CIAIAC

COMISIÓN DE
INVESTIGACIÓN
DE ACCIDENTES
E INCIDENTES DE
AVIACIÓN CIVIL

Report IN-031/2015

Incident involving an Airbus A-321-211, registration G-TCDX, operated by Thomas Cook Airlines, while on approach to the Menorca Airport (Balearic Islands, Spain) on 1 September 2015

GOBIERNO DE ESPAÑA
MINISTERIO DE FOMENTO

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Foreword

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

In accordance with the provisions in Article 5.4.1 of Annex 13 of the International Civil Aviation Convention; and with articles 5.5 of Regulation (UE) nº 996/2010, of the European Parliament and the Council, of 20 October 2010; Article 15 of Law 21/2003 on Air Safety and articles 1., 4. and 21.2 of Regulation 389/1998, this investigation is exclusively of a technical nature, and its objective is the prevention of future civil aviation accidents and incidents by issuing, if necessary, safety recommendations to prevent from their reoccurrence. The investigation is not pointed to establish blame or liability whatsoever, and it's not prejudging the possible decision taken by the judicial authorities. Therefore, and according to above norms and regulations, the investigation was carried out using procedures not necessarily subject to the guarantees and rights usually used for the evidences in a judicial process.

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

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

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Abbreviations

00:00	Hours and minutes (time period)
00.00:00	Hours, minutes and seconds (elapsed time)
00º	Geometric degrees / Magnetic course
00º00'00"	Degrees, minutes and seconds (geographic coordinates)
00 ºC	Degrees centigrade
AAIB	Air Accident Investigation Board (United Kingdom)
ACC	Area control center
ADX	Andraitx (IAF for the ILS approach to runway 06L at LEPA)
AEMET	Spain's National Weather Agency
AMC	Acceptable Means of Compliance
APP	Approach control station
ATC	Air traffic control
ATIS	Automated terminal information system
ATPL(A)	Air transport pilot license (airplane)
CAA	Civil Aviation Authority (United Kingdom)
dd/mm/aaaa	Day, month and year (date)
DEP .	Departures
ECAM	Electronic centralized aircraft monitor
EGSH	Norwich Airport in the United Kingdom
EGSS	Stansted Airport in the United Kingdom
FCL	Flight crew licensing
FDM	Flight data monitoring
FL	Flight level
FMGC	Flight management guidance computer
ft	Feet
GM	Guidance Material
GND	Ground control
hPa	Hectopascals
IAF	Initial approach fix
ILS	Instrument landing system
JAR	Joint aviation regulations
Kg	Kilograms
Km	Kilometers
LEBL / BCN	Barcelona Airport (ICAO / IATA codes)
LEIB / IBZ	Ibiza Airport (ICAO / IATA codes)
LEMH / MAH	Menorca Airport (ICAO / IATA codes)
LEPA / PMI	Palma de Mallorca Airport (ICAO / IATA codes)
LT	Local time
m.	Meters
MDA/H	Minimum decision altitude/Height
METAR	Aerodrome routine weather report
MHz	Megahertz
NM	Nautical mile
NDB	Non-directional beacon
NOTAM	Notice distributed by telecommunications means containing information on the establishment, condition or modification of any aeronautical facility, service, procedure or hazard, knowledge of which is essential to personnel charged with flight operations
OM	Operations Manual
PCMCIA	Memory card for personal computers
PF	Pilot flying
QAR	Quick access recorder
QNH	Altimeter subscale setting to obtain elevation when on the ground when landing and taking off
SPECI	Special aerodrome weather report
STAR	Standard terminal arrival route
TAF	Terminal aerodrome forecast

TOC	Top of climb
TOD	Top of descent
TWR	Aerodrome control tower
UTC	Coordinated universal time
VHF	Very High Frequency
VOR	VHF omni-directional range

Synopsis

Owner and Operator:	Thomas Cook Airlines
Aircraft:	Airbus A-321-211, registration G-TCDX
Date and time of incident:	1 September 2015 at 15:14 UTC[1]
Site of incident:	On approach to the Menorca Airport (Balearic Islands – Spain)
Persons onboard:	8 crew and 178 passengers. No injuries reported.
Type of flight:	Commercial air transport – Scheduled – International – Passenger
Phase of flight:	Approach
Date of approval:	31 May 2017

Summary of incident

An Airbus A-321-211 aircraft, registration G-TCDX, was making Thomas Cook Airlines flight TCX56CP from the Norwich Airport (EGSH), in the United Kingdom, to the Palma de Mallorca Airport (LEPA) in Spain. The flight plan listed the air-ports of Ibiza (LEIB) and Menorca (LEMH) as the alternate airports.

The weather forecast for the Balearic Islands has resulted in yellow alerts being issued due to a 40 to 70% chance of rain and storms on the island of Mallorca between 15:00 and 19:00. The aerodrome forecast (TAF) for the Palma de Mal-lorca Airport called for the temporary presence of storm clouds with a base at 2500 ft between 11:00 and 19:00, and for a moderate chance of the temporary presence of storms and precipitation between 12:00 and 17:00, and for the pres-ence of storm clouds with a base at 2000 ft.

Faced with the possibility of encountering unfavorable weather conditions at the Palma de Mallorca and Ibiza airports, the crew of the aircraft decided to load 600 kg of extra fuel in addition to that specified in the operational flight plan.

The aircraft was in the approach sequence to runway 06L at the Palma de Mallor-ca Airport during a time interval, between 14:30 and 15:00, when five special aerodrome reports were issued informing of the presence of storms and reduced visibility. In these conditions, five aircraft in the sequence went around, the second of which was the incident aircraft.

[1] All times in this report are in UTC. To obtain local time (LT), add two hours to UTC time.

The aircraft's crew, having received information that one aircraft had landed, decided to make a second approach to runway 06L at the Palma de Mallorca Airport. After being informed of the presence of windshear and worsening weather conditions, the crew asked to divert to the Menorca Airport, which ATC services immediately facilitated.

While en route to the Menorca Airport, the crew noticed that with the fuel remaining onboard, the aircraft would land with less than final reserve fuel. As a result, the crew declared a MAYDAY FUEL, in keeping with their operations manual. The aircraft landed with 900 kg of fuel onboard. The final reserve fuel specified in the operational flight plan was 1292 kg.

The investigation has determined that the probable cause of the incident was the crew's failure to report their minimum fuel situation after the second approach. Contributing to the incident was the weather situation, which prevented aircraft from completing their approaches and made it difficult to control the traffic flow.

1. FACTUAL INFORMATION

1.1. History of the flight

An Airbus A-321-211 aircraft, registration G-TCDX, was making Thomas Cook Airlines flight TCX56CP from the Norwich Airport (EGSH), in the United Kingdom, to the Palma de Mallorca Airport (LEPA) in Spain. The flight plan listed the airports of Ibiza (LEIB) and Menorca (LEMH) as the alternate airports.

The aircraft was flying standard terminal arrival route (STAR) LORES2M to runway 06L. At 14:26:18, when it was close to point LORES, the crew contacted the Palma de Mallorca Area Control Center (ACC), which cleared them to fly direct to Andraitx (initial approach fix for the ILS approach to runway 06L) at 14:28:10. During the segment, the crew were given successive descent instructions and at 14:31:50 they were transferred to the final approach frequency (APP) at Palma de Mallorca, which gave them vectors until, at 14:39:40, they received a final vector to establish on the runway 06L localizer. APP also cleared the crew to land as number three. At 14:41:36, they were transferred to the control tower (TWR), which cleared them to land on this runway. At 14:46:45, while on short final, the crew decided to go around. A little over two minutes earlier, the preceding aircraft had gone around, as did the three that followed it in the approach sequence.

Again in contact with Palma de Mallorca approach control, the crew were given radar vectors to make a new approach. They were informed that the preceding aircraft had landed. At around 15:00, the crew were again transferred to Palma de Mallorca final approach (APP). At 15:03:25, as the aircraft was approaching the runway 06L localizer, the crew were informed that the preceding crews had reported the presence of windshear on short final, and the crew of the aircraft requested to proceed to the Menorca Airport and asked for a direct heading.

The crew received instructions to proceed to the alternate, entering a complicated traffic flow that ATC had to resolve after three additional go-arounds. At 15:12:05, the crew were cleared to proceed direct to the Menorca VOR (MHN – initial approach fix for the ILS approach to runway 01) at flight level 100. At 15:13:10, the crew reported that they were at flight level 100 direct to Menorca, and at 15:13:25 they declared a MAYDAY FUEL. At 15:21:00 they were cleared to descend, and at 15:22:20 to make the ILS approach to runway 01. They were then transferred to the Menorca Airport control tower. Once cleared to land, the aircraft did so without further incident at 15:32:30.

It should be noted that the weather conditions in the Balearic Islands on 1 September 2015 were characterized by the presence of storms, intense rain and strong downdrafts. This resulted in numerous inbound aircraft having to hold before making the approaches to the Palma de Mallorca and Menorca airports, as well as in constant diversions to other airports and/or go-arounds at the Palma de Mallorca Airport.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Other
Fatal				
Serious				
Minor				N/A
None	8	178		N/A
TOTAL	8	178		

1.3. Damage to aircraft

The aircraft was not damaged.

1.4. Other damage

None.

1.5. Personnel information

The captain of the aircraft, a 40-year old British national, had a JAR-FCL airline transport pilot license (ATPL(A)) issued by the United Kingdom's Civil Aviation Authority (CAA), with an A320/321 type rating that was valid until 31/06/2016. He also had a class-1 medical certificate that was valid until 26/11/2015. He had a total of 12309 flight hours, 3817 of which had been on the type.

The aircraft's first officer, a 33-year old British national, had a JAR-FCL airline transport pilot license (ATPL(A)) issued by the CAA, with an A320/321 type rating that was valid until 30/09/2015. He also had a class-1 medical certificate that was valid until 14/04/2016. He had a total of 3620 flight hours, 3420 of which had been on the type.

1.6. Aircraft information

Aircraft G-TCDX was an Airbus A321-211, serial number 1887. It was outfitted with two CFM International CFM56-5B3P engines. The aircraft had a certificate of airworthiness, number 054566/002, issued on 06/01/2015 by the CAA. At the time of the incident, it had approximately 48900 flight hours and 37550 flight cycles, and it had been maintained in

accordance with its approved maintenance program. The last type-A check (A3) had been performed on 11 January 2011 when the aircraft had 45379 hours and 34718 cycles.

1.7. Meteorological information

The appendix to this report includes the report issued by Spain's National Weather Agency (AEMET) on the weather situation in the Balearic Islands on the day of the incident.

According to said report, the situation aloft in the Balearic Islands was dominated by a weak low-pressure area centered between the Gulf of Lion and the Gulf of Genoa but that, due to the high seawater temperatures around the Balearic Islands, produced an intense convection arc whose cells affected both the islands of Mallorca and Menorca throughout the day. At the Palma de Mallorca Airport there were storms accompanied by intense rain and strong downdrafts, which had a significant impact on operations at the airport.

There were yellow alerts for the island of Mallorca due to a 40 to 70% chance of rain and storms between 15:00 and 19:00.

The aerodrome forecasts (TAF) indicated the temporary presence of storm clouds with bases at 2500 ft between 11:00 and 19:00, and a moderate probability of temporary storms and precipitation and the presence of storm clouds with bases at 2000 ft between 12:00 and 17:00.

As concerns the aerodrome reports, it should be noted that the Palma de Mallorca Airport issued five special reports (SPECI) between 14:30 and 15:00 that reflected the presence of storm phenomena with reduced visibility.

As for the Menorca Airport, the aerodrome forecasts (TAF) indicated the temporary presence of storm clouds with bases at 2000 ft between 09:00 and 17:00. The normal aerodrome reports issued between 14:30 and 15:30 indicated a visibility in excess of 10 km with no stormy weather.

1.8. Aids to navigation

All of the navigation aids along the route taken by the aircraft, and for the ILS approaches to runways 06L/R at the Palma de Mallorca Airport and runway 01 at the Menorca Airport, were operational on the day of the incident.

1.9. Communications

The aircraft crew were in contact with the following control stations:

- Palma de Mallorca Control Center (ACC) on frequencies of 119.15 MHz, approach (APP) on 119.4 MHz and final approach (Final) on 118.95 MHz.
- Palma de Mallorca airport control tower (TWR) on 118.3 MHz.
- Menorca airport control tower on 119.65 MHz and Menorca ground (GND) on 121.75 MHz.

The communications with all of the stations worked correctly and the most relevant content is reproduced in point 1.1.

1.10. Aerodrome information

The Menorca Airport (LEMH) is 4.5 km southwest of the city of Mahón, in the Balearic Islands (Spain). Its reference point is at an elevation of 92 m (302 ft) and it has one asphalt runway in a 01/19 orientation that is 2550 m long and 45 m wide.

The aircraft was cleared to proceed direct to point BALIO, the initial approach fix (IAF) for the ILS approach to runway 01.

The Palma de Mallorca Airport (LEPA) is located 8 km east of the city of Palma de Mallorca, in the Balearic Islands (Spain). Its reference point is at an elevation of 8 m (27 ft) and it has two parallel asphalt runways in a 06/24 orientation, measuring 3270 x 45 m (06L/24R) and 3000 x 45 m (06R/24L).

There are twelve published standard terminal arrival routes for runways 06R/L, including route LORES2M, which was being flown by the aircraft.

1.11. Flight recorders

Due to the time that elapsed between the date of the incident and when it was reported to the CIAIAC, it was not possible to recover the information from the aircraft's flight recorders.

The aircraft, however, had a quick access recorder (QAR) that stores information on a PCMCIA card. As part of its flight data monitoring (FDM) program, the operator downloaded the information from this card weekly, but the data for the incident flight were not available because they had been corrupted and rendered useless.

1.12. Wreckage and impact information

Not applicable.

1.13. Medical and pathological information

Not applicable.

1.14. Fire

There was no fire.

1.15. Survival aspects

Not applicable.

1.16. Tests and research

1.16.1. Reports from the aircraft crew

The pilots of the aircraft were asked to provide to the investigation detailed information on the event through the United Kingdom's Air Accidents Investigation Branch (AAIB).

Reports were received from both pilots in English, the contents of which were translated into Spanish.

1.16.1.1. Report from the Captain

The crew had commenced their activity on the morning of 1 September at 08:40 UTC, when they reported to the crew room at the Stansted Airport (EGSS), in the United Kingdom, 15 minutes before they traveled to the Norwich Airport (EGSH). All of the relevant flight information was downloaded and printed out there.

On the way to Norwich, they read the weather reports, the NOTAMs and the flight plans. Since the weather forecast for the Palma de Mallorca Airport (LEPA) indicated a 30% chance of temporary scattered cumulonimbus at 2000 ft for their scheduled arrival time, they decided to load 600 kg of extra fuel to the amount specified in the flight plan. They also decided that the first officer would be the pilot flying (PF) during the leg.

When they arrived at the Norwich Airport, they proceeded to the airplane and carried out all of the usual tasks and checks. The airplane later left on time. During the cruise phase, while flying over France, the weather information for the Palma de Mallorca and Ibiza airports was updated to warn of weather phenomena in the area, and that visibility at the Ibiza Airport had fallen to 1000 m due to heavy rain and some storm activity.

Because they were not affected by any NOTAMs, and since the wind was from the east, they programmed the FMGC to fly arrival route LORES2M and make an ILS approach to runway 06L. These maneuvers were commented by the crew prior to reaching the planned descent point. The crew later received the following ATIS information:

ATIS "M" 1410Z ILS06L Trans FL070 060/15 10000 m FewCB/2000 Sct2800 30/22 1015 Tempo TS RA

From the start of the descent it was apparent from the weather radar echoes that they would not be able to complete the published approach maneuver due to the presence of significant phenomena around the north of the island, in the vicinity of point TUENT. They thus requested to proceed directly to the Andraitx NDB (ADX). During all this time, they did not receive information from control stations regarding windshear, go-arounds or any problems experienced by preceding traffic. They started the initial approach with 3200 kg of fuel. Due to high traffic density, they were guided to make a long final approach to the ILS.

When they intercepted the ILS, the radar echoes made it more obvious that the significant weather phenomena had expanded to the center of the island as well. As they descended on the approach, the rain intensity increased, and when they reached the approach minimums with no visual contact with the runway, they executed a go-around, in accordance with the standard missed approach procedure. Before completing this maneuver, which ended at the Capdepera VOR (CDP), control provided them with vectors to the south for the downwind leg.

During this time the crew explained to the passengers the situation and updated the weather information for the Ibiza (IBZ) and Menorca (MAH) airports.

IBZ ATIS "T" 050/6 10000m FewCb 2000 Sct 4500 27/23 Q1015 Tempo TS RA

MAH ATIS "S" 040/17 10000m Few 1200 Few TCu 1800 26/20 1015

They reviewed their options thoroughly and concluded that the Menorca Airport was their best alternative, since there were no reports of storms and, with 2600 kg of fuel onboard, they were still above alternate fuel and final reserve fuel. With a 2400-kg limit to divert, they agreed to proceed to the Menorca Airport if necessary. Since ATC was now telling them that the weather had improved significantly and that aircraft were landing, they deemed it safe and appropriate to make a second approach.

While they were receiving vectors for an approach to long final, and just before intercepting the localizer, control reported that the preceding aircraft had gone around due to windshear and that weather conditions had deteriorated. They then requested to divert immediately to the Menorca Airport, but they were instructed to maintain 360º and 3000 ft. They reprogrammed the FMGC with a route to land at the Menorca Airport, and the FMGC initially indicated that they would be able to land above final reserve fuel.

Communications were hampered by the volume of traffic on the radio, with many conversations taking place in Spanish. They made another announcement to the passengers. After about ten minutes and numerous attempts to receive a direct vector, they were routed to the east. At that point the fuel remaining indicated that they would land below final reserve fuel, and so they declared a MAYDAY.

They were given a direct heading to the initial approach fix, BALIO, for the approach to the Menorca Airport but due to the weather, they were unable to fly direct. While en route to this point they received an ECAM "FUEL L + R WING TK LO LVL" alert, so they decided to open the fuel crossfeed. They held the briefing[(2)] for the ILS 01 approach and shortly afterward proceeded direct to a fix in the center of the approach.

The captain decided to take over as the pilot flying. After a normal approach and landing, they parked the aircraft at the stand with 900 kg of fuel remaining.

He called the pilot on duty to report that they had declared an emergency due to landing below final reserve fuel, as per their operating procedures,

1.16.1.2. Report from the First Officer

They traveled from the Stansted to the Norwich airport by taxi. During the trip, they checked all the documentation and agreed to request an additional 600 kg of fuel due to the weather forecast for the Palma de Mallorca Airport.

They left Norwich on time and received regular weather updates for the Ibiza and Menorca airports.

They held the approach briefing, noting the alternates and the fuel required for each. The traffic situation was complicated and many of the communications were in Spanish.

During the arrival maneuver for the Palma de Mallorca Airport, they requested to avoid the weather phenomena and to proceed direct to the Andraitx NDB (ADX). They received a vector for long final to the 06L ILS, where they flew into an intense squall that prevented

[2] A briefing is a summary of the procedures and routes available and of the different options to take in response to any eventuality.

them from establishing visual references at the decision altitude, so they executed a standard go-around. This maneuver ends at the Capdepera VOR (CDP), but control instructed them to turn south before completing the maneuver while they were at a safe altitude for the sector of 3000 ft.

Control informed them that the weather had significantly improved and that the preceding traffic had landed. They were told they were number seven for the approach, to which they replied they would have to divert to the alternate in that case. Control answered that they could make an immediate landing if they agreed to continue.

With fuel above that required for the diversion to the Menorca Airport, they decided to make a second approach based on the information provided by control about the significant improvement in the weather, the landing of the preceding traffic and the option to land immediately.

Just before intercepting the localizer for the second approach, they were told that the preceding traffic had gone around due to windshear and bad weather. They requested to divert immediately to the Menorca Airport. They were instructed to continue flying north at 3000 ft.

They updated the route to proceed to the Menorca Airport as their destination with 2400 kg of fuel remaining onboard. There was a lot of traffic around them and the control environment was very busy. After numerous requests to proceed direct to the Menorca Airport, they were given a vector to the east and then a direct vector to the center fix for the ILS 01 approach to the Menorca Airport. Initially they were unable to follow the route direct because of the weather. As a result, after making minor adjustments to the northeast, they were able to proceed directly to the Menorca Airport. As soon as they received the notification of fuel below final reserve, they declared an emergency.

The first officer had been the pilot flying (PF) up to that point, after which the captain took control. They briefed the ILS approach to land on runway 01, which they did normally. They had 900 kg of fuel upon arriving. The captain called the pilot on duty to report the emergency declaration, in keeping with the airline's operating procedures.

1.16.2. Reports from the ATC stations

It is worth noting that the control room log for the Palma de Mallorca Control Center (ACC) contains an entry that specified the following between 15:00 and 16:00:

> Strong storm at LEPA requires stopping DEPs and traffic to enter holding patterns. The following diverted to alternates: EZY15R to LEIB, AEA4014 to LEIB, RYR21W to LEBL, VLG1233 to LEMH and TCX56CP to LEMH. This last traffic declared a fuel emergency

at 15:14 and landed at 15:32. Capacity reduced to 13/60, gradually increased to 20/60 and 26/60.

1.16.3. Radar track

The information obtained from the Air Traffic Control Services included data and graphs on the path taken by the aircraft, just as it was detected by the radar stations covering the route.

The flight path followed by the aircraft from its initial contact with the Palma de Mallorca Control Center (ACC) until it landed at the Menorca Airport is shown below.

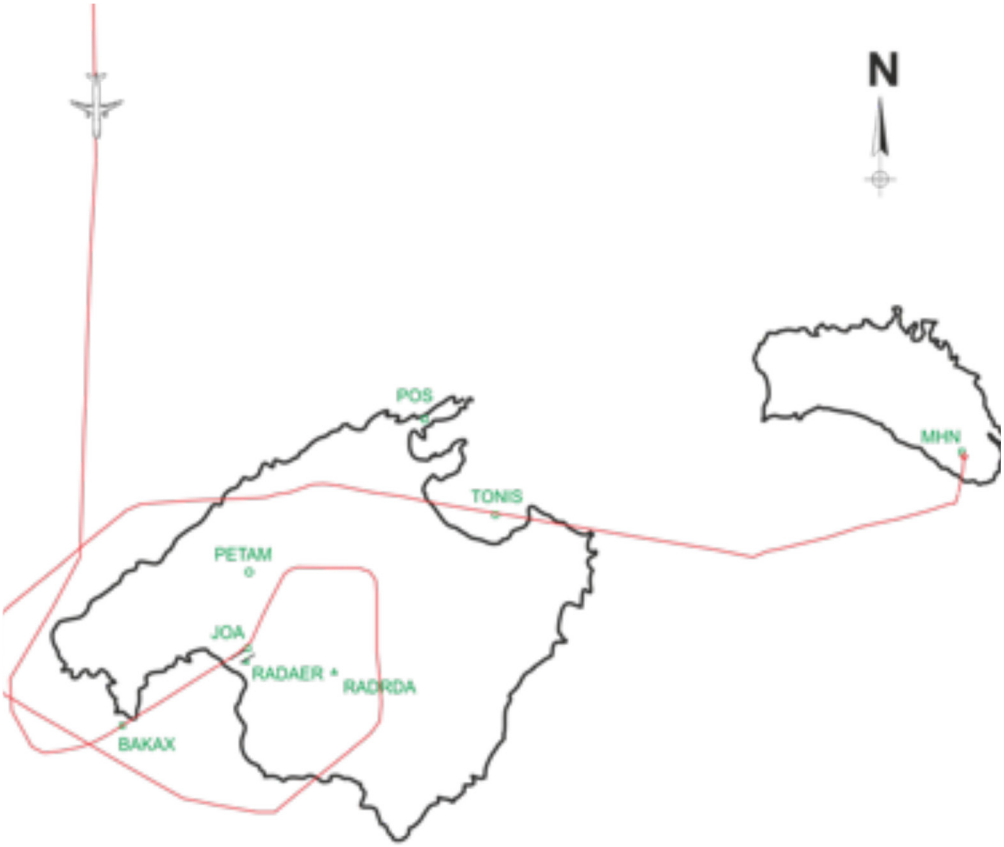


Figure 1. Aircraft's flight path

1.17. Organizational and management information

Not applicable.

1.18. Additional information

1.18.1. Information available to plan the flight

When the flight was dispatched, the crew had available to them the operational flight plan, NOTAMs and weather information.

The NOTAMs they had contained relevant information that could have affected the planning, as it involved false readings they could receive for the runway 06 localizer at the Ibiza Airport at around the time they were scheduled to arrive (NOTAM E4269/15).

With regard to the weather information, the crew had significant weather phenomena charts for flight levels (FL) 100 to 450 for the period in question. These showed the presence of storm clouds and instability all along France's Mediterranean coast, extending to the vicinity of Barcelona. They also had a wind map for FL340 that showed the wind was from the east at up to 60 knots along their route. Both maps were valid for 12 UTC on 1 September. They contained no relevant information that could have indicated to the crew the presence of the weather phenomena they would subsequently encounter.

The METAR information for the Palma de Mallorca Airport that was given to the crew, and generated at 08:00 on the 1st, did not contain any relevant information, since it indicated calm winds, visibility in excess of 10 km, scattered clouds at 3500 ft, a temperature of 27º C, a QNH of 1015 hPa and no significant weather phenomena.

The TAF forecast, however, generated on the 1st at 05:00, alerted to the temporary presence of few cumulonimbus at 2500 feet between 06:00 and 19:00, with storms and precipitation between 12:00 and 18:00.

Similarly, the weather information they had on the alternate airport (Ibiza) also contained nothing of significance, since it specified that winds were calm, visibility was in excess of 10 km, few clouds at 2000 ft, a temperature of 30º C, QNH of 1015 hPa and no significant weather phenomena. The TAF forecast, generated on the 1st at 08:00, alerted to the moderate probability of temporary few cumulonimbus at 2000 feet between 09:00 and 17:00.

As concerns the Menorca Airport, the second alternate considered in the operational flight plan, the METAR information specified that the winds were calm, visibility was in excess of 10 km, few clouds at 1000 ft, a temperature of 27º C and QNH of 1015 hPa. The TAF indicated the temporary presence of developing storm clouds between 09:00 and 16:00.

Over the course of the flight, the crew stated that they were mindful of the evolving weather phenomena forecast for the airports of Palma de Mallorca and Ibiza, and had noticed the weather phenomena in the area and that the visibility in Ibiza had fallen to 1000 m due to heavy rain and some storm activity.

Upon starting their approach, the crew heard (and noted in the flight plan) the ATIS "M" information at LEPA, which reported the presence of convective clouds and temporary precipitation due to storms.

Likewise, after executing the go-around maneuver, the crew updated the information on their alternate airports, which they noted on the flight plan. The presence of storm activity at the Ibiza Airport, reflected in the ATIS reports, made the crew opt for the Menorca Airport as the alternate.

1.18.2. Operational flight plan

The captain reported that in light of the weather forecast they had, they decided to add 600 kg of extra fuel, which would allow them to cover not only the first alternate airport (Ibiza), but also the second one proposed (Menorca). According to the load sheet, this meant having 9300 kg of fuel onboard on takeoff and 6200 kg of trip fuel.

The amount of fuel required by the flight plan was as follows:

• Trip fuel to LEPA	6174 kg	02:09 hours
• MIN contingency fuel (LEBL as reference)[3]	213 kg	00:05 hours
• Alternative (LEIB)	989 kg	00:19 hours
• Final reserve	1292 kg	00:30 hours
• Minimum fuel at takeoff	8668 kg	03:03 hours
• Taxi fuel at EGSH	212 kg	00:12 hours
• Minimum block fuel	8880 kg	

With the additional amount requested by the captain, the block fuel was 9500 kg.

The flight plan was prepared for an estimated takeoff weight of 74350 kg. The actual weight was 75003 kg, which was 653 kg higher. The operational impact of this excess weight is not important since, according to the operational flight plan, a 1000-kg increase meant an increased fuel consumption of 52 kg.

[3] As required by the criterion of 5 minutes at hold speed at 1500 ft (450 m) above the destination aerodrome in standard conditions, contained in the operator's Operations Manual, Part A.

Onboard the aircraft were 183 passengers (178 adults and 5 children) and 8 crew, with 2418 kg of baggage distributed in cargo holds 3, 4 and 5.

The takeoff maneuver was conducted using flex thrust, considering an assumed temperature of 35º C and a setting of flaps 3.

The crew logged the taxi start time at 12:24 and the takeoff at 12:36. This implies a taxi time of 12 minutes, which coincides with the time planned for this phase.

The departure and cruise route were as planned, and the crew checked their fuel (as required in regulation CAT.OP.MPA.185 and in the company's OM A 8.3.4.11.1) above point SITET at 13:07, which yielded an amount of fuel onboard that was 900 kg above that required in the operational flight plan for that point.

The flight plan was prepared for a flight level of FL350 at 0.77 Mach. There is no evidence that the crew deviated from either of these two parameters as specified in the flight plan.

There is evidence of two direct clearances, the first from SORAP to BALAN on airway UN859, and the second from BALAN to GAILLAC (GAI), also on that same airway.

At point TUSAK, at 13:51, the crew did a second fuel consumption check and determined that they had 900 kg of fuel more than required in the operational flight plan at that location.

The operational flight plan assumed the standard terminal arrival route for runway 24 L/R, i.e. LORES 1P. However, the crew were cleared to fly LORES2M for runway 06L. This second maneuver is 30 NM longer than the planned route.

After the first approach to the Palma de Mallorca Airport, the crew determined that their priority alternate was the Menorca Airport, as there was no storm activity reported there. They calculated that they would need a minimum of 2410 kg of fuel to divert to that airport.

The final fuel readings taken by the crew showed that they had left with 9500 kg of fuel and that they had 900 kg of fuel upon landing (392 kg below final reserve), making for an estimated consumption of 8600 kg.

The landing time recorded was 15:32 and their on-block time was 15:37.

This means that their actual flight time was 2:56 hours, versus a planned flight time of 2:09 hours, subject to a 21-minute increase, which is how long the flight plan estimated it would take them to land at the alternate airport (Menorca) if they proceeded there directly from the missed approach point for runway 06L at the Palma de Mallorca Airport to the final approach fix for runway 01 at the Menorca Airport at a flight level of 130.

1.18.3. Operator's Operations Manual, Part A

The operator's Operations Manual contains its fuel policy, which is an accurate reflection of the specifications in CAT.OP.MPA.150, "Fuel policy", and of its AMC and GM.

As concerns in-flight fuel management, the operator's Operations Manual, section 8.3.4.11, specifies that the crew is to monitor the fuel status, track potential changes in the operational state of the destination and alternate airports, deviations from the flight plan, the aircraft's operational state, weather conditions and so on.

It also requires the crew to check the fuel remaining every 30 minutes and to log it in the operational flight plan every 60 minutes (OM A 8.3.4.11.2).

It also specifies the communications procedures to employ in the event of minimum fuel or of a fuel emergency (OM 8.3.4.11.4).

1.19. Useful or effective investigation techniques

Not used.

2. ANALYSIS

The aircraft was flying from the Norwich Airport (EGSH) in the United Kingdom to the Palma the Mallorca Airport (LEPA) in Spain. The flight plan specified the Ibiza Airport (LEIB) as the alternate and the Menorca Airport (LEMH) as the second alternate airport.

The weather forecast for the Balearic Islands had resulted in yellow alerts being issued on the island of Mallorca due to a 40 to 70% chance of rain and storms between 15:00 and 19:00. The aerodrome forecasts (TAF) for the Palma de Mallorca Airport indicated the temporary presence of storm clouds with bases at 2500 ft between 11:00 and 19:00, with a moderate probability for temporary storms and precipitation and the presence of storm clouds with bases at 2000 ft between 12:00 and 17:00.

When preparing for the flight, the aircraft crew had the relevant weather information available to them, which included the significant weather and winds aloft charts and aerodrome reports, which did not contain any information that could have alerted the crew to the presence of adverse weather phenomena. They also had aerodrome forecasts that indicated the moderate possibility of encountering storms and precipitation at the airports of Palma de Mallorca and Ibiza.

In light of this possibility, the aircraft crew decided to load 600 kg of extra fuel over the amount specified in the operational flight plan. According to the information contained on the load sheet, the aircraft took off with 653 kg of fuel more than initially planned, corresponding to the extra fuel requested by the crew plus the increased consumption resulting from the extra fuel.

As a result, the crew had loaded extra fuel that would allow them to cover the two alternate airports (Ibiza and Menorca) specified in the operational flight plan in anticipation of a weather situation whose severity could not be clearly deduced from the operational information received prior to takeoff.

The aircraft was in the approach sequence for runway 06L at the Palma de Mallorca Airport during a time period, between 14:30 and 15:00, when five special aerodrome reports were issued that informed of the presence of storm phenomena and reduced visibility. Under these circumstances, five aircraft missed their approach, the second of which was the incident aircraft.

As concerns the operational flight plan, it relied on a fuel calculation for the alternate airport that included:

- Fuel for the missed approach route from the applicable minimum decision altitude (MDA/H) or decision altitude (DA/H) at the destination airport at the go-around altitude, assuming the entire missed approach procedure;

- Fuel to climb from the missed approach altitude to cruise altitude or level;

- Fuel for the cruise segment from the top of climb (TOC) point to the top of descent (TOD) point;

- Fuel for the descent from the TOD to initial approach fix, assuming the expected arrival procedure;

- Fuel to carry out an approach and landing at the destination.

These considerations do not take into account how operational circumstances can cause deviations from the route, which is calculated to be flown along the most direct path possible, and which result in the route not matching or, as in this case, in considerable differences from the planned route.

Attempting a second approach at the Palma de Mallorca Airport after being informed by ATC that the preceding traffic had landed resulted in increased fuel consumption and in joining an additional traffic sequence. This increased the distance traveled by the aircraft considerably over what it would have covered had it flown the planned diversion route.

When they requested the diversion, the crew did not issue a MINIMUM FUEL call, which, according to the operator's procedures, would have allowed ATC to know beforehand their need to proceed direct to the alternate, lest the situation deteriorate into a fuel emergency.

As shown in the operational flight plan, the diversion route to runway 01 at the Menorca Airport is on a course of 080º and assumes a distance of 96 NM. The consumption on this route is calculated assuming a cruise level of FL130 and a 14-knot tailwind.

It is estimated that the distance traveled by the aircraft from the missed approach point was 153 NM, and not at FL130, but at altitudes below FL100, and in some segments below 5000 ft, with the corresponding increase in fuel consumption.

The operational flight plan anticipated a fuel amount to fly for 2:33 hours before tapping into the final reserve, assuming the Ibiza Airport as the alternate. The actual flight, however, lasted 2:56 hours from takeoff to landing, which in and of itself would explain how the extra fuel was consumed and why the aircraft landed with less than final reserve fuel onboard.

Given these circumstances, the crew declared a MAYDAY due to fuel, in keeping with the standard criteria specified in the Operations Manual of the aircraft operator.

It should also be noted that the handling of the situation by control services is deemed to have been correct. They provided information on the options available to avoid the convective cells and gave priority to aircraft in distress. ATC cooperated at all times with the crew of the aircraft to ensure the safety of the operation.

3. CONCLUSIONS

3.1. Findings

- The crew of the aircraft were properly qualified, experienced and in good physical condition, and they had valid licenses.

- The aircraft had been maintained in accordance with the approved Maintenance Program and it had a valid Certificate of Airworthiness and Certificate of Registration.

- The aids to navigation were operational and no deficiencies in their functioning were detected.

- Ground-air communications worked correctly at all times.

- The aircraft's crew had the relevant weather information needed to prepare for the flight.

- The aircraft's crew anticipated potential diversions and took on extra fuel in addition to that specified in the operational flight plan.

- The weather conditions deteriorated while the aircraft was on approach to runway 06L at the Palma de Mallorca Airport, and five aircraft in the sequence went around, the second of which was the aircraft involved in this incident.

- The aircraft's crew decided to attempt a second approach to runway 06L at the Palma de Mallorca Airport after being informed by ATC that the preceding traffic had landed. When informed of the presence of windshear and that the weather conditions had again worsened, they asked to divert to the Menorca Airport. ATC immediately facilitated the operation, vectoring the aircraft through the traffic flow to proceed to the alternate.

- The crew did not make any MINIMUM FUEL declarations, which, in keeping with the operator's procedures, would have allowed ATC to know beforehand their need to proceed direct to the alternate, lest the situation deteriorate into a fuel emergency.

- While en route to the Menorca Airport, the crew realized that with the fuel remaining onboard the aircraft would land with less than final reserve fuel, as a result of which they declared a MAYDAY FUEL, as required by their operations manual.

- The aircraft landed with 900 kg of fuel onboard; the final reserve fuel specified in the operational flight plan was 1292 kg.

- The duration of the flight, the deviations and their execution under conditions different from those planned explain how the extra fuel was consumed and why the aircraft landed with less than minimum reserve fuel.

3.2. Causes

The probable cause of this incident was the crew's failure to report their minimum fuel situation after making the second approach.

The weather situation, which prevented aircraft from completing their approaches and created a traffic flow that was difficult to manage, contributed to the incident.

4. SAFETY RECOMMENDATIONS

No safety recommendations are issued as a result of the investigation into this incident.

5. APPENDIX

ANNEX 1. WEATHER REPORT ISSUED BY THE AEMET

ANNEX 1

WEATHER REPORT ISSUED BY THE AEMET

GOBIERNO DE ESPAÑA · MINISTERIO DE AGRICULTURA, ALIMENTACIÓN Y MEDIO AMBIENTE

AEMet Agencia Estatal de Meteorología

Informe meteorológico para la región de las ISLAS BALEARES el día 1 de septiembre de 2015

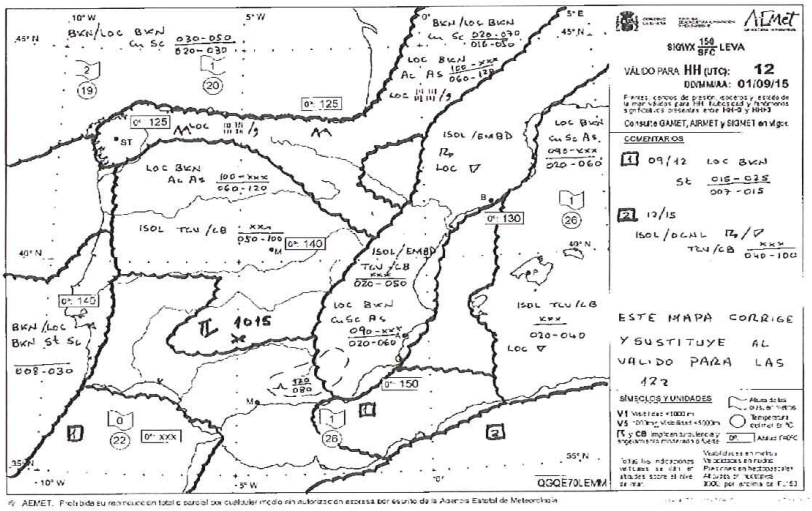
Situación meteorológica sobre la Península y Baleares

La situación en altura en la zona de las Islas Baleares estaba dominada por una vaguada débil centrada entre el Golfo de León y de Génova pero que, debido a las altas temperaturas del agua del mar en la zona de Baleares, produjo un arco de convección intenso cuyos núcleos fueron afectando a lo largo del día tanto a la isla de Mallorca como a la de Menorca. En el aeropuerto de Palma se produjeron tormentas acompañadas de chubascos intensos y fuertes corrientes descendentes que afectaron notablemente a la operación del aeropuerto (como puede verse en los Metar de alrededor del mediodía). En las imágenes de radar (nos mostradas aquí) se observan los núcleos de tormentas abarcando gran parte de la zona de las islas de Mallorca y Menorca.

La evolución temporal de la situación puede seguirse a partir de los datos detallados debajo.

Datos concretos sobre la situación:

a) Mapas significativos de baja y media-alta cota del día 1/09/2015.



CORREO ELECTRONICO
jgarciamoyaz@aemet.es

c/ Leonardo Prieto Castro, 8
28071 Madrid
Tel. 91 5819647
Fax. 91 5819767

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b) Avisos/boletines de alerta, etc. emitidos ese día.

BASE DE DATOS DE PRODUCTOS: AVISOS

AVISOS DE SITUACIONES AMARILLAS PARA LA C.A. DE ILLES BALEARS

```
AGENCIA ESTATAL DE METEOROLOGIA
BOLETIN DE FENOMENOS ADVERSOS DE NIVEL AMARILLO
C. AUTONOMA: ILLES BALEARS
BOLETIN NUMERO 215/64IBB_C_C_AM_TT
EMITIDO A LAS 16:09 HORA OFICIAL DEL 01/09/2015
VALIDO HASTA LAS 00:00 HORA OFICIAL DEL 03/09/2015

FENOMENOS PREVISTOS

FENOMENO(1) - LLUVIAS.
              PRECIPITACION ACUMULADA EN UNA HORA: 20 MM.
NIVEL: AMARILLO.
AMBITO GEOGRAFICO: MALLORCA (INTERIOR, SUR, LEVANTE MALLORQUIN).
HORA DE COMIENZO: 16:00 HORA OFICIAL DEL 01/09/2015.
HORA DE FINALIZACION: 20:00 HORA OFICIAL DEL 01/09/2015.
PROBABILIDAD: 40%-70%.

FENOMENO(2) - LLUVIAS.
              PRECIPITACION ACUMULADA EN UNA HORA: 20 MM.
NIVEL: AMARILLO.
AMBITO GEOGRAFICO: IBIZA Y FORMENTERA.
HORA DE COMIENZO: 00:00 HORA OFICIAL DEL 02/09/2015.
HORA DE FINALIZACION: 16:00 HORA OFICIAL DEL 02/09/2015.
PROBABILIDAD: 10%-40%.

FENOMENO(3) - TORMENTAS.
NIVEL: AMARILLO.
AMBITO GEOGRAFICO: MALLORCA (INTERIOR, SUR, LEVANTE MALLORQUIN).
HORA DE COMIENZO: 16:00 HORA OFICIAL DEL 01/09/2015.
HORA DE FINALIZACION: 20:00 HORA OFICIAL DEL 01/09/2015.
PROBABILIDAD: 40%-70%.

UN AVISO DE NIVEL AMARILLO POR TORMENTAS INDICA QUE EN LA  ZONA
PROVINCIAL AFECTADA SE PREVEN (DE ACUERDO CON EL PLAN METEOALERTA)
"LLUVIAS LOCALMENTE FUERTES Y/O VIENTOS LOCALMENTE FUERTES Y/O
GRANIZO INFERIOR A 2 CM".  DADO EL CARACTER DE ESTOS FENOMENOS
EXISTE LA POSIBILIDAD DE QUE SE PUEDAN PRODUCIR TORMENTAS DE
INTENSIDAD SUPERIOR DE FORMA PUNTUAL.
```

c) pronósticos de aeródromo de Palma de Mallorca y Menorca del día 1/09/2015 hasta las 16:00 UTC

FT01/09/2015 02:31->

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         TEMPO 0111/0119 FEW025CB
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         TX31/0113Z TN21/0205Z
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         TEMPO 0106/0119 FEW025CB
         BECMG 0114/0117 05010KT
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         BECMG 0114/0117 05010KT
         PROB30 TEMPO 0112/0117 TSRA FEW020CB BKN025
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         PROB30 TEMPO 0114/0117 3000 TSRA FEW020CB BKN025
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         BECMG 0121/0124 05005KT
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         BECMG 0110/0113 02012KT=
FT01/09/2015 04:37->
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d) Informes METAR de Palma de Mallorca y Menorca del día 1/09/2015 hasta las 16:00 UTC.

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SA	01/09/2015 02:00->	METAR LEPA 010200Z 03001KT 9999 FEW030 26/22 Q1012 NOSIG=
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SA	01/09/2015 06:30->	METAR LEPA 010630Z 00000KT 9999 FEW030 26/23 Q1014 NOSIG=
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SA	01/09/2015 01:00->	METAR LEMH 010100Z NIL=
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SA	01/09/2015 02:00->	METAR LEMH 010200Z NIL=
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SA	01/09/2015 03:00->	METAR LEMH 010300Z 05004KT 9000 FEW010 25/24 Q1012=
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SA	01/09/2015 04:00->	METAR LEMH 010400Z 36005KT 8000 FEW010 24/23 Q1013=
SA	01/09/2015 04:30->	METAR LEMH 010430Z 35005KT 310V010 6000 FEW010 FEW020CB 24/23 Q1013=
SA	01/09/2015 05:00->	METAR LEMH 010500Z 28005KT 240V320 4000 BR FEW010 24/23 Q1015=
SA	01/09/2015 05:30->	METAR LEMH 010530Z VRB01KT 5000 BR FEW010 24/23 Q1015=
SA	01/09/2015 06:00->	METAR LEMH 010600Z 00000KT 8000 FEW010 24/24 Q1014=
SA	01/09/2015 06:30->	METAR LEMH 010630Z 08003KT 040V130 9000 -RA FEW010 25/24 Q1014=
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	07:00->	
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SA	01/09/2015 11:00->	METAR LEMH 011100Z 35009KT 300V040 9999 FEW018TCU SCT024 29/24 Q1015=
SA	01/09/2015 11:30->	METAR LEMH 011130Z 36014KT 330V030 9999 FEW014 FEW018TCU SCT024 28/23 Q1016=
SA	01/09/2015 12:00->	METAR LEMH 011200Z 01018KT 9999 FEW012 FEW018TCU SCT024 29/23 Q1016=
SA	01/09/2015 12:30->	METAR LEMH 011230Z 01017KT 9999 FEW012 FEW018TCU SCT024 27/23 Q1016=
SA	01/09/2015 13:00->	METAR LEMH 011300Z 01019KT 9999 FEW012 FEW018TCU SCT024 27/22 Q1016=
SA	01/09/2015 13:30->	METAR LEMH 011330Z 02018KT 350V050 9999 FEW012 FEW018TCU 26/21 Q1016=
SA	01/09/2015 14:00->	METAR LEMH 011400Z 02018KT 9999 FEW012 FEW018TCU 27/21 Q1016=
SA	01/09/2015 14:30->	METAR LEMH 011430Z 02018KT 9999 FEW012 FEW018TCU 26/20 Q1016=
SA	01/09/2015 15:00->	METAR LEMH 011500Z 03016KT 9999 FEW016 FEW020TCU 27/21 Q1016=
SA	01/09/2015 15:30->	METAR LEMH 011530Z 03017KT 9999 FEW016 26/20 Q1015=
SA	01/09/2015 16:00->	METAR LEMH 011600Z 03017KT 9999 FEW018 26/21 Q1015=
SA	01/09/2015 16:30->	METAR LEMH 011630Z 03016KT 9999 FEW018 26/20 Q1015=
SA	01/09/2015 17:00->	METAR LEMH 011700Z 04015KT 9999 FEW018 26/21 Q1015=

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