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AVIACIÓN **C**IVIL

Report IN-047/2016

Incident involving a Boeing B-737-800, registration PH-HZW, at the Málaga/Costa del Sol Airport (Spain) on 2 December 2016

GOBIERNO DE ESPAÑA
MINISTERIO DE FOMENTO

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SUBSECRETARÍA
COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

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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.

Contents

Abbreviations

° ' "	Sexagesimal degrees, minutes and seconds
° C	Degrees centigrade
ACC	Area control center
ACP	Area control procedural rating
ACS	Area control surveillance rating
ADI	Aerodrome control instrument rating
ADV	Aerodrome control visual rating
AEMET	Spanish National Weather Agency
AENA	Spanish airport operator
AESA	Spain's National Aviation Safety Agency
AIP	Aeronautical information publication
AIR	Air control endorsement
APP	Approach
APS	Approach control surveillance rating
APU	Auxiliary power unit
ARP	Aerodrome reference point
ATC	Air traffic control (in general)
ATCO	Air traffic controller
ATIS	Automated terminal information service
ATL	Aircraft technical logbook
ATPL(A)	Airline transport pilot license (airplane)
AZFW	Actual zero-fuel weight (AZFW
CAT	Category
CECOA	Airport coordination center
CEOPS	Airport operations center
CI	Cost index
CIAIAC	Spain's National Civil Aviation Accident and Incident Investigation Committee
CPL(A)	Commercial pilot license (airplane)
Doc	Document
DVOR	Doppler VOR
EASA	European Aviation Safety Agency
EHAM	ICAO airport code for the Amsterdam-Schiphol Airport
ENS	Event notification system

EZFW	Estimated zero-fuel weight
FCOM	Flight crew operating manual
FL	Flight level
FMC	Flight management computer
FOD	Foreign object debris
ft	Feet
GMC	Ground movement control endorsement
GMS	Ground movement surveillance endorsement
GND	Terrain
H	Hours
Hpa	Hectopascals
IAF	Initial approach fix
ICAO	International Civil Aviation Organization
ILS	Instrument landing system
IR(A)	Instrument rating (airplane)
JRZ	Jerez airport (Spain)
kg	Kilograms
Kg/L	Kilograms per liter
kt	Knots
L	Liters
lb	Pounds
LECS-APN	ICAO airport code for Seville approach
LECS-SEV	ICAO airport code for Seville control
LEMG	ICAO airport code for the Málaga Airport
LEZL	ICAO airport code for the Seville Airport
LEJR	ICAO airport code for the Jerez Airport
m	Meters
M	Mach number
MDA/DH	Minimum decision altitude/height
METAR	Aviation routine weather report
MHz	Megahertz
mt	Metric tons
MTOW	Maximum takeoff weight
N	North
N/A	Not affected
NM	Nautical miles

No.	Number
NOTAM	Notice containing information concerning the establishment, condition or change in any aero nautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations
OFP	Operational flight plan
OM A	Operating Manual, Part A
PAR	Precision approach radar endorsement
QAR	Quick access recorder
QNH	Altimeter subscale setting to obtain elevation when on the ground
RAD	Radar endorsement
RCA	Spain's Air Traffic Regulations
RFFS	Rescue and firefighting service
RVR	Runway visual range
s	Seconds
SRA	Surveillance radar approach endorsement
STAR	Standard terminal arrival route
T	Metric tons
TAF	Aerodrome forecast
TCL	Terminal control endorsement
TOAM	Movement area operations technician
TWR	Control tower/Tower control endorsement
UTC	Coordinated universal time
VNAV	Vertical navigation
VOR	HVF omnidirectional range
W	West

Synopsis

Owner and Operator:	TRANSAVIA
Aircraft:	BOEING B-737-800, registration PH-HZW
Date and time of incident:	Friday, 2 December 2016 at 11:39:40[1]
Site of incident:	Málaga-Costa del Sol Airport (Spain)
Persons aboard:	171 passengers, 6 crew, none injured
Type of flight:	Air transport– Scheduled – International - Passenger
Phase of flight:	Approach
Date of approval:	25 October 2017

Summary of the event:

The Boeing B-737-800, registration PH-HZW and operated by TRANSAVIA, with callsign TRA29B, was flying from the Amsterdam-Schiphol Airport (EHAM) to the Seville Airport (LEZL).

As it neared its destination, the crew were informed that the runway at the airport had been rendered temporarily inoperative due to an incident involving another aircraft. Initially the crew decided to wait, but later, as the wait was delayed more than anticipated, the crew decided to divert to the Málaga Airport (LEMG).

While on final for runway 13 to this airport, the tower controller instructed the crew to initiate a go-around due to a runway incursion by another aircraft.

While executing the go-around procedure, the crew declared a fuel emergency due to the low fuel quantity remaining.

The aircraft eventually made a normal landing with no injuries or material damage.

The investigation has determined that the incident analyzed in this report was caused

1 All times in this report are UTC unless otherwise indicated. To obtain local time, add one hour to UTC.

by successive delays to the flight for reasons beyond the control of the crew.

The following factors are deemed to have contributed to this event:

- The inefficient handling of the incident that caused the closing of the runway at the destination airport, in terms of the exchange of information between the stations involved and the lack of a realistic time estimate for a return to normal operations.

- The misinterpretation by the crew of the aircraft with callsign AEA5036 of the controller's instruction, which resulted in that aircraft's runway incursion.

Two safety recommendations are issued to AENA/Seville Airport.

1. FACTUAL INFORMATION

1.1. History of the flight

The B-737-800 aircraft, registration PH-HZW, operated by TRANSAVIA with callsign TRA29B, left the Amsterdam-Schiphol Airport (EHAM) at 08:26:52 on a scheduled flight to the Seville Airport (LEZL) with 6 crew and 171 passengers onboard.

The aircraft flew standard terminal arrival route HIJ3F into the Seville Airport, as assigned (see Figure 1).

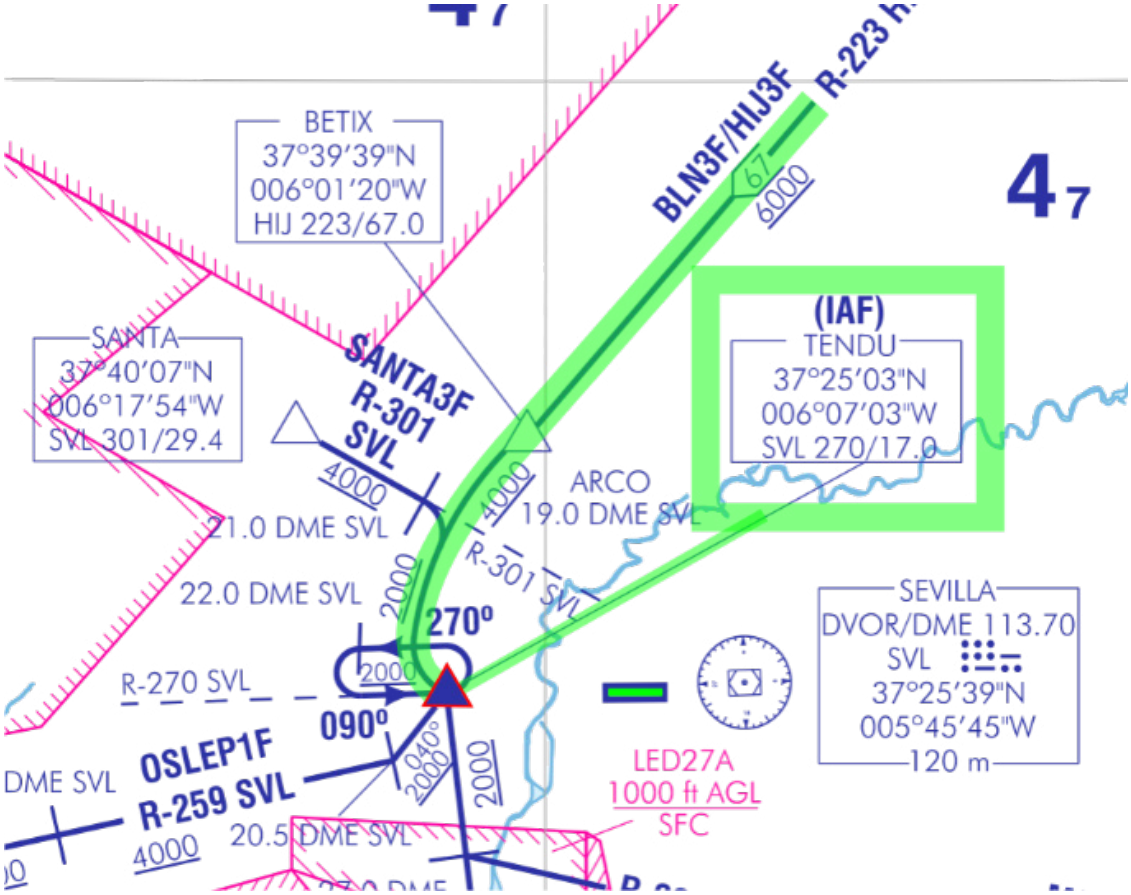

Figure 1. Excerpt from the terminal arrival chart for runway 09 at the Seville Airport, with the route taken by the aircraft (HIJ3F), point TENDU and the runway at the Seville Airport highlighted in green

At 10:56:14, when the aircraft was between points BETIX and TENDU, which is the IAF for the approach to runway 09 at the Seville Airport, the approach controller called the aircraft to inform the crew that an aircraft was stopped on the runway, meaning the runway was currently not available. The controller asked the crew to circle left and said he would call them right back.

The aircraft that was blocking the runway at the Seville Airport had sustained a flat tire during the landing and was stopped on taxiway E3, between the runway and the holding point marking. The aircraft was unable to move by itself and required assistance from the Rescue and Firefighting Service (RFFS) to move.

At 10:56:37, the controller again contacted the crew of flight TRA29B, instructing them to circle again at an altitude of 2000 ft, once more telling them that he would call back with more information as soon as he could.

At 10:59:01, the crew called the controller to ask if they would have fly another 360º circle (the third), to which the controller answered yes.

As they were finishing the third circling maneuver, the crew received a call from the controller, who told them that work to remove the aircraft would be delayed at least ten more minutes. The crew replied they did not have enough fuel to wait that long and that they wanted to go to the Málaga Airport.

The controller gave them instructions to proceed to that airport, informing them that runway 13 was in use.

The crew flew the aircraft to the Málaga Airport, completing the terminal arrival route and then commencing the ILS approach procedure to runway 13 at the Málaga Airport.

In the meantime, an ATR72-212-A aircraft, registration EC-LYJ and operated by SWIFTAIR, was preparing to carry out flight AEA5036, from Málaga to Madrid. At 11:24:40, the crew of this aircraft were cleared to taxi to the runway 13 holding point, which they reached at 11:30:45. The crew then called the control tower to report they were ready for takeoff.

The controller replied, "Hold short, traffic on final, I'll call you back". The crew acknowledged "Line up and wait runway 13", and started taxiing into the runway.

The controller replied "negative" to warn of the incorrect acknowledgment of the instruction, repeating "Traffic on final, hold short runway 13". The crew of aircraft AEA5036 replied they were holding short of the runway.

The controller asked the crew to confirm the runway was clear. The crew reported they had taxied over the holding point marking by only one meter.

Immediately afterward, specifically at 11:31:42, with aircraft TRA29B just over 1 NM out from the runway 13 threshold, the tower controller at the airport instructed

the crew to go around because a traffic had crossed the holding point marking. The crew acknowledged the instruction and added they were low on fuel.

At 11:33:17, in contact with approach, they confirmed they had reached 2400 ft on runway heading, and when they were instructed to turn left heading north and climb to 4000, they declared an emergency ("MAYDAY MAYDAY MAYDAY") due to low fuel.

The controller acknowledged the message and instructed the crew to descend and join the left downwind leg for runway 13. They were subsequently cleared to make a visual approach and finally landed at 11:39:45.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total	Others
Fatal	-	-	-	N/A
Serious	-	-	-	N/A
Minor	-	-	-	N/A
None	6	171	177	N/A
TOTAL	**6**	**171**	**177**	N/A

1.3. Damage to aircraft

The aircraft was not damaged.

1.4. Other damage

There was no other damage.

1.5. Personnel information

1.5.1. Crew of aircraft TRA29B

1.5.1.1. Captain

The 36-year old captain had an airline transport pilot license (ATPL(A)) since 4 April 2008, and an instrument rating (IR(A)) and a BOEING 737 300-900 type rating, both valid until 30 September 2017. He had a total of 6100 flight hours, of which

4300 had been on the type. In the previous 90 days he had flown 189 h and in the previous 30 days 50 h. He also had a class-1 medical certificate that was valid until 6 December 2016.

1.5.1.2. Copilot

The 36-year old copilot also had an airline transport pilot license (ATPL(A)) since 29 November 2010, and the same ratings, which were valid until 30 June 2017. He had a total of 5842 flight hours, of which 5636 had been on the type. In the previous 90 days he had flown 203 h and in the previous 30 days 49 h. He also had a class-1 medical certificate that was valid until 26 October 2017.

1.5.2. Crew of aircraft AEA5036

1.5.2.1. Captain

The 46-year old captain had an airline transport pilot license (ATPL(A)), first issued by AESA on 9 December 2010, an instrument rating (IR(A)) and an ATR 42/72 type rating, both valid until 30 November 2017. He had a total of 6600 flight hours, of which 4800 had been on the type. In the previous 90 days he had flown 106 h and in the previous 30 days 42 h. He also had a class-1 medical certificate that was valid until 5 July 2018.

As for language proficiency, he had a level six (6) in Spanish and four (4) in English.

1.5.2.2. Copilot

The 48-year old copilot had commercial pilot license (CPL(A)), first issued by AESA on 21 June 2013, an instrument rating (IR(A)) and an ATR 42/72 type rating, both valid until 30 September 2017. He had a total of 800 flight hours, of which 447 had been on the type. In the previous 90 days he had flown 104 h and in the previous 30 days 40 h. He also had a class-1 medical certificate that was valid until 4 December 2017.

As for language proficiency, he had a level six (6) in Spanish and four (4) in English.

1.5.3. Air traffic control service

1.5.3.1. Approach controller at the Málaga Airport

The controller at the approach station was 42 years old and had had an air traffic controller (ATCO) license since 16 June 2011. He had the following ratings, which

were valid until 17 September 2017:

- Aerodrome control visual (ADV).
- Aerodrome control instrument (ADI) with the following endorsements: tower control (TWR), ground movement control (GMC), ground movement surveillance (GMS), air control (AIR) and aerodrome radar control (RAD).
- Approach control surveillance (APS) with the following ratings: precision approach radar (PAR), surveillance radar approach (SRA) and terminal control (TCL).
- Area control procedural (ACP).
- Area control surveillance (ACS) with terminal control (TCL) endorsement.

As for language proficiency, he had a level six (6) in Spanish and five (5) in English.

He also had a medical certificate that was valid until 26 July 2017.

1.5.3.2. Controller in the control tower at the Málaga Airport

The controller in the control tower was 43 years old and had had an air traffic controller (ATCO) license since 21 April 2010. He had the following ratings, which were valid until 29 May 2017:

- Aerodrome control visual (ADV).
- Aerodrome control instrument (ADI) with the following endorsements: tower control (TWR), ground movement control (GMC), ground movement surveillance (GMS), air control (AIR) and aerodrome radar control (RAD).
- Approach control surveillance (APS) with the following ratings: precision approach radar (PAR), surveillance radar approach (SRA) and terminal control (TCL).
- Area control procedural (ACP).
- Area control surveillance (ACS) with terminal control (TCL) endorsement.

As for language proficiency, he had a level six (6) in Spanish and five (5) in English.

He also had a medical certificate that was valid until 21 November 2017.

1.6. Aircraft information

1.6.1. General information

The aircraft was built in 2002. It had serial number 29345 and at the time of the incident it had a certificate of airworthiness, whose corresponding airworthiness review certificate was valid until 30 November 2017.

At the time of the incident, it had 51857 flight hours and 19464 cycles.

1.6.2. Description of the fuel system

According to the airplane manual, the Boeing 737-800 has three fuel tanks. The two main tanks are integrated into the wing structure, arranged symmetrically in the two wings (the left is tank no. 1 and the right is no. 2). The center tank is in the wing box, the space between the points where the two wing roots are attached to the fuselage.

Each main tank has a maximum capacity of 4876 L (3915 kg[2]), and the center tank has a capacity of 16273 L (13066 kg), meaning the total capacity is 26025 L (20896 kg).

The amount of fuel used and remaining is provided by the fuel indicators in the cockpit, as well as by the flight management computer (FMC).

The estimated amount is shown on the FMC in units and tenths of metric tons (t) on the PROGRESS page. Figure 2[3] shows how the amount of fuel remaining onboard is displayed (no. 7), and the amount estimated for coming waypoints and the landing site.

The FMC uses the last valid fuel quantity to predict consumption and enable the management of the vertical navigation (VNAV) mode. The crew has to manually enter the figure for the estimated fuel weight on takeoff.

The system displays a CHEK FMC FUEL QUANTITY if it detects an unexpected drop in the quantity.

2 Usable fuel with level wings and a density of 0.8029 kg/l. The fuel load sheet specified a density of 0.798 kg/l.

3 Image property of Boeing 737 FCOM

The FMC constantly estimates the fuel quantity remaining when flying the active lateral route. It will issue a USING RSV FUEL message if it estimates that the amount of fuel remaining on landing will be below the amount specified for this parameter. It will also display INSUFFICIENT FUEL if the prediction for landing is at or below 2000 lb (900 kg).

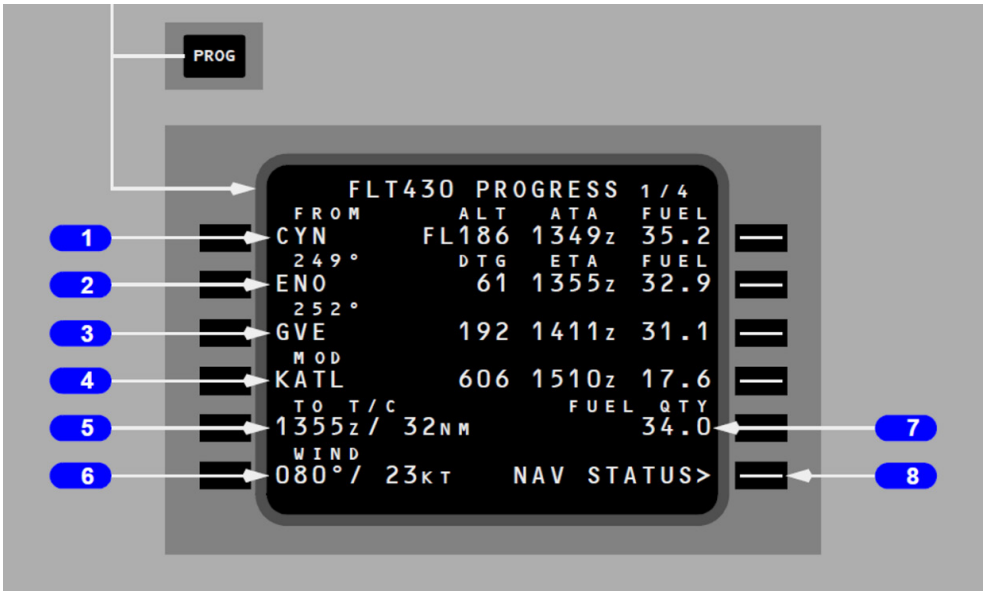

Figure 2. PROGRESS page on the FMC

The aircraft issues a FUEL LOW caution (amber) whenever the quantity of fuel in either main tank is below 453 kg. This caution will remain on until the quantity is increased to 567 kg.

1.7. Meteorological information

The weather information was requested from Spain's National Weather Agency (AEMET), which provided the following information.

1.7.1. General meteorological conditions

The general weather situation was governed by the presence of a high-pressure system over the British Isles that extended to France and the Iberian Peninsula. There was cold low at medium and high levels over the northeastern part of the peninsula. The most significant phenomenon that day was fog, locally persistent in Castilla y Leon and in the Ebro River Valley. The clouds that were entering from the southwest of the peninsula did not start to produce significant precipitation until the morning of 3 December.

1.7.2. Conditions at the Seville Airport

The Seville METARs issued between 10:00 and 12:00 UTC (interval during which the incident occurred) were as follows:

021000Z 06007KT 9999 FEW015 15/13 Q1020 NOSIG=

021030Z 05005KT CAVOK 15/14 Q1019 NOSIG=

021100Z 05004KT 010V080 9999 FEW040 16/14 Q1019 NOSIG=

021130Z 05004KT 9999 FEW039 17/14 Q1019 NOSIG=

021200Z 04006KT CAVOK 17/14 Q1018 NOSIG=

The existing TAF during that interval was:

020800Z 0209/0309 06005KT 9999 SCT030 TX20/0215Z TN11/0209Z

PROB40 TEMPO 0209/0210 3000 BR BKN008

PROB40 TEMPO 0221/0309 4000 RA BKN010=

This information shows that there were reduced visibility in Seville airport, with a minimum visibility of 400 m at 06:00 UTC, but not at the time of the incident, by which time conditions had improved, especially after 09:00 UTC. The forecast in effect indicated a probability of haze with a visibility of 3000 m and a cloud ceiling of 800 ft until 10:00 UTC.

1.7.3. Conditions at the Málaga Airport

The Málaga airport METARs issued between 10:00 and 12:00 UTC were:

021000Z 12003KT 060V170 9999 FEW035 SCT045 17/13 Q1021 NOSIG=

021030Z 10004KT 060V140 9999 FEW016 SCT045 16/13 Q1021 NOSIG=

021100Z 11005KT 060V170 9999 FEW017 17/13 Q1020 NOSIG=

021130Z 11004KT 070V160 9999 FEW017 17/13 Q1020 NOSIG=

021200Z 13004KT 090V160 9999 SCT040 17/13 Q1019 NOSIG=

The existing TAR in force was:

TAF AMD LEMG 020509Z 0206/0306 09005KT 9999 SCT020 TX17/0215Z TN14/0220Z

PROB40 TEMPO 0206/0209 3000 BR BKN008

PROB40 TEMPO 0221/0306 4000 RA BKN010=

This information shows that there were no significant reductions in visibility in the hours prior to the incident, and that the precipitation did not start until the morning of the next day (3 December).

1.8. Aids to navigation

All of the aids to navigation at the destination and alternate airports were operational, except for the following:

- Jerez Airport. DVOR JRZ, which was out of service.
- Málaga Airport. RVR for threshold 30 and the midpoint of runway 12/30 were out of service.

1.9. Communications

1.9.1. Seville Control

The crew established radio contact with Seville Control (LECS-SEV sector) at 10:30:52, reporting they were at FL330.

The controller confirmed radar contact and informed them the runway would be 09 and to fly standard terminal arrival route HIJ3F, which the crew acknowledged correctly.

There were several subsequent exchanges before the controller eventually transferred them to Seville approach (LECS-APN) at 10:40:08.

The crew contacted this station seconds later, reporting they were at FL230 descending to FL210.

The controller confirmed radar contact and instructed them to descend to 5000 ft, informing them that QNH was 1020 hPa.

The crew acknowledged the information and requested direct radar vectors to mile 8 on final.

The controller gave them a revised QNH setting of 1019 and asked them to repeat their intentions. The crew replied they were descending to 5000 ft and if there was any chance to proceed directly to mile 6 on final.

The controller instructed them to follow the standard route and that he would call them back.

At 10:51:19, the controller instructed the crew to descend to 4000 ft, which the crew correctly acknowledged.

At 10:53:16, the controller authorized the descent to 3000 ft, and 32 s later to 2000 ft, also clearing the crew to proceed direct to the runway 09 ILS, at their discretion, which the crew acknowledged.

At 10:55:43, the planning controller at Seville approach (LECS-APN) received a call on the hotline from the controller in the Seville Airport control tower, who informed him that an aircraft was having problems and was stopped on exit taxiway E3, very close to the runway and that it could not move under its own power. He added that the firefighters would respond and try to move the aircraft quickly, and asked the planning controller if he could instruct the Transavia to circle in the meantime.

They agreed to have the aircraft circle at point TENDU at 3000 or 2000 ft.

At 10:56:14, the controller called the aircraft to inform the crew that there was an aircraft on the runway, which was unavailable at that moment, and to instruct the crew to make a 360° left turn and that he would call them right back.

The crew asked him to repeat the message and asked specifically if the runway was available or not.

The controller told them that the runway was blocked by a light aircraft, which is the information he had just received.

At 10:56:37, the controller again called the crew to instruct them to make a 360° left turn at 2000 ft and that he would call them back as soon as possible to give them more information.

About two minutes later the crew again called the controller, asking if there were any new developments on the runway situation. The controller replied that he would update the information when he could and that he was waiting for a response from the Seville TWR.

The approach controller then called the Seville TWR on the hotline to request updated information. The TWR controller reported that the firefighters were arriving at the location where the aircraft was stopped, and that he hoped it would not take long to move it.

The approach controller asked the tower controller how long he should tell the Transavia crew to expect their landing to be delayed, to which the latter replied five minutes and that he would call back before that time was up with updated information.

The approach controller replied that he would tell the crew to plan on a three-minute delay, and asked the tower controller if he thought it a good idea to have them do another 360, to which he replied yes.

At 10:59:01, the crew called the approach controller to ask if they had to do another 360, to which the controller replied yes.

Thirty seconds later, the controller called the crew back to inform them that he had been told by the Seville tower that the runway would be clear in about 3 minutes. The crew replied that 3 minutes was not a problem and that they would wait.

At 11:01:05, the crew again asked the controller if they should do another 360, to which the controller replied that he hoped it would be the last. The crew replied that they were proceeding to do another 360.

At 11:02:32, the approach controller called the tower to ask if the runway was clear. The tower replied that the firefighters had not even left yet and that it would take a while. The controller in the Seville tower added that he thought they would need 10 minutes to clear the runway, though it could be less.

At 11:03:47, the crew of the aircraft called the controller to ask when he thought they would be able to start the approach. The controller asked them to stand by, that he would call back in a minute.

At 11:05:05, the controller called the crew to inform them that the delay would last at least 10 more minutes.

The crew replied that they could not wait that long, that they did not have enough fuel and that they wanted to head to Málaga right away.

Control asked if they were going to Málaga or Jerez, with the crew confirming Málaga.

Around 30 seconds later, the controller called the crew to give them radar vectors to head to Málaga, telling them to climb to 3000 ft and head north.

At 11:07:01, control was on the telephone with airport services to find out if the airplane blocking the runway had been moved yet and to report that the TRANSAVIA aircraft had diverted to the Málaga Airport.

At the same time, they cleared the airplane to climb to FL150.

At 11:07:51, they gave the crew a heading of 100° and reported that the runway in use at the Málaga Airport was 13.

At 11:08:50, and for approximately four minutes, control was on the telephone with airport services trying to find out when they thought the runway would be clear and clarifying on several occasions that the TRANSAVIA airplane had been forced to divert to Málaga. Airport services never provided clear details on how the efforts to clear the runway were progressing.

At 11:14:17, control instructed the crew to proceed to point OMIGO, contact Málaga APP on 123.85 MHz and then signed off.

1.9.2. Málaga Airport

At 11:18:33, the ATR72 aircraft with callsign AEA5036, operated by SWIFTAIR, contacted ground control (GND) at the Málaga Airport to request departure clearance for the Madrid Airport.

The controller cleared the crew to take off from runway 13, climb initially to FL90 and assigned squawk code 2646.

At 11:19:28, they were cleared for start-up and pushback.

At 11:24:40, they were cleared to taxi to the runway 13 holding point via taxiways L and A ("Lima and Alfa"), which the crew acknowledged.

At 11:28:07, GND instructed them to call the tower on 118.15 MHz when ready

and signed off.

At 11:30:45, they contacted the tower to report they were at the runway 13 holding point and fully ready for departure. Control replied "HOLD SHORT RUNWAY 13 traffic on final I'll call you back". They replied hesitantly "LINE UP AND WAIT RUNWAY 13", and the tower at 11:31:01, informed them of their incorrect acknowledgment, repeating the instruction ("Europa 5036 NEGATIVE, traffic on final. Hold short runway 13").

Then, at 11:31:13, they replied, indicating that they were waiting near runway 13.

The controller asked them to confirm that the runway was clear.

The crew replied that they had taxied just one meter past the "holding short" marking.

At 11:31:42, ATC instructed the crew of TRANSAVIA 29B to go around because a traffic had taxied past the holding point marking.

Nine seconds later, they confirmed the instruction and informed they were running low on fuel.

At 11:31:55, ATC acknowledged and told them they would relay it to the approach service: "29B Roger, I will report to my colleague in approach".

At 11:32:06, ATC told them they would call back, and 25 s later, ATC instructed them to contact approach on 123.85 MHz.

At 11:32:59, the crew confirmed, at the request of the approach controller on 123.85 MHz, that they were at 2400 ft on runway heading. ATC instructed the crew to turn left to course north and climb to 4000 ft. At that point, specifically at 11:33:17, the crew declared an emergency ("MAYDAY MAYDAY MAYDAY") and reported they were descending to runway 13. Approach instructed them to contact the tower on 118.15 MHz.

At 11:33:44, the tower informed the crew of AEA5036 that its takeoff clearance was cancelled and to enter the runway to return to the holding point and vacate it as quickly as possible. At 11:34:50, AEA5036 reported the runway clear.

At 11:34:56, the TRANSAVIA was cleared to land, and finally, at 11:40:06, its crew reported vacating the runway after landing.

1.10. Aerodrome information

1.10.1. Seville Airport

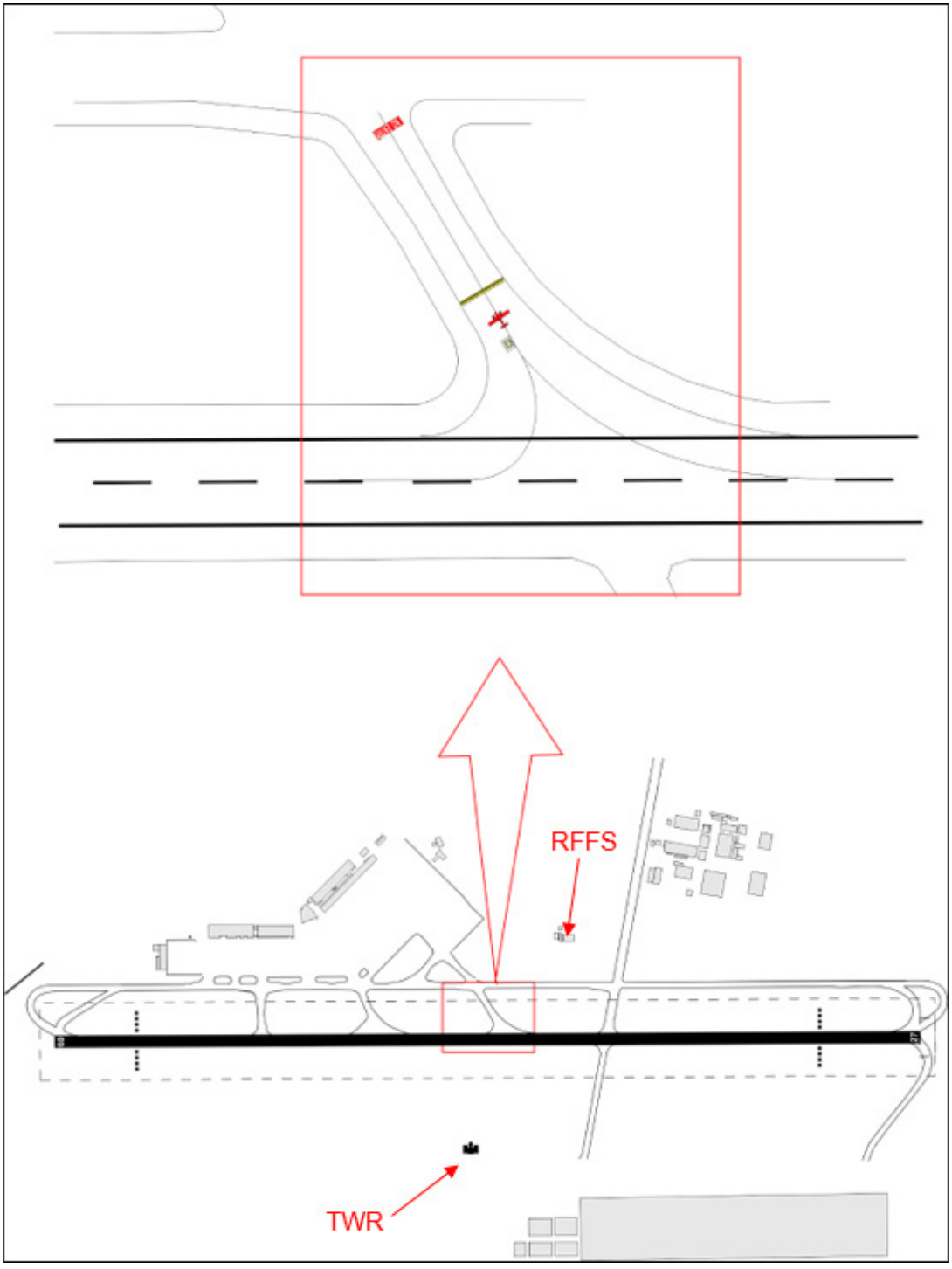

Figure 3. General map of the Seville Airport, showing the locations of the RFFS building, the control tower and the area where the aircraft had stopped (bottom image), and a close-up of this area (top image).

The Seville Airport (LEZL) is located 10 km northeast of the city. It is an ICAO reference code 4-E[4] airport.

According to the information in the AIP (Aeronautical Information Publication), its reference point (ARP) is at coordinates 37° 25' 05" N – 5° 53' 56" W and an elevation of 34 m (111 ft). It has one runway in a 09/27 orientation that is 3362 m long and 45 m wide.

Both thresholds of runway 09/27 have a CAT I instrument landing system (ILS).

The transition altitude is set at 1850 m/6000 ft.

1.10.2. Málaga Airport

The Málaga Airport (LEMG) is located 8 km northeast of the city and is an ICAO reference code 4-E airport. Its master plan was approved by Ministry of Development Order 2614/2006, and its main activity is scheduled international passenger traffic.

According to the information in the AIP, its reference point is at coordinates 36° 40' 30" N – 4° 29' 57" W and an elevation of 16 m (52 ft). It has one runway in a 13/31 orientation that is 3200 m long and 45 m wide, and another runway in a 12/30 orientation that is 2750 m long and 45 m wide.

Even if runway 12/30 is out of service, if the airport operator concludes that its use is required based on traffic demand or other operational reasons (contingencies and/or maintenance activities on runway 13/31), the runway can be placed in service and reported via NOTAM and/or ATIS.

The transition altitude is set at 1850 m/6000 ft.

Both thresholds on runway 13/31 have a CAT I instrument landing system (ILS).

The taxiway parallel to the runway and threshold 13 are connected via four

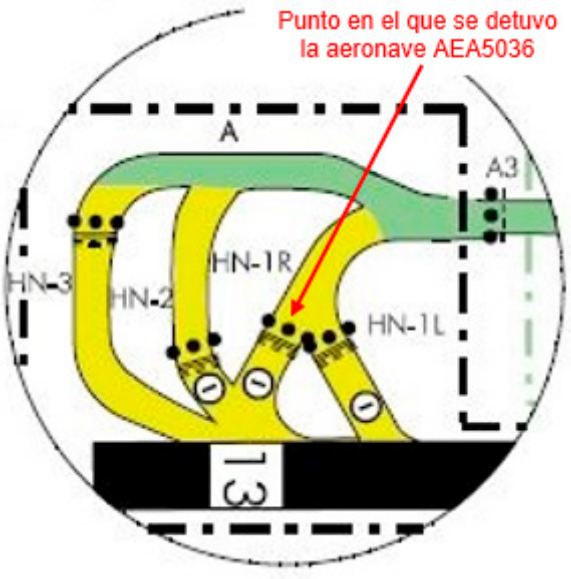

Figure 4. Close-up of the runway 13 threshold area at the Malaga Airport.

4 (4) Runway length 1800 m or longer. (E) Can accept aircraft with a wingspan of between 52 and 65 m or an outer main gear wheel span of 9 to 14 m.

taxiways called HN-1L, HN-1R, HN-2 and HN-3 (see Figure 4). Each one has a holding point marking.

1.11. Flight recorders

1.11.1. Quick access recorder

The investigators were unable to access the flight recorders because the CIAIAC was informed of the circumstances of the event on 5 January 2017 by means of AESA's Event Notification System (ENS). This was over one month after the incident, which made it impossible to recover the data.

The operator, however, downloaded the data contained in the quick access recorder (QAR) and provided the raw data file. The aircraft manufacturer also sent the relevant file needed to convert said raw data into engineering units (parameter data frame). This made it possible for investigators to use and analyze the parameters recorded during the flight, which yielded the following results:

The aircraft took off at 08:26:52, with the airplane travelling at an indicated speed of 166 kt on a heading of 241° (takeoff from runway 24 [5]).

It reached FL370 at 08:46:22 and remained at this level for approximately 38 minutes, flying on a heading to the south/southeast (between 203° and 213°), after which it began to climb for 3 minutes to FL390, during which time it changed its heading to the southwest (around 220°).

At 10:24:15, it began to descend gradually to 2000 ft and leveled out, making a total of four 360° turns, corresponding to the holding pattern flown in the vicinity of the Seville Airport (around 10 minutes).

At 11:06:00, with 2576 kg of fuel remaining onboard, the aircraft started the diversion to Málaga. Climbing to the east until it reached FL150, before starting a new continuous descent to 500 ft. At 11:32:04, it initiated a go-around maneuver with 1410 kg of fuel remaining. During the climb-out maneuver to 4000 ft the aircraft turned to downwind and performed a visual circuit for runway 13 at the Málaga Airport.

Touchdown at Málaga airport was at time 11:39:45 with 1034 kg of fuel remaining.

5 The Amsterdam-Schiphol Airport has six runways, designated as 18L/36R, 18C/36C, 18R/36L, 04/22, 06/24 and 09/27.

After landing, 1:52 minutes later at 11:41:37, the cockpit alert indicating low fuel level in the right tank was activated.

The initial fuel levels recorded were 3030 lb in the center tank, 8620 lb in the right tank and 8610 lb in the left tank [6], which would correspond to 1374 kg, 3910 kg and 3905 kg, respectively. The fuel in the center tank was consumed in the first 10:53 minutes of flight.

While it was holding at the Seville Airport, it consumed 850 lb or 356 kg.

When it landed, it had 1020 lb in the right tank and 1260 lb in the left for a total of 2280 lb, or 1034 kg. At the time when the low-level alert was received, the total remaining was 2180 lb (980 lb in the right tank and 1200 lb in the left), or 989 kg.

1.11.2. Radar track

The investigators analyzed the radar track from 10:32:00 UTC until the time the aircraft landed at the Málaga Airport.

According to this information, the aircraft reached point BETIX, which is a fix on the HIJ3F STAR (see Figure 1) for the Seville Airport, at 10:52:02, at an altitude of 5200 ft.

The aircraft then descended as it continued toward TENDU, which is the IAF for the instrument approach for runway 09.

At 10:56:10, the aircraft was very close to point TENDU. It stopped its descent at 2000 ft, where it leveled out.

At 11:05:20, after circling three times around point TENDU at 2000 ft, the aircraft headed north and started to climb 50 seconds later.

At 11:08:15, it turned right to head in an easterly direction. At that point it was at 5800 ft.

It reached FL150 at 11:11:40, remaining at that level until 11:15:00, when it started to descend.

6 The fuel quantity values are recorded in pounds (lb) and recorded by the QAR every 64 s. The reading for the left tank is recorded first, then the right tank and finally the center tank, each 4 s apart.

It reached point NEPUR, a fix on the instrument approach to runway 13 at the Málaga Airport, at 11:25:40 at an altitude of 5500 ft.

Twenty seconds later it was lined up on the runway heading at 5300 ft.

At 11:32:10, while at an altitude of 500 ft, it began to climb until it reached 4000 ft at 11:33:56.

It made a turn north of the airfield and at 11:38:05 it was again lined up on the runway heading at an altitude of 1400 ft.

It eventually landed at 11:39:50 on runway 13 at the Málaga Airport.

1.12. Wreckage and impact information

The aircraft landed without causing any damage.

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

According to the delivery note indicating the amount of fuel loaded into the airplane at the departure airport, prior to the flight the center tank was empty, the right tank had 1380 kg and the left 1360 kg.

All three tanks were refueled, and the airplane left with 1400 kg in the center tank and 3900 kg in the other two.

1.17. Organizational and management information

1.17.1. Seville Airport. Procedure for moving disabled aircraft

The actions required to move a disabled aircraft in or near the movement area at the Seville Airport are contained in procedure SVQ-OPS-15.

According to this document, the body responsible for overseeing these actions is the airport authority, in the following order of priority: the duty manager, the chief of the Operations Department and the Airport Director.

The designated airport authority shall, among other measures and responsibilities, be charged with coordinating all airport operations with ATC stations (control tower) and ACC (Area Control Center) so that aerial activities can be resumed if possible.

The procedure also assigns to CECOA-CEOPS the task of coordinating the information flow between the TWR and ACC in terms of the availability of airport resources and affected operations, and of maintaining the airport authority informed.

As for the task of removing the aircraft, it specifies that small aircraft (MTOW<4mt) may be removed by the airport's RFFS with the approval of the aircraft's crew.

1.17.2. Handling of the emergency involving aircraft AEP761

1.17.2.1. Seville Airport

Investigators gathered information from the Seville Airport from the time the runway was blocked until it was reopened, which allowed them to establish the following timeline of significant events:

At 10:55, personnel from the Operations Office (CEOPS) heard as the aircraft with callsign AEP761 reported to the control tower (TWR) at the Seville Airport that a tire had blown out and that it had come to a stop on E3. The CEOPS then notified the Maneuvering Area Operations Technician (TOAM) and the Rescue and Firefighting Service (RFFS).

At 10:59, the TOAM reported that the airplane was stopped inside the runway safety strip.

At 11:05, the RFFS reached the area where aircraft AEP761 was stopped with towing equipment.

At 11:10, the aircraft with callsign TRA6729 diverted to the Málaga Airport.

At 11:12, the TWR reported that the aircraft with callsign VLG8831, TAP1102 and VLG1298 were circling until the runway was cleared.

At 11:21, the TOAM informed the tower that the safety strip was clear and exit taxiway E3 was blocked.

At 11:53, the airplane with callsign AEP761 reached the general aviation stand, towed by the RFFS.

1.17.2.2. Aerodrome control service at the Seville Airport

The aerodrome control service at the Seville Airport provided a timeline for the most relevant actions and communications involving the removal of the aircraft with callsign AEP761.

According to it, at 10:53:47 the controller informed the CECOA that this aircraft had a problem with a tire and that it would try to vacate the runway via E3 so as not to block it. The controller also requested that the firefighters be sent to see if they could assist.

At 10:54:43, the crew of aircraft AEP761 informed the controller that they had exited the runway but could not continue taxiing and had stopped before reaching the marking for the runway holding point.

Around one minute later, the controller called the approach controller to inform him of the situation. He added that he was sending the firefighters and asked the approach controller if he could instruct the Transavia crew to fly a few circles.

At 10:56:12, the controller asked the firefighters but received no response.

The controller repeated the call 18 s later, receiving a response this time. He informed the RFFS that an aircraft had come to a stop on the edge of the runway, and asked if they could move the aircraft enough to remove it from the runway. The RFFS replied that they were proceeding to the location.

At 10:57:09, the controller called the crew of the aircraft and asked if they had had a blow-out, which the crew confirmed, adding that it had been of the right tire.

The controller then called the TOAM to have him do a check of the runway from HP2 to E3.

At 10:59:09, the TWR controller spoke with the approach controller, who asked the former for an estimate of how long the Transavia would be delayed. The TWR controller replied that the RFFS was proceeding to the site and that the aircraft had to be moved some 30 m to clear the runway, so he did not expect it would take long.

He then called another TOAM (hereinafter TOAM-2), who stated that he was proceeding to the location where the aircraft was stopped. The controller asked him to try to move the aircraft so they could return the runway to service.

A minute later, the TOAM-2 called the TWR to report that he was alongside the aircraft, which he confirmed had a flat tire. He added that if the aircraft could not move under its own power it would have to stop its engines so it could be towed. The controller asked the crew to stop the engines.

At 11:02:45, the TOAM reported that he had completed the check of the runway.

At 11:04:06, the controller called the CECOA to ask if they knew what was happening with the RFFS. The CECOA technician replied that he did not know, that he supposed they were gathering the necessary equipment. The controller asked him to call the RFFS.

Sixteen seconds later, the controller called the TOAM-2 to inform him that he could see the RFFS leaving the station at that moment.

At 11:06:58, the TWR and APP controllers spoke, with the former saying that the RFFS was placing the dolly on the leg with the flat tire. The APP controller said that the Transavia crew had requested to proceed to Málaga.

At 11:10, the TWR controller asked the TOAM to inquire from the RFFS as to a time estimate. The TOAM replied that the tire had blown out and that it would take more time.

1.17.3. Flight planning

The investigators analyzed the operational flight plan (OFP) filed, including the crew's entries.

For the leg from Amsterdam to Seville, the crew filed a flight plan that indicated the airports of Jerez and Málaga as the first and second alternates, respectively, and an estimated takeoff time of 08:35.

Figure 5 shows an excerpt from the OFP involving the fuel planning. These calculations indicate that:

- 231 kg of extra fuel was added prior to takeoff (9300 kg vs 9069 kg).

- The trip fuel calculated was not corrected for the difference between the actual and expected takeoff weights. The actual zero-fuel weight (AZFW) resulted in a difference of over 1000 kg below that estimated in the consumption calculation. The OFP specified a reference value that in this case reduced the expected consumption by 83 kg, meaning that the takeoff fuel required for the operation was 112 kg below the quantity initially expected (8802 kg vs 8690 kg).

- No contingency fuel in addition to that calculated was added, this being defined, as per Part A of the Operations Manual (OM A) as that required to compensate for unforeseen factors such as deviations from the planned route or cruise level or for weather reasons, as well as for consumption differences between a specific aircraft and the planned quantity.

- The 9300 kg loaded upon departure covered the possibilities for diverting to both the first alternate, Jerez (LEJR), and the second, Málaga (LEMG). As Figure 5 shows, in the first case the diversion route required a consumption of 996 kg flying direct to the JRZ VOR at FL100. In the second case, the planned diversion route required a consumption of 1079 kg at FL150 via the MAR VOR.

- The final reserve fuel was 1133 kg.

- No additional fuel was added, defined by the OM A as that required based on the operation type and determined by the operator's Technical Flight Department.

- The captain, at his discretion, added 231 kg of extra fuel. There was no entry in the OFP to justify this quantity.

- The taxi fuel was 267 kg.

Therefore, the amount of block fuel required, with Jerez as the alternate airport, was 9069 kg (recall that the crew refueled 9300 kg according to the load sheet), and the aircraft's estimated zero-fuel weight (EZFW) was 58306 kg. This means that once the taxi fuel was consumed (267 kg for APU and taxi operations), the aircraft's estimated takeoff weight was 67108 kg. This is the weight that was used for the

performance and trip consumption calculations.

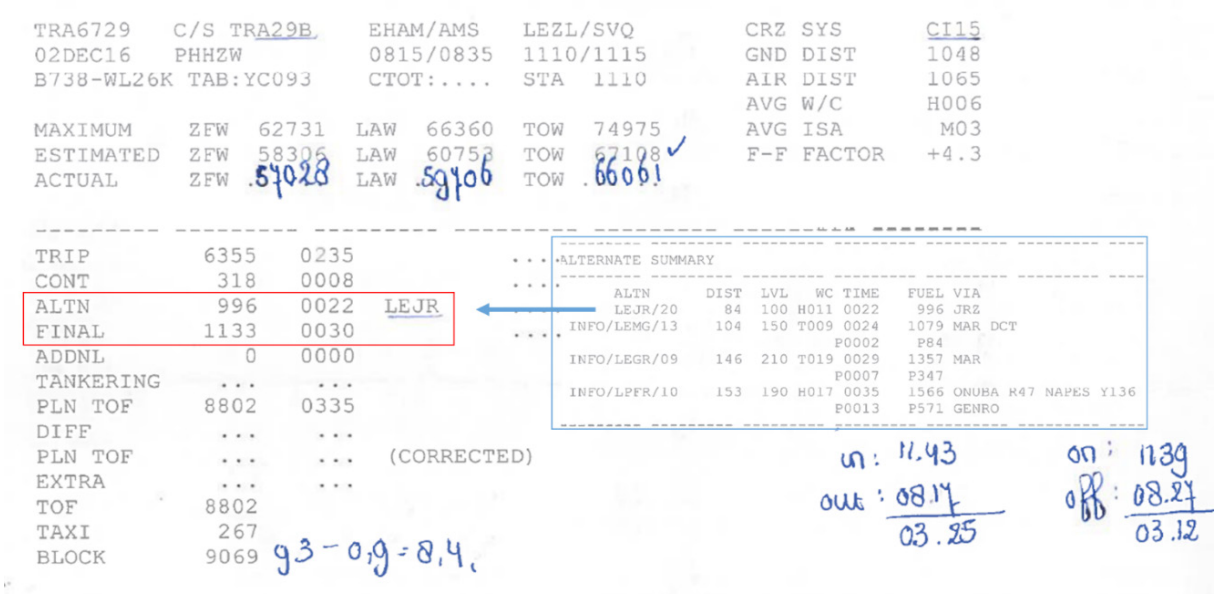

Figure 5. Fuel calculations for the incident flight (OFP)

The flight plan assumed the aircraft would fly SID LEKKO3V after taking off from runway 36L at the Amsterdam Airport and then fly at a cruise level of FL370. The fuel calculation was based on a cost index[7] of 15 (CI15), which yielded an ideal speed of around 0.77 M. The fuel factor[8] applied was +4.3.

The OFP also showed (Figure 5) information on four alternate airports in order of preference, with Jerez being the first and Málaga the second. For each, the OFP gave the distance, wind component, time, flight level and fuel required. To reach the Jerez Airport, with the approach to runway 20, the OFP showed a distance of 84 NM and a flight time of 22 minutes. In the case of Málaga, the distance was 104 NM, maneuvering to land on runway 13, with an estimated flight time of 24 minutes. Therefore, the lowest fuel required for the two alternates was 2129 kg and 2212 kg, respectively.

The crew had made handwritten entries at four different points along the route, recording the fuel and time. In general, they showed that the quantity of fuel remaining was around 400 kg more than the fuel quantity estimated in the OFP for those points.

7 The cost index is a value that relates the direct operating costs to the price of fuel. The FMC uses this figure to calculate the most economical cruise speed.

8 The fuel factor is a variable that corrects consumption based on how the aircraft's aerodynamic characteristics degrade over time.

As for the weather information, the crew had METAR and TAF reports for the destination and alternate airports. The conditions described for these reports were conducive to normal flight operations, with high visibilities, few clouds, little wind and high atmospheric pressure.

They also had weather forecasts and wind charts, which showed no significant phenomena that would entail diverting from their planned route.

As for the NOTAMs:

- At the Jerez Airport, no. 1E6044/16 was in effect from 2 December at 08:00, and it stated that the JRZ DVOR, on a frequency of 113.00 MHz, was out of service due to false readings.

- At the Málaga Airport, no. 1B6659/16 was in effect from 1 December at 17:57, which indicated that the RVR meter for the runway 30 threshold and the midpoint of runway 12/30 was out of service. In light of the prevailing weather conditions at the time of the incident, this situation did not limit operations at the airport.

1.17.4. Operational information for Transavia

The fuel policy of the operator, Transavia, is specified in its Operations Manual A (OM A 8.1.7), and adheres to the stipulations of the European Air Ops regulation (CAT.OP.MPA 150 Fuel Policy). It states that flight planning shall be based on procedures and data provided by the manufacturer and on the specific data for each aircraft, as obtained from the fuel consumption monitoring system. The operating conditions under which the flight will be conducted must also be considered, including:

- Realistic aircraft fuel consumption data;

- Anticipated masses;

- Expected meteorological conditions;

- Air navigation service provider(s) procedures and restrictions.

The pre-flight calculation for the usable fuel required will include:

- *Taxi fuel:* Fuel required for taxi operations before takeoff, including APU consumption and engine start-up and ground movement operations.

- *Trip fuel:* Fuel required to fly from the departure to the destination airport, calculated based on the operating conditions.

- *Reserve fuel:* Sum of

    - *Contingency fuel*: Compensates for unforeseen factors that could have an effect on consumption. This quantity shall be the higher of:

        - 5% of the planned trip fuel

        - Fuel to fly for 5 minutes holding at 1500 feet above the destination airport in standard conditions.

    - *Alternate fuel:* Fuel needed to proceed to the alternate aerodrome after executing the missed approach from the MDA/DH at the destination and flying along the planned route to land at the alternate.

    - *Final reserve:* Fuel needed to fly for 30 minutes at holding speed at 1500 ft above the aerodrome in standard conditions, calculated using the estimated mass on arrival at the alternate aerodrome.

    - *Aditional fuel:* The quantity of fuel required by the technical flight department based on the type of operation.

The minimum block fuel for dispatching the aircraft must be the sum of these quantities.

- *Extra fuel:* A quantity of fuel in excess of the minimum fuel required, the amount of which is left to the captain's discretion. The main reason for needing this extra fuel must be indicated on the Operational Flight Plan (OFP).

In addition, the Manual (OM A 8.1.7) states that crews are required to enter the amount of fuel indicated onboard prior to the flight in the aircraft technical logbook (ATL), as well as the amount remaining after the flight. On the day of the incident, the crew entered in the ATL that the amount of block fuel, after taking on 6600 kg, was 9300 kg, and that the fuel remaining upon arrival was 900 kg.

The crew also entered the off-blocks time and takeoff time in the ATL, which were 08:17 and 08:27, as well as the landing and arrival at parking stand times, which were 11:30 and 11:43.

On the in-flight fuel management policy (OM Part A 8.3.7):

The Manual, in accordance with CAT.OP.MPA.280, indicates the need for crews to regularly monitor the amount of fuel remaining while in flight. This quantity must be logged in the Operational Flight Plan and, in order to compare actual and planned fuel consumption, the fuel remaining must be verified to be sufficient to complete the flight and to determine the amount estimated upon arriving at the destination.

If as the result of an in-flight fuel check, the quantity remaining expected upon landing is below that required to proceed to the alternate plus the final reserve, the captain shall consider the traffic situation, taking into account information on delays and the prevailing operational conditions at the destination aerodrome, as well as the diversion route and conditions at the alternate, to decide whether to continue to the planned destination or divert, such that the aircraft does not land with less than final reserve fuel.

As for the "MINIMUM FUEL" declaration, the Operations Manual states:

"If decided to land at a specific airport and any change to the existing ATC clearances may jeopardize final reserve fuel, the commander shall advise ATC of a minimum fuel state by the call "MINIMUM FUEL".

Note: The "MINIMUM FUEL" call informs ATC that any change to the communicate (diversion) plan may result in a landing with less than final reserve fuel.

Note: This call is not a fuel emergency, but an indication that should any alteration to the intended route be made, a fuel emergency is possible.

Note: Priority handling as result of a "MINIMUM FUEL" call should not be expected. ATC will, however advise flight crew of any additional delays as well as coordinate transferring of control to ensure other ATC units are aware of the flight's fuel state."

The captain must declare an emergency immediately upon realizing that the fuel onboard upon landing at the nearest aerodrome where a safe landing can be performed will be below final reserve fuel. The distress declaration "MAYDAY MAYDAY MAYDAY, FUEL" will be used. An emergency declaration due to low fuel indicates the need for priority handling by ATC to ensure a safe landing. The amount of usable fuel in minutes will be reported to ATC, along with the crew's intentions.

The inclusion of this terminology follows the recommendation provided in EASA Safety Information Bulletin 2013-12, which recommends applying the relevant provisions of ICAO Annex 6.

1.18. Additional information

1.18.1. Statement from the crew of the aircraft registration PH-HZW

"Before we initiate the descent to 2000 feet for the final approach to Seville, ATC informed us that the runway was occupied by a small plane with technical problems. The expected initial waiting time that was communicated to us was 4 minutes. After 5 minutes holding, we were informed that an additional delay of 10 minutes was expected. At that time we decided to divert to Málaga airport, which required 2.2 tons of fuel. We start the deviation route with a remaining amount of fuel of 2.4 tons. During the approach maneuver to Málaga, ATC informed us that the runway at Seville was open and available again. 27 minutes had elapsed since the initial ATC call about the closing of the runway. The estimated landing fuel was 1.2 tons. Once in short final, the control tower of Málaga ordered us to execute the missed approach maneuver, because an airplane had crossed the waiting line for runway 13. Once the missed approach maneuver was executed, we declared fuel emergency (FUEL MAYDAY), since the fuel estimated at landing was less than 1.1 tons. We made a short visual circuit concluding in a landing without incident. The fuel remaining at landing was 900kgs. The passengers were informed during the holding maneuvers, the transit to the diversion airport and after landing."

They demanded that they would have been useful if ATC had used English language during the occupation of both runways, which would have given them a better situation awareness of the situation.

The decision to proceed to Málaga, its second alternative in the OFP, was due to the fact that this airport has two runways with a length greater than that of Jerez airport (their first alternative). They also opted to give preference to Málaga airport since the crew had greater operational knowledge of this airport.

1.18.2. Statement from the crew of the aircraft with callsign AEA5036 operated by SWIFTAIR

The communications between the aircraft crew and the control tower were carried out almost exclusively in English.

The crew of the ATR-72-212A stated that when they reached holding point HN-1R for runway 13, they stopped the aircraft and called the tower to report they were

ready for takeoff. Both crewmembers stated that they heard the TWR controller instructing them to "LINE UP RUNWAY 13", which they acknowledged by repeating the instruction to "LINE UP RUNWAY 13".

As they started to taxi the aircraft into the runway, the controller called them back saying "HOLD SHORT, HOLD SHORT", at which point they stopped the airplane. The controller asked them if the runway was clear, and they replied, in Spanish, that they had taxied one meter beyond the holding point. They then heard the controller instruct the traffic on final to "go around" due to a "runway incursion".

Following this, the controller called them and cleared them to "LINE UP RUNWAY 13". Once lined up, they were cleared for takeoff, though almost immediately the controller asked them to abort the takeoff and vacate the runway as quickly as possible because there was an aircraft declaring an emergency.

They left the runway via the first available exit, reported it and were cleared to proceed once more to the runway 13 holding point.

When the traffic that had declared an emergency landed, they were cleared to take off, which they did normally, completing their flight to Madrid without further incident.

1.18.3. Statement from approach controller at the Málaga Airport

The controller stated that the airplane with callsign TRA29B had been diverted from the Seville Airport because a runway was blocked.

When he contacted the airplane, the crew asked him if there were any delays, to which he replied no.

When they were 15 NM away from the airport, he transferred the crew to the tower to guide them in during the landing.

A short time later, he was informed by the local tower that the aircraft had gone around. He was asked to instruct the crew to maintain runway heading and climb to 4000 ft and to contact him (approach).

When the crew contacted him, he instructed them to turn left heading north. The pilot asked for confirmation of the heading, after which he declared a MAYDAY due to fuel.

He acknowledged and instructed them to proceed to the left downwind leg for

runway 13 and to contact the tower.

1.18.4. Statement from the tower controller at the Málaga Airport

The controller stated that the aircraft with callsign AEA5036 contacted the tower while at the holding point for runway 13. Its crew were instructed to hold short of the runway because TRA29B was on final.

Aircraft AEA5036 acknowledged, saying "LINE UP AND WAIT RUNWAY 13", and started taxiing into the runway.

He informed the crew of their incorrect acknowledgment and instructed them once more to hold short of runway 13. He then asked them for confirmation that the runway was clear, to which the crew replied they had taxied 1 m past the holding point marking.

The airplane on final was approximately 3 NM out. Its crew were informed that an aircraft had taxied past the holding point and instructed to go around. Aircraft TRA29B acknowledged and reported they were "short of fuel".

The tower coordinated with approach control, informing them that TRA29B was short of fuel. Approach replied, instructing the tower controller to have the aircraft climb to 4000 ft on runway heading.

At that point there was a second aircraft on final with callsign AEA1034, which was 12 NM out.

The tower coordinated the departure of traffic AEA5036 with approach, receiving instructions to have the aircraft maintain runway heading after takeoff at an altitude of 2000 ft, which had already been vacated by TRA29B. That was when the tower was informed that TRA29B had declared a fuel emergency, so the takeoff instruction for AEA5036 was cancelled, and its crew instructed to vacate the runway immediately via exit E6.

The AEA1034, which was on final, was informed of the situation and instructed to go around on runway heading and climb expeditiously to 5500 ft to clear TRA29B, which was west of runway 13 at an altitude of 4000 ft.

Once TRA29B was on the tower frequency, its crew were instructed to start the descent to 2000 ft in visual contact with the ground. Once clear of AEA1034, which was on final, it was cleared to make a visual approach to runway 13 and to land.

While the emergency was in progress, the RFFS and the duty manager at the airport were alerted, though the airplane was able to land normally.

1.19. Useful or effective investigation techniques

Not applicable in this case.

2. ANALYSIS

2.1. Analysis of the flight and its planning

The aircraft left from the Amsterdam Airport (EHAM) with 231 kg of extra fuel over that required in the Operational Flight Plan (OFP), which allowed having both the Jerez (LEJR) and Málaga (LEMG) airports as alternates. The flight planning operational and weather information available to the crew did not indicate any adverse situation that would hamper the normal course of the flight.

After making the required approach maneuver to the destination airport in Seville (LEZL), while nearing the initial approach fix (TENDU) for the ILS maneuver to runway 09, the crew were instructed to circle and wait for clearance to complete the approach.

The Seville Airport (LEZL) was forced to suspend operations on the runway in use due an incident involving a light aircraft that had come become immobilized within the runway safety strip.

The tower controller in Seville coordinated with the assistance services (RFFS and TOAM) to ascertain the estimated delay and provide that information to aircraft waiting to land.

The aircraft was instructed by Approach Control to wait at 2000 ft.

A little over three minutes later, the crew were informed that the runway would be cleared in three minutes, which the crew accepted.

However, 5:44 minutes later the controller informed the crew to expect an additional 10-minute delay. In light of this information, the crew asked to proceed to Málaga (LEMG) immediately.

After being questioned about the option to proceed to Málaga (LEMG) instead of Jerez (LEJR), which was the first alternate listed in their OFP, they received radar vectors to proceed to the airport requested at FL150.

Once established on final for the ILS approach to runway 13, they were instructed by the controller in the Málaga tower (LEMG) to go around, which the crew did with 1410 kg of fuel remaining.

The reason for not being cleared to land was a runway incursion by an ATR 72 aircraft operated by Swiftair. A misunderstanding by the crew involving an instruction

provided in English resulted in the aircraft taxiing over the runway holding point, despite being instructed to hold short of the runway.

While in contact with approach, the crew declared a fuel emergency so as not to delay their landing any further, which they calculated they would carry out with a fuel quantity below their final reserve, which was 1133 kg.

After being cleared to fly a visual circuit, the aircraft landed without further incident on runway 13 at Málaga with 1034 kg of fuel remaining.

2.2. Analysis of the handling of the emergency at the Seville Airport

The first information on the incident of aircraft AEP761 was received at 10:53:47, when the controller in the control tower at the Seville Airport called the CECOA to report the event. During that same exchange, the controller asked that the firefighters be dispatched to aid the crew of the aircraft.

Around one minute later, the crew of the aircraft spoke with the controller, informing him that they had stopped and could not move the aircraft. When asked by the controller, they specified that they were off the runway, but that they were still ahead of the holding point marking.

As Figure 3 shows, taxiway E3, where the aircraft stopped, and the building of the airport's firefighting service are practically opposite the TWR, not far from it (500 m and 870 m away, respectively). The controller would thus have had a good view of the entire area.

It might have been this good view that allowed him to realize that the aircraft only had to be moved a few meters to leave the runway clear, in which case it could have been placed back in use.

His location also provided a clear view of the RFFS building, allowing him to see any departing vehicles.

It is likely that after waiting for a minute and a half after having requested assistance from the firefighters and seeing no RFFS vehicles exit the building, he decided to call the firefighters, though he received no reply.

He called back 18 s later. This time there was a reply, and the controller informed the firefighters that there was an aircraft holding on final and that it would stay there until they moved the aircraft.

The firefighters replied that they were on their way.

The controller then called the TOAM to ask him to check the runway.

This check is required before reopening the runway and is intended to detect and, if necessary, remove any element that may have detached from the aircraft (FOD) during the event.

The TOAM-2 called the controller at 11:00:42 from the aircraft's location, where he had just arrived, to confirm that the aircraft had a flat tire.

At 11:04:06, a little over 10 minutes after the controller asked the firefighters for assistance, the controller called the CECOA to ask what was happening, since the firefighters had not even left the building yet. The CECOA replied they did not know, that they assumed they were preparing the equipment.

The firefighters left a few seconds after this conversation.

During those 10 minutes, the controller was coordinating with the approach controller, arranging for tasks that could be carried out simultaneously (runway inspection), and updating the information on the efforts to move the airplane.

The exchange of information between the airport authority and the TWR does not seem to have been as effective as desired. In fact, during those 10 minutes, the controller did not receive any calls informing him of the work to move the aircraft. Even the calls he placed in an effort to obtain information were unsuccessful.

The CECOA's reply that they "must be preparing the equipment" to the controller's question as to why the firefighters had not left yet, as well as the subsequent confirmation that they were installing the dolly (see 1.17.2.2), seems to indicate that the firefighters' delay in leaving their building was likely due to the fact that they were gathering the equipment needed to move the airplane. This could have been motivated by one of two reasons: either they had specific information on the condition of the aircraft's tire that indicated the need to use this equipment, or it was routine practice.

Regardless of the information available, the first airport operator to reach the aircraft was the TOAM-2, who did so six minutes after the controller requested the firefighters' assistance. It does not seem that the firefighters' decision to bring this additional equipment was based on specific information on the event.

As a result, it seems like this is a routine practice; but even so, it should be included

in the procedure for moving disabled aircraft.

In any event, the RFFS must have been mindful of the fact that more time would be required to gather their equipment. This information did not seem to reach either the TWR or the CECOA.

The information that the TWR controller had involving the removal of the aircraft was limited to knowing that it was just a few meters away from being clear of the runway safety strip. As for the resources required to move it, he had no information and it was only his judgment, based on the fact that the damage was limited to a flat tire, that led him to think that it could be moved simply by pushing it.

This is why the time delay estimate that the TWR controller provided to the approach controller, who in turn passed it on to the crew of the aircraft, was so unrealistic.

Any decision-making process is based on an assessment of the situation. Logically, the more knowledge one has of the situation, the more able one will be to make the correct decisions.

In this regard, the aircraft's crew decided to hold in light of the estimated delay time they had been given, to the point that by the time they had been circling for over nine minutes, they were informed to expect an additional delay of at least 10 minutes.

While they were circling, the aircraft burned approximately 386 kg of fuel. When they landed, they had 1035 kg remaining in the tanks, which was just under 100 kg below their final reserve quantity. Based on the consumption while circling, 100 kg of fuel is equivalent to about 2.5 minutes of flight time.

For a crew in a situation like the one involved in this incident, it is essential to have accurate information on the expected delay, since even though aircraft carry sufficient fuel onboard to deal with these scenarios, any fuel consumed while waiting reduces safety margins.

In this case, even though the aircraft reached the alternate airport with sufficient fuel, a new problem at the alternate led to an additional delay, which consumed the remaining fuel in excess of their final reserve fuel.

If information had flowed smoothly between the RFFS, CECOA and TWR on the resources needed to move the aircraft and the time required to do so, the crew's situational awareness would have been improved, allowing them to make better decisions.

As a result, two safety recommendations are issued in this report, directed at the AENA/Seville airport. The first recommends that it review the procedure for moving disabled aircraft in order to guarantee the proper flow of information between all of the stations affected.

The second also involves this procedure and calls on the airport to analyze the advisability and viability of setting up a mechanism that can be used in the initial moments following an incident of this type to estimate the minimum length of time that operations will be affected.

2.3. Analysis of the approach to the Málaga Airport

The air traffic regulations define the concept of "runway incursion" as "Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take off of aircraft".

The protected area extends out to either side of the runway centerline by a distance that depends on its classification code and the types of operations that are carried out on the runway (visual, non-precision instrument, precision instrument, etc.).

The runway holding point markings are located exactly that far away from the runway centerline, providing a visual indication of the limits of the protected area.

In this regard, point 4.5.6.4.1.6.1 of Spain's Air Traffic Regulations (RCA) specifies that, except as otherwise provided in 4.5.6.4.1.6.2 or unless the air traffic service provider indicates differently, aircraft shall not be kept waiting a distance away from the runway that is less than that to a runway holding point.

Therefore, the presence of any aircraft, vehicle or person beyond the holding point marking constitutes a runway incursion.

The RCA also provides instructions on the actions for a controller to take in the event of a runway incursion. Specifically, point 4.5.5.4.1 states that if the aerodrome controller, after issuing a takeoff or landing clearance, becomes aware of an actual or imminent runway incursion, or of the presence of any obstacle in the runway or its vicinity that could jeopardize the safety of a landing or departing aircraft, he/she shall take the following appropriate measures:

A. cancel the takeoff clearance for departing aircraft;

B. instruct a landing aircraft to initiate a go-around or missed approach procedure;

C. in either case, inform the aircraft of the runway incursion or obstacle and of its position relative to the runway.

As the crew of the aircraft with callsign AEA5036 recognized, after receiving the controller's instruction, they began taxiing into the runway, going past the holding point marking, before the controller could warn them of their incorrect acknowledgement of his instruction.

Based on the definition provided in the first paragraph of this section, since the aircraft crossed the holding point marking, even if it only went a meter beyond it, this would qualify as a runway incursion.

In such a case, as specified in the RCA, the controller should take action as indicated in letter a) of point 4.5.5.4.1 and "instruct a landing aircraft to initiate a go-around or missed approach procedure", which is what the controller at the Málaga TWR did.

Therefore, his actions are deemed to be fully consistent with the requirements in the RCA.

As for the severity of the incursion, the ICAO's Manual on the Prevention of Runway Incursions (doc. 9870) classifies runway incursions into five categories, A, B, C, D and E, ranging from most to least severe.

Category D is defined as "an incident that meets the definition of runway incursion such as incorrect presence of a single vehicle/person/aircraft on the protected area of a surface designated for the landing and take-off of aircraft but with no immediate safety consequences".

The incursion that occurred at the Málaga Airport during the approach of the aircraft with callsign TRA29B is best described by the above definition, and as result it is assigned severity level D.

3. CONCLUSIONS

3.1. Findings

- The Boeing B-737-800 with callsign TRA29B left the Amsterdam-Schiphol Airport at 08:26:52, en route to the Seville Airport (LEZL), with 177 occupants onboard.

- Both the crew of this aircraft, and of the aircraft with callsign AEA5036, had valid licenses and medical certificates.

- The controllers with whom they maintained contact during the incident had valid licenses and medical certificates.

- The aircraft's documentation was in order and it was airworthy.

- At 10:56:14, during the approach to the Seville Airport, the crew were informed by the APP controller that the runway was not available because there was an aircraft stopped on it and that they would have to hold.

- The Seville TWR controller asked the firefighters to aid in removing the aircraft immediately after it stopped on the runway.

- For the next ten minutes, the controller received practically no information on how the work to remove the aircraft was progressing or on how long this work was expected to take.

- The TWR controller gave the APP controller time estimates for the delay based only on his visual perception of the aircraft and the place where it had stopped, which the former then relayed to the crew of aircraft TRA29B.

- At 11:05:05, the controller called the crew to inform them that the removal of the aircraft from the runway would be delayed at least ten additional minutes.

- The crew of aircraft TRA29B replied they did not have enough fuel and that they wanted to head to the Málaga Airport.

- At 11:07:02, they were cleared to climb to FL150, vectored on heading 100º and told that the runway in use at the Málaga Airport was 13.

- At 11:30:45, the ATR 72-212 aircraft with callsign AEA5036 arrived at the

runway 13 holding point at the Málaga Airport and contacted the tower, which instructed the crew to hold short of the runway.

- The crew of AEA5036 misunderstood the controller's instruction to hold short of the runway and thought that he had said "Line up and wait runway 13...", so they acknowledged with this last instruction.

- The Málaga TWR controller corrected the acknowledgment, repeated the instruction and requested confirmation that the runway was clear.

- The crew of AEA5036 reported they had taxied only one meter past the runway holding marking.

- At 11:31:42, the Málaga TWR controller instructed TRA29B to go around because there was an aircraft that had taxied past the holding point marking.

- The crew of TRA29B acknowledged the instruction and reported they were low on fuel.

- At 11:37:17, while in contact with approach at 2400 ft on the runway heading, the crew of TRA29B declared a fuel emergency ("MAYDAY MAYDAY MAYDAY").

- The aircraft landed on runway 13 at the Málaga Airport at 11:39:45 with less than final reserve fuel in its tanks.

3.2. Causes/Contributing factors

The incident analyzed in this report was caused by the successive delays introduced into the flight for reasons beyond the control of its crew.

The following factors are deemed to have contributed to this event:

- The inefficient handling of the incident that caused the closing of the runway at the destination airport, in terms of the exchange of information between the stations involved and the lack of a realistic time estimate for a return to normal operations.

- The misinterpretation by the crew of the aircraft with callsign AEA5036 of the controller's instruction, which resulted in that aircraft's runway incursion.

4. SAFETY RECOMMENDATIONS

REC. 72/17. It is recommended that AENA/Seville Airport review the procedure for moving disabled aircraft in order to guarantee the proper flow of information between all of the stations affected.

REC. 73/17. It is recommended that AENA/Seville Airport analyze the advisability and viability of setting up a mechanism that can be used in the initial moments following an incident of this type (aircraft stopped in the movement area) to estimate the minimum length of time that operations will be affected.