

CIAIAC

COMISIÓN DE
INVESTIGACIÓN
DE **A**CCIDENTES
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AVIACIÓN **C**IVIL

Report IN-021/2013

Incident on 4 July 2013,
involving an Airbus A-320
aircraft, registration G-OZBW,
operated by Monarch Airlines,
while on approach to the
Málaga Airport (Spain)



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SUBSECRETARÍA

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DE ACCIDENTES E INCIDENTES
DE AVIACIÓN CIVIL

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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.

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Abbreviations

ACC	Area Control Center
APP	Approach control office
ATC	Air traffic control
ATPL(A)	Airline transport pilot license (airplane)
CAA	Civil Aviation Authority (United Kingdom)
CIAIAC	Civil Aviation Accident and Incident Investigation Commission (Spain)
CVR	Cockpit voice recorder
EASA	European Aviation Safety Agency
EGBB	Birmingham Airport designator (UK)
EZFW	Estimated zero-fuel weight
FDR	Flight data recorder
FL	Flight level
FMGS	Flight management and guidance system
ft	Foot
ICAO	International Civil Aviation Organization
ILS	Instrument landing system
kg	Kilogram(s)
km	Kilometre(s)
LXGB	Gibraltar Airport designator (UK)
m	Meter(s)
METAR	Aerodrome weather observation report
MHz	Megahertz(s)
NM	Nautical(s) mile(s)
OM	Operations Manual
OPF	Operational flight plan
PANS/OPS	Procedures for air navigation services – aircraft operations
QAR	Quick access recorder
S/N	Serial number
SIB	Service information bulletin
SRA	Surveillance radar approach
TAF	Aerodrome forecast
TWR	Control tower
UTC	Coordinated universal time
ZFW	Zero fuel weight

Synopsis

Owner and operator:	Monarch Airlines
Aircraft:	Airbus A320, registration G-OZBW
Date and time of incident:	Thursday, 4 July 2013; at 08:54 UTC ¹
Site of incident:	Approach to the Málaga Airport
Persons onboard:	173; 167 passengers, uninjured; 6 crew, uninjured
Type of flight:	Commercial air transport – Scheduled – International – Passenger
Date of approval:	28 September 2015

Summary of incident

On Thursday, 4 July 2013, aircraft G-OZBW, operated by Monarch Airlines, with 173 persons onboard, took off at 06:15 from the Birmingham Airport en route to the Gibraltar Airport. Even though weather conditions satisfied the operating minimums at the airport, the presence of clouds prevented the crew from establishing visual contact with the runway when they reached the decision height while making the approach to runway 09 at the Gibraltar Airport.

The crew executed a missed approach and despite having planned their fuel using the Tangiers Airport as their alternate, the crew headed for the Málaga Airport, where they hoped to be able to make a direct approach, which would enable them to land with reserve fuel. The traffic situation at Málaga kept the aircraft from making the flight in the conditions that the crew had hoped for, and they were forced to declare a fuel emergency at 08:54. After receiving landing priority, the aircraft landed at 09:04 at the Málaga Airport with reserve fuel plus 20 kg. There were no damages or injuries and the aircraft did not require any assistance from emergency services.

The investigation analyzed the weather information and the changing weather conditions during the flight in an effort to determine whether the decision to go to Gibraltar was correct or not, as well as the factors that influenced the crew's decision to change their alternate airport.

The report contains four safety recommendations, three for the operator, Monarch Airlines, and one for the United Kingdom's Civil Aviation Authority.

¹ All times in this report are in UTC and were obtained from air traffic control.

1. FACTUAL INFORMATION

1.1. History of the flight

On Thursday, 4 July 2013, aircraft G-OZBW, an Airbus A-320 operated by Monarch Airlines with callsign MON446G, took off at 06:15 from the Birmingham Airport (EGBB) en route to the Gibraltar Airport (LXGB). It was a scheduled flight² with 173 persons onboard, 167 of them passengers.

The crew had planned the flight using the Tangiers Airport as the alternate airport. It was based on this planning that the airplane had been refueled.

The flight was uneventful and the aircraft was transferred to Gibraltar Radar at 08:31, although 20 minutes earlier the crew had contacted this facility to request the latest weather information on Gibraltar (the 07:50 METAR). When they started the approach, the weather conditions at the airport complied with the requirements for operating at that airport. The aircraft made the approach to runway 09 using the surveillance radar, and upon reaching the decision height, at 08:41, the crew decided to go around since they were unable to establish visual contact with the runway.

Even though the planned alternate airport was Tangiers, the crew decided to go to their second alternate, Málaga. While flying from Gibraltar to Málaga, they received low fuel warnings, and when it became impossible to make a direct approach due to the presence of other traffic, the crew declared a fuel emergency at 08:54 using the MAYDAY term.

Air traffic control gave them priority over other traffic and eventually, at 09:04, the aircraft landed at the Málaga Airport without further incident and without requiring assistance from any emergency services. There was no evacuation.

There were no injuries and the aircraft was not damaged during the incident.

1.2. Injuries to persons

There were no injuries to persons.

Injuries	Crew	Passangers	Total in the aircraft	Others
Fatal				
Serious				
Minor				Not applicable
None	6	167	173	Not applicable
TOTAL	6	167	173	

² The airline flew the incident route on Thursdays and Sundays, departing Birmingham at 05:35 and arriving in Gibraltar at 08:30.

1.3. Damage to aircraft

None.

1.4. Other damage

None.

1.5. Personnel information

1.5.1. *Captain*

The captain, born in the United Kingdom, was 54 years old. His airline transport pilot license (ATPL(A)), issued by the United Kingdom's Civil Aviation Authority, and medical certificate, were valid³ at the time of the incident. He had 14,000 total flight hours and 3,000 on the type. He had undergone his line check in April 2013. In March 2013 he completed the license proficiency check and the operator's proficiency check.

He had been flying into Gibraltar since the year 2000. From January until July 2013, he had flown into the Gibraltar Airport five times, the last time 10 days earlier. On the day of the incident he had gone on duty at 04:35 in Birmingham.

1.5.2. *First officer*

The first officer, born in the United Kingdom, was 35 years old. His airline transport pilot license (ATPL(A)), issued by the United Kingdom's Civil Aviation Authority, and medical certificate, were valid⁴ at the time of the incident. He had 4,500 total flight hours and 350 on the type. He had undergone his line check in April 2013, and in December 2012 he completed the operator's proficiency check

He had been working at the airline since October 2012 and had never before flown into Gibraltar.

1.6. Aircraft information

Aircraft G-OZBW, an Airbus 320-210, S/N 1571, owned by Monarch Airlines, was used for the public transport of passengers.

The fuel indicating system included a visual low fuel level warning (LO LVL, below 750 kg) for each of the two wing tanks.

³ License valid until 09/12/2014 and medical certificate valid until 22/12/2013.

⁴ Valid until 30/04/2014.

1.7. Meteorological information

The meteorological information available at the Gibraltar Airport was provided by the United Kingdom's weather service, which made available observation reports (METAR/SPECI) and aerodrome forecasts (TAF). On the day of the incident, the maps showed the presence of low clouds and reduced visibility at around 08:00 (the aircraft started its go around at 08:41) in and around the Gibraltar Airport.

1.7.1. Forecasts for the Gibraltar Airport (TAF)

The forecast for the province of Cádiz indicated conditions favorable to the formation of low clouds and reduced visibility due to early-morning fog. This situation was reflected in the aerodrome forecasts⁵ for the Gibraltar Airport. The first two TAFs for that morning (04:25 and 05:41) called for a 30% probability that visibility would drop between 06:00 and 09:00 due to haze and fog and to the presence of clouds at 800 ft and 300 ft. The 06:09 forecast called for improved conditions for that same time period.

1.7.2. Observation reports at the Gibraltar Airport (METAR)

The satellite images showed stretches of low clouds along the Straits, one of which extended to Gibraltar. The METAR reports for the Gibraltar Airport between 04:50 and 08:50⁶ showed that visibility worsened and the cloud ceiling⁷ dropped due to the presence of fog, and that this situation improved over the course of the morning. The reports called for improving conditions (BECMG), which they did in terms of visibility but not in terms of the height of the cloud base. The progression was as follows:

- At 04:50, there was maximum visibility and scattered clouds (3-4 octas) at 800 ft.
- At 05:50, the visibility had dropped to 2,500 m, there was fog within 8 km of the airport, the scattered clouds (3-4 octas) had dropped to 200 ft and the cloud ceiling was at 1,200 ft.
- At 06:50, conditions were at their worst. The fog had reached Gibraltar and the visibility was 400 m. The scattered clouds remained at 200 ft. The forecast was for the visibility to increase to 9000 m, the clouds to diminish from scattered to few (1-2 octas) and the clouds to rise to 1,200 ft.
- By 07:50, the fog had dissipated but it was still hazy. The visibility had gone up to 6,000 m and there were two layers of scattered clouds at 400 and 1,100 ft.

⁵ TAF LXGB 040425Z 0406/0415 08010KT 9999 FEW012 PROB30 TEMPO 0406/0409 7000 HZ SCT008=
TAF LXGB 040541Z 0406/0415 08010KT 9999 FEW012 PROB30 TEMPO 0406/0409 2000 BR SCT003=
TAF LXGB 040609Z 0406/0415 08010KT 0500 FG SCT001 BKN006 BECMG 0406/0409 9999 NSW FEW012=

⁶ METAR LXBG 040450Z 07005KT 9999 SCT008 21/18 Q1017=
METAR LXBG 040550Z 07008KT 2500 VCFG SCT002 BKN012 21/20 Q1018 BECMG 4000 SCT007=
METAR LXBG 040650Z 06007KT 0400 FG SCT002 21/20 Q1018 BECMG 9000 FEW012=
METAR LXBG 040750Z 07010KT 6000 HZ SCT004 SCT011 23/20 Q1019 BECMG 9000 FEW012=
METAR LXBG 040850Z 08011KT 8000 HZ SCT004 SCT011 BKN012 22/20 Q1019 TEMPO FEW012=

⁷ It is considered as cloud ceiling from 5 octas, which correspond to terms BKN and OVC.

- At 08:50, ten minutes after the aircraft initiated the go around, the visibility had increased to 8,000 m, it was still hazy, there were scattered clouds at 400 and 1,100 ft and the cloud ceiling (5-7 octas) was at 1,200 ft.

1.7.3. *Meteorological information available to the crew*

When the crew started preparing for the flight at 04:35, the dispatch information they had included the latest automated METARs⁸ for 02:50 and 03:50, which reported maximum visibility and no clouds. The dispatch information did not include any TAF forecasts since they were not available at that time⁹.

By the time the crew reported to the aircraft, they had the first TAF forecast for the Gibraltar Airport, which called for conditions suitable for operating in Gibraltar (few clouds at 800 ft and a visibility of 7,000 m due to mist).

During the flight, the crew updated the weather information as they approached their destination. They noted in the onboard documentation the Gibraltar METARs for 06:50 and 07:50. The METAR available just prior to their approach to Gibraltar was the one from 07:50, which was provided by ATC at 08:10.

At 08:31, ten minutes before they initiated the go around, they again received weather information from the controller at Gibraltar, who asked the crew to confirm they would make the approach with haze and 6,000 m of visibility on the runway. These conditions were the same as those indicated in the last METAR issued.

1.7.4. *Meteorological conditions at the Tangiers and Málaga airports*

The weather information provided with the flight dispatch and the updated information collected by the crew during the flight showed that weather conditions at both the Tangiers and Málaga airports were both suitable for operations.

1.8. Aids to navigation

The ATC communications recordings, the radar data and the data from the quick access recorder were used to reconstruct the sequence of events described below.

The aircraft took off from the Birmingham Airport at 06:15 with a total weight of 66,370 kg. The arrival in Gibraltar was through the Seville ACC, which transferred the crew to Gibraltar Radar approach control (122.8 MHz) when they were northeast of the airfield at FL90. The crew kept in contact with Gibraltar radar until they were south of

⁸ Observation reports made with no human intervention. Labeled with the word AUTO.
040250 AUTO 07006KT 9999 // NCD 21/19 1017
040350 AUTO 08005KT 9999 // NCD 21/18 1017

⁹ The airport did not start operations until later.

the airfield, at which time they were transferred to Gibraltar Talkdown (130.4 MHz), with which they completed the approach to runway 09. After the missed approach maneuver, Gibraltar Talkdown transferred the crew back to the Seville ACC.

Figure 1 shows the descent into Gibraltar, the approach to runway 09 and the subsequent diversion to the Málaga Airport.

Cruise and descent to Gibraltar

- 08:10:50 UTC: In the cruise phase, and while still under Seville ACC control, the crew contacted Gibraltar radar to request weather information, with Gibraltar Radar providing it the 07:50 METAR.
- 08:28:25 UTC: Exchange between Gibraltar Radar and Seville ACC to coordinate the transfer level for the aircraft.
- 08:31:40 UTC: (Point 1, figure 1) Transferred to Gibraltar Radar northeast of the airfield at FL90. Gibraltar Radar confirmed the runway conditions, "Confirm you are happy to make an approach with 6 km in haze".
- 08:37:09 UTC: Turn to the west. Aircraft at 1,600 ft.

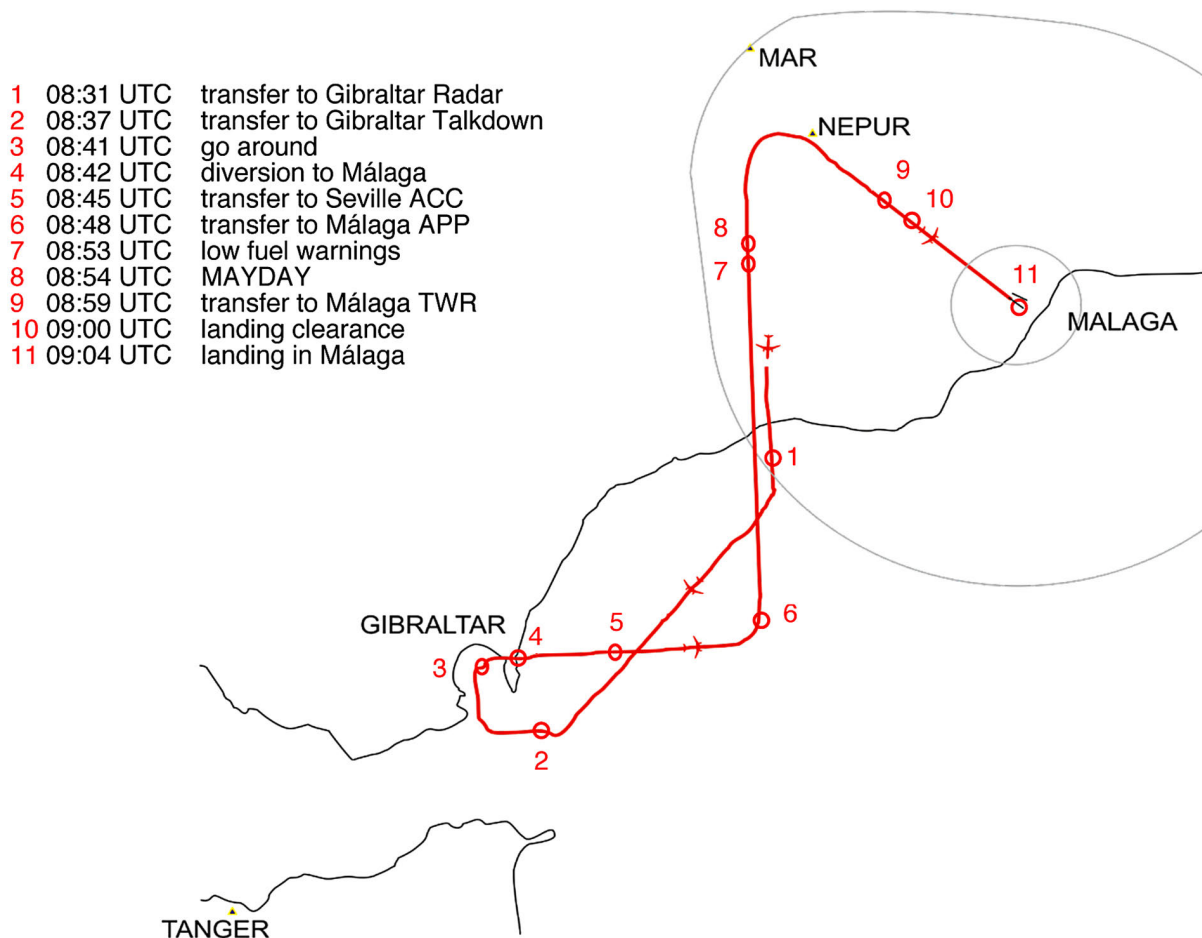


Figure 1. Approach to Gibraltar and diversion to Málaga

08:37:28 UTC: (Point 2, figure 1) Transferred to Gibraltar Talkdown. Aircraft southeast of the airfield at 1600 ft and flying west to join circuit south of the 6.0 NM point¹⁰.

Approach

08:38:48 UTC: Turn north. Aircraft at 1,600 ft.

08:39:16 UTC: Gear selected down. Aircraft at 1,561 ft.

08:39:54 UTC: Aircraft at 6.0 NM point of approach.

08:40:25 UTC: Aircraft heading north at 5.0 NM point on approach and at 1,550 ft. Descent started after being cleared by ATC.

08:40:44 UTC: Aircraft 4 NM out at 1,200 ft.

08:40:52 UTC: Landing clearance.

08:41:00 UTC: Aircraft 3.5 NM out at 1,050 ft.

08:41:04 UTC: (Point 3, figure 1) Input to throttles to increase thrust. Start of go-around maneuver. Aircraft at 1,039 ft. A second later, informs Gibraltar Talkdown, "MON446G going around". Total aircraft weight: 60,037 kg. Fuel¹¹: 2,307 kg.

08:41:06 UTC: Lowest point on trajectory: 1,014 ft.

08:41:16 UTC: Gear lever up. Aircraft at 1,256 ft climbing due east.

Decision to divert to Málaga

08:42:19 UTC: (Point 4, figure 1) The aircraft had just flown over the runway. In contact with Gibraltar, the crew reported being close on fuel and ask, "Any chance you can negotiate direct Málaga?" Gibraltar confirmed if they wanted to go to Málaga, with the crew responding, "If we can get a straight in approach now. If not, it'll be Tangiers." (08:42:30). Total weight: 59,947 kg. Fuel: 2,217 kg.

08:42:48 UTC: Exchange between Gibraltar Radar and Seville ACC to report diversion to Málaga. Crew instructed to fly direct to reporting point MARTIN (shown as MAR in figure 1) at FL90.

08:43:09 UTC: Crew notified of clearance to climb to FL90 and fly to MARTIN.

08:43:41 UTC: Gibraltar asked if they were "OK for fuel". The crew replied, "We're OK for fuel if we can get a straight-in approach" and requested FL200 for the segment. Gibraltar contacted Seville ACC to convey the FL200 request. The ACC replied they would try but to maintain FL90 for now and the same destination (MARTIN).

08:45:59 UTC: (Point 5, figure 1) Aircraft climbing heading east. Transferred to Seville ACC. Flight level authorized: FL100.

08:48:23 UTC: (Point 6, figure 1) Transferred to Málaga APP. Requested direct approach. Aircraft at FL100, which it would maintain for the rest of the flight.

¹⁰ The 6.0 NM point is a point on the approach maneuver to runway 09 (see section 1.10 and figure 2).

¹¹ Calculated based on the aircraft's zero fuel weight of 57,730 kg (see section 1.16.4).

Emergency declaration

- 08:53:31 UTC: (Point 7, figure 1) Low fuel warnings.
- 08:54:28 UTC: Request to descend and direct to NEPUR for approach. Málaga APP denied request due to traffic, informed crew they were number 6 in the sequence and instructed them to maintain heading for MARTIN.
- 08:54:37 UTC: (Point 8, figure 1) Fuel emergency declaration. "In that case, MAYDAY MAYDAY MAYDAY fuel emergency". Málaga APP immediately instructed three aircraft on approach to divert to give priority to the aircraft in distress. Total aircraft weight: 59,186 kg. Fuel: 1,457 kg.
- 08:56:02 UTC: Cleared for ILS approach to runway 13.
- 08:57:17 UTC: APP Málaga asked what kind of assistance they needed. The crew replied none, that it was a fuel emergency.
- 08:59:34 UTC: (Point 9, figure 1) Transferred to Málaga TWR.
- 09:00:41 UTC: (Point 10, figure 1) Aircraft established on localizer. Cleared to land.
- 09:04:56 UTC: (Point 11, figure 1) Landing in Málaga. Total weight: 58,967 kg. Fuel: 1,237 kg.

On 4 July 2014, the only traffic at the Gibraltar Airport between 08:00 and 09:00 was flight MON446G. At 07:37 another aircraft did a go around due to a lack of visibility caused by low clouds (8000 m visibility, haze and scattered clouds at 400 ft). It managed to land on the second attempt at 07:47.

1.9. Communications

The most relevant communications were included in the trajectory and are shown in section 1.8.

1.10. Aerodrome information

The Gibraltar Airport is a dual-use (civil and military) airport owned by the United Kingdom. The airport is at an elevation of 12 ft and it has a single 1,829 m asphalt runway in a 09/27 orientation. It is regarded as one of the most dangerous airports in the world due to the location of the 1,420 ft high Rock of Gibraltar next to the runway, to the presence of birds, to the wind currents in the Straits of Gibraltar and by the effects of turbulence and windshear around the Rock. These features are described and included in the information published on the airport, which includes a chart devoted to the effects of the wind.

Figure 2 shows the surveillance radar approach (SRA) used by the aircraft on the incident flight¹².

¹² This is the chart used by the operator for a surveillance radar approach (SRA). A SRA uses radar vectors from ATC, along with a step-down approach, to guide the aircraft to the minimums, from where the crew is expected to report "runway in sight". From there, the approach is completed using visual references.

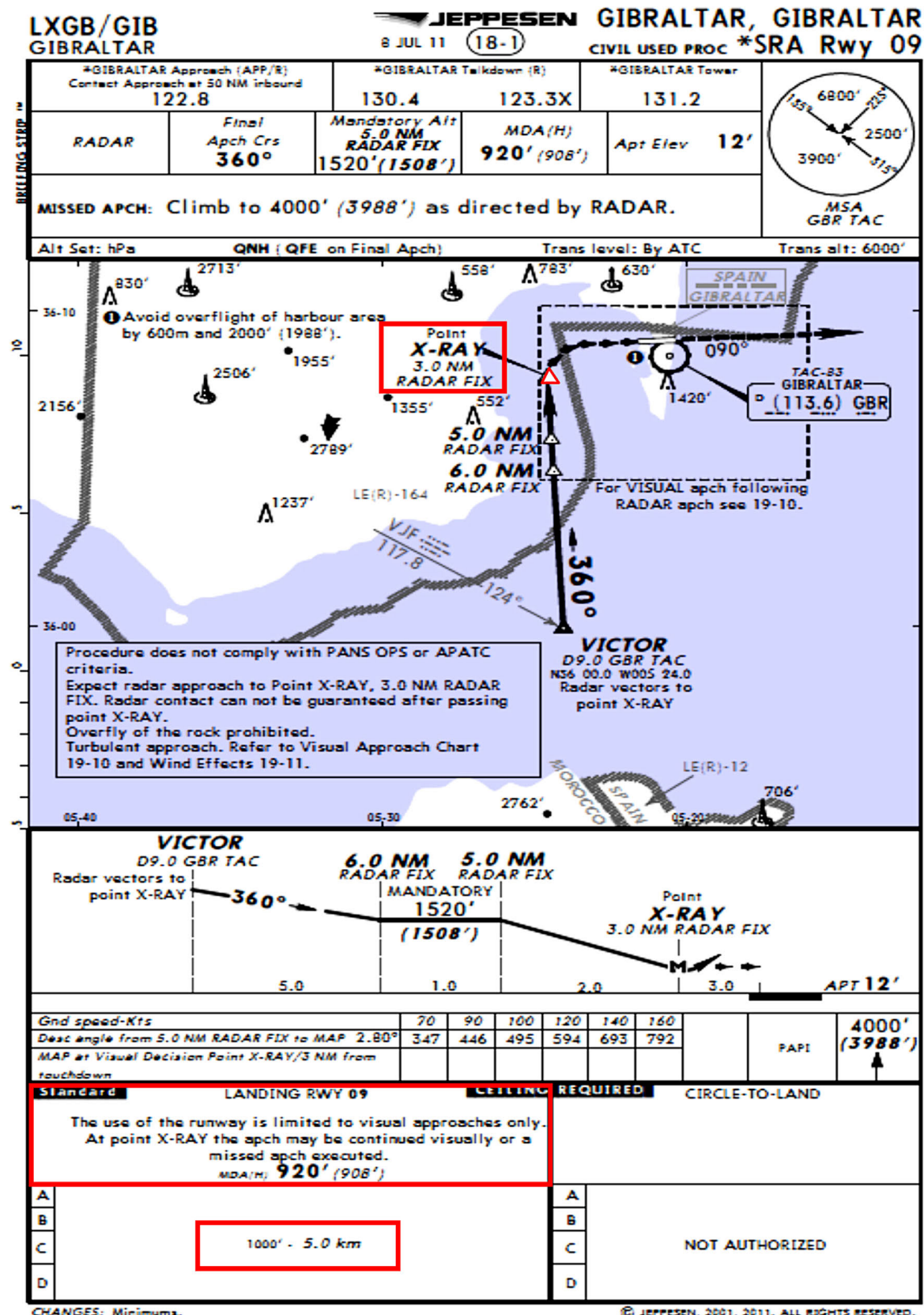


Figure 2. Approach procedure for runway 09 at the Gibraltar Airport

The procedure¹³ begins with a radar approach that passes through three points located 6, 5 and 3 NM out (shown in figure 2). These points are called 6.0 NM, 5.0 NM and X-RAY on the approach chart. The controller leaves the aircraft at point X-RAY (3 NM), which is not lined up with the runway. From there, the crew must make a 90° right turn to line up with the runway. After X-RAY, radar coverage is not guaranteed and the approach continues visually. If the crew cannot establish visual contact with the runway, a missed approach must be executed. The minimum descent altitude published on the chart is 920 ft.

The weather requirements for civil aircraft operations at the Gibraltar Airport are a cloud ceiling (BKN or OVC) at 1,000 ft or higher and a visibility of or greater than 5 km.

1.11. Flight recorders

The aircraft was equipped with a flight data recorder (FDR), a quick access recorder (QAR) and a cockpit voice recorder (CVR). The incident was reported via the event notification system, which subsequently informed the CIAIAC of the event. This process delayed the decision to commence an investigation into the event by 18 days, meaning the CVR data were not preserved. The flight data of most relevance to the incident are shown as part of section 1.8.

1.12. Wreckage and impact information

The aircraft was not damaged during the incident.

1.13. Medical and pathological information

No one was injured during the incident.

1.14. Fire

There was no fire in the aircraft.

1.15. Survival aspects

There was no emergency evacuation. After landing in Málaga, the aircraft taxied normally to its parking stand without assistance from emergency services.

¹³ The approach procedures for civil use do not satisfy the ICAO PANS/OPS design criteria (procedures for air navigation services – aircraft operations). This is noted on the chart.

1.16. Tests and research

1.16.1. *Captain's statement*

According to his statement, on the day of the incident the captain felt rested and in perfect condition for the flight. They went on duty at 04:35. He felt he was familiar with the characteristics of the Gibraltar Airport.

Flight planning: The airline gave them information from the two automatic METARs from Gibraltar. He knew that the TAF would be issued as soon as the Gibraltar office opened, and he asked the company's operations department to send the TAF to his mobile as soon as it was issued. They asked for 8,800 kg of fuel to be taken on, based on the 8,756 kg of fuel required by the calculations, assuming Tangiers as the alternate airport. They received the TAF and verified that the conditions¹⁴ satisfied the operating minimums at Gibraltar.

Cruise: during the flight they received the 06:50 and 07:50 METARs. In the final stages of the cruise phase, the captain started programming the alternate routes into the FMGS (Flight Management and Guidance System). At that point he realized that the Tangiers Airport was not in the database. He thought it too late to enter and generate a new airport and its approaches in the FMGS, so he specified the shortest possible route to runway 13 at Málaga via points PIMOS-MARTIN-ILS13 in the FMGS. They continued with the flight and held the approach briefing, with Tangiers as the alternate airport.

Approach and go around: during the approach to runway 09, they noticed that the clouds around the airport were located on the final approach path. They descended to 1,000 ft, but they were still above the clouds and, since they did not have visual contact with the runway, they decided to go around.

Diversion to Málaga: during the initial ascent after the go-around, the FMGS was indicating that a diversion to Málaga was possible, though they would arrive with final reserve fuel, though only if they flew direct. During the segment to MARTIN, they received the low fuel warning for the left wing tank (L WING TK LOW FUEL), followed shortly thereafter by the combined warning for both tanks (L+R WING TK LOW FUEL). Associated with these warnings was a message instructing them to land as soon as possible (LAND ASAP).

Despite knowing there were other aircraft arriving at Málaga, they asked ATC to fly direct to NEPUR to make a direct approach, at which point ATC informed them they were number six to land. At that point, the captain asked the first officer to declare a fuel emergency. They had approximately 1,400 kg of fuel, with 1,200 kg predicted at

¹⁴ Meaning the weather conditions.

landing. ATC gave them priority and the landing was eventually made with 1,280 kg of fuel.

The captain had diverted to both Tangiers and Málaga before, and even though Tangiers was the closest airport, they preferred Málaga from a commercial standpoint, as it was easier to transport the passengers after landing.

1.16.2. *First officer's statement*

The first officer's statement matched that of the captain. The additional details provided by the first officer in his statement are provided below.

Flight planning: they picked up the flight information and, since there was no TAF for the destination airport, he suggested they take on fuel for two alternate airports. After talking it over with the captain, and since they expected to receive the TAF before takeoff, they initially decided to take on the fuel calculated for a single alternate airport, and if the TAF did not arrive, to take on more fuel and add a second alternate airport. After receiving the TAF and evaluating it, they decided not to take on more fuel.

Cruise: during the flight, they received the 06:50 METAR, which gave a visibility at Gibraltar of 400 m. He and the captain discussed this information and the likelihood that it would improve during the rest of the flight. They agreed that the first officer would contact Gibraltar as soon as they were able to in order to ask for weather information. If the conditions did not satisfy the operating minimums, they would divert there and then to Málaga. The next weather information they received from Gibraltar indicated that conditions were improving, as indicated by the forecasts, and that conditions were suitable for landing at Gibraltar. They held the briefing considering Tangiers as the alternate, but kept Málaga as an option. Since Tangiers was not in the database, they noted that the deviation would have to be done without relying on the FMGS.

Approach and go around: during the approach, they saw there were clouds at 700 ft. The captain stated they had sufficient fuel to go to Málaga and that he would rather divert to that airport. He told the first officer to ask if direct was possible. He saw no problems in going to Málaga since both pilots knew the airport and the weather conditions were good. The first officer was handling the communications with ATC.

1.16.3. *Flight plan*

The crew filed a flight plan that indicated Tangiers and Málaga as the first and second alternate airports, with an estimated takeoff time of 05:30.

1.16.4. Operational flight plan

The investigators obtained the operational flight plan, including the crew’s notes. Figure 3 shows an extract from the operational flight plan involving the fuel planning. These calculations indicate that:

- a) Only the fuel expected to be needed for the operation was taken on before takeoff.
- b) The trip fuel calculation did not have to be corrected¹⁵ for the increased weight of the aircraft.
- c) No fuel in excess of the contingency fuel calculated was added.
- d) They took on fuel for Tangiers as the alternate airport, which worked out to 760 kg of fuel flying at FL100. They did not take on fuel for a second alternate.
- e) The final reserve fuel was 1,217 kg.
- f) They did not add maneuvering fuel¹⁶.
- g) They did not add additional fuel for anti-ice procedures.

Therefore, the fuel amount required (REQD), assuming Tangiers as the alternate airport, was 8,756 kg (the captain took on 8,800 kg). The aircraft’s estimated zero fuel weight (EZFW) was 58,244 kg. This means that once the before-takeoff fuel (160 kg for APU/TAXI) was consumed, the aircraft’s estimated takeoff weight was 66,840 kg. This figure

EZFW	58244	COST INDEX	12	FORECAST TIME	03/07/13 1800
DIST	1042NM	COMP	6	CORR	AV TR 189 ALL WEIGHTS KGS
a-APU/TAXI	160				5 MINS TAXI = 57 KGS
b-TRIP	6419	2:24			BURN CORR 96 PER 1000 KGS
c-CONT3%	200				CONT5%= 321 NOMINATED ERA
d-ALTN	760	0:19			GM TT TANGER /OTHER
e-F/RSV	1217	0:30			
REQD	8756	3:13			
ADJ	0				
g-MNVR	0				
h-ANTICE	0				
FOB	8.8				
RES d+e	1977				

	ALTERNATES LIST	DIST	TK	COMP	TIME	FUEL	MSA	FL
F	GM TT TANGER	57	228	9	0:19	760	9.4	100
C	LEMG MALAGA	155	052	-8	0:33	1595	9.4	270
	GM TN TETOUAN	59	178	-3	0:19	788	9.4	110
	LEZL SEVILLE	151	341	2	0:33	1560	9.4	270
	LEJR JEREZ	195	316	5	0:39	1829	9.4	320

Figure 3. Fuel calculations for the incident flight (operational flight plan)

¹⁵ If the actual weight had been greater than calculated, the flight plan considered a consumption correction of 96 additional kg for every 1,000 kg of excess weight (BURN CORR 96 PER 1,000 KG). It did not have to be applied in this case.

¹⁶ Fuel loaded on when the crew does not expect to make a direct approach. See section 1.17.

was used to do all the performance and in-flight consumption calculations, which did not have to be corrected.

The QAR data showed that at takeoff, the aircraft weighed 66,370 kg, 470 kg under the estimated weight. This condition was favorable to the conduct of the flight. Considering the fuel taken on (8,800 kg), and assuming the 160 kg of before-takeoff fuel was consumed, yields an actual zero fuel weight (ZFW) for the aircraft of 57,730 kg.

The flight plan was designed for a cruise level of FL370. Had this level not been available for whatever reason (weather, ATC instructions, etc.), the operational plan offered fuel usage and flight time data for the new conditions. It also provided information on five alternate airports in order of preference (figure 3), with Tangiers being the first and Málaga the second. The OFP showed the distance to each, the wind, the time, the flight level and the fuel needed. To reach Málaga, the OFP indicated a distance of 155 NM and showed they would 1,595 kg of fuel flying at FL270.

The OFP contained hand-written entries made by the crew at various points during the flight indicating fuel usage, time and wind information, which showed they were experiencing no significant deviations from the plan.

1.17. Organizational and management information

The operator's Operations Manual specifies the following criteria:

- Regarding the selection of the alternate airport (OM Part A, 8.1.3.1): the alternate airports are to be selected bearing in mind the weather conditions expected upon arrival, which must satisfy the minimums specified by the operator.
- Regarding the number of alternate airports (OM Part A, 8.1.2.7)¹⁷: for flights such as the incident flight, one or two alternate airports will be selected. Two alternate airports will be selected when:
 - there is no weather information for the destination airport, or
 - when the weather conditions forecast or reported at the destination airport within ± 1 hour of the estimated arrival time indicate the conditions will be below the operating minimums (in this case, 1,000 ft cloud ceiling and a visibility of 5 km).
- Regarding the fuel amount (OM Part A, 8.1.7.1): the required fuel for flights will be the sum of:
 - APU/Taxi: the fuel needed before takeoff.
 - TRIP: the fuel needed for the flight.
 - CONT3%: the contingency fuel, which in this case is 3% of the trip fuel.

¹⁷ These criteria are specified in EU-OPS 1.295 (d) Selection of aerodromes.

- ALTN: the fuel needed to fly from the destination airport to the alternate airport. If two alternate airports are selected, the higher of the two values will be used to calculate the alternate fuel.
 - F/RSV: the final reserve fuel needed to hold for 30 minutes at 1,500 ft.
 - ADJ: additional fuel for certain types of flights.
 - MNVR: maneuvering fuel for when a direct approach is not expected.
 - ANTICE: the fuel needed for anti-ice procedures.
 - EXTRAFUEL: any additional fuel that, in the captain's judgment and justified beforehand, may be required. The reasons may be adverse weather conditions forecast, holding patterns, etc.
- Regarding the fuel policy and management in flight (OM Part A, 8.3.7.5):
 - Priority for the approach and landing is to be requested if the fuel after landing is expected to be less than final reserve fuel (F/RSV)¹⁸:
 - The captain will declare an emergency when the fuel onboard is less than final reserve fuel (F/RSV).
 - Regarding the Gibraltar Airport (OM Part D):

The operator considered the Gibraltar Airport as a category C airport, with a detailed study of the airport's characteristics and specific training. Due to the high complexity of operating at the airport, the operator had issued a special briefing to underscore the special characteristics of operations at the Gibraltar airport. This briefing differentiated between the operational and commercial aspects of the airport. Of particular relevance to this incident are the following:

- It describes the meteorological and geographical difficulties at the airport.
- It places special emphasis on interrupting the maneuver if there is no visual contact with the runway.
- The operator indicates Málaga as the preferred alternate airport.

1.18. Additional information

After the incident, the operator added the Tangiers Airport to its Flight Management and Guidance System database.

1.19. Useful or effective investigation techniques

None.

¹⁸ This criterion is less restrictive than EU OPS 1.375 (b.3), In-flight Fuel Management, which specifies that in this situation, the captain will declare an emergency. In addition, the ICAO has adopted new phraseology involving in-flight fuel management that will modify requirement EU OPS 1.375 (b.3). This modification is the subject of an EASA information bulletin (SIB 2013-12), which recommends to operators that they include this phraseology in their operations manuals.

2. ANALYSIS

At 06:15 on Thursday, 4 July 2013, aircraft G-OZBW, operated by Monarch Airlines, took off from the Birmingham airport en route to the Gibraltar Airport. The crew, after attempting an approach at the destination airport, diverted to the Málaga Airport even though the fuel planning calculation had used the Tangiers Airport as the alternate.

The analysis of this incident was divided into three sections that analyze the suitability of making the approach to Gibraltar; of not attempting a second approach and of changing the initial decision regarding the alternate airport. The following conclusions were reached:

- From a meteorological standpoint, diverting to another airport en route and not attempting the approach to the Gibraltar Airport would not have been justified.
- The specific hazards at the Gibraltar Airport, regarded as one of the most dangerous in the world, validate the crew's decision to interrupt the approach and not make a second attempt.
- The fuel planning in Birmingham was carried out properly and considered one alternate airport, and not two, due to the existence of weather information.
- The decision to load fuel for Tangiers as the alternate airport did not leave them enough fuel to go to Málaga. Despite this, the crew's decision to change alternate airports could have been affected by:
 - Having Málaga as the preferred alternate airport in the operator's briefing, despite not being reflected in the operational flight plan.
 - Not having Tangiers in the FMGS.
 - The possibility of diverting to Málaga following the direct route shown by the FMGS, even though this required traffic and flight level conditions that were unlikely.

2.1. Decision to make the approach to Gibraltar

After taking off from Birmingham, the flight of aircraft G-OZBW transpired normally and with no significant deviations in terms of the anticipated times, fuel use and winds.

The special nature of the Gibraltar Airport meant the crew was mindful of obtaining information on the weather at their destination. So mindful, in fact, that about two hours before arriving the crew were already gathering weather information on Gibraltar (06:50 METAR). The first METAR they obtained indicated conditions below the operating limits at Gibraltar, but it called for improved conditions (expecting no clouds below 1,200 ft and a visibility of 9,000 m). The crew's assessment at that time was correct, and they opted to continue with the flight, as they were still two hours

away and improved conditions were forecast. Even so, they decided that if conditions did not improve, they would divert as soon as they received the next weather information.

Weather conditions did in fact improve, though not as much as forecast. The 07:50 METAR indicated that visibility and cloud ceiling conditions satisfied the conditions to operate at Gibraltar, and it continued to forecast the same improvements as the previous METAR. This forecast was correct in terms of the visibility, but not in terms of the clouds. At 08:10, the crew received the latest METAR available (07:50) and decided to continue to their destination.

At 08:31 the aircraft was transferred to the Gibraltar Radar facility. At that time there was haze in Gibraltar with 6,000 m of visibility and two layers of scattered clouds, at 400 and at 1,100 ft. This situation satisfied the operating minimums (cloud ceiling at 1,000 ft and visibility of 5 km) and had been known to the crew 20 minutes earlier and confirmed by the controller at Gibraltar. In other words, from a meteorological standpoint, not attempting to reach their destination or diverting to the alternate at that point would not have been justified.

Minutes later they commenced their surveillance radar approach (SRA) to runway 09, joining the approach from the east, south of the 6.0 NM reporting point. The aircraft continued the approach, following the established flight profile. It was the only aircraft at that time, meaning the aircraft was tracked, attended to and monitored constantly and without interruption by Gibraltar ATC.

At 08:41 the aircraft reached the 3.0 NM decision point, where the crew had to establish visual contact with the runway to continue the approach. The crew stated that the clouds were on the approach path and prevented them from establishing visual contact. This information is consistent with the METAR that was issued 10 minutes later, which indicated scattered clouds (3-4 octas of cloud cover) at 400 and 1,000 ft, and with the weather maps that showed the presence of low clouds. Due to the aircraft's altitude at the decision point, it was the clouds located at 400 ft that must have affected them. In this incident, the clouds, not the visibility, were the deciding factor, and even though neither the extent nor altitude of the cloud layers impeded attempting the approach, they did prevent its completion.

As specified in the operator's Operations Manual, it was the captain who was making the approach and landing. The decision to go around was correct given their situation and the airport involved. The captain, who had considerable flying experience on the aircraft and at the Gibraltar Airport, made the decision at the right moment (the decision point), and did not delay the start of the go around or informing ATC. The operator's policy in this regard is very clear due to the particular complexity of this airport, and states that if the conditions required to make a safe approach and landing are not present, to interrupt the maneuver.

2.2. Decision not to attempt a second approach

The crew did not attempt to make a second approach to the Gibraltar Airport after the go around. This decision was correct in light of the airport's characteristics. Perhaps at another airport, this same crew would have tried to land a second time, but at this one they did not consider it. This decision is in keeping with the operator's policy regarding the operational hazards present at this airport.

Considering the airport in question, that the conditions could not change much by the time they attempted a new approach and that the forecast for improved conditions issued almost two hours earlier had not been correct, the crew's decision to divert to another airport is understandable. A second attempt did not guarantee a safe landing, and the amount of fuel also limited the number of options available to them.

2.3. Decision to go to the Málaga Airport as their alternate

There were no significant deviations during the flight and their fuel use was as expected. The crew started the approach to Gibraltar with the expected amount of fuel. As a result, any subsequent fuel problems cannot be attributed to excessive fuel use during the earlier phases of the flight.

The pre-flight fuel planning conditioned the rest of the flight. They took on only enough fuel for one alternate airport, since the Gibraltar TAF was available to them prior to takeoff and it indicated conditions were favorable for landing. In other words, the fuel planning was correct and all of the requirements specified in the Operations Manual were complied with.

The operator's documentation exhibits some discrepancies as regards the selection of the alternate airport for fuel planning purposes. On the one hand, the Gibraltar Airport briefing stated that Málaga was the preferred alternate airport, but on the other, the operational flight plan indicated Tangiers as the alternate airport. In this case, the captain logically accepted the planning that the company proposed in the OFP, with Tangiers as the first destination in the event of a diversion.

Given the little difference in the fuel amounts needed to go to Málaga as the alternate instead of Tangiers (760 vs 1,595 kg), the fact that Gibraltar Airport has a high likelihood of requiring a go around or a diversion to other airports, and that Málaga was the preferred airport from a commercial standpoint, a recommendation is issued to the operator so that it consolidate its criteria in terms of what the alternate airport for Gibraltar is, and so that it take the measures needed to reflect this decision in the fuel and operational flight plans prepared for its crews.

This discrepancy in the alternate airports was influential in this incident. It was present while preparing the landing briefing, in which the crew considered Málaga as a possible alternate airport. Combined with this is the fact that the Tangiers Airport was not in the FMGS database¹⁹, even though the Tangiers Airport presents no complications and diverting there would not have given this crew any problems. This also weighed more on the crew's decision to opt for Málaga than it should have when they made the decision to divert.

2.3.1. *Fuel*

Since the trip fuel was planned with Tangiers as the alternate airport, the aircraft had 2,307 kg of fuel when the crew initiated the go-around procedure. This meant they had 1,090 kg of fuel available for the diversion, since the aircraft was required to finish the flight with no less than 1,217 kg of reserve fuel. This amount was 505 kg below that specified in the flight plan (1,595 kg) to divert to Málaga.

Despite this, the crew considered the data provided by the FMGS, assuming a direct route to Málaga, which showed they could make it if they followed this route. In fact, the final fuel consumption on this segment was 1,070 kg and the aircraft landed with 20 kg of fuel above the required fuel thanks to the priority they received from Málaga APP over all other traffic, and which allowed them to shorten their approach. The time required for the diversion was 9 minutes under the time estimated in the flight plan.

This fuel value used by the crew when deciding the viability of going to Málaga as their alternate airport required very favorable conditions during the flight: a direct approach, the absence of other aircraft to wait behind and flying at too high a flight level (FL 270). None of these conditions was satisfied.

As a result, during the segment to Málaga, the fuel amount fell below 1,500 kg, causing the low fuel warnings to be received in the cockpit. About one minute later, with 1,457 kg of fuel, the crew declared a fuel emergency after seeing they were not being given priority or direct vectors to their planned route, and because there were five aircraft ahead of them in the approach sequence.

2.3.2. *Communications with ATC*

The crew's decision to go to the Málaga Airport was conditioned by, among other factors, a fuel calculation in the FMGS that showed it was possible to divert if certain traffic and flight level conditions were satisfied. Since the crew knew the airport, they

¹⁹ Since the operator has already addressed this concern by including this airport into its fleet's database, no safety recommendation is issued in this regard.

must have realized that these conditions were unrealistic and that the decision was at the limit, which is why they conveyed their factors to ATC, in this case Gibraltar Talkdown.

For one and a half minutes during the go around, the crew informed Gibraltar Talkdown three times that they would go to Málaga if they could fly direct. The aircraft at that point was still in position to divert to Tangiers, as they were climbing on the runway heading. They were still deciding and were within the decision window to proceed to Tangiers or Málaga.

Conveying these factors to ATC was inappropriate. The decision should have been made by the crew and then relayed to ATC, which is what ATC expects. ATC also did not have the information they needed to reply. Even if they had wanted to confirm the conditions, Gibraltar Talkdown would have had to contact the Seville ACC, and this ACC with Málaga APP, which is the facility that might have had this information. The crew would not have been able to wait for this sequence of messages to be relayed and would have had to make their decision sooner.

The conditions that the crew relayed to ATC were interpreted as a decision that had been made already. ATC assumed that the crew wanted to proceed to Málaga, and that is what was passed along to the other facilities (Seville ACC and Málaga APP), even though the flight levels and direct route requested by the crew were also relayed. That is why the crew were instructed to proceed to Málaga, and why they never received confirmation that they could fly direct.

2.3.3. *Flight level used to calculate the fuel to the alternate*

Lastly, we consider the fact that the flight plan showed the fuel consumed at FL270. This level is unrealistic for the distance involved (155 NM) and for the airspace between Gibraltar and Málaga. This was reflected in the incident flight when, despite the repeated requests by the crew for FL200, ATC assigned them FL90 and FL100. This suggests that the fuel calculated for the diversion to Málaga should have been higher, since the actual flight levels were well below those in the plan. As a result, a safety recommendation is issued to the operator to have it check the flight levels used in the fuel calculations for the alternate airports included in their flight plans.

2.3.4. *MAYDAY declaration*

The crew's decision to issue a MAYDAY to report their situation was correct and consistent with the EU OPS regulations. The MAYDAY term alerts ATC and other crews in the area to the gravity of their situation so they can act accordingly. In this

case, the requirement in the operator's Operations Manual is less stringent than the regulation (EU OPS 1.375), instructing crews to request priority and not declare an emergency.

Since EU OPS 1.375 will be amended in the near future to incorporate the terminology approved by the ICAO for in-flight fuel management, and since the EASA SIB 2013-12 already recommends to operators that they incorporate these changes into their operating procedures and manuals, a safety recommendation is issued to the operator that it update its Operations Manual to reflect the new phraseology requirements pertaining to fuel, as specified in Amendment 36 to ICAO Annex 6, which will be incorporated into the EU OPS and are already contained in EASA SIB 2013-12.

3. CONCLUSIONS

3.1. Findings

General:

- The aircraft had the necessary licenses to make the flight.
- The crew had the necessary licenses to make the flight.
- The aircraft took off from the Birmingham Airport at 06:15 and landed at the Málaga Airport at 09:04 after executing a missed approach at the Gibraltar Airport.
- The weather conditions at the Gibraltar Airport satisfied the operating minimums. The two METAR reports issued prior to the approach, and which forecast improving conditions, were only partially correct, in that the visibility improved but the cloud situation did not.
- From a meteorological standpoint, it would not have been justified to divert while en route to an alternate airport without first attempting to land at Gibraltar.
- Almost two hours before their scheduled arrival time, the crew started gathering information on the weather conditions at the Gibraltar Airport.
- The crew were unable to establish visual contact with the runway when they reached the decision point due to the presence of clouds, which was confirmed in the METAR reports from before and after the maneuver and in the weather maps.
- The crew did not attempt a second approach at the Gibraltar Airport.
- The crew declared a fuel emergency while en route to the Málaga Airport.
- Málaga APP diverted other traffic and gave priority to the aircraft to land.
- The landing was normal and there was no emergency evacuation.

As concerns the alternate airports to Gibraltar:

- The flight planning considered a single alternate airport, Tangiers, for fuel calculation purposes, as indicated on the operational flight plan.
- Planning alternate fuel for a single alternate airport, and not two, was in keeping with the requirements in the Operations Manual and in EU OPS.
- The operational flight plan had been prepared to use Tangiers (57 NM away) as the first alternate and Málaga (155 NM away) as the second alternate airport.
- The special briefing for the Gibraltar Airport specified that Málaga was the preferred alternate airport for Gibraltar, but this criterion had not been reflected in the operational flight plan.

Regarding fuel:

- There were no deviations from the flight plan during the flight in terms of time or fuel use.
- The aircraft initiated the go-around procedure with less fuel than required in the operational flight plan to divert to Málaga.

- During the diversion to Málaga, the crew received low fuel warnings for both tanks.
- After being denied priority and since they were sixth in the approach sequence, the crew declared a fuel emergency with 1,457 kg of fuel.
- Thanks to being given priority over other traffic by ATC and to being allowed to make a direct approach, the aircraft landed with final reserve fuel plus 20 kg.

Regarding the operator:

- The operator had a special briefing for the Gibraltar Airport due to the dangers associated with it.
- The operator's documentation underscored how crews should not continue with the approach if a safe approach and landing could not be guaranteed.
- The Tangiers Airport was not included in the aircraft's FMGS database. The operator took steps after the incident to include this airport in all its aircraft.

3.2. Causes/Contributing factors

The incident involving aircraft G-OZBW occurred when the crew decided to head to the Málaga Airport as their alternate instead of the Tangiers Airport, which had been used in the fuel calculation. The impossibility of making a direct approach and the prospect of having to wait due to the presence of other traffic on approach to the Málaga Airport forced the crew to declare a fuel emergency.

Contributing to the incident were:

- The discrepancy in the operator's documentation regarding which is the alternate airport to Gibraltar (Tangiers or Málaga).
- The absence of the Tangiers Airport in the FMGS database.

4. SAFETY RECOMMENDATIONS

- REC 52/15.** It is recommended that the operator, MONARCH AIRLINES, reviews its operational documentation to ensure that adequate procedures and policies are in place for the selection of preferred alternate airfields. This decision should be reflected in the fuel planning which is included in the operational flight plan.
- REC 53/15.** It is recommended that the operator, MONARCH AIRLINES, reviews the flight levels used to calculate the fuel required for the nominated alternates in the operational flight plan. This recommendation is issued as a consequence if the inadequate flight level used after the diversion.
- REC 54/15.** It is recommended that the operator, MONARCH AIRLINES, adjusts the requirements on its Operations Manual 8.375 regarding emergency calls in case of on board fuel issues to reflect EASA SIB 2013-12.
- REC 55/15.** It is recommended that the United Kingdom's Civil Aviation Authority audits the requirement 8.375 of the MONARCH AIRLINES Operations Manual regarding emergency calls in case of on board fuel issues, as per EASA SIB 2013-12.

