CIAIAC

COMISIÓN DE
INVESTIGACIÓN
DE **A**CCIDENTES
E **I**NCIDENTES DE
AVIACIÓN **C**IVIL

Report IN-039/2013

Incident on 8 November 2013 involving a Boeing 737-800, registration EI-DPF, operated by Ryanair, while climbing after taking off from the Tangiers Airport (Morocco)

GOBIERNO DE ESPAÑA
MINISTERIO DE FOMENTO

Report

IN-039/2013

Incident on 8 November 2013 involving a Boeing 737-800, registration EI-DPF, operated by Ryanair, while climbing after taking off from the Tangiers Airport (Morocco)

GOBIERNO DE ESPAÑA
MINISTERIO DE FOMENTO
SUBSECRETARÍA
COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

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

NIPO: 161-16-174-0

Diseño y maquetación: Phoenix comunicación gráfica, S. L.

COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

Tel.: +34 91 597 89 63
Fax: +34 91 463 55 35

E-mail: ciaiac@fomento.es
http://www.ciaiac.es

C/ Fruela, 6
28011 Madrid (España)

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) n.º 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.

Table of contents

Abbreviations

00°	Degree(s)
00 °C	Degrees centigrade
ACC	Area Control Center
AENA	Spanish Airports and Air Navigation (Airport Services Provider)
AMM	Aircraft maintenance manual
APP	Approach Center
APU	Auxiliary Power Unit
ATC	Air traffic control
ATPL(A)	Airline transport pilot license (Airplane)
CAS	Calibrated airspeed
CECOA	Airport Operations Coordination Center
cm	Centimeter(s)
CPL (A)	Commercial pilot license (Airplane)
CVR	Cockpit voice recorder
EDLV	Niederrhein Airport identifier (Germany)
FA	Flight attendant
FDR	Flight data recorder
FFS	Firefighting Service
FL	Flight level
ft	Feet
g	Gravity force
GMTT	Tangier's Airport identifier (Morocco)
h	Hour(s)
ICAO	International Civil Aviation Authority
ILS	Instrument landing system
kg	Kilogram(s)
km	Kilometer(s)
kt	Knot(s)
LEZL	Seville Airport identifier (Spain)
m	Meter(s)
min	Minute(s)
METAR	Aerodrome meteorological report
NITS	Nature of the emergency, intentions, time and special conditions
NM	Nautical miles
P/N	Part number
QNH	Altimeter sub-scale setting to obtain elevation when on the ground
S/N	Serial number
sec	Second(s)
SL	Service letter
TWR	Control tower
UTC	Coordinated universal time
VOR/DME VHF	Omnidirectional range/Distance Measurement Equipment

Synopsis

Owner and operator:	Ryanair
Aircraft:	Boeing 737-800, registration EI-DPF
Date and time of incident:	Friday, 8 November 2013; at 19:30 UTC[1]
Site of incident:	Climbing out of the Tangiers Airport (Morocco)
Persons onboard:	181; 175 passengers, none injured; 6 crew, none injured
Type of flight:	Commercial air transport – Scheduled – International – Passenger
Date of approval:	28 September 2015

Summary of incident

On 8 November 2013, after taking off from the Tangiers Airport (Morocco) at 19:25:01 en route to the Niederrhein Airport (Germany), aircraft EI-DPF, with 181 persons onboard, suffered an in-flight emergency when smoke appeared above the overhead compartment in row 12 left[2]. The crew declared an emergency due to smoke in the cabin and at 19:30:00 it diverted to the Seville Airport, where it landed on runway 27 at 19:47:52 without any problems.

The aircraft left the runway via exit taxiway E-3, where it came to a halt, and the firefighters entered the aircraft. Even though there were no signs of fire or smoke, the captain decided to disembark the passengers in the taxiway. The passengers disembarked normally and were taken to the terminal before being boarded on another aircraft four hours later to proceed to their destination. No one was injured and the airplane was undamaged.

The investigation determined that the incident was caused by tape in poor condition in three of the connections between the overhead distribution duct and the sidewall riser ducts. Due to the lack of adhesive on the tapes, these joints had become loose and the air that was coming out through the connection likely stirred up the dust in the overhead panels, producing what the cabin crew identified as a white, thick, odorless and cold smoke.

The report includes two safety recommendations, one for the operator Ryanair and one for Aena-Seville Airport.

[1] All times in this report are in UTC.
[2] Left as seen from the rear of the passenger cabin.

1. FACTUAL INFORMATION

1.1. History of the flight

On 8 November 2013, the crew of a Ryanair 737-800, registration EI-DPF, started its activity at 14:25[3] to make their first flight of the day: Niederrhein EDLV (Germany) – Tangiers GMTT (Morocco). The flight was uneventful and landed at 18:33.

At 19:25:01, the aircraft took off from Tangiers on the return flight to Niederrhein. Aboard were 2 pilots, 4 flight attendants (FA) and 175 passengers. It was a night with no adverse weather conditions.

Three minutes into the flight, it was transferred to Seville APP (approach control), with which the crew established radio contact. APP cleared them to climb to FL200. Within 10 seconds of acknowledging the instruction, with the aircraft climbing through about 8,500 ft at 250 kt[4], the cabin crew made an emergency call to report the presence of smoke above the overhead compartments in the passenger cabin.

As a result of this call, the aircraft halted its climb and stabilized at FL110. The crew decided to divert to the Seville Airport, which was some 85 NM away on their heading. At 19:30:00, they declared an emergency to Seville APP due to smoke in the cabin. The first officer was the pilot flying throughout the flight.

The smoke began to clear and within five minutes of declaring the emergency, the purser informed the captain that the smoke was dissipating and that the situation was improving. ATC gave landing priority to the aircraft and the emergency protocol was activated at the Seville Airport.

The aircraft continued flying toward Seville, where it landed uneventfully after a 22 min 51 sec flight at 19:47:52. As the captain had planned and reported prior to landing, the aircraft left runway 27 via exit taxiway E-3 and stopped on the taxiway. The crew stopped the left engine and opened the front left door. The firefighters, who had been notified, entered the aircraft to inspect it. There was no smoke or sign of a fire and the captain decided to disembark the passengers on the taxiway.

The passengers disembarked normally and were off the airplane by 20:32. Four hours later they were boarded onto another flight to their final destination.

The aircraft taxied to parking stand R16, where it was parked at 20:47. The emergency was declared over at 20:52.

[3] 45 min before the scheduled time of the first flight.
[4] All speeds in this report are calibrated air speeds (CAS).

1.2. Injuries to persons

There were no injuries.

Injuries	Crew	Passangers	Total in the aircraft	Others
Fatal				
Serious				
Minor				Not applicable
None	6	175	181	Not applicable
TOTAL	**6**	**175**	**181**	

1.3. Damage to aircraft

The aircraft was not damaged in the incident.

1.4. Other damage

None.

1.5. Personnel information

1.5.1. *Captain*

The captain, born in the Netherlands, was 31 years old. He had an airline transport pilot license (ATPL(A)) issued by the Irish civil aviation authority and a Boeing 737-800 rating that was valid[5] at the time of the incident. He had a valid[6] medical certificate and had a total of 5,000 flight hours, 4,400 of them on the type. He had been at Ryanair since 2006.

1.5.2. *First officer*

The first officer, born in Germany, was 28 years old. He had a commercial pilot license (CPL(A)) issued by the Irish civil aviation authority and a Boeing 737-800 rating that was valid[7] at the time of the incident. He had a valid[8] medical certificate

[5] Until 31/05/2014.
[6] Until 27/06/2014.
[7] Until 31/12/2014.
[8] Until 18/11/2014.

and had 1,919 total flight hours, 1,133 of them on the type. He had been at Ryanair for a year and a half.

1.5.3. *Activity on the day of the incident*

The crew had started its activity at 14:25, 45 minutes before the first scheduled flight.

1.6. Aircraft information

Aircraft EI-DPF, a Boeing 737-800, S/N 33606, had a total of 23,311 flight hours and 14,096 total cycles at the time of the incident.

The incident flight was the sixth of the day for the aircraft. The first four had been flown by another crew and the last two by the incident crew. The aircraft was returned to service the following morning.

The most recent maintenance checks done on the aircraft had been on 4 November 2013 (four days before the incident) and on 31 October 2013, both of them 50 cycle inspections. In October 2013 it had undergone a type-A inspection and in May 2013 a type-C inspection.

There was no record of any malfunctions or incidents occurring to the aircraft related to the incident either in the day's five previous flights or in the five months prior to that[9].

1.6.1. *Passenger cabin air conditioning distribution system*

Air in the passenger cabin is distributed through a system of ducts and outlet vents located throughout the cabin. The part of the system of relevance to this incident is described below (figure 1):

- From the air conditioning packs, the air goes to the main distribution manifold.
- From the main distribution manifold the air flows through sidewall riser ducts (shown in green in figure 1), along the fuselage, to the overhead distribution duct.
- The overhead distribution duct (shown in blue in figure 1) is a cylindrical tube that runs the length of the passenger cabin in the overhead. All along this duct there are air outlets that connect to secondary hoses/diffusers (shown in orange in figure 1) that route air to the overhead vents and to the sides of the cabin.

[9] It was reviewed the flight logs (technical log, where the captain notes any discrepancies or defects found on each flight) and the cabin defect logs (where the purser notes any discrepancies found by the flight attendants in the passenger cabin, discrepancies that may be entered into the technical log depending on their nature) for the five months before the incident.

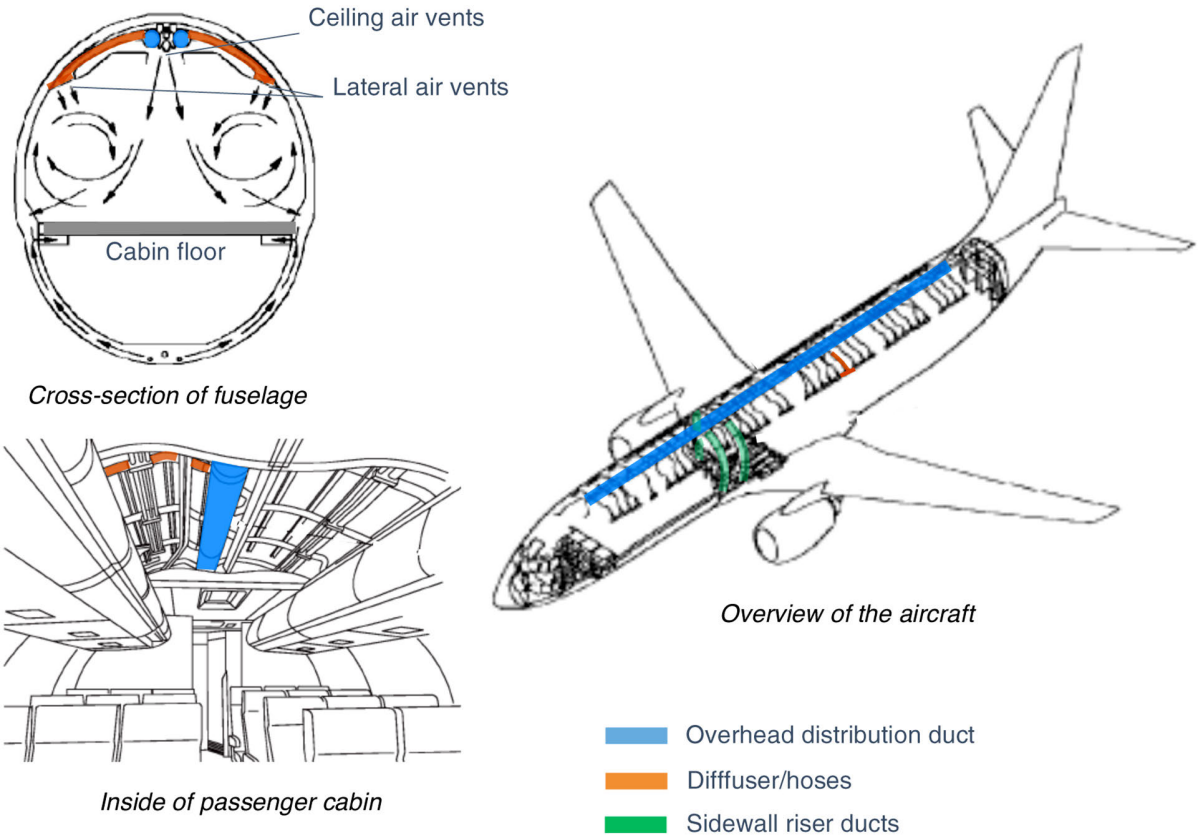


Figure 1. Air distribution in the passenger cabin

1.7. Meteorological information

The METAR for the Seville Airport[10] in effect at the time of the incident (19:30) indicated a wind from 260° at 3 kt, swirling between 230° and 290°, visibility in excess of 10 km, a layer of scattered clouds (3-4 octas) at 3,800 ft, a temperature of 18 °C and a QNH of 1,021. The crew was aware of the previous METAR (19:00), whose conditions were similar to those of the 19:30 METAR. The information provided by the crew indicated that weather conditions were good and that they were able to establish visual contact with the ground.

1.8. Aids to navigation

The information of most relevance to the investigation is given, along with the communications and the flight recorder data, in Section 1.11.

[10] METAR LEZL 081930Z 26003KT 230V290 9999 FEW038 18/15 Q1021
METAR LEZL 081900Z 27004KT 9999 FEW028 SCT038 19/15 Q1021

1.9. Communications

The information of most relevance to the investigation is given, along with the data on the aids to navigation and the flight recorder, in Section 1.11.

1.10. Aerodrome information

The Seville Airport[11] is some 100 NM north of the Tangiers Airport. It is at an elevation of 111 ft and it has a single 3,362 m long runway in a 09/27[12] orientation, with one taxiway (A) parallel to the runway. The operator had a base at this airport. When landing in runway 27, the exit taxiways are to the right. Exit taxiway E-3, where the aircraft stopped, is the second taxiway when landing on runway 27 and it has one holding point[13] located 90 m from the runway centerline[14] (figure 2).

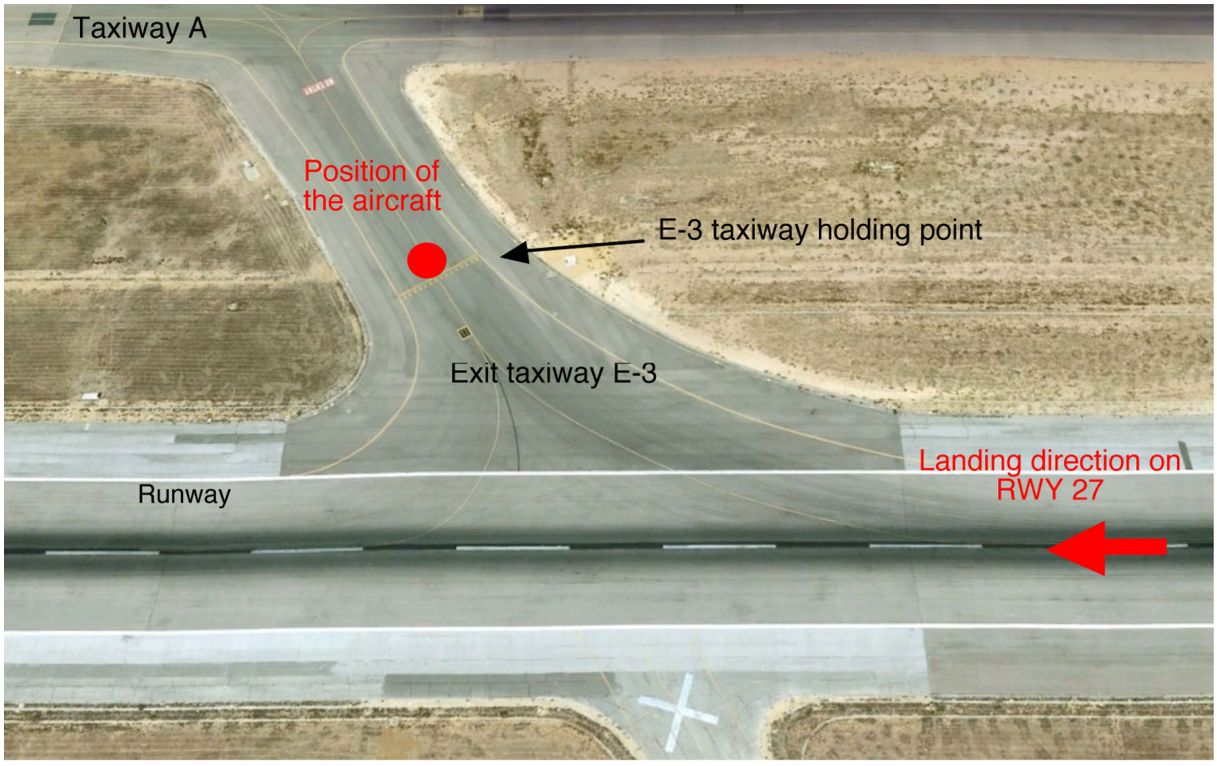


Figure 2. E-3 exit taxiway and aircraft's position

[11] 4-E ICAO category airport.
[12] Runway for category I precision approaches.
[13] ICAO Annex 14, on airport design and operation, defines a runway holding point as a point designed to protect a runway at which taxiing aircraft and vehicles are to stop and wait.
[14] For category 4 airports and category I, II and III precision approaches, Annex 14 specifies a minimum distance of 90 m (table 3.2, Annex 14) between the runway centerline and a runway holding point so as to protect the runway.

The Jerez Airport is some 63 NM north of the Tangiers Airport on the same approximate heading as Seville. It has a single 2,300 m long runway in a 02/20 orientation. The aerodrome's elevation is 93 ft.

Figure 3 shows the position of these two airports with respect to Tangiers.

1.11. Flight recorders

The aircraft was outfitted with two flight recorders: a flight data recorder (FDR P/N 980-4700-042 S/N SSFDR-12969) and a cockpit voice recorder (CVR P/N 980-6032-001 S/N CVR-01607). Both were preserved.

The flight parameter data, the cockpit voice recordings, communications with air traffic control services[15] and radar data yielded information on the progress of the flight.

The total flight time[16] was 22 min 51 sec, and the flight path was as shown in figure 3.

Takeoff and climb until the emergency (4 min 5 sec):

At 19:25:01, the aircraft took off from the Tangiers Airport. The pilot flying was the first officer. They completed all of the before and after-takeoff checklists. The crew spoke with Tangiers three times, and three minutes after takeoff, the aircraft was transferred to Seville APP while at an altitude of 6,000 ft.

At 19:28:44 Seville APP cleared them to head to the SVL VOR/DME[17] at FL200.

Emergency (1 min 19 sec):

At 19:29:06 the purser made the emergency call (three chimes) to the pilots. There were no warning or caution lights in the cockpit. The captain answered the call, instructing the pilot to monitor ATC communications. The conversation with the purser lasted over one minute. The purser informed the captain about the presence of smoke in the cabin, telling him that the emergency exit was full of thick smoke, that it was strange and that he had never seen anything like that before. Both the captain and the purser were calm. The captain asked a few questions about the situation and then took the following actions:

[15] Stations involved: AENA, as the airport services provider at the Seville Airport, ENAIRE, as the approach control services provider at APP Seville, and FERRONATS, as the control services provider at the Seville Tower.
[16] As determined by the gear position parameter (air/ground) on the FDR.
[17] The SVL VOR/DME is the initial approach fix to runway 27 at Seville. It is approximately 4 NM away from runway 27.

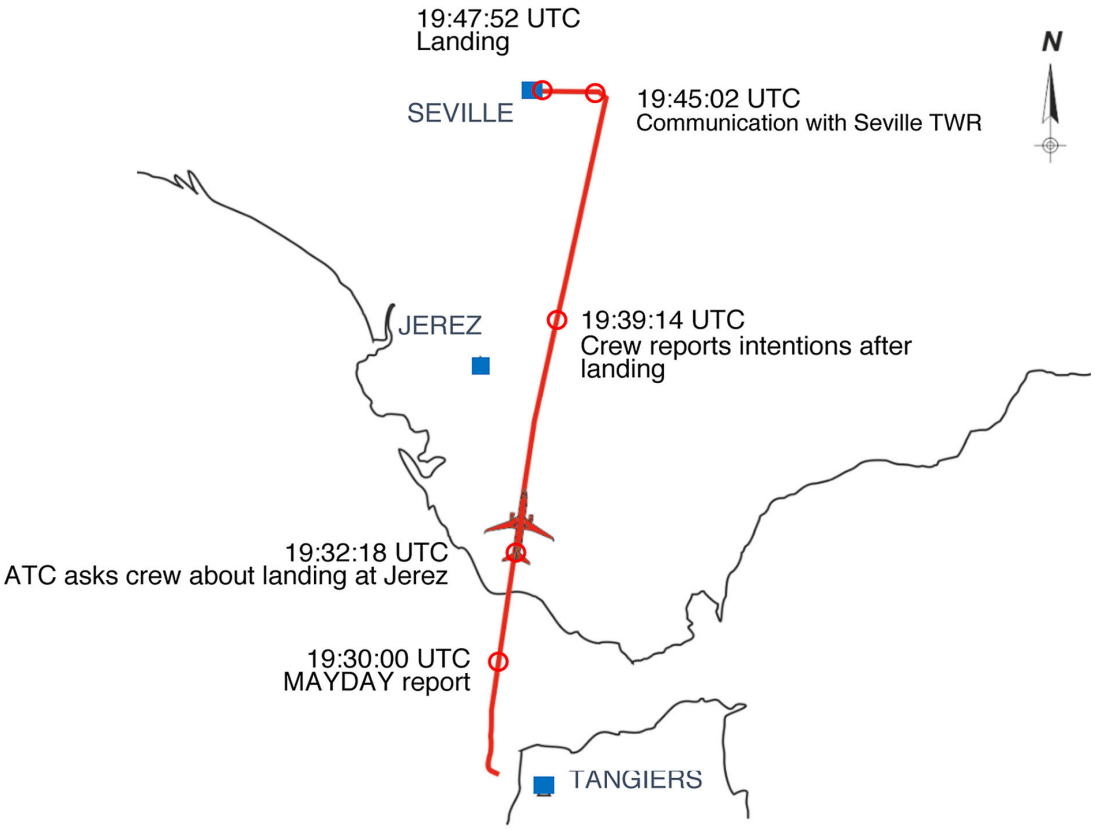


Figure 3. Flight path of aircraft EI-DPF

- 12 sec after receiving the call he told the first officer about the autopilot, which was engaged at 19:29:19. The aircraft was at 8,960 ft and 250 kt.
- 44 sec after the call he told the first officer, "Start diverting to Seville, smoke in the cabin, stop climbing, Mayday".
- 54 sec after the call (19:30:00) the first officer declared an emergency to Seville APP: "MAYDAY MAYDAY MAYDAY smoke in cabin. We need to divert immediately to Seville". The captain was still speaking with the purser.
- They stopped the climb and informed Seville APP that they would maintain FL110.
- 69 sec after the call he told the purser they would go to Seville, to keep him informed and that they would land in 15 minutes.

After talking with the purser, the captain again took over communications with ATC and repeated the MAYDAY. From then until the end of the flight, the task assignments in the cockpit were the same as they had been before the emergency, with the first officer as the pilot flying.

Cruise (9 min 10 sec):

At 19:30:25 the aircraft was stabilized at FL110 and shortly thereafter reached 330 kt, values that would be maintained for the rest of the cruise phase. There were no

references to the smoke checklist[18]; instead, they immediately started planning the landing in Seville.

At 19:31:32 the captain asked Seville APP about the runway in use and requested complete weather information for the Seville Airport. ATC informed him to expect vectors for an ILS instrument approach. The crew was heard entering the airport into the flight computer and receiving a warning about being too high.

At 19:32:18 Seville APP informed them that the Jerez Airport was 30 NM north of their position. The captain replied that they needed to prepare for the descent and approach and that they would land in Seville. The crew were heard talking about the ILS frequency, the aircraft's weight, speeds and flight levels.

At 19:34:34 the aircraft asked Seville APP if they could fly direct to mile 10. At this point Seville APP relayed the emergency to the Seville TWR, which asked about the number of passengers.

At 19:35:32 there was a call from the captain to the purser. This call, which was interrupted by ATC to inquire about the number of passengers onboard, lasted two minutes. The purser informed him that the situation was better, that they had carried out the test with the lights, that it could be the air conditioning but that they could not be sure what exactly was happening, and that the smoke had dissipated but not disappeared. The captain informed the purser that in twelve minutes they would land, leave the runway and turn off one engine, and that he should then open the front door. He again asked the purser to keep him informed. The first officer acknowledged understanding their intentions upon landing. They reviewed the aircraft's landing configuration, the approach procedure, the go around, the ILS frequencies, which side the runway exits were on, verified that their weight was within limits and the amount of braking power they would use.

Descent and approach (8 min 17 sec):

At 19:39:14, the captain requested instructions for the descent, and Seville APP cleared them to 4,000 ft. At 19:39:35 the aircraft started its descent. The captain informed Seville APP that upon landing, they would exit the runway, stop the aircraft on a taxiway, stop one engine and open the front left door so the firefighters could enter the airplane. This information was relayed by Seville APP to the Seville TWR. They completed the descent and approach checklists and the captain asked the first officer if he wanted to continue as the pilot flying, to which the first officer answered yes.

[18] Smoke, Fire or Fumes.

At 19:41:20 they were cleared to descend to 2,000 ft, and shortly afterwards for the ILS approach to runway 27.

At 19:41:51, at the request of the airport's firefighters, Seville APP asked the aircraft about the amount of fuel onboard. The crew replied they were carrying 8,700 kg of fuel.

At 19:42:34 the captain informed the passengers about the emergency and their destination, and asked them to remain seated when the airplane came to a stop.

At 19:45:02 the aircraft was transferred to the Seville TWR, and in his first contact with the tower the captain repeated the MAYDAY notification. The aircraft was established on the runway 27 ILS 6 NM out. The Seville TWR cleared them to land and informed them that the firefighters were standing by. They did the landing checklist and the captain was heard saying that he had the firefighters' truck in sight.

At 19:47:09 the autopilot was disengaged. The aircraft's speed was 145 kt.

Landing and deplaning of the passengers:

At 19:47:52 the FDR recorded the landing at 138 kt. The aircraft left the runway via exit taxiway E-3, located to the right of the runway, and stopped just beyond the E-3 holding point, according to information provided by the airport (figure 2).

On the CVR the purser was heard instructing the passengers to remain seated. The crew started the APU and closed down both the left and right engine. The captain asked the cabin crew to disarm the ramps and to open the L1 (front left) door only. At 19:49:07 the captain informed the Seville TWR that they had stopped on the taxiway and were going to open the front left door so the firefighters could board the airplane.

At 19:51:53, after the stairs were in place, three firefighters entered the aircraft. They verified that there was no smoke or signs of fire and asked the captain if he wanted to taxi to parking or deplane the passengers there. At first the captain said they would taxi to parking, but at 20:00:24 he reported that the passengers would be disembarking there.

The passengers were disembarked by 20:32:00 and taken to the terminal building in two buses. There were no injuries. The firefighters inspected the aircraft once more, finding no indications of smoke or fire. The aircraft was towed to parking stand R16, which it reached at 20:47. At the captain's request, the firefighters stayed onboard during towing. Once it reached parking they again inspected the aircraft and did not find any problems.

The passengers were boarded onto another Ryanair airplane that took off for Niederrhein at 00:21.

1.12. Wreckage and impact information

After landing at the Seville Airport, the aircraft was inspected at 23:40 by the operator's own maintenance personnel. The aircraft did not exhibit any damage and there were no signs of smoke or fire. After removing the central overhead panels from rows 12-13 in the passenger cabin, three flex hoses were found to have come loose from their associated overhead distribution duct joints (Section 1.16.7).

1.13. Medical and pathological information

There were no injuries during the accident.

1.14. Fire

There was no fire in the aircraft, and no signs of smoke or fire were detected onboard.

1.15. Survival aspects

The emergency report was made on the Seville APP frequency at 19:30:00. Seville APP passed on the information to the relevant collateral station, in this case the Seville TWR, at 19:34:02. At 19:36:00 the Seville TWR in turn informed the airport's firefighting service (FFS) and the Airport Operations Coordination Center (CECOA). The information requested by the airport to deal with the emergency concerned the number of people and the amount of fuel onboard.

The call by the TWR resulted in the airport's emergency plan being activated from 19:37 to 20:52. All of the units[19] specified in the emergency plan were pre-alerted. An ambulance and firefighters from the city of Seville also reported to the airport. All of the information provided by the crew of the aircraft concerning their intentions upon landing was relayed to all of the affected units, as a result of which they were standing by when the aircraft landed.

When the captain made his decision to offload the passengers, airport maintenance suggested that the centerline lights of the taxiway where the passengers would be standing be turned off as a precautionary measure.

Based on the firefighters' assessment of the situation, there was no emergency evacuation of the aircraft and the passengers used the normal stairs.

[19] Firefighting service, medical, duty manager, security, Civil Guard, national police, 112 emergencies, airport director, signalmen, operator, operator's handling company, chief of operations, government representative, Aena network management and the Civil Aviation Accident and Incident Investigation Commission.

1.15.1. *Airport operability during the emergency*

When the aircraft exited the runway and stopped on E-3, the airport's duty manager informed the Seville ACC and Seville APP that the runway was clear and that the airport was fully operational. As a result, at 20:01:00 APP cleared an aircraft for an ILS approach to runway 27 and to descend to 3000 ft.

At 20:02:43 the Seville TWR instructed Seville APP to call off the aircraft on final. This surprised Seville APP, which thought that the airport was operational. A minute later the Seville TWR received a call from the ACC complaining that they had been informed the airport was operational and that there was traffic at 6,000 ft. The controller at the Seville TWR informed the ACC that he had not reported the termination of the emergency and that even though the runway was clear, there were people, buses, firefighters, etc. on the taxiways.

At 20:03:10 the traffic on approach was instructed to cancel the previous clearance from the Seville APP and to enter a holding pattern. The Seville TWR tried to contact the duty manager at 20:04 but was unable to reach him until 20:14. In the meantime, the Seville TWR spoke to the CECOA to try to find out who had reported the airport as operational. The CECOA confirmed that since the airplane was not on the runway but on the taxiway, they assumed that the duty manager had interpreted this to mean that the airport was operational.

The controller in the tower replied that to him the airport was not operational "until the firefighters confirmed that the emergency was over and the duty manager informed him that everyone was beyond the safety distance". At 20:12:56 the Seville TWR contacted the firefighters who were with the aircraft and received confirmation that there were no signs of smoke or fire in the cabin and that while they saw no risk of a fire, they were still disembarking the passengers and that the emergency was not yet over.

At 20:14:52 the duty manager called and confirmed that he thought the airport to be operational but that taxiway E-3 was closed. When the TWR asked him if landings and takeoffs were allowed and if taxiway A was clear, the duty manager told the TWR controller to stand by. Two minutes later, at 20:16:14, the duty manager confirmed that the runway was clear but that taxiway A was not clear yet. As a result, the TWR decided to allow incoming aircraft on runway 27 on the condition that they leave the runway via the last exit taxiway or at the end of the runway. Departing traffic was still not allowed. This decision was relayed by the Seville TWR to Seville APP and to the duty manager. The first landing (the aircraft in the holding pattern) after the emergency took place at 20:19:56, and the second one at 20:35:05.

No aircraft were allowed to take off until EI-DPF started taxiing to its parking stand and the firefighters reported the taxiway clear.

At 20:44:52 the Seville TWR reported "normal operations at the airport" to the Seville ACC. The third landing following the incident took place at 20:44:59 and the first take off at 20:46:10.

1.16. Tests and research

1.16.1. *Captain's statement*

On the day of the incident they reported to the airport on time. They were not in a hurry and the flight to Tangiers was uneventful. The aircraft's hold-item list was empty. He had been the pilot flying on the first leg, and the first officer would fly the return leg as the pilot flying. The airplane was full. During the takeoff briefing they noted that if anything happened, they would go first to Tangiers, and then to Malaga or Seville, which were the nearest Ryanair bases. They decided to engage the autopilot later than usual (typically done at 1,000 ft) since there were no problems and the skies were clear. The weather was good. It was nighttime.

They turned off the seat belt sign at 4,000 ft and continued climbing. At 8,000 ft they received an emergency call from the passenger cabin. By then they had been transferred to Seville APP and cleared to FL200. The Seville Airport was in their flight path. They immediately engaged the autopilot and he answered the call. The purser told him there was smoke in the cabin and gave him all the other information they had at that time. He knew that the action to take in the event of smoke in the cabin was to land as quickly as possible.

They immediately leveled off at FL110. They recognized the lights of the city of Seville from afar and, since they were familiar with the airport and they had to land as soon as possible, they decided to proceed to Seville, after which they reported the emergency to ATC.

He then called the purser and held the NITS[20] briefing. He thinks they made the decision at 19:36 and landed in Seville at 19:48, 12 minutes later. They prepared the approach and delayed the descent until he had finished talking to the purser. He wanted both himself and the first officer to be focused on the flight.

They did not do the smoke checklist because they did not want to delay the landing. They knew the list and knew that at some point the checklist instructed not to delay the landing to do the checklist. They received no cautions or warnings of any type in the cockpit.

[20] NITS (nature, intentions, time, specifics). The cabin crew are told of the nature of the emergency, their intended destination, the estimated time and any special instructions for the cabin crew (evacuation plans, etc.).

The first officer remained the pilot flying during the emergency.

They did not execute an overweight landing, though they considered it. The landing was uneventful. He saw the emergency units waiting to the right of the runway, so he decided to exit the runway to the right and stop the aircraft. The firefighters went onboard and confirmed there was no danger and that they could even continue taxiing, but the captain decided to have the passengers disembarked right there.

At no point did they consider an evacuation. The assistance from ATC was excellent and they were given landing priority.

He did not see the smoke since they stayed in the cockpit during the emergency. When they landed and stopped the airplane he left the cockpit but he did not see any smoke.

1.16.2. *First officer's statement*

The first officer's statement confirmed what the captain had said and added no new information.

1.16.3. *Statement from FA-1*

After takeoff there was a call from a passenger. Since they were not yet authorized to get up, they were unable to attend to the call. About one and a half minutes later, the seatbelt sign was turned off and they were able to get up. As the purser he started giving the safety message to the passengers via the intercom when FA-2, who was standing at row 12, activated the call bell three times.

He went to the area of the call, where FA-2 and FA-3 were already standing, and immediately saw the smoke. They saw that the smoke was issuing from the overhead compartment, near the lights. The smoke was white, odorless and they could feel no heat. With this information, he proceeded to the rear of the aircraft to call the pilots. He made the emergency call to the cockpit using code 222 and reported what was happening, relaying all the information they had up to that point.

About a minute later he received the NITS briefing from the captain, who told him of their intention to land in Seville. He passed the information to the rest of the cabin crew and they synchronized their watches. They prepared the cabin for landing and took their seats. The passengers were still seated, meaning the cabin was prepared very quickly. The smoke dissipated gradually but it did not disappear completely until they landed.

After landing two firefighters went onboard and informed them there was no danger.

1.16.4. *Statement from FA-2*

She was first alerted to the presence of smoke by the passengers seated in seats located to the right of the aisle (as seen from the rear of the cabin) in rows 25-24, who indicated there was a fire forward of their position. After being allowed to unbuckle their seat belts, she went forward to attend to the call placed by the passenger in row 12 and saw smoke issuing from the overhead compartment above the left-hand seats in that row, near the lights. She opened the luggage compartment, removed the bags and checked the panels to see if she could smell anything or feel heat and if the smoke was due to a fire or not. She verified that the temperature in the compartment was not high and that the smoke was cold. They thought the lights could have been the source of the smoke.

1.16.5. *Statement from FA-3*

When he saw calls from passengers during takeoff, he thought they were probably activated by mistake, since oftentimes the passengers hit the call button when in fact what they want is to turn on the light. When they were able to get up, he went to the area and saw smoke in the overhead compartment above row 12. Since FA-2 was already there, he would be the backup firefighter, so he gathered all the equipment necessary. They verified the smoke was odorless and not hot, which the purser relayed to the flight deck. They thought it might have been a problem with the lights. Since they were dimmed, they turned them on so they could dim them again. The smoke did not vary when they made this change.

1.16.6. *Statement from FA-4*

The day before she had flown on this same aircraft. The flight to Tangiers had been uneventful. On takeoff they dimmed the lights in the passenger cabin and the passengers were the first to notice the smoke between rows 12 and 14. They turned on the aisle lights.

Her job during the emergency was to help the purser by relaying information to and from FA-2 and FA-3.

1.16.7. *Inspection of the aircraft after the incident*

The inspection of the aircraft after the incident showed that, above row 12, three sidewall riser ducts had detached from their connections to the overhead distribution duct. The strap and the tape were still attached to the hoses. Figure 4 shows the condition of the connections. Those joints found loose during the inspection are labeled.

Two of them (shown in green in figure 4) had the tape removed before the photograph was taken.

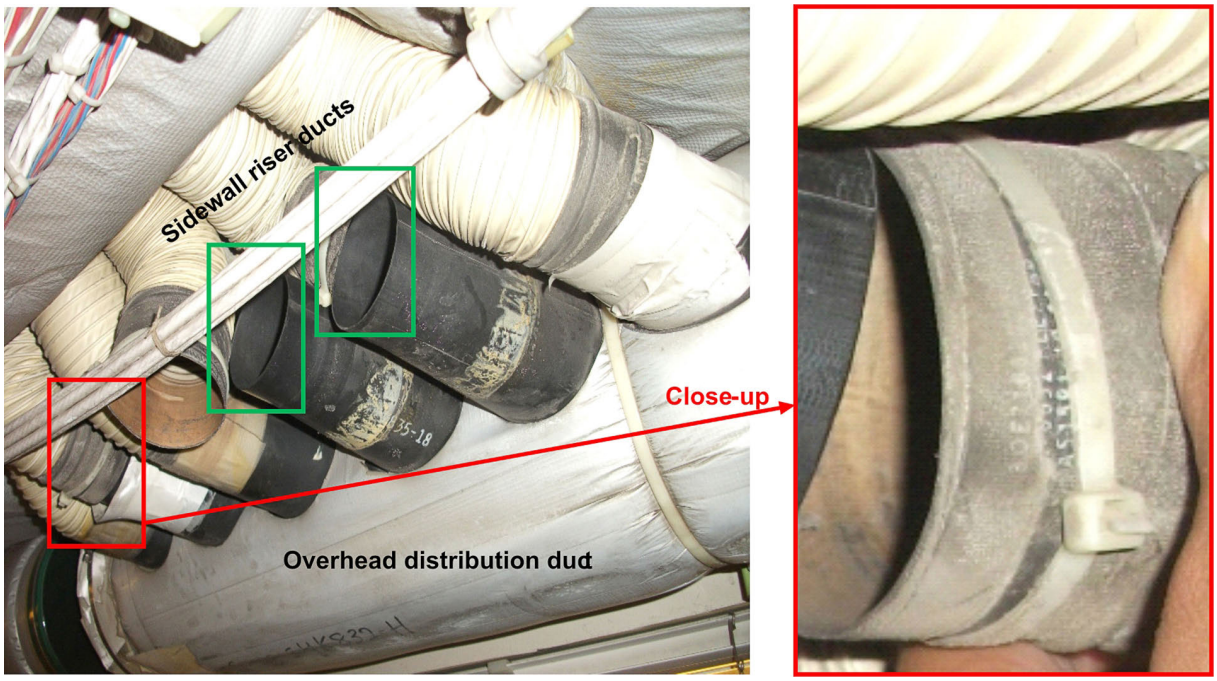


Figure 4. Detached conexions on the overhead distribution duct above row 12

An inspection of the conections above row 12 revealed that:

- There were two different types of adhesive tape (one was yellowish and the other white).
- The plastic tie strap could not be seen in the hoses in good condition, but it was evident below the adhesive tape.
- The marks left below the tie straps indicated that they had been installed directly on the hoses, and not on the tape, as specified in the Maintenance Manual. This installation, with the the strap directly on the hoses, is the same as current production configuration (see Section 1.16.9).

1.16.8. *Actions carried out after the incident*

As recorded in the technical logbook, the joints were reinstalled using adhesive tape G50344 Nitto P-212HD. Once the hoses were attached, a leak test[21] was carried out, which was satisfactory. The aircraft did not reported any similar event after this incident.

1.16.9. *Installation and maintenance of the hoses*

The Maintenance Manual[22] describes how to connect the sidewall riser ducts to the overhead distribution duct. It specifies to overlap the two ducts half an inch[23] and aply 2-4

[21] AMM subtask 21-23-02-790-001.
[22] AMM task 21-23-04-400-801 (subtasks 21-23-04-420-008) to install the sidewall riser ducts.
[23] Approximately 1.2 cm.

laps of a fire retardant adhesive tape[24]. An adjustable plastic strap[25] is then installed on top of the adhesive tape. In other words, in a correct installation the strap will go on top of the tape. Despite of the fact the installation was similar for other conexions, maintenance manual did not clearly illustrate, as is the case of figure 401, the correct installation of the tape and the strap helping the maintenance personnel to verify the correct installation. The manufacturer does not specify an inspection schedule for the flex hoses.

In adition, Boeing had issued Service Letter 737-SL-21-065-A[26] in 2007 to inform operators about a possible inconsistent adhesion on the tapes used to secure the hoses in the air distribution system. Several operators had found detached hoses and Boeing decided to replace the adhesive tape it had used initially with P-212HD. The manufacturer stated that inspections were not needed unless unusual noises or temperature control problems were detected in a specific area. Given its date of manufacture, the incident aircraft was affected by this service letter. The operator confirmed that the service letter had not been applied to aircraft EI-DPF.

The manufacturer confirmed that the condition of the conexionsg on aircraft EI-DPF was similar to that in previous events involving the tape.

During the investigation of this event, and during the inspection by the operator to its aircraft, it was identified that the manufacturer had change the method in which the sidewall riser ducts are attached to the overhead distribution duct. There were airplanes with tape and strap, and there were airplanes with only the strap. The manufacturer informed the currect production configuration uses an adjustable plastic strap but doesn´t use tape, and the use of tape as part of the attachment method was discontinued.

It was confirmed by the manufacturer that both configurations, with and witout tape, were valid. As a cuonsequence, the manufacturer will issue a revision and udate of the aircraft maintenance manual[27] and service letter[28], for the installation of the sidewall riser ducts on the overhead distribution duct, to include instructions for installing the riser ducts without tape and with the straps.

1.16.10. *Previous events*

Only one similar incident was found involving the same aircraft. It happened on 28 August 2010 when a passenger seated in seat A16 complained about a loud noise coming from the ceiling during the flight. A subsequent inspection showed that two

[24] Item G50344: adhesive tape Nitto P-212HD (Formerly Permacel) Glass Cloth.
[25] Item G50625: adjustable tie strap, 14.40 inches long (approx. 36 cm).
[26] 737-SL-21-065-A: Air conditioning flex hose separation at the overhead distribution taped joints. 23 August 2007.
[27] Dated June 2016.
[28] Date January 2016.

flex hoses had detached from the overhead distribution duct above rows 12 and 13 due to a bad adhesive tape condition. The hoses were reconnected to the distribution duct using new adhesive tape. A leak test was satisfactory.

On 22 October 2013, 15 days before the incident, the incident experienced a hard landing with a vertical acceleration of 2.26 g. As a result of this landing the aircraft was inspected[29].

1.17. Organizational and management information

Not applicable.

1.18. Additional information

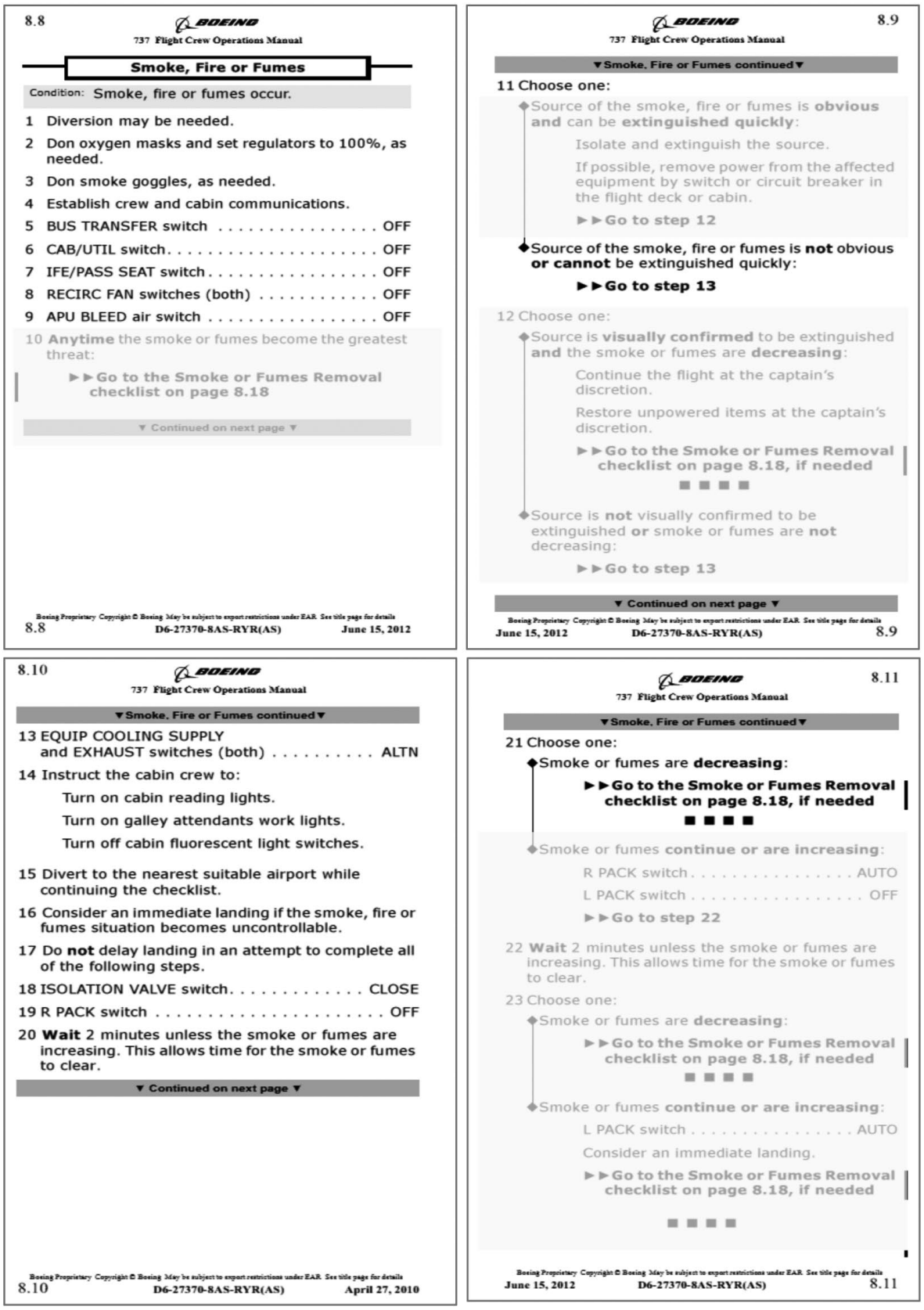
The applicable procedure in the event of smoke is contained in the non-normal checklist, *Smoke, Fire or Fumes*. It has 23 items, which include decision points for the crew to select the option that best describes the actual situation that is taking place. These decision points involve:

- Whether the source of the smoke is obvious and can be rapidly extinguished or not.
- Whether the smoke is increasing or decreasing.

Figure 5 shows this procedure[30] with the tasks that would have been applicable in this case (the options that are not applicable are grayed out).

[29] The inspection specified in the Maintenance Manual (AMM 05-51-01) in the event of a hard landing includes an inspection of the panels in the passenger cabin to check for damage. The procedure does not include an inspection of the air distribution ducts, focusing instead on panels, monitors and baggage compartments.

[30] The procedure refers constantly to another checklist (Smoke or Fumes Removal) to remove the smoke if necessary.



8.8

BOEING

737 Flight Crew Operations Manual

Smoke, Fire or Fumes

Condition: Smoke, fire or fumes occur.

1 Diversion may be needed.

2 Don oxygen masks and set regulators to 100%, as needed.

3 Don smoke goggles, as needed.

4 Establish crew and cabin communications.

5 BUS TRANSFER switch . . . . . OFF

6 CAB/UTIL switch. . . . . OFF

7 IFE/PASS SEAT switch . . . . . OFF

8 RECIRC FAN switches (both) . . . . . OFF

9 APU BLEED air switch . . . . . OFF

10 **Anytime** the smoke or fumes become the greatest threat:

►►Go to the Smoke or Fumes Removal checklist on page 8.18

▼ Continued on next page ▼

Boeing Proprietary Copyright © Boeing. May be subject to export restrictions under EAR. See title page for details

8.8 D6-27370-8AS-RYR(AS) June 15, 2012

8.9

BOEING

737 Flight Crew Operations Manual

▼Smoke, Fire or Fumes continued▼

11 Choose one:

◆Source of the smoke, fire or fumes is **obvious and** can be **extinguished quickly**:

Isolate and extinguish the source.

If possible, remove power from the affected equipment by switch or circuit breaker in the flight deck or cabin.

►►Go to step 12

◆Source of the smoke, fire or fumes is **not** obvious **or cannot** be extinguished quickly:

►►**Go to step 13**

12 Choose one:

◆Source is **visually confirmed** to be extinguished **and** the smoke or fumes are **decreasing**:

Continue the flight at the captain's discretion.

Restore unpowered items at the captain's discretion.

►►Go to the Smoke or Fumes Removal checklist on page 8.18, if needed

■ ■ ■ ■

◆Source is **not** visually confirmed to be extinguished **or** smoke or fumes are **not** decreasing:

►►Go to step 13

▼ Continued on next page ▼

Boeing Proprietary Copyright © Boeing. May be subject to export restrictions under EAR. See title page for details

June 15, 2012 D6-27370-8AS-RYR(AS) 8.9

8.10

BOEING

737 Flight Crew Operations Manual

▼Smoke, Fire or Fumes continued▼

13 EQUIP COOLING SUPPLY and EXHAUST switches (both) . . . . . ALTN

14 Instruct the cabin crew to:

Turn on cabin reading lights.

Turn on galley attendants work lights.

Turn off cabin fluorescent light switches.

15 Divert to the nearest suitable airport while continuing the checklist.

16 Consider an immediate landing if the smoke, fire or fumes situation becomes uncontrollable.

17 Do **not** delay landing in an attempt to complete all of the following steps.

18 ISOLATION VALVE switch. . . . . CLOSE

19 R PACK switch . . . . . OFF

20 **Wait** 2 minutes unless the smoke or fumes are increasing. This allows time for the smoke or fumes to clear.

▼ Continued on next page ▼

Boeing Proprietary Copyright © Boeing. May be subject to export restrictions under EAR. See title page for details

8.10 D6-27370-8AS-RYR(AS) April 27, 2010

8.11

BOEING

737 Flight Crew Operations Manual

▼Smoke, Fire or Fumes continued▼

21 Choose one:

◆Smoke or fumes are **decreasing**:

►►**Go to the Smoke or Fumes Removal checklist on page 8.18, if needed**

■ ■ ■ ■

◆Smoke or fumes **continue or are increasing**:

R PACK switch . . . . . AUTO

L PACK switch . . . . . OFF

►►Go to step 22

22 **Wait** 2 minutes unless the smoke or fumes are increasing. This allows time for the smoke or fumes to clear.

23 Choose one:

◆Smoke or fumes are **decreasing**:

►►Go to the Smoke or Fumes Removal checklist on page 8.18, if needed

■ ■ ■ ■

◆Smoke or fumes **continue or are increasing**:

L PACK switch . . . . . AUTO

Consider an immediate landing.

►►Go to the Smoke or Fumes Removal checklist on page 8.18, if needed

■ ■ ■ ■

Boeing Proprietary Copyright © Boeing. May be subject to export restrictions under EAR. See title page for details

June 15, 2012 D6-27370-8AS-RYR(AS) 8.11

Figure 5. Smoke, Fire or Fumes checklist

1.19. Useful or effective investigation techniques

None.

2. ANALYSIS

On 8 November 2013, after taking off from the Tangiers Airport (Morocco), aircraft EI-DPF had an in-flight emergency due to the appearance of smoke above the overhead baggage compartment in row 12 left[31]. The aircraft declared an emergency due to smoke in the cabin and diverted to the Seville Airport, where it landed without further incident.

The analysis of this incident was structured as follows:

- The source of the smoke in the cabin:
  - Three flex hoses in the cabin air distribution system were found disconnected.
  - The faulty adhesion on the tape as the cause of the detached hoses and previous events in the manufacturer's fleet.
  - The reverse order in the installation of the strap and the adhesive tape that secured the connections.
  - The lack of visual information in the maintenance manual to verify correct installation of the connections.
  - The confusion between the instructions in the maintenance manual, and the different configurations: connections with tape and strap and conexions only with strap (which is the currect production configuration).

- The handling of the emergency by the cabin crew:
  - The delay in responding to the call by the passengers due to the seat belt sign being on.
  - The fast, proper and complete actions and evaluations by the crew once the seat belt sign was turned off.
  - The fast and accurate report of the situation to the flight deck.

- The handling of the emergency by the flight crew:
  - Fast emergency declaration and diversion to the Seville Airport in response to the emergency.
  - Communication of intentions to cabin crew and ATC.
  - Non-performance of the smoke checklist to give priority to properly configuring and landing the aircraft.
  - Correct decision to disembark the passengers on the taxiway.

- The handling of the emergency by ATC and the Seville Airport:
  - Priority to the aircraft in distress with respect to other traffic.
  - Proper response by emergency services.

[31] Left as seen from the rear of the cabin looking forward.

- Constant requests for instructions from the pilot to ATC.
- Ignorance by APP of information needed by the airport that forced APP to consult with the aircraft's crew during the emergency.
- Lack of coordination and differing criteria between airport officials and TWR in determining the airport's level of operability.

2.1. Appearance of smoke in the passenger cabin

The smoke appeared in the passenger cabin due to a problem with the cabin's air distribution system. Three flex hoses from the sidewall riser ducts had detached from the overhead distribution duct.

The ducts are attached by placing one inside the other and securing them together using fire retardant adhesive tape and a plastic tie strap. The tape was no longer adhering the ducts together due to a problem with the adhesive, and the hoses had come loose due to the air blowing through the hoses and to vibrations during the flight. As a result, the air leaking through this loose joint must have caused the dust that had built up on top of the ceiling panels to blow out into the cabin. This, along with possible condensation of the air upon leaving the hose, must have caused what the crew identified as a white smoke. The location of the loose hoses above row 12 matched the area where the smoke was reported during the incident.

Since the source of the smoke was an air leak in the distribution system, there was no associated warning or caution in the cockpit and the pilots were unaware of the problem. The smoke did not have associated with it the odor typical of smoke from a fire (such as an electrical fire). The fact that the smoke was white, and not black, also indicated that it was not from a fire. It was also not associated with a high temperature of any component in the passenger cabin. In other words, the characteristics of the smoke correlated to its origin: a leak in the air distribution system.

The smoke dissipated during the flight, probably due to the decreasing amount of dust, but it did not disappear until the engines were stopped. This makes sense since when the engines were stopped, the air conditioning packs also stopped, meaning there was no more air pressure in the ducts. This is why by the time the firefighters entered the cabin, there was no smoke.

The manufacturer was aware of the problem with the adhesive tape, since other operators had complained of situations like the one involving EI-DPF. Boeing had already taken steps by changing the type of adhesive tape used. The problem had been communicated via service letter 737-SL-21-065-A. The level of compliance with the service letter stipulated by the manufacturer was adequate for the problem involving the tape's lack of adhesion. While in this incident the consequences of this problem led to a more dramatic situation (smoke in the cabin) than those initially described by the

manufacturer (noise and cabin temperature control problems), such a failure is not regarded as posing a flight risk, and thus it is not necessary to modify the distribution and compliance measures established by the manufacturer.

In addition to the problems with the tape's adhesion, an additional problem was detected with the installation of the tape and tie strap used to secure the hoses. It was noted that, both in the hoses that detached and in others that had posed no problems, the tape had been installed on top of the tie strap and not the other way around, as specified in the Maintenance Manual. On the other hand, it was determined that there were aircraft with different installations from the one defined in maintenance manual. In fact, current production configuration does not include the tape in the connection. This is considered as a confusing aspect that could affect the maintenance personnel when performing the installation of the sidewall riser ducts to the overhead distribution duct. In this sense, the maintenance manual did not include graphic information to verify the correct installation.

The manufacturer confirmed both installations (with or without tape) were valid, and that both posibilties will be included in the maintenance manual and servie letter. Such actions are considered appropriate to solve issues identified during this investigation.

With all the above information, a safety recommendation is issued to the operator in order to take measures in its fleet so that the installation of the connections between overhead distribution duct and sidewall riser ducts are according to one of the two valid methods: with tape and strap or only with the strap directy applied to the joint.

The incident could not have been prevented or detected. There had been no problems in previous flights that would have alerted the crew in any way. Although fifteen days before the airplane had experienced a hard landing, this is not believed to have played a role in the incident. The impact could have helped dislodge the hoses, which would have caused visible damage in the cabin panels, but this did not occur on this occasion.

2.2. Handling of the emergency by the cabin crew

The smoke appeared after takeoff while the seat belt sign was still on, meaning the flight attendants were also seated in their seats. None of the FAs detected the smoke; instead, it was the passengers who triggered the alert by using the call buttons located above their seats.

The response by the cabin crew to these calls was delayed by a minute and a half, as per their statements, until the seat belt sign was turned off. Except for one flight attendant who was verbally notified of the presence of smoke, the rest of the cabin crew was unaware of the situation and had not received any alert calls from the cockpit.

They thus attributed the calls to mistakes by the passengers who had intended to turn on the reading lights instead, and they waited until they were able to get up.

In this incident, the smoke that appeared in the cabin did not pose any risk to the safety of the aircraft, but the presence of smoke is one of the more serious in-flight situations, requiring immediate attention and overriding the seat belt sign.

The delay in responding to the calls, however, is not considered excessive, and once the seat belt sign was turned off the cabin crew responded immediately. The assignment of tasks to deal with the emergency was fast and proper, and every crew member, as they arrived at the scene, carried out the tasks defined in the procedure.

The actions taken by the cabin crew to assess and identify the type and source of fire (temperature, odor, color, density and affected area) were proper and thorough, such that when the purser called the captain, he was able to provide very detailed information about the situation that was unfolding. This initial assessment by the cabin crew was very fast, lasting on the order of two and a half minutes. The purser's call 4 min 5 sec into the flight to report what was happening was made correctly, using the emergency call, which pre-alerted the flight crew to the fact that something was happening.

The flight crew's subsequent action involving the cabin lights were correct, and is in fact part of item 14 in the smoke checklist.

There was only one call from the cabin crew to the cockpit, and it was the initial call. The purser made no additional calls since the situation was improving. Had the situation worsened there would have undoubtedly been more communications between the flight and cabin crews. The next exchange between the cockpit and the cabin crew was initiated by the captain five minutes into the emergency. It was during this call that the captain was informed of the improving situation.

The two communications between the captain and the purser allowed the cabin crew to know from the start that the aircraft was going to divert to Seville and what the crew had decided to do once they had landed there.

2.3. Handling of the emergency by the flight crew

The emergency call, placed by sounding the chime three times, served to alert the flight crew. Until then the airplane had been flown without the autopilot. When the emergency call was received, the autopilot was engaged, a decision that seems a proper response to aid in dealing with the emergency.

The decisions and actions carried out by the captain after being informed by the purser of what was happening were executed quickly and are regarded as correct. He relayed

specific and concise information to the first officer as to the nature of the emergency and the actions to take, and to the purser as to the decision he had made. Communications between the captain and first officer were good throughout the flight, and the mood in the cockpit was cordial. There were no conversations unrelated to the flight. Every action and decision was verbalized. The distribution of tasks before, during and after the emergency was kept the same, with no changes ensuing as a result. The situation in the cockpit was calm throughout the flight, including during the emergency. The pilots exhibited no signs of nervousness or of being overwhelmed by the situation.

The selection of Seville as the alternate airport is regarded as correct, since it was one of the two airports they had mentioned in the briefing before taking off. In addition, it was a Ryanair base, which made it easier to carry out the post-incident investigation and it was an airport known by the two pilots. Even though Jerez was closer, and they were informed by ATC of this fact, the crew did not make a hasty decision to land and continued with their plan to go to Seville. This also gave them a little more time to configure the aircraft correctly for a safe landing.

The priority of the flight crew during the emergency was to land in Seville. All of the actions taken in the 20 min 51 sec between the emergency and the landing were focused on preparing the approach, configuring the aircraft and ensuring that the rest of the flight was carried out in a stable and controlled manner. They did not want to have to do a go-around. The constant questions to Seville regarding the runway in use, the weather at their destination and descent instructions showed the crew's desire to plan ahead and not be caught off guard.

At no time during the pilots' conversation in the cockpit did they mention the smoke checklist. According to their statement, they knew it and were confident that the procedure itself instructed crews not to delay landing to execute the checklist. Even though the information available to them indicated that the smoke was from an unknown source, they did not consider taking the time to do the checklist, probably because they had no warnings of any type in the cockpit. Seville was near and they did not have too much time before the landing. A review of the applicable checklist revealed that many of the items were not applicable in their case or had already been completed (such as dropping the masks, deciding to divert to another airport or establishing communications with the cabin crew). Other steps, such as turning off air recirculation in the passenger cabin might have helped in other cases. In this incident, not doing the checklist did not have any effect due to the source of the smoke (which was not, in fact, smoke), meaning it was of no consequence in the end. The second exchange with the purser five minutes into the emergency confirmed that the situation was improving, which served to further justify their decision not to do the checklist.

Lastly, the captain's decision to ask the firefighters to check the cabin after landing yielded confirmation that the emergency was, in fact, unfolding favorably and that there was no apparent risk to the aircraft. Despite this information, and since the source

of the smoke was still unknown, the captain decided to disembark the passengers and not run any further risks while taxiing, thus avoiding a potential evacuation and deplaning the passengers safely.

2.4. Handling of the emergency by ATC and the Seville Airport

The aircraft was given priority to land and all the requests made by the crew were received and handled properly. The emergency was reported correctly between the various stations and both the information on the emergency and the crew's intentions and requests regarding the landing in Seville were conveyed to all of the stations involved: Seville APP, Seville TWR and Seville Airport.

The constant questions from the crew to ATC (runway in use, weather at Seville, descent instructions and vectors) showed an attitude by ATC that was not proactive or did not anticipate the needs of the crew, probably so as not to bother or interrupt the crew during the emergency. The result was that it was the captain who had to constantly request flight information.

The informational needs of the airport regarding the emergency (number of persons and fuel onboard) were also unknown to APP and were passed to the crew in two separate messages. Initially APP did not request any information from the crew.

At the airport, the emergency services were activated quickly and they were waiting for the aircraft when it landed. The firefighters accompanied the aircraft as it taxied and they went onboard when it stopped. The coordination with the other services in terms of disembarking the passengers was done correctly and the buses and remaining equipment needed to offload the passengers were sent to the taxiway. The services provided to the aircraft by every unit at the airport were complete and proper.

2.4.1. *Airport operability after the emergency*

While the situation with the aircraft in distress was handled properly, the determination of the airport's operability level following the emergency was not. Communications between the duty manager, CECOA, Seville TWR and Seville APP were not coordinated when it came to determining the airport's operability. The duty manager unilaterally determined that the airport was fully operational without consulting with the Seville TWR and without informing it of his decision, one that was based on the fact that the aircraft was on the taxiway and clear of the runway.

The communications with CECOA and the duty manager revealed that airport officials believed that if the runway was clear, the airport was operational. Such a decision should have involved:

- Checking that the aircraft was beyond the runway safety distance.
- Verifying that disembarking the passengers would not affect runway operations.

When the airport was initially declared fully operational, neither of these two conditions was verified. First because the passengers were going to be disembarked on the taxiway, with all of the emergency and handling equipment deployed to that area, and second because the aircraft had not been verified to be beyond the runway safety distance.

The runway holding point, which is where an aircraft can be situated without posing a risk to another aircraft using the runway, serves as a limit for ensuring that operations on the runway are free from obstacles. In other words, to determine whether the runway was clear, the aircraft should have been verified to have been further away from the runway than the holding point on taxiway E-3. As suggested by the communications and by the diagram of the incident sent by the airport, the aircraft was located beyond the holding point. This is the position that the duty manager should have checked when he reported "runway clear" to the Seville TWR at 20:16:14.

In addition, the decision to continue with normal operations was not reported to the Seville TWR, but it was reported to the Seville ACC, which continued to clear aircraft to land at the Seville Airport. In this case, the fast action taken by the Seville TWR upon realizing there was an aircraft on final, namely to have it hold because the emergency was not over, was correct. The TWR initiated a series of calls to the CECOA and firefighters to gather more information so as to correctly evaluate the airport's operability status. Once it had all the information, the decision to accept arrivals, once APP informed them to exit the runway via the end of the runway of the last exit taxiway, was communicated to airport officials and to Seville APP.

The duty manager's initial decision was hasty, as it did not consider the situation as a whole and it was made without checking with the Seville TWR. A safety recommendation is issued to the Seville Airport so that it:

- Consider the runway holding points as the limits for defining the safety distance when declaring a runway clear.
- Consider the overall situation in the runway and taxiways to define the airport's operability. In this case, with an aircraft's passengers being disembarked on an exit taxiway, the airport's operability should have been questioned.
- Consult with the Seville TWR when making decisions that affect the airport's operability.

3. CONCLUSIONS

3.1. Findings

General:

- The aircraft had the necessary licenses to carry out the flight.
- The crew had the necessary licenses to carry out the flight.
- The incident flight was the sixth of the day and the second of the day for the crew.
- The five previous flight had been completed without incident.
- Weather conditions were not limiting during the flight, which was carried out at night.

Smoke:

- The smoke appeared in row 12 left of the passenger cabin after takeoff.
- The smoke issued from above the overhead compartment and spread to the top part of the ceiling.
- The smoke was white, thick and odorless. There were no heat sources in the area.
- The situation did not deteriorate during the flight. The smoke dissipated but it did not disappear until the engines were stopped on the ground.
- No warnings were received in the cockpit.
- Three ducts in the air distribution system for the passenger cabin were found loose above row 12 left; three flex hoses from the sidewall riser ducts had detached from the overhead distribution duct.
- The loose hoses had been attached using a fire-retardant adhesive tape that was affected by a service letter from the manufacturer (737-SL-21-065-A), warning of adhesion problems.
- The service letter did not require that the adhesive tape be replaced.
- The manufacturer had changed the type of adhesive tape and was no longer using the type installed on the aircraft and that had come loose.
- In 2010 aircraft EI-DPF had had a similar event to that which occurred on the day of the incident.
- The sidewall riser ducts had not been attached to the overhead distribution duct as indicated in the aircraft's maintenance manual. The strap and the tape had been installed in reverse order.
- Aircraft maintenance manual did not include clear illustration of the correct installation configuration.
- The manufacturer had modified the method in which the sidewall riser ducts are attached to the overhead distribution duct: the use of the tape was intermittent and the currect production configuration does not use the tape, only the strap.
- Both configurations (with or without tape) were valid according to the manufacturer.

- Aircraft maintenance manual AMM 21-23-04-4 and service letter 737-SL-21-065-A will be revised to include instructions for installing sidewall riser ducts with tape and strap or only with strap.

Cabin crew:

- The smoke was detected by the passengers.
- The passengers' calls to the flight attendants were not immediately answered because the seat belt signs were on.
- The flight attendants were unable to stand up and attend to the passengers for a minute and a half.
- When the cabin crew were able to stand, they immediately responded to the emergency and carried out the actions for smoke in the cabin.
- The cabin crew evaluated and identified the type of smoke and provided full and adequate information to the flight deck.
- The cabin crew were informed from the start of the emergency of the intentions and decisions made by the flight crew.
- Two communications took place during the flight between the cockpit and the passenger cabin. The first was initiated by the purser to report the emergency, and the second was initiated by the captain to inquire about how the situation was progressing.

Flight crew:

- The flight crew never determined the source of the smoke but they knew that the situation was not deteriorating.
- The flight crew made fast decisions during the emergency that were reported to all of the parties (ATC and cabin crew).
- The smoke checklist was not carried out.
- The flight crew focused on planning and on configuring the aircraft to make a safe descent, approach and landing at the Seville Airport.
- The crew requested information from ATC to plan the flight, from the runway in service to instructions for the descent.
- 20 min 51 sec elapsed from the emergency until the landing.
- The crew ruled out diverting to Jerez due to lack of time to prepare for the landing.
- The aircraft exited the runway and stopped on exit taxiway E-3.
- The captain decided to disembark the passengers on exit taxiway E-3, and not risk having a new problem appear while taxiing.

Air traffic and airport services:

- The aircraft was given priority to land.
- Communications between the stations involved (Seville APP, Seville TWR and Seville Airport) were good.

- Activating the emergency at the airport allowed all service personnel to be ready when the aircraft landed.
- The firefighters entered the aircraft after it stopped taxiing. They were on the scene when the passengers were disembarked and inside the aircraft as it taxied.
- Seville Airport officials declared the airport operational without consulting with or informing the Seville TWR.

3.2. Causes/Contributing factors

The probable cause of the incident with aircraft EI-DPF was the bad condition of the fire-retardant adhesive tape used to attach three sidewall riser ducts to the overhead distribution duct. Because the adhesive on the tape was weak, the joints came loose and the air that was exiting at that point probably stirred up the dust that had accumulated above the overhead panels, producing what the cabin crew identified as a thick, white, odorless and cold smoke.

4. SAFETY RECOMMENDATIONS

Since the investigation found that the adhesive tape and plastic tie strap were applied in reverse order at the joint of the overhead distribution duct and the sidewall riser ducts, and that there are confusiong between the instructions in the maintenance manual and aircraft delivery configurations, the following recommendation is issued:

REC 56/15. It is recommended that Ryanair takes the necessary measures in its fleet so that the installation of the connections between the overhead distribution duct and the sidewall riser ducts is verified to have been carried out in one of the following methods:

- If fireproof adhesive tape (reference G50344) is installed, an adjustable strap should be installed over the tape (reference G50625) as define in the subtask 21-23-04-420-008 in the maintenance manual.
- If no fireproof adhesive tape is installed, the adjustable strap (reference G50625) should be fitted directly onto the joint.

Since, during the incident, the airport was declared operational while the aircraft was still in exit taxiway E-3 and its passengers were being disembarked, this declaration being made hastily and with no clear criteria as to the airport's overall situation and without reporting it to and agreeing with the Seville TWR, the following recommendation is issued:

REC 57/15. It is recommended that Aena-Seville Airport take the measures needed so that its personnel adhere to procedures and, when establishing the airport's level of operability, that they:

- Consider the runway holding points as the limits for defining the safety distance when declaring a runway clear.
- Consider the overall situation in the runway and taxiways to define the airport's operability. In this case, with an aircraft's passengers being disembarked on an exit taxiway, the airport's operability should have been questioned.
- Consult with the Seville TWR when making decisions that affect the airport's operability.