may proceed further in accordance with (2) when the lights are switched off."

Point 4.5.16.7 of Spain's Air Traffic Regulations reiterate the contents of ICAO Document 4444.

"Stop bars shall be switched on to indicate that all traffic shall stop and switched off to indicate that traffic may proceed."

The European Action Plan for the Prevention of Runway Incursions specifies that pilots must not cross illuminated stop bars when taxiing into position on a runway or when crossing a runway unless contingency procedures are in effect, such as to allow for those cases when the stop bars are inoperative.

The EASA has published a Notice of Proposed Amendment (NPA) that will establish the allowable means of compliance and guidelines for a new European regulation to be published in coming months. This NPA is subject to change until it goes into effect. In the meantime, the following guidelines are provided for contingency measures to be used when the lights on a stop bar cannot be turned off:

- Disconnect the power supply from the affected stop bar.
- Dim the lights on the affected stop bar.
- Provide a vehicle to drive the aircraft across the stop bar.

1.19. Useful or effective investigation techniques

Not applicable.

2. ANALYSIS

2.1. General

On 7 January 2016, aircraft GMI6129 was preparing to fly from the Gran Canaria airport to the Friedrichshafen airport in Germany.

The airport has two parallel runways, 03L/21R and 03R/21L, with takeoffs normally being on runway 03R and landings on 03L.

On the day of the incident, there was survey work in progress on the runway 03R/21L strip, which forced the closing of this runway and the airport to use a single runway, 03L/21R. There was a vehicle on runway 03R with a person inside. The runway closing had been announced via a NOTAM.

GMI6129 was cleared by GMC to proceed to the runway 03L holding point and transferred to the LCL frequency.

2.2. Aspects involving the controller turnover

Before going on watch, the LCL controller received operational information indicating that runway 03R/21L was closed. He signed to acknowledge receipt of this information. Furthermore, during the turnover the offgoing controller informed him that runway 03R/21L was closed.

Section 6.3 of Annex B of the Unit Operations Manual contains a turnover checklist. According to information supplied by the services provider, the use of the checklist was in place and its use was recommended. However, on the day of the incident an updated copy was not available at the LCL post. In its report on the internal investigation into the incident, the services provider made a recommendation to implement the use of the checklist during turnovers as a safety measure. In February 2016, the navigation services provider required the use of this checklist at the GCLP TWR; as a result, the CIAIAC deems it unnecessary to issue a safety recommendation in this regard.

2.3. Controller's actions

The oncoming controller took over the frequency at 14:33:04. Within a few minutes he correctly cleared VKG5636 to line up on runway 03L and then, at 14:41:32, to take off. Only eight seconds later he instructed GMI6129 to cross runway 03L and line up and wait on 03R, repeating the instruction when he did not receive a reply. As he recalled the event, he stated that he was focused on recovering a helicopter and on the entry into effect of a new procedure for helicopters. According to the statement from the

control tower supervisor at GCLP, the procedure was complex as it required a great deal of coordination with the GMC post. The controllers had only been given one classroom training session on it. The fact that they had not received any simulator training on the helicopter recovery maneuver and on the coordination required to carry out the procedure helped increase the stress level and workload of the controller at that moment, shifting his attention away from GMI6129. As the GCLP tower supervisor stated, even though the unit has a simulator, it is primarily used to train on emergency and contingency situations. If the controller had received simulator training on this procedure, it could have reduced his workload and the likelihood that he would lose situational awareness. A safety recommendation is issued in this regard.

The controller had not been on duty for very long that day, which could have kept him from being fully adapted to airport operations. This could have made him issue the typical instructions for departing aircraft for the current airport operations.

The controller then transferred VKG5636 to the takeoff frequency twice, without receiving a reply. The crew of GMI6129 then reported that the S4 stop bar remained on. At that very moment the controller was monitoring the takeoff frequency to which he had transferred VKG5636 to make sure its crew had made contact on that frequency, since they had acknowledged either of his transfer instructions. This resulted in the controller only partially hearing the report from GMI6129. As per his statement, he assumed that they were making the usual report that they were ready for takeoff. He then cleared them again to line up and wait on runway 03R. The fact that the controller did not ask the crew of GMI6129 to repeat its report, instead clearing them again to line up and wait on runway 03R, meant that the illuminated stop bar did not act as a protective barrier, since the crew assumed they were clear to cross it. The services provider made a recommendation in its internal analysis of the incident that specified that if a controller monitoring another frequency became aware of another traffic calling, it should request that the message be repeated to avoid misunderstanding or mistakes. This action is considered to be sufficient and thus no safety recommendation is issued in this regard.

At 14:45:40, the LCL controller cleared GMI6129 to take off on runway 03R. Four minutes elapsed between the controller first clearing the crew to line up and hold on the runway and clearing them for takeoff. As per the controller's statement, the visual aids indicating the temporary closure of the runway were in place. The main aid in the control tower involved placing a flight progress strip across the traffic bay with the name of the obstacle on the runway. The air navigation services provider reviewed the measures implemented in the tower to alert/remind controllers that a runway is closed, and it decided to place an additional strip on the wind gauge when the runway is occupied. The idea is that when a controller clears an aircraft to take off/land, he would look at the wind reading and see that the runway is closed. This measure is deemed sufficient, and thus no safety recommendation is issued in this regard.

He also failed to notice the presence of a vehicle on the runway during those four minutes that elapsed until he gave the takeoff clearance. As the controller stated, the car was not easily visible from his position in the tower since its dark color blended in with the runway's, and its lights were either not visible from the tower or they were off at the time. The crew recalled that the vehicle did not have its flashing lights on, though they could not be certain it was equipped with flashing lights. Investigators requested security camera footage from the time of the incident that showed runway 03R to see the conditions in which the vehicle was working, its position and the aircraft's path, but the airport manager replied that said footage was not available. AENA, in its investigation report, stated that the vehicle had flashing lights and that they were on during the work. It was thus not possible to ascertain whether the vehicle had flashing lights installed, though they may have been off at the time of the event. This would have hampered the controller's ability to detect its presence on the 03R runway strip. AENA already specifies in its Platform Safety Regulation the requirement to have flashing lights installed and turned on when the vehicle is on the runway strip, even it is not moving.

Finally, the controller stated that he noticed the presence of an object in the protected area for runway 03R. His colleague in the GNC position alerted him to it at the same time, and he quickly instructed the crew to cancel the takeoff.

2.4. Actions of the crew of GMI6129

The crew of GMI6129 noted in their report that they knew that runway 03R was closed, since they were familiar with the corresponding NOTAM and they had heard the ATIS broadcast.

The crew admitted their confusion when they were cleared to cross runway 03L and line up on 03R, but when the clearance was repeated, they decided to follow it. At S4 the crew noticed that the stop bar was illuminated. They stopped the aircraft for a few seconds and reported it to the controller. The fact that the stop bar was not at maximum intensity cannot be regarded as a contributing factor in this incident since the crew saw that it was on. Shortly afterwards they were again cleared to line up and hold on runway 03R, which they interpreted as the controller authorizing them to cross the stop bar.

According to applicable European regulation, a crew cannot cross a stop bar until they are explicitly cleared to do so by the controller and the stop bar is turned off. In this case the clearance was given by the controller but the stop bar was not turned off, meaning the crew might have assumed that the bar could not be turned off and that contingency measures were in place, though they were not informed about any such measures, nor did they ask.

The crew reported they were in visual contact with the vehicle after lining up on the runway, but they thought the vehicle's position did not pose a collision hazard, and they initiated the takeoff run when they were cleared to do so. The runway strip is intended to reduce the risk of damage to aircraft in the event of a runway excursion and to protect aircraft that fly over it during takeoff and landing operations. The crew, however, did not know the vehicle's intentions, since they were on different frequencies.

Later, the crew correctly followed the controller's instruction to cancel the takeoff.

2.5. Considerations pertaining to the regulation on stop bars

ICAO Annex 2 states that crews must stop at stop bars and continue after they have been turned off. For its part, the European regulation specifies that to continue taxiing, the stop bar must be turned off and explicit clearance must be received from ATC. No exceptions are considered.

However, both the ICAO's Manual on the Prevention of Runway Incursions (Document 9870) and the European Action Plan for the Prevention of Runway Incursions (EAPPRI) allow for the possibility of having an aircraft cross an illuminated stop bar when it cannot be turned off and contingency measures are in place.

The fact that no common procedure or standard phraseology exists to unequivocally indicate that contingency measures are in place could have caused the crew in this case to assume that said contingency measures were in place and that they could cross the stop bar, since they reported its status to ATC, which again cleared them to proceed. As a result, a safety recommendation is issued to the ICAO to draft a common procedure or phraseology applicable to all airports that helps crews clearly differentiate when contingency measures are in place involving the stop bars.

2.6. Considerations involving the LRSC

The LRSC at Gran Canaria held a regular meeting on 1 December 2015. The survey work to be conducted at the airport the next month was not addressed at this meeting. However, during the meeting, as a result of discussing some incidents that had occurred at the airport, a mitigation measure was proposed for preventing incursions on runways closed for brief periods of time, namely, the placement of cones at the runway thresholds. At this meeting it was decided that this measure should be implemented immediately.

The minutes from the 1 December meeting were not approved until 15 January 2016, after the incident occurred and one and a half months after the meeting was held. Had the measure been implemented, it would have provided a useful safety barrier to avoiding this incident by preventing the crew from starting their takeoff run.

On 21 December 2015, a meeting was held to coordinate the survey work that was not attended by all of the LRSC representatives. At this meeting, the risks associated with the work were analyzed and measures to mitigate them were taken. The risks stemming from the operational change in the airport, such as from temporarily closing a runway, were not analyzed, and no consideration was given to placing cones at the runway threshold.

The EAPPRI notes that changes to operational modes and to maneuvering area practices, including planned work, must take account of runway safety and may require consultation with the local runway safety team. An adequate risk assessment should be the basis for procedural and/or infrastructural changes in the maneuvering area.

Therefore, in those cases where work is going to be conducted at the airport, even if it does not involve construction, that has a significant impact on airport operations, such as temporary runway closures or changes to runway entry or exit points, a meeting of the LRSC should be held to analyze the risks and establish mitigation measures, which must be implemented before the start of the work.

3. CONCLUSIONS

3.1. Findings

- The aircraft's documentation was valid and it was airworthy.
- The licenses and medical certificates of the crew of GMI6129 were valid.
- The executive controller at the LCL post had a valid license, unit endorsements and medical certificate.
- Runway 03R was closed for survey work. There was a vehicle on the runway strip with a worker inside.
- That day, a helicopter recovery procedure was going into effect. The controller had received theoretical training well in advance of the date when the procedure went into effect.
- The controller knew that runway 03R was closed, as this information was contained in operational documents and had been relayed to him by the offgoing controller during their turnover.
- The crew of GMI6129 knew that runway 03R was closed, as this information was published in a NOTAM and broadcast on ATIS.
- The LCL controller took over the frequency at 14:33:04, and a few minutes later correctly cleared an aircraft to enter, line up and then take off from runway 03L.
- A few seconds later the controller cleared GMI6129 to cross runway 03L and line up and hold on runway 03R.
- The crew stopped the aircraft upon seeing the S4 stop bar illuminated, which they reported to ATC.
- At that moment the controller was monitoring the takeoff frequency to ensure that an aircraft had been transferred, and only partially heard the report from GMI6129.
- The controller again cleared GMI6129 to line up and hold on runway 03R.
- After being cleared, the crew crossed the illuminated stop bar and entered runway 03R.
- The applicable regulation specifies that to enter and line up on a runway, the crew must be explicitly cleared by ATC and the stop bar must be off.
- The European Action Plan for the Prevention of Runway Incursions states that an illuminated stop bar may be crossed when it cannot be turned off and contingency measures are in place.
- The crew were in visual contact with the vehicle on the strip.
- The controller cleared the aircraft to take off from runway 03R, and the crew started the takeoff run.
- The controller instructed the crew to cancel the takeoff after the aircraft had traveled some 270 meters.

3.2. Causes/Contributing factors

The incident was caused by the controller's loss of situational awareness, as he instructed the crew of GMI6129 to enter and then take off from runway 03R, despite knowing that it was closed.

Contributing to the incident was a series of factors that bypassed the safety barriers that could have prevented its occurrence:

- The controller did not detect his mistake despite the presence of visual aids in the tower indicating that the runway was closed. He also did not see the car in the runway 03R strip, though this may have been caused, as per the statement from the crew and the controller, by the fact that the car did not have its flashing lights on.
- The controller only partially heard a report from the crew notifying that the stop bar was illuminated, but he did not ask for the message to be repeated and again instructed the crew to line up and wait.
- The crew crossed an illuminated stop bar without having information regarding contingency measures in place to specifically allow this. Contributing to this is the fact that the regulation on stop bars and the applicable manuals are not clear or specific.
- The aircraft's crew started the takeoff run despite being in visual contact with the car that was stopped on the runway strip.
- The mitigation measure of placing cones at the threshold of the temporarily closed runway was not in effect, since the minutes of the Local Runway Safety Committee meeting, where this measure had been proposed, were not yet approved.

4. SAFETY RECOMMENDATIOS

The ICAO's Manual on the Prevention of Runway Incursions and the European Action Plan for the Prevention of Runway Incursions (EAPPRI) consider the possibility of crossing an illuminated stop bar if it cannot be turned off and if contingency procedures are in place. The investigation revealed a lack of common procedures or phraseology that allow crews to clearly identify if said measures are in effect. This could have created doubts in the crew of the Germania aircraft, since after informing ATC that there was an illuminated stop bar and being cleared once more to line up on the runway, they might have assumed that said contingency measures were in place.

REC 31/2016: It is recommended that the ICAO develop a common procedure or phraseology for the application of contingency measures in the event that a stop bar cannot be turned off such that crews can clearly identify when said contingency measures are in place.

On the day of the incident, a new procedure went into effect for recovering helicopters that resulted in a heavy workload, as it required coordinating with numerous adjacent sectors or controllers. The controllers at the unit received only one classroom course to train them on the new procedure. The fact that the controller was involved in carrying out this procedure for the first time could have raised his stress level, making him focus on recovering the helicopter and not paying enough attention to other traffic. If the controller had taken a practical training course, this would have reduced his stress level and workload, possibly preventing him from losing situational awareness.

REC 32/2016: It is recommended that ENAIRE include practical simulator training sessions for its controllers when new procedures are expected to go into effect that involve large operational changes or that greatly increase the workload of controllers.

A recommendation regarding the use of checklists was also deemed necessary: It is recommended that ENAIRE implement checklists to be used during turnovers at the unit.

However, since ENAIRE already implemented this measure following its internal analysis of the incident, the CIAIAC has decided not to issue this recommendation.