CIAIAC

COMISIÓN DE
INVESTIGACIÓN
DE ACCIDENTES
E INCIDENTES DE
AVIACIÓN CIVIL

Report IN-036/2013

Incident involving a Boeing 737-800 aircraft, registration G-FDZG, operated by Thomson Airways, while on approach to the Fuerteventura airport (Spain) on 22 August 2013

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

AAL	Altitude above aerodrome level
ACARS	Aircraft communications addressing and reporting system
ACC	Area control center
ADI	Aerodrome rating
AENA	Aeropuertos Españoles y Navegación Aérea
AESA	Spain's National Aviation Safety Agency
AIP	Aeronautical Information Publication
APP	Approach control
APU	Auxiliary power unit
ATC	Air traffic control
ATIS	Automatic terminal information service
ATPL(A)	Airline transport pilot license (airplane)
CAA	Civil Aviation Authority (United Kingdom)
CAVOK	Ceiling and visibility OK
CECOA	Airport coordination center
CDFA	Continuous descent final approach
CIAIAC	Spain's Civil Aviation Accident and Incident Investigation Commission
CVR	Cockpit voice recorder
DA	Decision altitude
DH	Decision height
DME	Distance measuring equipment
EGKK	London Gatwick airport identifier
EGPWS	Enhanced ground proximity warning system
EU	European Union
FCL	Flight crew license
FDM	Flight data monitoring
FDR	Flight data recorder
FIR	Flight information region
FL	Flight level
FMGS	Flight management and guidance system
FMS	Flight Monitoring System
Fpm	Feet per minute
ft	Feet
G	Gravity
GCFV	Fuerteventura airport identifier
GCLP	Las Palmas airport identifier
GCRR	Lanzarote airport identifier
GCTS	Tenerife South airport identifier
GMAD	Agadir-Al Massira airport identifier
GMC	Ground movement control
GMMX	Marrakech airport identifier
IAF	Initial approach fix
IAS	Indicated airspeed
ICAO	International Civil Aviation Organization
IMC	Instrument meteorological conditions
ILS	Instrument landing system
IR	Instrument rating
JAR	Joint Aviation Regulations
Kg	Kilograms
Km	Kilometers
Kt	Knots
LNAV	Lateral navigation
m	Meters
MAP	Missed Approach Point
mb	millibars

MCP	Mode Control Panel
MDA	Minimum descent altitude
METAR	Aviation routine weather report
Min	Minutes
MHz	Megahertz
NDB	Non-directional beacon
NOTAM	Notice to airmen
NM	Nautical miles
OFP	Operational Flight Plan
OM	Operations Manual
PANS/OPS	Procedures for air navigation services – aircraft operations
PAPI	Precision approach path indicator
PF	Pilot Flying
PFD	Primary flight display
PM	Pilot Monitoring
P-RNAV	Precision area navigation
QAR	Quick access recorder
QNH	Pressure adjusted to sea level
RAD	Radar control
RPM	Revolutions per minute
S/N	Serial number
SOP	Standard Operating Procedures
SPD	Speed
TACAN	Tactical air navigation
TAF	Aerodrome forecast
TLB	Technical log book
TMA	Terminal control area
TWR	Control tower
UTC	Coordinated universal time
VNAV	Vertical navigation
V/S	Vertical speed
VOR	VHF omnidirectional range
ZFW	Zero-fuel weight

Synopsis

Owner and Operator:	Thomson Airways
Aircraft:	Boeing 737-800, registration G-FDZG
Date and time of incident:	Thursday, 22 August 2013 at 10:50[1]
Site of incident:	Fuerteventura Airport (GCFV)
Persons onboard:	7 crew and 169 passengers, no injuries
Type of flight:	Commercial air transport - scheduled - international - passenger
Phase of flight:	Approach
Date of approval:	25 November 2015

Summary of the incident

On Thursday, 22 August 2013, a Boeing 737-800, registration G-FDZG, operated by Thomson Airways, which had taken off from the London Gatwick Airport (EGKK) on a scheduled flight with 176 persons onboard, was on approach to its destination airport on the island of Lanzarote (GCRR).

While on the downward leg of the approach to runway 03, they were instructed to modify their maneuver due to changing wind conditions and proceed to the LTE VOR to make a VOR approach to runway 21. While on final approach to runway 21, the approach became destabilized, as a result of which the crew executed a missed approach.

Due to the difficulties they encountered on the approach, the crew decided to proceed to their alternate airport on the island of Fuerteventura, where they were cleared for a visual approach. Since the fuel remaining was nearing final reserve fuel, the crew declared an emergency (Mayday).

The landing was normal and the passengers left the aircraft in an orderly fashion. There was no need to do an emergency evacuation.

[1] All times in this report are local. To obtain UTC, subtract one hour from local time.

1. FACTUAL INFORMATION

1.1. History of the flight

On Thursday, 22 August 2013, a Boeing 737-800, registration G-FDZG, operated by Thomson Airways and with callsign TOM85Y, which had taken off from the London Gatwick Airport (EGKK) on a scheduled flight with 176 persons onboard, was on approach to its destination airport on the island of Lanzarote (GCRR).

After planning an approach to runway 03 and while on the downwind leg, they were instructed to proceed to the LTE VOR and make a VOR approach to runway 21, since changing wind conditions required a change in runway. Once on the final approach, a sudden change in the wind destabilized their approach, as a result of which the crew executed a go-around.

The change in the active runway in Lanzarote, which reverted to its original configuration with runway 03 in use half an hour later, caused congestion problems in the ACC Canaries Approach sector. This is a highly complex sector due to the proximity of the Lanzarote and Fuerteventura (GCFV) airports, and due to how their operations affect one another when in certain runway configurations. In an effort to manage the flow of arriving traffic, aircraft were directed to enter various holding patterns.

In light of the problems encountered by approaching traffic, the crew decided to proceed to its alternate airport on the island of Fuerteventura, where they were cleared to make a visual approach. Since the fuel remaining was approaching final reserve fuel, the crew declared an emergency (Mayday).

The landing was normal and the passengers left the aircraft in an orderly fashion. There was no need to do an emergency evacuation.

The incident was reported via the Event Notification System, meaning the investigation was started two months late, on 24 October 2013.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total	Other
Fatal				
Serious				
Minor				N/A
None	7	169	176	N/A
TOTAL	7	169	176	

1.3. Damage to aircraft

None.

1.4. Other damage

None.

1.5. Personnel information

1.5.1. Flight crew

The captain of TOM85Y, a 60-year old British national, had a JAR-FCL airline transport pilot license (ATPL(A)) with B737-800 and instrument flight (IR) ratings, issued by the United Kingdom's Civil Aviation Authority and valid until 31 January 2014. He also had a class 1 medical certificate that was valid until 23 January 2014. He had a total of 12,060 flight hours, 780 of which had been on the type. He had been working for Thomson Airways since February 1998.

The first officer of TOM85Y, a 42-year old British national, had a JAR-FCL airline transport pilot license (ATPL(A)) with B737-800 and instrument flight (IR) ratings, issued by the United Kingdom's Civil Aviation Authority and valid until 22 February 2014. He also had a class 1 medical certificate that was valid until 31 January 2014. He had a total of 5,300 flight hours, 1,150 of which had been on the type. He had been working with First Choice since November 2005. In 2008, this company merged with Thomsonfly, which changed its name to Thomson Airways.

The flight crew's scheduled duty period was from 05:00Z until 15:00Z, and they had had their required rest period.

1.5.2. Controllers in the Lanzarote tower

The executive controller, who made the first change of the runway in use, was a 43-year old Spanish national. He had a community air traffic controller license issued by AESA and a class-3 medical certificate, both of them valid, as well as the required ratings and unit endorsements. He had an aerodrome rating (ADI), issued on 17 October 2012, and the AIR, GMC, RAD and TWR unit endorsements for GCRR, valid until 01 June 2014.

He had prior experience as a controller, having served in the Armed Forces. He had been trained as a civilian controller in August 2012, undergoing basic training and ADI rating

training (TWR) at the Czech Republic's Air Navigation Institute. He also took the radar (RAD) endorsement course in October 2012 at SENASA in Madrid. He had been on the staff of SAERCO since September 2012.

He did his GCRR Unit Training for Air Traffic Controllers from 03/12/2012 to 25/01/2013, as per SAERCO's Training Manual and the GCRR Unit Training Plan[2], approved by AENA (now ENAIRE)[3].

The executive controller on duty during the operation on runway 21 was a 33-year old Spanish national. He had a community air traffic controller license issued by AESA and a class-3 medical certificate, both of them valid, as well as the required ratings and unit endorsements. He had an aerodrome rating (ADI), issued on 02/08/2012. He had the AIR, GMC, RAD and TWR unit endorsements for GCRR, valid until 16/01/2014.

He had done his controller training from February to July 2012 at the Czech Republic's Air Navigation Institute, and had been a part of the SAERCO staff since September 2012.

He did his GCRR Unit Training for Air Traffic Controllers from 11/09/2012 to 17/01/2013, as per SAERCO's Training Manual and the GCRR Unit Training Plan, approved by AESA.

1.6. Aircraft information

The Boeing 737-800 aircraft, registration G-FDZG, S/N 35139, owned by Thomson Airways, was used for the public transport of passengers.

It had a certificate of airworthiness issued by the Civil Aviation Authority (CAA) on 01/05/2013. Its registration was issued on 24/04/2013.

It had 21,890:23 flight hours and 6,800 cycles.

This aircraft is rated for maximum tailwind during landing of 15 knots[4].

1.7. Meteorological information

The crew dispatched the flight at Gatwick at 05:00Z. The weather information available to them was from the 00:00Z METAR and the TAFOR from 23:00Z issued on the 21st, and which covered their flight's timeline. These reports forecast winds from 340º to 350º at 15 knots, clear skies and high visibility.

[2] Instruction Manual A331-10-MAN-005-2.0 /GCRR Unit Training Manual A331A-11-PES-024-2.0

[3] AENA Air Navigation became ENAIRE in July 2014

[4] (OM part B, Vol. 3, section 2.2 Operating Limits)

The crew gathered the following ATIS information, which they reflected in their operational flight plan:

- Information "J" at Lanzarote at 09:10Z, runway in use 03, wind 360º at 12, varying from 330º to 220º, CAVOK, temperature 31º, dew point 16, QNH 1012 mb.
- Information "N" at Lanzarote at 09:40Z, runway in use 21, wind calm, CAVOK, temperature 28, dew point 20, QNH 1013 mb.

The METARs published during the time of the incident were as follows:

SA 22/09:00
METAR GCRR 220900Z 36012kt CAVOK 31/16 Q1012

SA 22/09:30
METAR GCRR 220930Z 23011KT 190V270 CAVOK 27/19 Q1013

SA 22/10:00
METAR GCRR 221000Z 21005KT 170V240 CAVOK 28/19 Q1013

This weather information indicates that the wind veered from the north to 230 between 09:00Z and 09:30Z, lowering in intensity from 11 to 5 knots by 10:00Z.

The 10-minute wind data taken at the thresholds over the period in question, from 09:00Z to 10:00Z, were as follows:

Time	RWY 21	RWY 03
09:00	350º 15KT	350º 11KT
09:10	350º 17 KT	360º 17 KT
09:20	340º 17 KT	340º 17 KT
09:30	320º 14 KT	230º 19 KT
09:40	280º 04 KT	210º 19 KT
09:50	060º 01 KT	230º 10 KT
10:00	210º 05 KT	200º 08 KT

On that day there were three reports of windshear on approach and/or departure at different times, which were included in the ATIS. Also, between 12:08Z and 12:53Z, there were reported temperature differences between the thresholds of 5º C or more, information that was also included in the ATIS.

1.8. Aids to navigation

The navaids at the Lanzarote Airport were operational at the time of the incident.

As for the Fuerteventura Airport, it was affected by NOTAMs that indicated that both the Category I ILS approaches to runways 01R and 19L and their respective DMEs were being tested and were giving faulty readings.

1.9. Communications

TOM85Y established contact with the Canaries ACC on 129.3 MHz at 09:24:45, receiving vectors for the approach to runway 03.

At 09:27:42, the tower controller in Lanzarote spoke with the Canaries ACC to report changing wind conditions on the runway, communicating the decision to change the runway in use at 09:30:59.

At that point TOM85Y was instructed by ACC to fly to LTE and make the VOR approach to runway 21.

At 09:40:13, TOM85Y reported starting the approach maneuver, flying the outbound leg and descending as per the published procedure.

At 09:47:00, TOM85Y was transferred to the Lanzarote tower on 120.7 MHz.

At 09:47:10 the crew established contact with the tower, informing they were 10 NM out. They were cleared to land by the tower, which reported wind calm and QNH 1012 mb.

At 09:49:12, the crew requested wind information, with the tower reporting wind at the threshold from 130º at 2 knots.

At 09:50:29, the crew initiated the go-around procedure. Seconds later the tower cleared a Monarch flight, the next in the sequence, to land, indicating the wind at the threshold was from 170º at 4 knots, gusting to 19 knots.

TOM85Y reported its go-around maneuver and at 09:50:53 was cleared to execute the standard go-around maneuver. They reported having had a 17-knot tailwind on final.

At 09:51:43 they were again transferred to the Canaries ACC on 129.3 MHz.

Once in touch with ATC, they were instructed to turn left heading 090º as the initial vector to the initial approach fix (IAF) KLATO. Another aircraft on this same frequency asked about its reasons for going around, to which the crew replied that it was due to the tailwind.

At 09:53:28, the tower controller informed the ACC on the hotline that a second aircraft on approach also missed its approach due to the wind. The controller reported a wind at the tower from 200º at 3 knots, gusting to 9 knots.

At 09:53:43, the Lanzarote tower informed the ACC that aircraft were missing their approaches and that it intended to change its runway configuration to place 03 in use. The Canaries ACC controller objected to this decision, but eventually accepted it.

At 09:54:39, TOM85Y indicated its intention to divert to the Fuerteventura Airport and proceed directly to the IAF at TENDA. This initial report was difficult to understand and had to be repeated.

At 09:56:18, the Canaries ACC issued a general message to all traffic on the 129.3 MHz frequency, notifying them that in ten minutes, the runway in use at Lanzarote would be 03.

Half a minute later, the runway change at Lanzarote was coordinated to decide what the last traffic inbound to runway 21 would be. The tower reported that crews were reporting a tailwind of up to 25 knots.

While en route to Fuerteventura, there were communication problems between TOM85Y and ACC due to the frequency being saturated with calls from other aircraft requesting information on the conditions at the runway in use and their estimated approach times. TOM85Y was cleared for the ILS approach to Fuerteventura. After coordinating with the GCFV tower and verifying the unavailability of the ILS, TOM85Y was cleared to make a visual approach to runway 01R and transferred to 118.475 MHz.

Once in contact with the Fuerteventura Tower on 118.475, TOM85Y was cleared to make a visual approach to runway 01R. At the crew's request, the controller reported the weather conditions, and then coordinated with the CECOA[5] to assign them a stand.

At 10:06:21, the tower cleared TOM85Y to land on runway 01R, with wind from 030º at 7 knots.

At 10:07:27, the crew of TOM85Y declared a fuel emergency (Mayday), reporting they were 3 NM out on final to runway 01R, and rejecting the tower controller's offer of assistance from emergency services.

Finally, at 10:07:27, TOM85Y was cleared to leave the runway and follow the marshaller to parking.

[5] CECOA: Airport Coordination Center.

1.10. Aerodrome information

The Lanzarote Airport, managed jointly by ENAIRE and the military, is 5 km southwest of the city of Arrecife.

It has one 2400-m long, 45-m wide asphalt runway in a 03/21 orientation with magnetic bearings of 032º-212º. The airport is at an elevation of 47 feet.

Runway 03 has a precision ILS approach and a non-precision VOR, NDB and TACAN approach, as well as a PAPI with a nominal 3º slope.

Runway 21 only has a non-precision VOR approach, the final segment of which deviates 2º from the runway centerline. It has a PAPI with a 3.7º slope.

The AIP states that the use of runway 03 is preferred whenever the tailwind does not exceed 10 kt and braking efficiency is good.

The characteristics of the VOR approach to runway 21 make it an unusual approach. The final approach is affected by the elevation of the terrain in such a way that there are no approach minimums close to the threshold.

Section 4, Chapter 1 of the ICAO PANS-OPS defines a circling approach as:

"1.2.3.3 Circling approach

A circling approach will be specified in those cases where terrain or other constraints cause the final approach track alignment or descent gradient to fall outside the criteria for a straight-in approach..."

In fact, even though the deviation in the final approach track is only 2º from the runway centerline, the final part of the approach must be made in visual contact, maneuvering to adapt to the proper descent slope. To comply with the obstacle clearance criteria for a straight-in instrument approach, this slope would exceed the 6.1º limit specified in PANS-OPS. As a result, the minimums published in the AIP are 2020 feet, corresponding to a circling approach.

The VOR approach to runway 21 published in the Spain AIP on the date of the incident, in effect since 23 August 2013, is shown in Appendix 1 to this report.

The airport control services provider, SAERCO, identified the approach to runway 21 as being prone to cause conflicts resulting in missed approaches for the following reasons:

- The approach requires a descent with no vertical guidance since this runway lacks ILS.

- The track runs over mountainous terrain that can affect the winds and gusts such that these can be different from those measured on the ground.
- There are frequent windshear reports.
- EGPWS alerts can be triggered.
- Clouds often form northeast of the airfield in the proximity of the missed approach point (MAP), where crews must decide if they have the references needed to continue the approach or if, in contrast, they must initiate the go-around procedure.

The investigation revealed that the problems involved in determining the need to have runway 21 active, problems stemming from different wind components aloft and on the ground, have occurred in subsequent cases.

There are crews that are hesitant to make approaches to runway 21.

The various responses adopted by crews have been:

- to accept the approach to runway 21.
- if the tailwind is within limits, to request to land on runway 03.
- to make the ILS approach to runway 03 with circling to 21.
- some have restrictions on nighttime approaches and opt instead to proceed directly to the alternate.

This non-standard operation on runway 21 complicates how the traffic flow is managed with takeoff maneuvers since when surface wind conditions favor the use of this runway, takeoffs are limited to runway 21 due to its negative slope and the absence of obstacles in the initial part of the climb.

Thomson Airways categorizes the Lanzarote Airport as a type B for the 737-800. For this category, Part A of its Operations Manual (point 8.2.2.1 Airport Categories) specifies that an airport requires extraordinary considerations due to:

A. Non-standard approach aids and/or traffic circuits, or

B. Unusual local weather conditions, or

C. Unusual characteristics or performance limits, or

D. Any other relevant consideration, including obstacles and the physical layout of the airport.

1.11. Flight recorders

The aircraft was equipped with flight data (FDR), quick access (QAR) and cockpit voice (CVR) recorders. The time that elapsed from the time of the event until it was reported to the CIAIAC meant that the CVR and FDR recordings were no longer available.

Thomson Airways provided the flight data parameters contained in the QAR, which were used to analyze the event.

The QAR shows that the CMD A mode was engaged during the descent into Lanzarote, which is consistent with having the captain as the pilot flying.

The first pass over the airport was at 5000 feet, with 2400 kg of fuel remaining. It was then that the aircraft turned left south of the airport to fly the VOR/DME approach to runway 21, as it had been instructed to do.

During this turn to the south above the airport, the crew selected flaps 1.

At 09:39:53, as the aircraft was on a northeasterly course during the outbound leg, the crew selected flaps 5 while at the same time they began to descend from 5000 to 3000 feet.

The crew turned onto the inbound heading at mile 13.5 of the ATE VOR, and while passing through 300º, selected the automatic lateral control mode (LNAV) as well as the vertical navigation speed control mode (VNAV SPD).

At mile 13, they selected flaps 15 and lowered the landing gear as they started to descend to the 2800-ft altitude selected in the MCP. The FMS indicated a wind from 035º at 25 knots.

Upon reaching an altitude of 3450 ft, a new altitude of 2100 ft was selected on the MCP (corresponding to the approach MDA). The aircraft descended following the profile of the automatic vertical navigation mode (VNAV).

At 2720 feet the crew selected flaps 30.

Passing 2350 ft and 6.25 miles away from the VOR, the crew disengaged the autopilot and autothrust.

At 2000 ft they cycled the flight director and left it engaged. The crew then selected the vertical descent mode (V/S), which would help them follow the descent profile in manual flight. They were at 1860 ft and 5 NM.

At mile 4.5 the aircraft was following the required 3.7º approach profile. The recorded descent rate was 1500 fpm with the wind from 055º at 15 knots, which was equivalent to a tailwind.

At mile 3.5, the aircraft was slightly below the nominal glide slope at 1170 feet. The wind was from 040º at 18 knots. The descent rate was 1100 fpm.

At 370 ft their descent rate reached 1470 fpm, which caused the EGPWS to issue a sink rate alert. The wind recorded at that time was from 005º at 15 knots.

At a radioaltitude of 50 ft, the indicated airspeed was 156 knots (12 knots above the selected approach speed of 144 knots). The descent rate was 1150 fpm and the wind was from 350º at 15 knots (equivalent to an 11-knot tailwind).

Despite these parameters, the crew attempted to land and, at a radioaltitude of 10 ft (approach speed of 144 knots + 19), the thrust was at idle and the recorded wind was from 350º at 2 knots.

At 09:50:16, the crew initiated the go-around procedure without making contact with the runway. They selected go-around thrust (TOGA) and increased thrust until engine RPMs (N1) were at 100%.

They set the flaps to 15 and raised the landing gear upon attaining a positive climb rate. They followed the runway heading and at 1070 ft, they engaged the autopilot, with the HDG SEL and LVL CHG modes displayed on the PFD. The IAS reading was 174 knots (corresponding to approach speed + 20 knots).

At 1140 feet they engaged the autothrust. The aircraft's weight at that point was 58133 kg, with 1900 kg of fuel remaining.

At 1200 ft the thrust was reduced to 93% N1. At that point the crew also engaged the automatic lateral navigation mode (LNAV).

At 2700 ft they selected flaps 5 and at 3050 ft they retracted the flaps to position 1. The IAS reading was still 174 kts and the airplane was still on the runway heading with the wings level.

At 3100 ft the crew engaged the automatic lateral navigation mode (LNAV), starting a turn to heading 090º upon reaching 3500 ft. During this heading change they fully retracted the flaps. The IAS reading was 175 knots.

Upon reaching 4500 ft the PFD displayed CWS P mode, indicating an override command input to the control column. This was followed by the autopilot being disengaged. The

speed selection indicator was then set to 250 knots, the wings were leveled and the pitch angle was reduced. The speed rapidly recovered to the selected 250 knots.

In these conditions, the aircraft climbed through the 5000-ft altitude selected on the MCP to 5140 ft, since the crew were flying in manual. After correcting this, the crew engaged the autopilot which, from then on, held the set 5000-ft altitude and the IAS at 250 knots.

Once stabilized, the fuel remaining recorded was 1530 kg, which drove the crew to decide to proceed to their alternate airport in Fuerteventura. It was 09:54:10.

After receiving vectors, the crew made a visual approach to runway 01 at Fuerteventura, where they made an approach that satisfied the stabilized approach criteria defined by the company at 1100 ft.

Once they were cleared to land, and three miles out from runway 01 at the airport, the crew declared a fuel emergency (MAYDAY) in anticipation of landing with 1000 kg of fuel remaining, which was below the reserve fuel amount required.

1.12. Wreckage and impact information

The aircraft was not damaged in the incident.

1.13. Medical and pathological information

There were no injuries during the incident.

1.14. Fire

There was no fire in the aircraft.

1.15. Survival aspects

The crew declared a fuel emergency (MAYDAY) when they were 3 NM away on final and cleared to land. The tower controller asked the crew if they needed the fire trucks, to which they replied no.

After landing, the controller asked the crew if they needed any assistance, to which the crew again replied no.

There was no emergency evacuation. After landing at Fuerteventura, the aircraft taxied normally to its parking stand without receiving assistance from any emergency service.

The controller offered the crew help, but he did not properly apply the relevant regulation in terms of reporting the incident and of the guidelines provided by AENA (now ENAIRE) in the event of an emergency or a special situation. These guidelines state that an aircraft with a fuel emergency is prone to an engine failure and/or to land off the airfield. The MAYDAY protocol, however, was not initiated in the tower.

The daily ATC log at Fuerteventura from 22/08/2013 only notes that "at 10:11Z TOM85Y landed without problems after diverting from GCRR", mentioning nothing about the emergency.

The airport's Emergency Plan was not activated.

In this regard, the air navigation services provider AENA (now ENAIRE) conducted an internal investigation[6] that confirmed the controller's mistake. The company then issued an operational safety memo restating the applicable regulation.

1.16. Tests and research

1.16.1. Statement from the crew

They had started their activity at 05:00 at the Gatwick Airport (London), holding their briefing in the crew's office. They had the required rest period.

They knew each other from having flown together on other flights. Both had been at Thomson for more than five years.

Before the flight was dispatched, they checked the aircraft's technical log book (TLB), as per the company's standard procedures. There were no entries in the TLB from maintenance and there were no hold items.

The fuel planning was carried out as per the company's policy, which requires both crewmembers to agree on the amount of fuel to carry.

They had both flown before to Lanzarote and were familiar with procedures at the airport.

The pilot flying for this leg was the captain. The flight was uneventful until the runway change late in the flight.

[6] AENA Code 130822-GCFV-O-A

The weather conditions obtained during the flight via ACARS and the ATIS matched the dispatch forecast, meaning visibility was good with scattered clouds at 3000 ft and the wind from the north at 12 knots.

They did the approach briefing for runway 03, since the wind conditions indicated it would be the runway in use.

They were cleared for the TERTO 2P arrival route, during the final phase of which they were vectored to runway 03.

They were instructed to change the planned approach when they were some 8 NM northeast of the LTE VOR. Both pilots were familiar with the runway 21 approach, as they had flown it before.

They stated that they were first in a landing sequence of 3 or 4. They did not have a lot of time to reset the navaids for the approach and hold a new briefing, though they organized themselves to execute a proper approach. The initial part of the approach was not problematic, but they encountered a strong tailwind (15 to 18 knots) on final. The wind reports they were receiving indicated a wind from about 130º at 6 knots.

They realized their approach maneuver was unstable due to the increase in their IAS and the excess lift during the flare.

They initiated the established go-around maneuver to an initial altitude of 5000 ft. ATC changed this maneuver, instructing them to turn to heading 090º after reaching 2000 ft.

While executing the maneuver, the copilot informed ATC they had encountered an 18-knot tailwind during the approach. The communications between ATC and the next aircraft in the sequence indicated some uncertainty as to the suitability of the runway in use.

They executed a go around as they had planned, but they retracted the flaps before reaching a safe speed because they were distracted by the communications between ATC and other aircraft. The quality of the transmissions was not good, which hampered their clarity.

They had about 1800 kg of fuel at the start of the maneuver.

They had difficulty coordinating with ATC due to the problems they had contacting them because of the multiple calls made by other aircraft. They were cleared to proceed once more to the LTE VOR and make another approach.

The crew did not think this option appropriate because they were at the minimum reserve fuel specified by the company to proceed to Fuerteventura, runway 21 continued to be in use, meaning they would likely encounter the same tailwind on approach, and due to the presence of other aircraft holding over the LTE VOR.

When they were some 8-10 NM out on heading 090º with 1700 kg of fuel remaining, they finally decided to proceed to their alternate, Fuerteventura. The crew stated that ATC ignored several calls they made to indicate their intention to proceed to their alternate. They also had problems when they requested to be transferred to Fuerteventura ATC.

They declared a fuel emergency when, some 10 NM away from the airport, they noticed that their fuel remaining was 1100 kg. They requested a visual approach to runway 01R, since the ILS for both runways was out of service.

They managed to land without problems and with 1000 kg of fuel remaining.

The passengers, who had been informed of the diversion, were understanding and cooperative.

They concluded that their decision to divert to the alternate had been driven by the low amount of fuel remaining and by the apparent low priority they were given by ATC.

They could not understand why the runway was changed given the wind conditions they encountered. They reiterated how the communications and instructions from ATC were of no help to them.

1.16.2. Statement from the local controllers at the Lanzarote tower

The controller on duty during the first runway configuration change at Lanzarote stated that he had been the sole controller at the Lanzarote tower since 07:30Z. At the end of his partial shift, he noticed that the wind reading in the tower indicated it was coming from the south.

At 09:27Z he made a call to the ACC to inform that the wind was becoming stronger at the runway 03 threshold and shifting to 210º at 11-13 knots, meaning aircraft on approach would have a tailwind. The ACC controller told him it was his call and to notify him when he made the decision.

At 09:31Z he confirmed the trend in the wind direction and decided to change the runway in use to 21 after coordinating with the final aircraft.

He was then relieved of his post in the tower by a colleague.

He indicated his awareness that a double runway change can cause problems with traffic flow management, but based on the information in the tower, the conditions warranted such a change. The problems reported later by aircraft attempting to land conditioned the decision to once more change the runway in use.

He explained that changing wind conditions in Lanzarote are not rare and that he had been in this situation before, meaning one in which the wind direction and speed on the runway do not match those encountered by approaching aircraft. That information they receive from reports by crews.

SAERCO Operational Safety recently issued a Best Practices memo that refers to a runway change under similar conditions to those considered in this report, offering as an example of a good practice the actions taken at the GCRR TWR involving the runway change.

The controller who relieved him at 09:30Z reported that during the event, runway 21 was in use with two aircraft in the arrival sequence, the first being the Thomson aircraft (TOM85Y) and the second a Monarch aircraft.

The Thomson aircraft was cleared to land and given the wind information provided by CEFIRO[7]. The crew went around and gave as their reason the fast tailwind, which was completely different from the wind information that was indicated on the instruments in the tower.

The crew were instructed to execute the standard go-around procedure and transferred to approach control.

This aircraft did not return to the airport, proceeding instead to their alternate (GCFV). The tower was not notified by the crew or by approach control of their intentions. Instead, this information was received through the airport manager and later confirmed by the ACC.

The second aircraft in the sequence, the Monarch, was cleared to land and given the wind information available in the tower. This crew also missed their approach and was likewise given instructions to execute the standard maneuver and transferred to APP. They eventually returned to the airport and landed normally on runway 03 once it was returned to use.

[7] Instrument that provides wind readings from the runway threshold. The wind reading can be current or averaged out over the last 2 or 10 minutes.

1.16.3. Operational flight plan

Thomson Airways provided the operational flight plan (OFP), which included the required notes made by the crew. The data obtained from the OFP reveal the following:

- The zero fuel weight (ZFW) was lower than planned. This resulted in a takeoff weight that was lower by 1800 kg, which helped with the fuel consumption en route and avoided having to correct the fuel amount required by the flight plan.

- Their actual takeoff weight was 66600 kg.

- The captain decided to take on the amount of fuel required by the flight plan (10700 kg).

- The fuel calculation was done as specified in the company's OM Part A, setting the Fuerteventura Airport as their alternate. Flying to the alternate at an altitude of FL090 would require 760 kg of fuel. The flight plan also contained information on an additional three alternate airports (GCLP, GCTS and GMAD), showing the distance, wind, estimated time, flight level used for the calculations and the fuel needed to fly to each.

- The contingency fuel was 3% of the trip fuel and relied on using the Marrakech Airport (GMMX) as their en-route alternate.

- The final reserve fuel required was 1090 kg.

- They did not add "Extra" fuel, since they did not expect any significant deviations from their flight plan.

- The flight plan was calculated for a stepped climb to flight levels 330, 350 and 370. They were cleared to FL370 from the start of the route, and they remained at that flight level until they started the approach maneuver.

- According to the entries made by the crew, the amount of fuel used en route was as planned when they reached point VEDOD, near the start of the descent and where they were transferred to the Canaries ACC, where they were 50 kg above the fuel required by the flight plan.

- The OFP provided data to calculate variations in fuel consumption based on different conditions than those assumed when calculating the consumption figures, such as weight, wind speed, cruise altitude and speed.

1.17. Organizational and management information

1.17.1. Thomson's fuel policy

Part A of Thomson Airways' Operations Manual contains the company's fuel policy and offers the following guidance:

- (OM part A 8.3.2 General policy) The Operational Flight Plan (OFP) lists the correct amount of fuel needed to safely complete the flight under normal operating conditions. The fuel required as per the plan must be loaded into the aircraft unless the captain can provide good operational reasons for changing said fuel amount.

Through its policy, the company realizes that technical stops may occasionally be required due to deviations from the required amount, but in general it prefers this over carrying excess during flights.

As for the fuel amount (OM Part A, Chapter 8.3), it states that the OFP will contain information on:

- TRIPFUEL: the required fuel for use en route.

- CONT 3%: the contingency fuel is that required to account for any unforeseen factors en route that could affect consumption. In this case it is 3% of TRIPFUEL, assuming the alternate airport en route (GMMX Marrakech).

- 1st ALTN: the fuel required to fly to the first alternate. This must take into account the following:

  — Fuel to execute a go around from the MDA/DH at the destination airport to the altitude required if the complete missed approach procedure is carried out.

  — Fuel to climb from the MAP altitude to the cruising flight level/altitude, considering the arrival route.

  — Fuel from the maximum climb altitude/level required to the final descent point, considering the arrival route.

  — Fuel from the final descent point to the initial approach fix.

  — Fuel to make the approach and landing at the alternate destination airport.

- FINAL RES: the final reserve fuel that allows holding for 30 minutes at 1500 feet above the aerodrome.

- MINTOF: minimum takeoff fuel. The sum of all the other amounts.

- TAXI: the fuel expected to be used during taxiing and APU operations. This is a fixed amount calculated based on average historical consumption.

- REQD: the minimum fuel required to make a flight.

- EXTRA: an additional amount that the captain can add if there are operational reasons to do so. Any extra fuel taken on must be explained in an entry in the OFP.

- FOB: the fuel onboard is the amount of fuel that is finally loaded on the aircraft.

The Operations Manual adds a specific consideration for the B737-800, namely that the minimum fuel calculated in the OFP for landing must be 1800 kg.

As to fuel management in flight (OM Part A, Section 8.3.25), the operator specifies the following:

A. The flight must be made such that the usable fuel remaining calculated for the landing upon arriving at the destination aerodrome must not be less than:

   (1) the fuel required to proceed to the alternate plus the final reserve fuel, or

   (2) the final reserve fuel if no alternate aerodrome is required.

B. However if, due to an in-flight check of the estimated amount of usable fuel at landing, this amount is less than:

   (1) (1) that required for the alternate plus the final reserve fuel, the captain must take into account the traffic and the prevailing operating conditions at the destination aerodrome, at the alternate or at any other suitable aerodrome when deciding the convenience of proceeding to the destination aerodrome or diverting to another, such that a safe landing is made with no less than the final reserve fuel, or

   (2) the final reserve fuel, if an alternate aerodrome is not required, the captain must take proper actions and proceed to a suitable aerodrome where a safe landing can be made with no less than final reserve fuel.

C. The captain shall declare an emergency when the usable fuel calculated for landing at the nearest suitable aerodrome where a safe landing can be made is less than final reserve fuel.

1.17.2. Approach criteria of Thomson Airways

Before starting an approach for landing, the captain must make sure that, based on the available information, the weather at the airport and the runway conditions will not impede making a safe approach, landing or go around, considering the performance information contained in the Thomson Airways Operations Manual (OM Part A, 8.2.5.4 Approach).

As concerns circling approaches (OM Part A, 8.2.5.13 Circling Approach Minimums), the OM states that to fly a circling approach, the instrument approach procedure and the MDA must be observed until the aircraft is in the defined circling area. From there:

A. The runway area must be kept in visual contact while maneuvering.

B. The maneuver must be flown with visual references to allow establishing the aircraft on final as per the company's stabilized approach criteria. It may be necessary to mandate specific routes and, due to the elevation of the surrounding terrain and/or obstacles, to restrict the circling to certain segments of a defined area, e.g. only north of the runway centerline.

C. The final descent from the MDA may only be started when the landing threshold and any obstacle/terrain affecting the final descent are in sight. When the circling MDA is higher than 1000 ft AAL, it may be necessary to go below these minimums before turning onto final, requiring additional vigilance for those obstacles or terrain affecting the final descent.

D. The final glide slope to the runway must be flown as per the published approach angle guideline. If one is not published, a 3º nominal descent angle glide slope must be flown.

As specified in the Operations Manual, Part B (Vol. 3 "Stable Approach Criteria"), every flight should be stabilized on final approach at 1000 ft AAL, and must be stabilized at 500 AAL. In addition, on a non-precision CDFA approach in IMC, the approach must be stabilized at 1000 ft or at the DA/MDA, whichever is higher. An unusual approach procedure or one having a special condition that requires deviating from the stabilized approach criteria specified requires a special briefing. An approach is considered to be stabilized if it satisfies the following criteria:

1. The aircraft is on the correct flight path (on an ILS approach, the aircraft must be within one dot of the localizer and glide slope).

2. Only minor course, bank and altitude corrections are needed to stay on the correct flight path (except for a circling approach, in which the aircraft's wings must be level on final at 300 ft AAL).

3. The aircraft's indicated speed is not more than the desired speed (speed bug) plus 15 knots and not less than Vref (temporary deviations are allowed in turbulent or gusty conditions).

4. The sink rate must not exceed 1200 fpm; an approach requiring a higher rate must be noted.

5. The aircraft must be in the correct landing configuration.

6. The thrust must be adequate for the landing configuration.

Note: Any approach that becomes significantly destabilized below 500 feet requires an immediate go around.

Regarding the go-around procedure, the Operations Manual, Part B, contains the following table outlining the maneuver:

Pilot flying (PF)	Pilot monitoring (PM)
Simultaneously: • Press the TO/GA button • Request "flaps 15"	Place the flaps lever at 15 and monitor the retraction of the flaps
Verify: • Rotation to go-around attitude • That thrust increases	
	Verify that the thrust is sufficient for the go around or adjust as needed.
Verify positive rate on the altimeter and request "GEAR UP"	Verify positive rate on the altimeter and call out "POSITIVE RATE". Place the gear lever in the UP position.
	Verify that the missed approach altitude is set.
If the speed is within the amber band, limit the bank angle to 15°.	
When above 400 ft, verify LNAV or HDG SEL is selected, as appropriate.	
If needed request "TUNE NAV RADIOS FOR MISSED APPROACH"	Tune the nav radios as specified.
Verify the aircraft is on the missed approach heading.	
At the acceleration altitude, verify that the IAS/MACH display is blank or request "SET UP SPEED". Request "FLAPS __" based on the flap retraction sequence.	Position the flap lever as indicated and monitor the retraction of the flaps and slats.
After the flaps are in the desired position, select LVL CHG. VNAV mode can be selected if the flaps are UP.	
Verify climb thrust is set.	

Pilot flying (PF)	Pilot monitoring (PM)
Verify climb thrust is set.	
Verify the acceleration altitude is captured.	
	Select the gear lever to OFF once the gear retraction is complete. Set the engine start switches as needed.
Request "AFTER TAKEOFF CHECKLIST"	Do AFTER TAKEOFF CHECKLIST

1.18. Additional information

1.18.1. Congestion in the AAC approach sector of the Canaries TMA

The succession of changes to the active runway at Lanzarote caused traffic congestion in the AAC sector.

The Canaries AAC Approach sector is located in the east of the Canaries TMA, and includes the approaches to the Lanzarote (GCRR) and Fuerteventura (GCFV) airports.

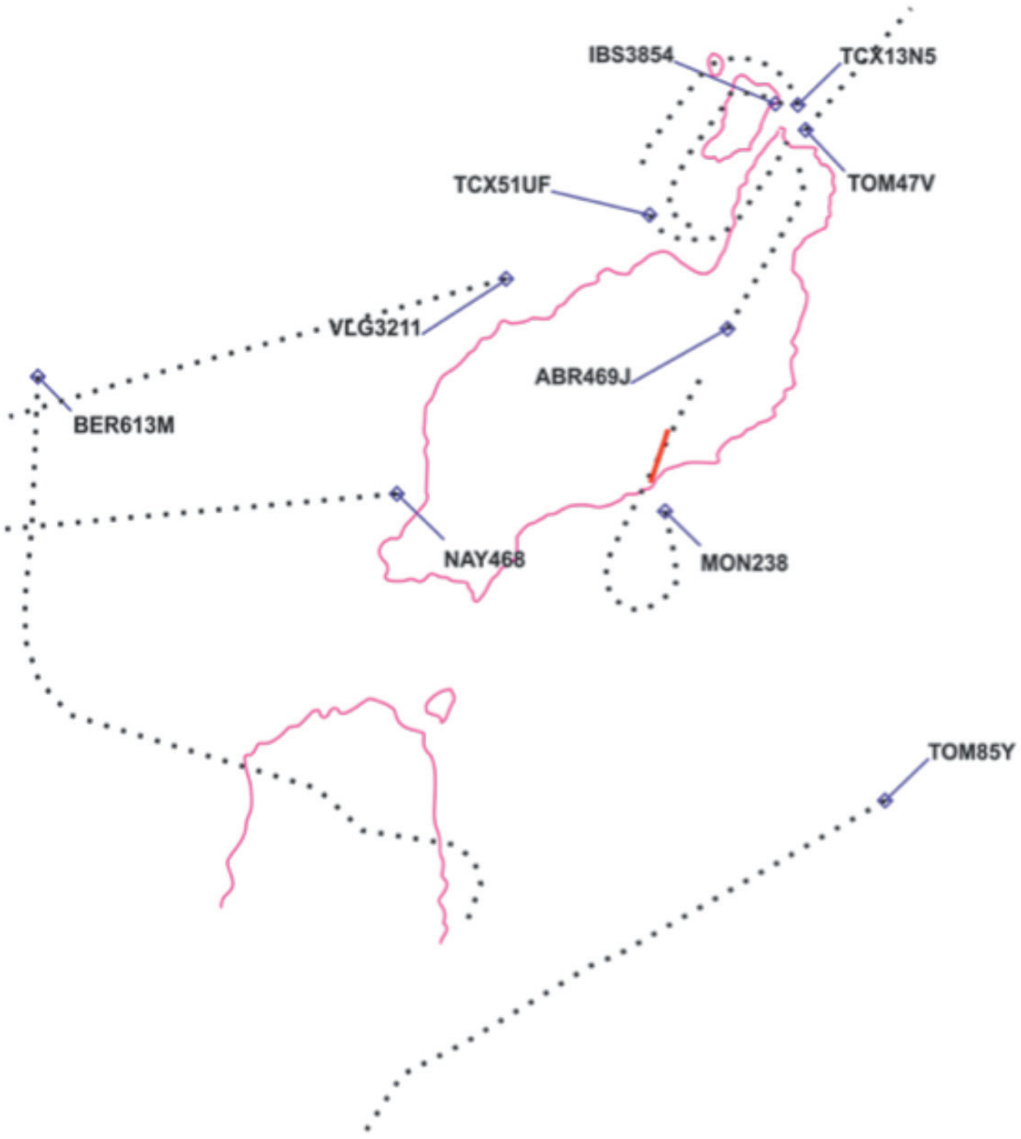
This sector is highly complex due to the proximity of the two airports and to how operations at one airport can affect maneuvers at the other when in certain runway configurations. On the date of the incident, and as was the case at the other approach sectors of the Canaries TMA, the procedures were conventional, based on the primary navaids at each airport: the LTE VOR/DME at GCRR and the FTV VOR/DME at GCFV.

The use of vector guidance was restricted to just one airport at a time; that is, if vector guidance was used to manage the flow of arrivals to GCRR, then traffic to GCFV was handled using published standard arrivals or, in the best of cases, with direct approaches, and vice versa.

The air navigation services provider SAERCO took over management of the airport, as the provider of ATS control services in GCRR, on 12/07/2013.

The traffic demand planned in the hour between 09:00Z and 10:00Z was for nine movements, a figure that increased to 13 and 17 in the following hourly intervals, which had the highest activity.

The Lanzarote tower had a single watchstander until the 10:00Z period, when an additional controller went on duty. The criterion used by SAERCO is to have a single controller on duty when 10 or fewer hourly operations are planned, to have two watchstanders with 15 or more operations planned, and to leave the number of watchstanders to the controllers' discretion when between 10 and 15. The stated capacity for the Lanzarote control tower is 22 movements per hour.



The Lanzarote tower controller saw that the wind readings in the tower would require changing the runway in use from 03 to 21.

This change coincided with the start of the period of peak activity for controllers in the AAC approach sector, which is why they complained about the little advance warning they received of the tower's intentions, since many of the expected aircraft had already started or were close to starting their approach maneuvers.

To handle the traffic, the Canaries ACC controllers were forced by the sector's limits to use holding patterns. The aircraft, which had mainly departed from the European mainland, started requesting estimated approach times so as to manage their fuel. The controllers did not know this information since the situation was unstable and aircraft were missing their approaches in Lanzarote. This generated a certain amount of tension.

After the missed approach by the aircraft in the sequence after TOM85Y, a Monarch aircraft with callsign MON238, due to a tailwind on approach, it was decided to change the runway in use to the runway 03 configuration.

This new runway change within 30 minutes forced a new reorganization of the approach sequence, with inbound traffic receiving new approach instructions. This surprised and upset some of the crews, who requested priority due to fuel. The problems were compounded by having to stagger departures on runway 21 with new vectors for approach to runway 03.

The figure, created using the radar information, shows the complexity of the traffic situation at 09:57:47, before the new runway change was agreed to. There were four aircraft holding and three on approach, as well as TOM85Y, which had diverted to Fuerteventura.

1.18.2. Measures taken by AENA (now ENAIRE)

As a result of the incident, AENA conducted an internal safety investigation[8] that reflected the problems encountered by the ACC Canaries sector controllers as a result of making two runway changes in such quick succession. This investigation recommended including this incident in the refresher and training courses for the Canaries ACC, as well as revising the Letter of Agreement (LOA) between the ACC and the Lanzarote tower by rewriting the procedure to use when changing runways such that it consider the problems it might cause for the ACC.

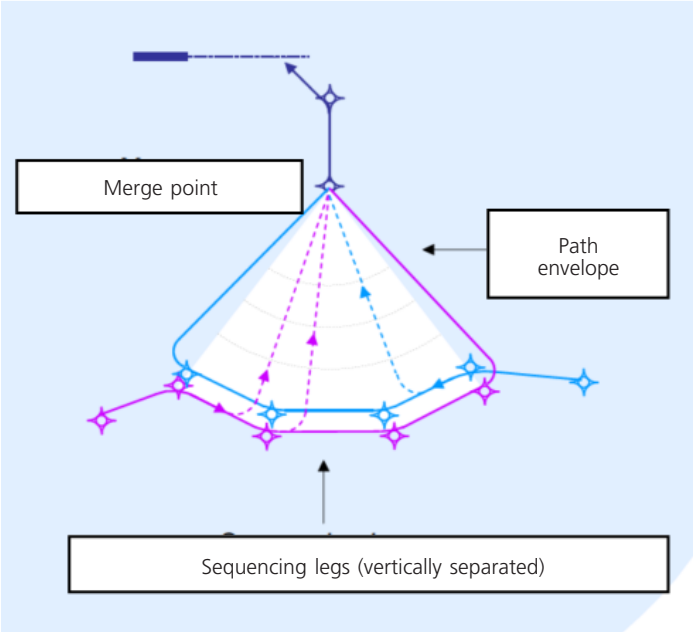
As concerns this procedure, the LOA has not been modified since it went into effect on 12/07/2013, stating that:

"D.1.4.1 LANZAROTE TWR will notify the CANARIES ACC of runway changes, even if temporary, sufficiently in advance to ensure proper operations at both facilities. The LANZAROTE TOWER shall be responsible for making the necessary changes to the SACTA system via the function specified for this purpose".

As concerns the operational difficulties in the ACC, AENA designed new procedures for the Lanzarote and Fuerteventura airports that maximize the use of P-RNAV trajectories (RNAV 1).

A study of the new design proposals for air spaces developed in recent years led AENA to consider the implementation of procedures based on the Point Merge technique as a possible solution, due to the advantages it offers.

[8] AENA code 130822-GCCC-I-A



The unique features of the Canaries ACC required adapting the technique to the features specific to this air space, namely:

- The proximity of the two airports.
- The mutual effect of approach maneuvers, especially in certain runway configurations: GCRR 03-GCFV 19.
- The high percentage of inter-island traffic operated by the airline Binter, which uses ATR 72 aircraft that are not equipped for P-RNAV precision air navigation.

After studying the initial design, a consensus was reached that allows proposing a change to the procedures to coordinate the design requirements and the viability of operations by the aircraft that could use it.

The benefits derived from implementing these procedures are:

- Vectoring airplanes to both airports simultaneously was not allowed, which reduced capacity. This limitation is resolved through the sequencing permitted by the Point Merge technique.
- The average distances flown by aircraft using the new procedures are comparable to those flown before. The arrival routes have not significantly increased the distance flown because the demand is satisfied through the most direct branches of the Point Merge technique.
- The new procedures improve how crossings are handled in the air space with respect to the previous method.

- The number of communications needed to manage traffic sequences is greatly reduced.
- The improved approach procedures at Lanzarote and Fuerteventura translate into less work for controllers and increased capacity for the AAC sector.

This system was implemented in September 2014. In February 2015, an assessment of the implementation determined that placing this system into service increased the traffic handling ability at these airports by 30% and reduced the number of air traffic-related delays to zero, all while maintaining the level of safety.

The new approach routes are shown in Appendix II.

1.18.3. Measures taken by SAERCO

SAERCO wrote an operational investigation report which determined that the incident involving the missed approach by TOM85Y had no direct, significant effect on the safety of the air space managed by SAERCO. The runway changes were consistent with Spain's Air Traffic Regulations and with the local procedures in the AIP, and were made in response to changing wind conditions.

Due to the routine nature of the missed approach to runway 21, this event was not reported internally. After receiving the CIAIAC's request, SAERCO launched an investigation, which resulted in no safety recommendations.

As a mitigative measure related to this specific event and to the runway changes, an Operational Safety Memo was circulated in April 2014 reminding that during the spring and summer seasons, changing winds are common at the Lanzarote Airport, and their directions could affect the determination of the runway in use. The memo also referenced the relevant regulations (both national air traffic regulations and the local GCRR procedures published in the AIP) applicable to this type of situation.

1.18.4. Measures taken by Thomson Airways

Thomson Airways stated that as a result of this incident, it conducted an FDM analysis of the circumstances and gave specific training to the incident crew, after which they were returned to normal flight duties.

1.19. Useful or effective investigation techniques

Not applicable.

2. ANALYSIS

2.1. General

On 22 August 2013, changing winds at the Lanzarote Airport (GCRR) forced changing the runway in use to runway 21. This situation coincided with the start of a period of peak activity, during which a significant increase in the number of arrivals to and departures from Lanzarote was expected.

The new operation required restructuring the traffic flow toward the airport. The limitations of the Canaries AAC approach sector forced controllers to resort to using holding patterns to regulate the traffic.

The first few aircraft went around upon encountering a strong tailwind during the final approach.

The Thomson Airways aircraft executed a non-standard go around maneuver, meaning the aircraft's speed was not appropriate for its configuration.

Given the uncertainty of the approach to Lanzarote and the limiting fuel amount onboard, the crew decided to divert to the Fuerteventura Airport. When in contact with the control tower and close to landing, they declared an emergency (MAYDAY) due to low fuel.

The Fuerteventura tower offered assistance to the crew, but the controller did not carry out the actions specified for an emergency declaration by an aircraft.

The changing wind conditions that were forcing aircraft to go around led to a new change in the runway in use at Lanzarote, which greatly complicated traffic management at the Canaries AAC approach sector.

2.2. Flight operations

The crew went on duty at the Gatwick Airport (London). They were an experienced crew with more than five years of service at Thomson Airways. They had been paired up on previous flights, and thus it was not their first time flying together.

The weather information available both during the initial dispatch and then in flight, provided via ACARS and ATIS, did not indicate that runway 21 would be in use at Lanzarote.

Thomson's fuel policy calls for its crews to adhere to the fuel requirements shown on the Operational Flight Plan (OFP). The captain must provide a reason for taking on additional (EXTRA) fuel. In fact, the policy states the company's preference to have a

crew divert to the alternate airport than to carry extra fuel as a matter of course. This measure is clearly economic in nature, as it aims to control overall fuel consumption at the company. It also conditions the crew's decision-making ability, though the final decision is the captain's, as the person ultimately responsible for the operation.

This airport is classified by Thomson as a category B, meaning that if there had been any indication that runway 21 would be used, this runway not having a precision approach, this could have led the crew to take additional measures with regard to the amount of fuel requested.

Instead, the crew requested a fuel load that was in keeping with the requirements of the OFP (10700 kg), requesting no extra fuel.

The fuel consumption matched the OFP forecast, and the aircraft reached the transfer point with the Canaries ACC with 50 kg more fuel than expected.

The change in the runway in use forced an adjustment to their approach trajectory that increased their distance to the runway.

The fuel onboard when they passed over the LTE VOR was 2400 kg. The crew made the VOR approach maneuver published for runway 21.

As they were making the approach, the crew configured the aircraft to make a stable approach, which was made using the automatic lateral and vertical navigation modes. This takes some of the workload off the crew and provides greater accuracy in following a stable descent angle. These modes were used until they reached 2350 feet, close to the published MDA of 2000 ft, where the autopilot and autothrust were disengaged.

From then on, the recorded sink rates reached values in excess of the 1000 feet per minute required for a stabilized approach, as per Thomson's criteria. Below 500 ft AAL, values of up to 1470 fpm were reached. This triggered the "sink rate" alert from the EGPWS at an altitude of 370 ft. At that point the crew should have started the go-around maneuver.

By increasing the ground speed, the presence of a tailwind component on final approach requires increasing the sink rate to stay on the desired glide slope.

When the flare maneuver was initiated at 50 ft, the IAS was 156 knots. This was 12 knots over the approach speed (144 knots). The sink rate was 1150 fpm, which exceeds the limits established by Thomson.

During the flare, at a radioaltitude of 10 ft, the IAS was 163 knots, 19 knots above the approach speed.

Finally, when they detected that the aircraft was floating, the crew decided to execute the standard go-around maneuver. This decision was made too late, in light of the problems encountered during the approach maneuver to remain within the stabilized approach parameters.

At 1070 ft, the crew engaged the autopilot, which adjusted the pitch angle to maintain an initial climb speed of 174 knots (flaps 40º approach speed + 20). The lateral HDG SEL and vertical LVL CHG modes were engaged. Shortly afterwards they also engaged the autothrottle. At 1200 ft they reduced thrust and selected the LNAV lateral tracking mode.

This is when they reported the go-around to the tower. The fuel onboard was 1900 kg, very close to the amount required by the OFP to proceed to the alternate airport in Fuerteventura plus the final reserve fuel.

The frequency change and the instruction to turn to heading 090º coincided with the flap retraction sequence. The current vertical navigation mode maintains the initial MAP speed, which is the speed needed to fly safely in a 15º-flap configuration, but it does not increase the speed unless commanded by the crew. In the automatic VNAV vertical navigation mode, this process happens automatically and the crew only has to retract the flaps at the indicated speeds.

With the lateral navigation mode selected, the crew began the flap retraction sequence, but they forgot to increase the airplane's speed. As a result, the aircraft began turning at a 30º bank angle in LNAV in a clean configuration at 175 knots. The minimum speed for selecting flaps up is estimated to have been 201 knots, meaning the aircraft was 26 knots below this speed.

Upon reaching 4500 ft, CWS P was displayed on the PFD. The autopilot was then disengaged. This implies that the pilot realized his mistake and made an input to the control column to lower the pitch angle that overrode the autopilot, which was subsequently disengaged.

Following this indication, the crew accelerated to 250 knots and climbed to 5000 ft before once more engaging the autopilot.

The flight parameters were just above the minimum maneuvering values (shown on the PFD as a yellow strip shown on the wind gauge). This means that the aircraft was able to maneuver at 1.3 g's. For the maneuver performed, this means that if the bank angle had been 10º steeper, the stick shaker would have activated, warning of an imminent stall. It should be noted, however, that the LNAV lateral navigation mode, which was engaged, does not allow a bank angle in excess of 30º.

After this occurrence, which should have peaked the crew's alert level, they assessed the amount of fuel remaining and the possibility of not being able to land in Lanzarote due to the wind conditions, since other aircraft were also going around.

When the fuel amount fell to 1530 kg, they decided to proceed to the alternate. This decision is deemed to have been correct, since the amount of fuel needed to fly to Fuerteventura, shown on the OFP, was calculated to be 760 kg, assuming FL090.

Upon contacting Fuerteventura and being cleared to make a visual approach, the crew rigorously adhered to the requirements of its Operations Manual Part A, declaring a fuel emergency (MAYDAY) when they realized that the fuel available to land (1000 kg) was below the final reserve fuel (1090 kg). This policy is in keeping with the European regulation that governs air operations (EU OPS CAT.OP.MPA.150 Fuel policy).

The event was reported by the crew in the associated safety report, which was analyzed by the operator as part of its flight data monitoring (FDM) program.

The operator reported that the crew underwent a training program, after which they were returned to normal flight duty.

The go-around procedure is practiced regularly during refresher simulator training. As a result, and given the crew's experience, this error is being regarded as a one-time event aggravated by the tension and confusion of the situation.

For this reason, the issuance of a safety recommendation involving crew training on complying with standard operating procedures (SOP) is not deemed necessary. Likewise, the decisions made by the crew are regarded as correct.

2.3. Actions of ATS

Due to the wind conditions at the Lanzarote Airport, the controller on duty at the tower, run by the air navigation services provider SAERCO, changed the runway in use twice in a span of under 30 minutes. The high traffic flow in the Canaries AAC sector leads controllers to rely on the published holding patterns due to the limitations present in this sector.

The controller in the Lanzarote tower fulfilled his responsibility to change the runway when the readings in the tower suggested such a change. Despite complying with the terms of the letter of agreement regarding notifying his colleague in the ACC, this notification was not provided sufficiently in advance for the ACC controller to be able to route arriving traffic to the new runway, while at the same time handling departing traffic.

His task was complicated by the missed approach maneuvers of traffic attempting to land on runway 21 at Lanzarote.

Though the controller in the Lanzarote tower had prior experience as a military controller, the air navigation services provider SAERCO had only been in charge of the facility for 40 days, meaning the controller probably lacked experience in assessing the operational environment specific to this airport.

It is very important that coordination efforts be made well in advance so that both en route and approach controllers can re-route traffic. In the case of Lanzarote, this is doubly important since aircraft have to start their descent while at the Casablanca FIR. By the time they are transferred to the Canaries ACC, these aircraft have already started the maneuver.

The approach to runway 21 at Lanzarote is complicated by the characteristics of the approach and of the surrounding geography. The published approach is a non-precision approach requiring specific conditions, as a result of which it must be categorized as a circling approach.

The mountains and the coastal location lead to unstable wind conditions. When the wind is from the south, the geography often causes windshear conditions that can compromise an operation's safety. Similarly, the steep approach angle required, with no vertical guidance in the final segment, is not conducive to stabilized approaches.

All of these factors point to the need to limit activity at runway 21. The changing wind conditions aloft suggest that approach conditions should be verified with an aircraft crew before proceeding with the runway change.

The hesitation of some crews to accept an approach to runway 21 is worth noting. The various alternative options complicate traffic flow management.

This analysis suggests that parameters should be defined for evaluating the suitability of operating on runway 21 in a stable manner. In this regard, a safety recommendation is issued to SAERCO, the airport control services provider.

The Canaries AAC approach sector, which covers all traffic to and from airports on Lanzarote and Fuerteventura, is highly complex due to the proximity of the two airports and to how operations at one airport can affect maneuvers at the other, when in certain runway configurations.

The air navigation services provider AENA (now ENAIRE) has restructured the arrival and departure routes in the AAC sector using the Point Merge technique and air navigation (P-RNAV). This Commission does not deem it necessary to issue a safety recommendation

in this regard since the data obtained following the implementation of the new routes indicate a substantial improvement in traffic flow. This shows that the corrective measure was effective in helping to alleviate the problems detected.

2.4. Survival aspects

The controller at the Fuerteventura tower, then managed by AENA, despite offering assistance to the crew following their Mayday call, did not adhere to the applicable regulation in terms of reporting the emergency. He also did not abide by the AENA regulations laid out in in its Procedure for Aircraft Emergencies and Special Situations. According to this document, in addition to offering assistance to the crew, the controller should have immediately called and activated the airport's Emergency Plan so as to allow rescue vehicles to get into position as required by said plan.

AENA (now ENAIRE) conducted an internal investigation which found fault with the controller's handling of the situation and issued an operational safety memo to its personnel noting the mistake and the applicable regulation.

As a result, no safety recommendation is issued in this regard.

3. CONCLUSIONS

3.1. Findings

- The crew of the aircraft had the required licenses and training for the operation at the Lanzarote Airport. They also had valid medical certificates.

- The control personnel providing air traffic control services at the Lanzarote Airport had the licenses and training required to work at the facility. They also had valid medical certificates.

- The aircraft's licenses and certificates were valid and it had been maintained in keeping with its approved maintenance program.

- The surface wind conditions indicated in the Lanzarote tower suggested changing the runway in use to runway 21.

- The controller did not confirm, by asking the crew of aircraft that were in approach about the present wind conditons found, the need to change the runway in service

- ATC personnel at the Canaries AAC sector receivedinsufficiently in advance the notice of the runway change

- Operations at the Canaries AAC are limited due to overlapping arriving and departing traffic from the Lanzarote and Fuerteventura airports.

- The restrictions in the sector and the short notice of the communication of the incident forced the AAC sector controllers to use published circuits to manage traffic.

- Aircraft TOM85Y was the first to make the approach to runway 21, but it had to do a go around upon encountering a tailwind.

- After the go-around maneuver, the aircraft was flying at a speed that was not adequate for its configuration.

- The aircraft proceeded to its alternate airport, Fuerteventura, where it declared a fuel emergency and landed without further problems.

- The tower controller at Fuerteventura offered assistance to the aircraft but did not carry out the notification procedure, and thus the airport's Emergency Plan was not activated.

- The changing wind conditions required a new change in the active runway in Lanzarote, further complicating traffic management in sector AAC.

- Approach maneuvers to runway 21 entail operational difficulties.

- AENA (now ENAIRE) has restructured the arrival and departure routes for sector AAC using the Point Merge technique and area navigation (P-RNAV).

3.2. Causes/Contributing factors

The incident was caused by the execution of a non-precision approach at a high rate of descent with a tailwind. This resulted in a go-around maneuver and a subsequent diversion to the alternate airport, which forced the crew to declare a fuel emergency (Mayday).

Contributing to the incident was:

- The limiting characteristics of the Canaries AAC sector, which hampered traffic management.

4. SAFETY RECOMMENDATION

The investigation underscored the operational difficulties posed by operating with runway 21 at the Lanzarote Airport. At the same time, viewing the special meteorological features of such airport, it has been also revealed the problems facing controllers when anticipating the suitability of placing this runway in service.

As a result, the following safety recommendation is issued to SAERCO, the airport control services provider at Lanzarote:

REC 61/15. *It is recommended that the air navigation services provider SAERCO conduct a detailed study of the meteorological and operational conditions that require placing runway 21 into service so as to enable controllers to make a decision that provides for stable operations.*

Thomson Airways stated that as a result of the incident, they carried out a FDM analysis of the circumstances and gave specific training to the incident crew, after which they resumed their normal flight duties. These measures are regarded as sufficient, and thus no safety recommendation is issued in this regard.

The air navigation services provider AENA (now ENAIRE) has restructured the arrival and departures routes for sector AAC using the point merge technique and air navigation (P-RNAV). Since these measures have proven their effectiveness in improving traffic flow in the affected sector, no safety recommendation is issued in this regard.

An internal investigation was also carried out that concluded ATC made a mistake by not activating the Fuerteventura Airport's Emergency Plan following the fuel emergency declaration. An operational safety memo was circulated to all personnel noting the mistake and the applicable regulation. This measure is regarded as sufficient to prevent a reoccurrence, and thus no safety recommendation is issued.

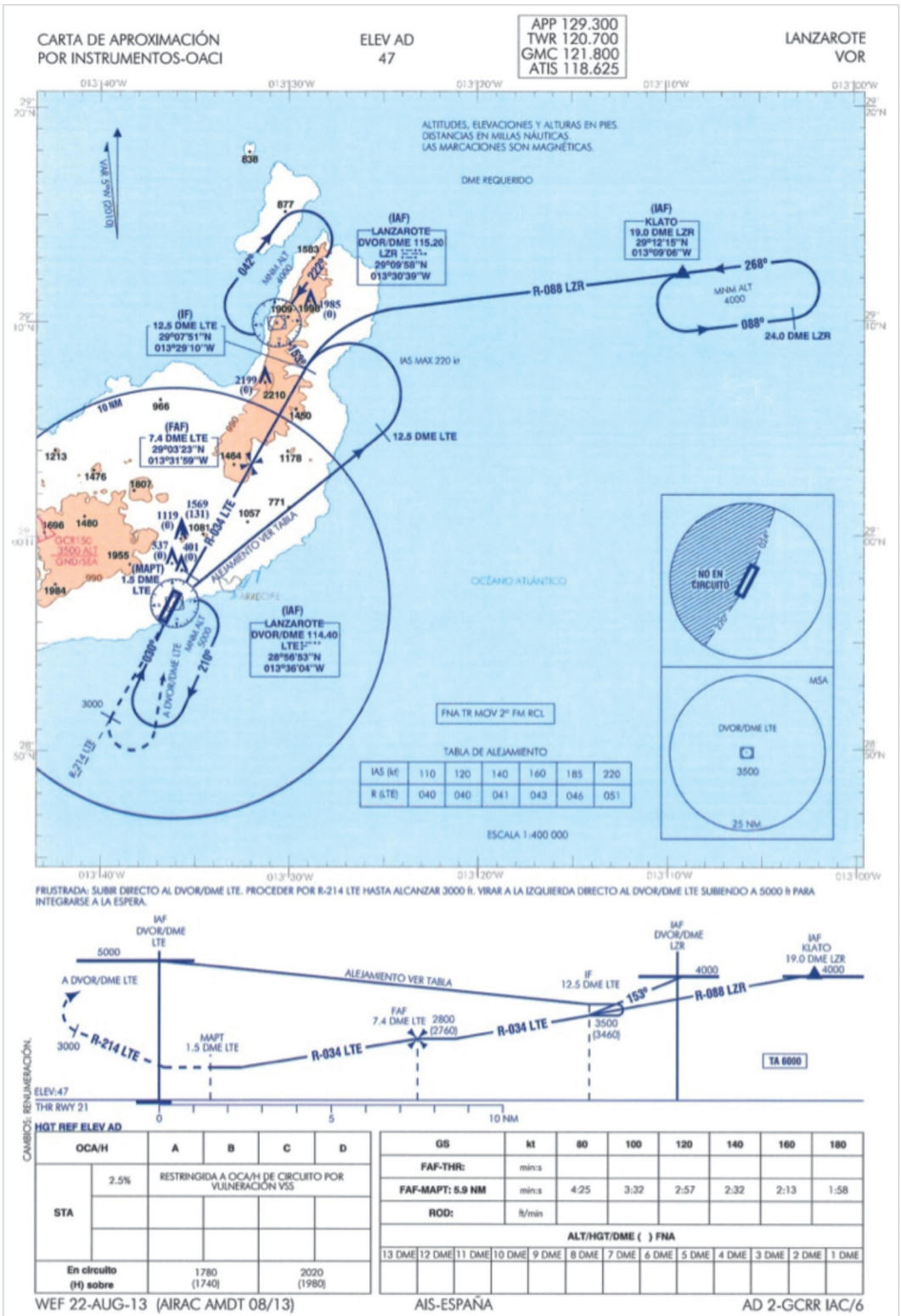
5. APPENDICES

APPENDIX I: VOR APPROACH MANEUVER TO RUNWAY 21 AT LANZAROTE.

APPENDIX II: MODIFICATION OF THE ARRIVAL AND DEPARTURE ROUTES IN THE AAC CANARIES SECTOR BASED ON THE POINT MERGE TECHNIQUE.

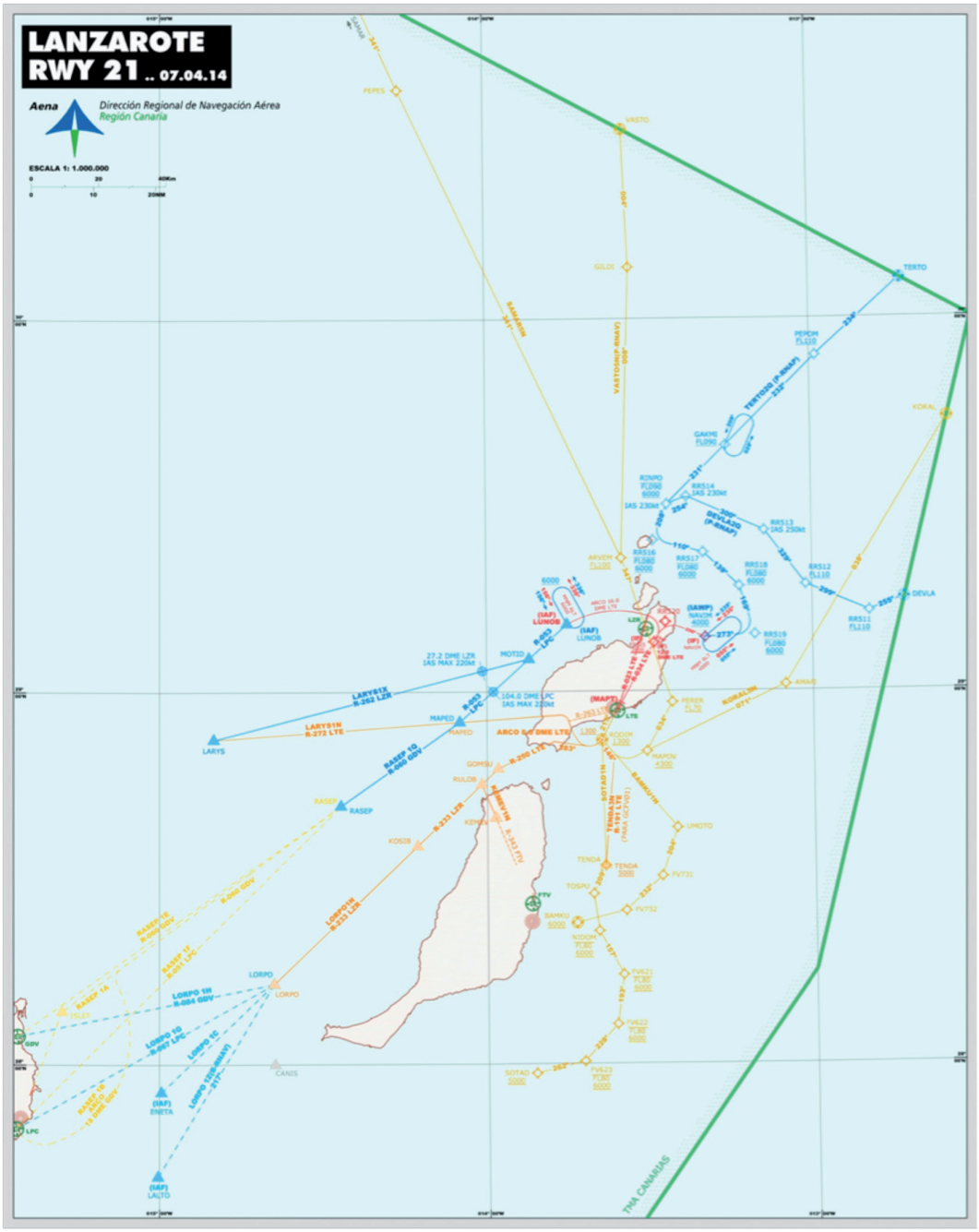
APPENDIX I

VOR APPROACH MANEUVER TO RUNWAY 21 AT LANZAROTE


CARTA DE APROXIMACIÓN
POR INSTRUMENTOS-OACI
ELEV AD
47
APP 129.300
TWR 120.700
GMC 121.800
ATIS 118.625
LANZAROTE
VOR
ALTITUDES, ELEVACIONES Y ALTURAS EN PIES.
DISTANCIAS EN MILLAS NÁUTICAS.
LAS MARCACIONES SON MAGNÉTICAS.
DME REQUERIDO
(IAF)
LANZAROTE
DVOR/DME 115.20
LZR
29°09'58"N
013°30'39"W
(IAF)
KLATO
19.0 DME LZR
29°12'15"N
013°09'06"W
R-088 LZR
268°
088°
24.0 DME LZR
MNM ALT 4000
042°
222°
(IF)
12.5 DME LTE
29°07'51"N
013°29'10"W
IAS MAX 220 kt
12.5 DME LTE
10 NM
(FAF)
7.4 DME LTE
29°03'23"N
013°31'59"W
R-034 LTE
ALEJAMIENTO VER TABLA
OCÉANO ATLÁNTICO
ARRECIFE
(IAF)
LANZAROTE
DVOR/DME 114.40
LTE
28°56'53"N
013°36'04"W
030°
210°
A DVOR/DME LTE
MNM ALT 5000
3000
R-214 LTE
FNA TR MOV 2º FM RCL
TABLA DE ALEJAMIENTO
IAS (kt) 110 120 140 160 185 220
R (LTE) 040 040 041 043 046 051
ESCALA 1:400 000
NO EN CIRCUITO
MSA
DVOR/DME LTE
3500
25 NM
FRUSTRADA: SUBIR DIRECTO AL DVOR/DME LTE. PROCEDER POR R-214 LTE HASTA ALCANZAR 3000 ft. VIRAR A LA IZQUIERDA DIRECTO AL DVOR/DME LTE SUBIENDO A 5000 ft PARA INTEGRARSE A LA ESPERA.
IAF
DVOR/DME
LTE
5000
A DVOR/DME LTE
ALEJAMIENTO VER TABLA
IF
12.5 DME LTE
IAF
DVOR/DME
LZR
4000
IAF
KLATO
19.0 DME LZR
4000
153°
R-088 LZR
FAF
7.4 DME LTE
2800
(2760)
R-034 LTE
3500
(3460)
MAPT
1.5 DME LTE
R-034 LTE
R-214 LTE
3000
TA 6000
ELEV:47
THR RWY 21
0
5
10 NM
CAMBIOS: RENUMERACIÓN.
HGT REF ELEV AD
OCA/H A B C D
STA 2.5% RESTRINGIDA A OCA/H DE CIRCUITO POR VULNERACIÓN VSS
En circuito (H) sobre 1780 (1740) 2020 (1980)
GS kt 80 100 120 140 160 180
FAF-THR: min:s
FAF-MAPT: 5.9 NM min:s 4:25 3:32 2:57 2:32 2:13 1:58
ROD: ft/min
ALT/HGT/DME ( ) FNA
13 DME 12 DME 11 DME 10 DME 9 DME 8 DME 7 DME 6 DME 5 DME 4 DME 3 DME 2 DME 1 DME
WEF 22-AUG-13 (AIRAC AMDT 08/13)
AIS-ESPAÑA
AD 2-GCRR IAC/6

APPENDIX II

MODIFICATION OF THE ARRIVAL AND DEPARTURE ROUTES IN THE AAC CANARIES SECTOR BASED ON THE POINT MERGE TECHNIQUE


LANZAROTE
RWY 21 .. 07.04.14
Aena
Dirección Regional de Navegación Aérea
Región Canaria
ESCALA 1: 1.000.000
TMA CANARIAS