DATA SUMMARY

LOCATION

Date and time	**Tuesday, 5 June 2007; 10:45 local time[1]**
Site	**Lanzarote Airport**

AIRCRAFT

Registration	**OE-LMM**
Type and model	**MD-83**
Operator	**MAP**

Engines

Type and model	**PRATT & WHITNEY JT8D-219**
Number	**2**

CREW

	Captain	Copilot
Age	**60 years old**	**36 years old**
Licence	**ATPL**	**CPL**
Total flight hours	**21,000 h**	**2,180 h**
Flight hours on the type	**7,700 h**	**2,000 h**

INJURIES

	Fatal	Serious	Minor/None
Crew			**6**
Passengers			**140**
Third persons			

DAMAGE

Aircraft	**None**
Third parties	**None**

FLIGHT DATA

Operation	**Non-scheduled – Domestic – Passenger transport**
Phase of flight	**Takeoff**

REPORT

Date of approval	**28th October 2009**

[1] All times in this report are local. To obtain UTC, subtract two hours from local time in the mainland and one hour in the Canary Islands.

1. FACTUAL INFORMATION

1.1. History of the flight

The crew started its day at Barajas Airport on 5 June 2007 at around 06:55 local time. The flight was operated by MAP under a wet lease arrangement for Air Plus Comet. The crew picked up the documentation for the flight at the Air Plus Comet office at Barajas Airport. The flights scheduled for that day were Madrid-Lanzarote-Barcelona and then back to Madrid as passengers.

The aircraft assigned for the flight was an MD-83, S/N 53377, registration OE-LMM. During the night, the maintenance crew had performed the Service check and the Daily check, which are required every 72 and 24 hours, respectively.

1.1.1. *Flight Barajas-Lanzarote*

The first flight of the day was from Madrid-Barajas to Lanzarote. The pilot flying was the captain. The copilot undertook responsibility for the cockpit preparations and required checks. However, despite being part of the cockpit preparation checklist, the crew did not check the operation of the TOWS or of the GPWS.

While the copilot was doing the cockpit checks, the captain oversaw the refueling of the airplane and other pre-flight tasks. Once in the cockpit, the captain did not ask the copilot to read the cockpit preparation checklist.

The crew did not comment on any of the anomalies listed in the aircraft logbook during the performance of the checks.

While taxiing to the threshold to the takeoff runway, fault indications were received for the Stall IND FAILURE[2], Flight Director, AHRS Basic mode and EPR limit flag systems that the copilot tried to "reset", according to his statement. The crew did not attempt to investigate why they had received these fault indications.

The crew decided to do a flex takeoff[3]. The aircraft took off from Barajas at 08:15 local time, runway 36L. On starting the takeoff run and with the autothrottle engaged, the throttle levers retarded automatically to 2° and the EPR[4] fell to 1.1. The throttle levers were then advanced manually and the aircraft took off. The crew decided to continue the flight to Lanzarote, which went without further incident.

The crew did not report any abnormalities upon reaching Lanzarote.

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[2] This is an indication that the Stall Warning system isn't worked properly. It is a NO GO system, meaning the aircraft cannot initiate a flight until the appropriate maintenance actions have been performed to correct the malfunction.
[3] A flex takeoff is one in which a higher temperature than actual is assumed, the object being to extend engine life.
[4] The EPR (engine pressure ratio) is the ratio between the total exhaust gas pressure and the total compressor inlet air pressure. On this type of engine the EPR is the primary indicator of generated thrust.

1.1.2. *Flight Lanzarote-Barcelona*

The passengers for the Lanzarote-Barcelona flight embarked without incident. The aircraft's takeoff weight was 64 tons (140,000 lb), and its payload consisted of 140 passengers, their baggage and 10 tons of fuel. The takeoff warning system was not checked prior to engine start, contrary to what it is said at the "Cockpit preparation" checklist, and if a circuit breaker (cb) panel check was accomplished it did not capture and correct an open ground control relay cb.

In preparation for the flight to Barcelona, both powerplants were started normally. Before taxiing, the crew did not select takeoff flaps-slats.

On starting the taxi run, they had to check with ATC on who had priority, since other traffic had started to taxi moments earlier. They then received the same fault indication warnings as during the previous flight. (Stall IND FAILURE, Flight Director, AHRS[5] Basic mode and EPR limit flag systems) Again, the copilot tried to "reset" all these systems, according his statement, as they were taxiing to the threshold of the runway without attempting to determine why they received these fault indications.

During the taxi phase, as the aircraft was waiting at the runway hold point, a transmission took place between an arriving aircraft and the Control Tower involving a TCAS warning the arriving aircraft had received and which indicated possible traffic at the runway threshold.

The takeoff from Lanzarote took place at 10:45 local time from runway 03 using autothrottles. The pilot flying was the copilot. After the rotation, which was conducted at an approximate speed of 145 kt, the stick shaker[6] activated and the aircraft started to roll to both sides to an angle of 63° to the right and 60° to the left. The captain retracted the landing gear approx. 25-30 seconds after liftoff, while the aircraft was still oscillating back and forth in the roll axis. The aircraft continued the roll oscillations until it reached a speed in excess of 200 kt.

The aircraft climbed to 5,000 ft and the crew initially decided to continue with the flight, this decision being immediately reversed and the aircraft returned to Lanzarote. The crew did not declare an emergency. The landing was normal and no further incidents took place.

No one was injured and the aircraft was undamaged. The passengers disembarked normally.

When the aircraft landed and reached the apron, the crew checked with maintenance personnel at Barajas by telephone. They were told that the cb for the "Left ground

[5] AHRS Attitude and Heading Reference System. Two AHRS, AHRS-1 and AHRS-2, are installed to supply attitude information through Symbol Generator to the Captain's and F/O's Primary Flight Display respectively.
[6] This is an indication that the aircraft is approaching a stall condition.

control relay"[7] had been found tripped on the same aircraft the day before when another crew returned to the parking area following the receipt of various alarms (as indicated in the Technical Logbook, the 3 AHRS lights were on in Basic Mode, there was no left or right flight director, the STALL IND FAILURE light was on and the EPR LIMIT flag was activated). Corrective action was reported to be to resettling the cb.

With this information the crew checked the cb panel and noted that the "left ground control relay" cb was tripped. They subsequently, during their statements, reported having some difficulty finding the cb because the white area that indicates the tripped condition was of a grayish color due to its frequent use by maintenance personnel.

In accordance with the information found on the data recorder, the crew conducted the takeoff from Lanzarote in a non-approved configuration. The slats were retracted and the flaps were up. The takeoff warning system (TOWS) did not warn of this incorrect configuration because the aircraft was in flight mode (the system only works on the ground) due to the fact that the left ground control relay cb was open. The aircraft had been in flight mode since the maintenance check the night before in Barajas.

According to the maintenance1A Strobe Light check task card, when the circuit breaker was opened to check the strobe lights, there were not any specific indications about what to do when they open the c.b. (safety tag, collar, etc.). This task check instructed maintenance to close the cb after the check. In addition, the AMM, Chapter 20 Standard Practices- Airframe, instructs maintenance crew to tag and collar any cb open, and to un-tag, un-collar, and close the cb when they are done.

1.2. Personnel information

1.2.1. *Captain*

Sex, age:	Male, 60
Nationality:	Argentina
License:	ATPL (Argentine license with Austrocontrol validation certificate)
Ratings:	BA11, B732, DHC6, DC9, MD80, MD88, IR
Total flight hours:	21,000 h
Total hours on the type:	7,700 h
Total hours as captain:	4,000 h

[7] Named K33, it is located in the panel after the LH seat in the cockpit.

Hours in last 90 days:	70 h
Hours in last 30 days:	45 h
Hours in last 24 hours:	3 h
Date of last check flight:	20 May 2007
Date of last proficiency check:	3 May 2007
Date hired:	1 May 2007

The captain had rested the day before the incident, 4 June 2007. On 3 June he had flown to Rome. He had been flying regularly with the copilot in the two weeks prior to the incident.

Training

Operator conversion course: from 04 April 2007 to 05 April 2007

As reported by the company, the ground portion of the operator conversion course taken by the captain included a course called Flight Safety Training.

The information provided by the captain after the incident said he had taken the following courses:

- Aircraft Safety
- Security
- Evacuation
- Dangerous Goods
- Wet Drill
- Medical

Line training: 3 flights, block time 6h 30 min, as revealed by data provided by the company. Other information from the company was that the line training involved 2 flights.

According to the captain's "Flight Progress Folder", the line training lasted 3.1 hours and involved just one flight (Shannon-Fari) and the line check consisted of two flights lasting 2.7 hours on the same Shannon-Faro-Shannon route. This contradicts the check pilot's own statement and the information provided by the company.

Both the line training and line check took place on 20 May 2007. The line check for both the pilot and copilot was supervised by the same person.

1.2.2. *Copilot (CM-2)*

Sex, age:	Male, 36
Nationality:	Venezuelan
License:	CPL (Venezuelan license with Austrocontrol validation certificate)
Ratings:	DC9, MD80, IR
Total flight hours:	2,180 h
Total hours on the type:	2,000 h
Hours in last 90 days:	200 h
Hours in last 30 days:	70 h
Hours in last 24 hours:	3 h
Date of last check flight:	26 May 2007
Date of last proficiency check:	28 March 2007 (before being hired)
Date hired:	15 April 2007

The copilot had rested the day before the incident, 4 June 2007. On 3 June he had flown to Rome.

Training

Operator conversion course: from 2 April 2007 to 06 April 2007, which was prior to the date he was hired by the operator of the incident aircraft.

As reported by the company he had taken the following courses:

- OM-A, OFP (OM-A, operational flight planning): 02/04/2007
- Flight Safety Training: 3/04/2007
- Ditching: 04/04/2007
- SOP, Loadsheet: 05/04/2007
- First Aid: 06/04/2007
- Cold Weather: 06/04/2007
- RVSM (Reduced Vertical Separation Minimum): 06/04/2007
- Fire Fighting: 06/04/2007

The information provided by the copilot following the incident revealed that he had taken the following courses:

- Aircraft Safety
- Security
- Fire/Smoke
- Evacuation
- Dangerous Goods
- Wet Drill
- First Aid

In his statement he declared that one afternoon of the ground training course was devoted to general company procedures and the Operations Manual.

Line training: 12 flights, block time 23 h 33 min.

The copilot's "Flight Progress Folder" was not available, but the information provided by the company was that he did the line training from 7 May 2007 to 26 May 2007. This contradicts both the captain's and copilot's statements, who said they had been flying together for 2 weeks. It also disagrees with the timeline provided by the instructor who as the company affirms was responsible for the training and who was mentioned by the pilot in his statement.

The copilot also stated during the interviews that he started flying to Greece in late April 2007 with another Spanish-speaking captain.

1.2.3. *Operator conversion training as per the OM-D and the OM-A*

The OM part (A) specifies that all pilots joining the company as captain must pass a conversion course (OM-A, 5.2(a) and 5.4(a)), whose syllabus is contained in the OM part (D) 2.1.1, "Operator conversion course". Also specified is that the practical flying instruction is to be adapted to the candidate pilot's previous experience, which is to be entered in the candidate's file.

As for the syllabus referred to in the OM-D Chapter 2.1.1, both pilots should have received training on the following topics:

- Ground Training:

  — CRM (Cockpit Resource Management)
  — Route Documentation
  — Flight Planning
  — Mass and Balance
  — Performance
  — OM-A
  — Standard Operating Procedures

— RVSM (Reduced Vertical Separation Minimum)
— Dangerous Goods

- Emergency and Safety Equipment Training:

  — First Aid
  — Aeromedical topics
  — Effect of smoke
  — Security, Rescue and Emergency Services Procedures
  — Survival information appropriate to the area of operation and training in the use of survival equipment
  — Ditching training
  — Instruction on the location of emergency and safety equipment, correct use of all appropriate drills and procedures.

- Aeroplane/ STD Training:

  — Familiarization of the Flight Crew with all aspects of limitations and normal/abnormal and emergency procedures
  — LOFT (Line-Oriented Flight Training) with emphasis on CRM
  — Take off and landing training in the airplane (not applicable for Zero Flight Time Conversion)

- Line Flying under supervision:

  — Sectors/hours according to OM Part A Chapter 5
  — Line Check

The practical training (flights under supervision), according to information provided by the company (which does not agree with what is listed in part A of the OM, Chapter 5[8]), consisted of:

- For copilots with more than 100 h of experience on the type and over 2,000 total hours, 5 sectors and 20 h, in addition to a line check.
- For captains with more than 500 h as PiC on the type, over 1,000 h as PiC and over 5,000 total hours, 3 sectors and 10 h, in addition to a line check.

1.3. Aircraft information

The MD-83 is a medium-range, narrow-body turbojet passenger airplane that can seat 155-172 passengers depending on the version. Its design evolved from that of the

[8] Chapter 5 says that after the MD-83 conversion course captains must fly at least 100 h and 20 sectors under supervision. For copilots it is 25 h and 10 sectors.

DC-9 aircraft, which was manufactured by the Douglas Aircraft Company, a predecessor to the McDonnell Douglas Corporation and The Boeing Company.

1.3.1. *Ground sensing system*

Various aircraft systems operate differently on the ground than in the air. To provide this information to the systems, the aircraft is equipped with two sensors in the nose gear (the Left and Right Nose Oleo switches). When the nose gear strut is compressed and the left and right ground control relay circuit breakers are closed, the switches provide an electrical ground to energize left and right ground control relay circuits, each of which has multiple individual relays sending signals to various airplane systems to inform them of the ground or in-flight state of the aircraft. If the cb for these relays is open, the relay will not be energized and therefore the systems that rely on this circuit will assume that the flight mode is in effect.

When the "Left ground control relay cb" is open and the airplane is on the ground, several systems will not function properly, triggering warnings in the cockpit. For example the "STALL IND FAILURE" light in the overhead panel is energized, instrument cooling does not work (this is noticeable in the cockpit by the noise the fan generates when operating), the EPR Limit flag appears, RAT probe heating is energized and its temperature rises, the Take Off Warning System check would fail, the NO AUTOLAND warning turns on (amber light), the left engine idle will change from ground idle to flight idle and thus will be greater than the right engine's idle, and the AHRS will be in basic mode (blue light).

1.3.2. *Boeing recommended maintenance practices*

According to the Boeing Maintenance Check Manual (MD-80 MSG-3), Volume 1, Section 3, Line Maintenance, there is a recommended "Service Check" that is performed every three days.

The task card for the "Service Check"[9] (number 80LM-002) states in its procedure, item 8: "Perform the following Electrical Checks":

G. Check external lights and lenses for proper operation.

This section and version of the document, used by the operator's maintenance personnel, provides no indication or definition of which lights are the "external lights".

[9] According to information provided by Boeing, the use of task cards is recommended and each operator can develop their own cards.

The only requirement to check the strobe lights is found in Boeing task card no. 801A-001 (CHECK 1A), corresponding to inspection interval 1A, which is performed every 450 hours. This card states in the task description, item 1: Do an operational check of the following light systems:

B. Strobe Lights

1) Open left ground control relay circuit breaker on the upper EPC panel.
2) Place glareshield POS/STROBE switch to BOTH positions.

WARNING: DO NOT LOOK AT THE LIGHTS FOR A LONG TIME.

THE LIGHTS CAN CAUSE INJURIES TO YOUR EYES.

3) Check that each fwd and aft strobe light in the left and right wingtip flashes.
4) Close left ground control relay.
5) Make sure strobes stop operating.
6) Place POS/STROBE switch to OFF.

1.3.3. *Actions taken by Boeing*

On 1 August 2008, Boeing issued a revised and reformatted task card for checking the strobe lights (33-042-01-01, which superseded 801A-001), which, as before, instructed that the check be conducted during every 1A inspection (every 450 hours), and which specified that the open "left ground control relay" breaker be indicated with a safety tag.[10]

Boeing clarified that the strobe lights should not be checked on every "Service Check", and that it was never Boeing's intention for them to be, as there would have been a requirement to open and close the left ground control relay cb included in the task card, and as the requirement to check the strobe lights was already a 1A check with its own task cards.

To reduce the likelihood of confusion, Boeing has issued new "Service Check" (MSG-3) and "Service/Overnight Check" (MSG-2) cards in March 2009, which eliminate all references to an external light check.

The MSG-3 task card index specify the time interval for checking each of the external lights. As before, an interval of 450 h (1A) is assigned for the strobe lights in the MSG-3 program.

[10] The entire MD-80 MSG-3 Maintenance Check Manual has been converted to a new document called "Task Cards," and uses a new authoring and formatting system. Task Card 33-042-01-01 utilizes this new format. As of May 1, 2009, the "old" MSG-3 format will no longer be available to the operators.

1.3.4. *Maintenance practices as performed by the maintenance company*

Maintenance personnel at the maintenance company reported that the strobe lights were checked during every "Daily Check" (despite the "Daily check" card requiring no such action) and "Service Check". They did so by opening the "Left ground control relay" cb, which was not an instruction in either task card.

The day prior to the accident, in response to the alarms received in the cockpit, the crew decided to return to parking. The "Left ground control relay" was identified as being open due to, as listed in the "Technical Logbook", damaged wire on LH ground control relay cb.

Maintenance personnel working on the malfunction reported that the only corrective action taken was to reset the circuit breaker and there were not damaged wires. The circuit breaker was pulled but maintenance crew stated they didn't find anything about wires but they wrote down there were some damaged wires trying to explain the delay of the flight.

Personnel for the company that operated the aircraft informed that the circuit breaker for the "Left ground breaker relay" was found open on other occasions in MD airplanes in the summer of 2007, on flights departing from different European countries, and for which the line maintenance was performed by different companies.

Note that Chapter 20 of the MD-80 AMM (STANDARD PRACTICES–AIRFRAME), Pages 201 and 202, entitled 'Electrical/Electronics Safety and Equipment – Maintenance Practices", Paragraph 2, entitled "Safety and Operating Precautions," provides procedures for maintenance personnel to follow when cb's are required to be opened. These general practices require safety collars and tags be applied to the opened cb's, and the removal of the tags and collars (and closure of the cb) when maintenance actions are complete. The operator's maintainers were not following these Boeing-recommended Standard Practices.

1.4. Meteorological information

The meteorological information at Lanzarote airport METAR for that day was as follows:

METAR GCRR 050930Z 33014KT 9999 FEW020 23/15 Q1013=
METAR GCRR 051000Z 34015KT 300V020 9999 FEW020 23/15 Q1013=

Winds were variable and its strength was between14 and 15 kt and the outside temperature was 23°.

1.5. Communications

During the flight the aircraft was in radio contact with the Control Tower at Lanzarote airport and with the Canaries Control Center. The communications proceeded normally.

The Control Tower cleared the aircraft for start-up and push back from gate C at 10:31 for taxi to the threshold. The aircraft was informed of standard departure procedures and given a transponder code.

At 10:35 the crew of the aircraft confirmed it was ready to taxi and received clearance to taxi to the runway 03 hold point. At 10:36 the crew requested clarification over whether it had priority or not over previously cleared traffic, which the Control Tower confirmed it did not.

At 10:42 the aircraft reported that it was at the runway 03 hold point. ATC informed them to maintain position at the hold point.

At 10:43 they were cleared to line up and wait.

At 10:44 they received wind information and takeoff clearance.

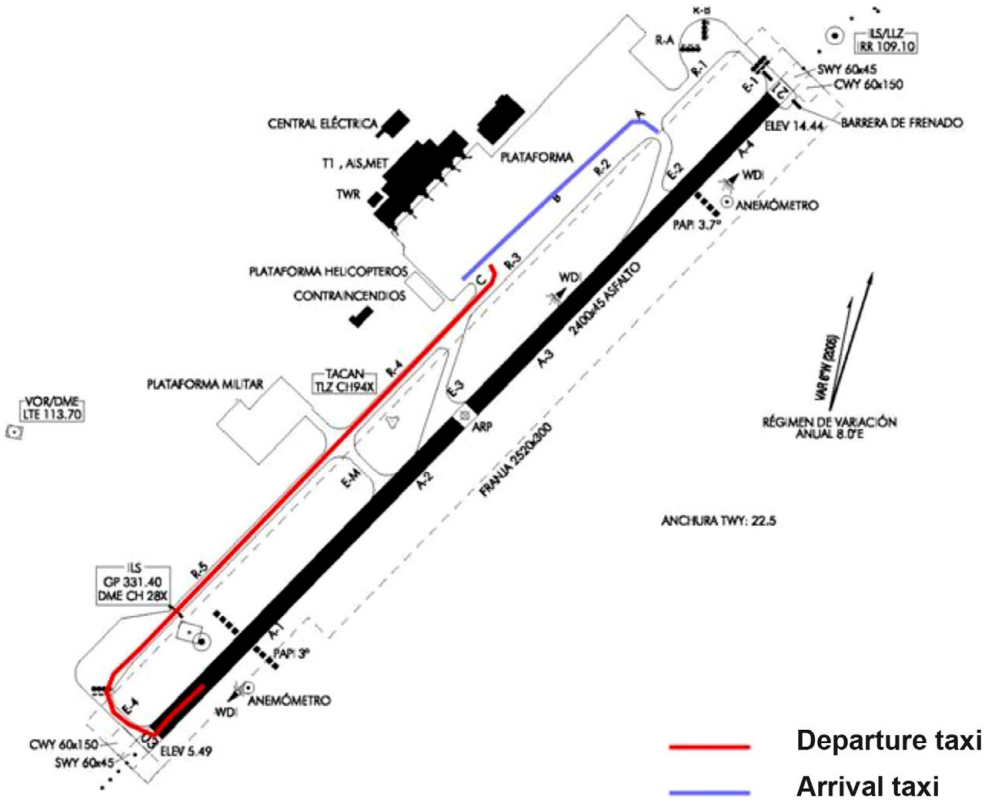

Figure 1. Departure and arrival taxi at Lanzarote airport

At 10:47 the aircraft contacted ATC to report that they had had a problem and were in a hold.

At 10:49:15 they reported the problem was solved and they were continuing with the climb.

At 10:50:38 the aircraft reported it was returning to Lanzarote airport.

At 10:59:09 they reported being 5 miles out from the airport and ATC cleared them to land.

At 11:02:03 the aircraft reported runway clear.

At 11:05:50 they were instructed to go to parking stand 26, a remote stand.

As reported by ATC while the aircraft was taxiing to the threshold, information was received about TCAS warnings on an aircraft on approach.

1.6. Aerodrome information

The airport in Lanzarote has a 2,400 m long and 45 m wide asphalt runway, 03/21. Its elevation is 47 ft.

The aircraft took off on runway 03. Before takeoff it had taxied from the stand to the runway 03 threshold, leaving from gate C and taxiing on taxiways R3, R4 and R5.

1.7. Recorders

The aircraft was equipped with digital flight data recorder (DFDR) and cockpit voice recorder (CVR). They were recovered after the incident from the aft compartment where they were installed. They were in good condition and were kept so their data could be extracted.

1.7.1. *Flight data recorder*

The flight data recorder was a digital Honeywell recorder, P/N 980-4100-DXUS. It had a capacity for 91 flight parameters and a 25-hr recording time. The recording started when the aircraft was energized, despite of both engines weren't working and the parking brake was set. Normally the DFDR doesn't record on the ground with both engines switch off and the parking brake sets, but if the information provided to recorder is that the aircraft is in the air the two previous interlocks don't work and the recording starts as soon as there is power.

Two graphs are provided below. The first shows parameters from the takeoff conducted at Madrid airport en route to Lanzarote. Note the decrease in the EPR and the retard of the throttle levers just as EPR T/O[11] mode was selected on the TRI[12].

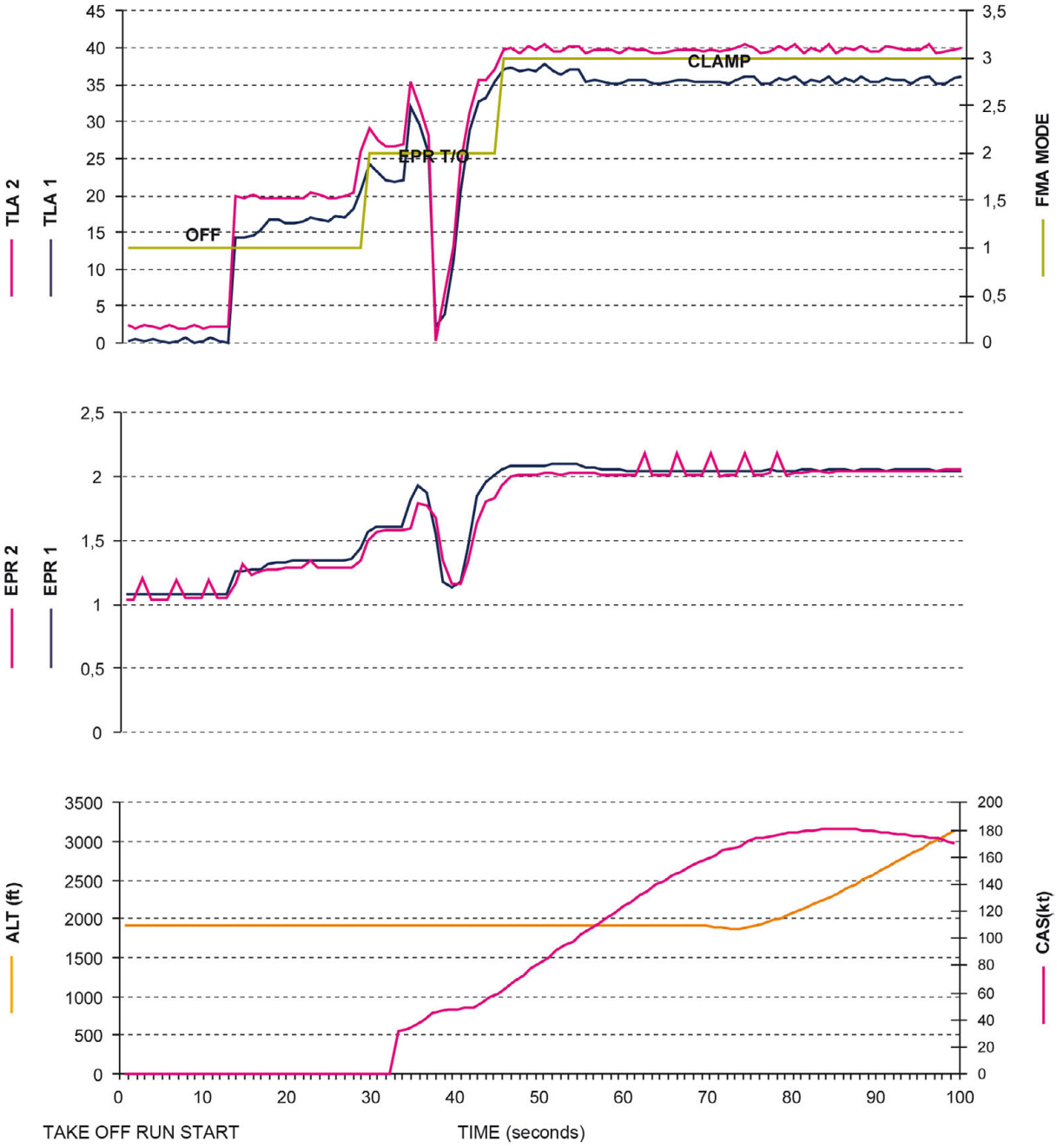

Figure 2. Take off from Madrid-Barajas

[11] Mode selected with the autothrottle engaged when performing an automatic takeoff.
[12] The TRI (Thrust Rating Indicator) is a panel where the autothrottle modes are selected for the different phases of flight.

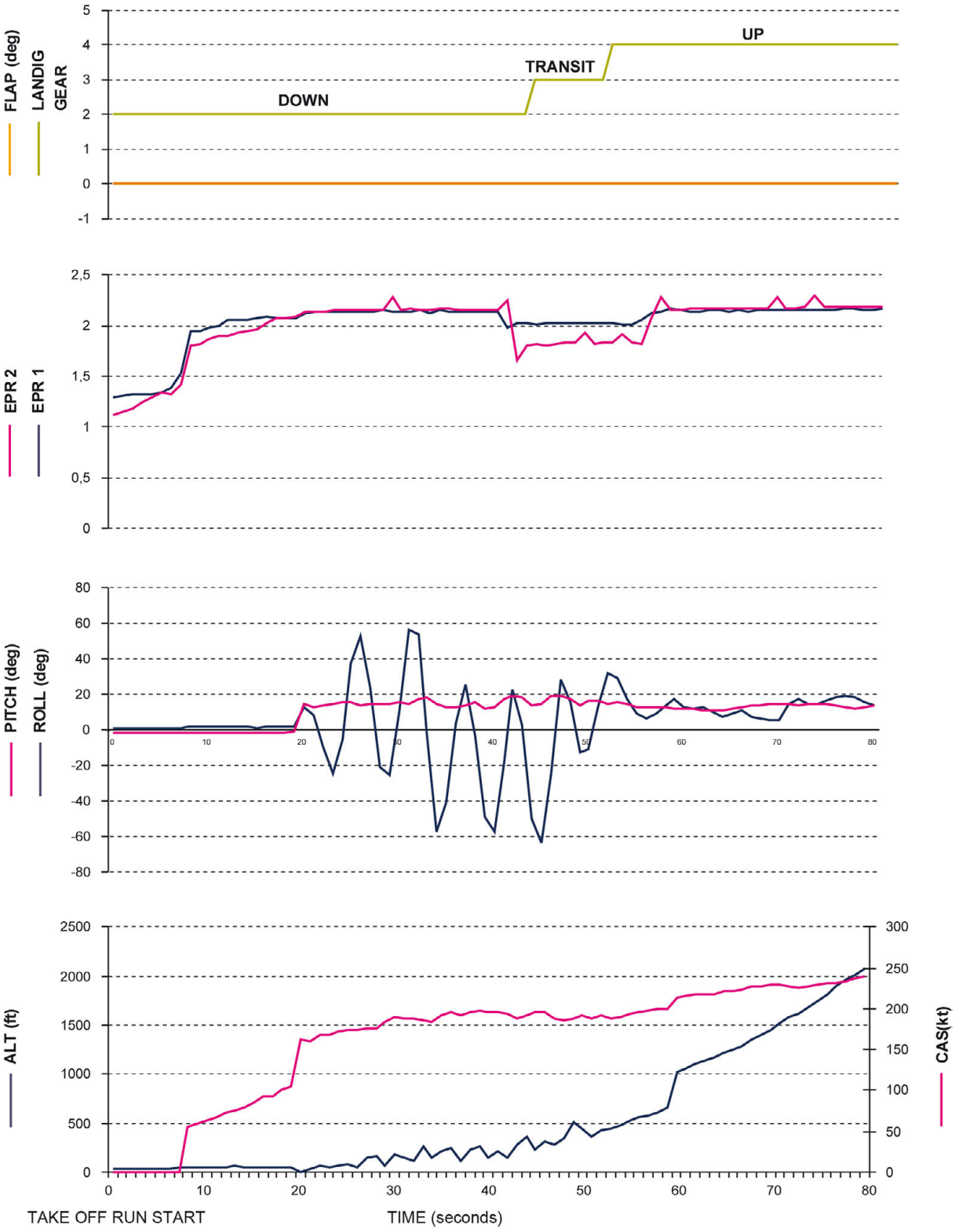

Figure 3. Take off from Lanzarote

The second graph shows the takeoff for the Lanzarote-Barcelona flight[13]. Of note in this case is, first, that the flaps are selected to 0°, and second, the prominent rolls suffered by the aircraft after the rotation, and how these rolls subside as the indicated airspeed increased.

According to information supplied by Boeing, the stall speed out of ground effect for the aircraft at its takeoff weight and with a 0° flap and slats retracted configuration was 161 kt. When the aircraft started to roll the speed was 159 kt. The oscillations increased the stall speed up to approximately 202 kt.

The lateral oscillations continued until the speed surpassed 200 kt. Although other factors, such as the center of gravity or spoiler deflection affect the stall speed, these are considered minor in a situation as dynamic as the one that took place. Boeing reported that the response of the aircraft was consistent with the behavior typical of swept-wing passenger turbojets when flying below the stall speed.

1.7.2. *Cockpit voice recorder*

The cockpit voice recorder was a Honeywell AV557C recorder, P/N 980-6005-076. The duration of the recording was 30 minutes. Since the crew left the APU on when it left the aircraft following the incident, the information on the recorder was subsequent to the incident and therefore not applicable to the investigation.

1.8. Tests and research

During the investigation the proper operation of the autothrottle system with DGFC 1 (Digital Flight Guidance Computer) and DGFC 2 was verified. After performing the troubleshooting procedure specified in the AMM Chapter 22-31-00, the results indicated that the autothrottle system was working properly on both computers.

When the test was repeated with the "Left ground control relay" open, the result of the test was "NO GO".

So as to identify the alarms that appeared in the cockpit when the breaker for the "Left ground control relay" was open, a test was conducted in an MD-82 type C flight simulator, which means that its configuration doesn't match integrally with the MD83 one, but for the purpose of the test performed, the conclusions reached are completely valid. During the simulator session it was noted that the TOWS had been wired in

[13] There are some data dropouts which haven't been included at the graph. So the information the graphs shows is only qualitative.

accordance with AD-90-04-05, which requires that warnings be displayed only when both thrust levers are advanced.

When the "Left ground control relay" breaker was opened the following took place:

- The amber "NO AUTOLAND" light came on in both the pilot and copilot FMAs (Flight Mode Annunciators).
- No temperature variation was detected, probably because the simulator does not model RAT probe heating.
- The TOWS did not activate when the system check was performed.
- The amber "AUTO SPOILER FAIL" light turned on in the upper panel.

Additional tests were performed [14]using an MD88[15] aircraft on the ground at Reagan National Airport in Washington D.C. The test consisted of opening the "Left ground control relay" breaker, which resulted in the following:

- The red "Stall Indication Failure" light turned on
- The amber "NO AUTOLAND" light turned on
- The RAT probe temperature rose
- The TOWS did not work when the system was checked
- The N2 indication for the LH engine increased to 65%, and maintained 50% for the RH engine.
- Instrument cooling wasn`t heard in the cockpit.

1.9. Organizational and management information

The company that operated the incident aircraft was founded in 2002 and in the summer of 2007, when the event took place, it was operating half a dozen different executive twin jet airplanes and three MD-83, offering wet lease services for all kinds of charter flights. It was the second year of operation of the company's MD83 fleet.

Given the business structure, the company resorted to hiring pilots at the start of the high season through an aviation company headquartered in a Central American country.

The pilots hired by the company for its MD fleet were from various backgrounds, multi-culturality being a common factor to all the crews. There was a core of Spanish-speaking pilots, however, who tended to be scheduled together. These pilots, despite their common language, were from different airlines and had different nationalities, and as such had different "operational cultures" among them.

[14] The tests were performed by US NTSB and Technical Advisors as support of the CIAIAC investigation related to the accident of the aircraft MD-82, registration EC-HFP, at Madrid-Barajas airport on the 20th of August 2008.
[15] Its configuration doesn't match integrally with the MD83 one, but for the purpose of the test performed, the conclusions reached are completely valid.

1.9.1. *Crew selection and training process*

According to the statements by the pilots and by the check pilot himself, the hiring process involved a personal interview, after which an MD80 simulator session was conducted which doubled as a professional evaluation prior to hiring and to familiarize the pilot with the company's operational procedures.

The 4-hr simulator session was preceded by a 60-minute briefing and a 30-minute debriefing. During this session they were given the company's normal checklists.

Upon successful completion of this phase, the training shifted to ground instruction, during which they took the courses listed in Section 1.2, Personnel information.

All of these courses were certified on the same date, 5 May 2007, for the captain. No completion date is shown for the copilot, although during the interview he asserted having completed the courses a few days after being hired, in Vienna.

Lastly they completed the line training, whose duration and number of flights is described in Section 1.2.

Once the line training was finished, a line check was arranged. Both incident pilots were supervised by the same person, the company's check pilot, who was also the incident captain's instructor as listed in his Flight Progress Folder.

1.9.2. *Operational documentation*

A large percentage of the operational documentation was copied from Austrian Airlines, as evidenced by the logos on most of the documentation provided by the company to the investigation. Austrian Airlines was no longer flying the MD80 by then.

There are very few references in the documentation analyzed concerning the use of checklists, only a mention that the captain's authority must be reflected when complying with the operational procedures and the checklists (OM, Rev 10, Part A – Feb07 – par. 1.4); that the preflight must be done as per the checklists (par. 1.4.1); and that the improper use of checklists and defective preflight procedures are a common source of incidents (par. 2.3). According information provided by the company, both the captain and copilot received the OM-A. The copilot also received a training program about OM-A including a written test.

According to information provided by the flight crew, the expanded normal checklists hadn't been given to the crew before the time of the incident. Moreover, the crew was not trained on the contents of said documentation.

As already mentioned, the pilots did not have in their possession the expanded checklists at the time of the incident. These checklists explain exactly what is to be checked and how the status of each item on the checklist is to be verified, as well as who is responsible for the tasks. Each pilot, then, performed the checklists according to their own best judgment, their experience, or in accordance with the SOPs at their company of origin.

It was concluded from the interviews held with the pilots that the company's policy consisted of having the copilot read the checklist items on the ground, even if the captain did not request that a specific checklist be performed. This finding, though it seems to reflect actual practice, is not supported by any of the company's operational documentation.

1.9.3. *Operating procedures and checklists*

As already noted, the company copied a great deal of its documentation from Austrian Airlines, the expanded checklists having been developed within that group.

The checklists completed before takeoff are:

1. Cockpit preparation (on the first flight of the day) or Transit cockpit preparation (on normal-transit stops)
2. Before engine Start
3. After engine Start
4. Taxi
5. Before Departure

In item 15 of the "After Engine Start" checklist the flaps are selected for takeoff, verifying that the indicator marks the selected position. Then again in item 8 of the "Taxi" checklist the flaps are verified selected by means of the flaps and slats indicator. The copilot reported that the "cockpit preparation", "transit cockpit preparation" (which, as indicated on the checklist itself is performed "on normal transit stops…"), "after engine start" and "taxi" checklists were not requested by the captain, and the copilot performed them all from memory.

Both the "cockpit preparation" and "transit cockpit preparation" checklists require verifying that no breakers are open and that the TOWS is functioning properly. None of them was completed by the crew.

Another item present on both checklists is a check of the TRI, and involves reading the temperature indicated by the temperature probe and verifying the EPR limit reading.

An examination of the documentation related to the checklists and operating procedures, that is, of AOM 3.3 pages 1 to 17 (included within the company's OM-B folder), did not reveal any reference of interest on the following topics:

- checklist execution and verification
- definition of assignments involving checklists
- takeoff briefing, contents or requirement to hold one

1.9.4. *Actions taken by the company*

After the incident in Lanzarote, the company informed its crews about the event and about how to identify if the "Left ground control relay" breaker was open.

A bulletin was issued dated 28 June 2007 notifying of the company's intention to modify its checklists so that the flaps would be checked on the "After Engine Start" and "Taxi" checklists. These items were already present on the checklists the crew should have used on the day of the incident.

The MD crews were also supplied with the expanded checklists, which had not been available before then.

1.10. Additional information

1.10.1. *Operational regulations*

JAR OPS regulation 1.085, "Crew responsibilities", states that "… the commander shall ensure that all operational procedures and checklists are complied with". This regulation is currently in OPS 1.085.

JAR OPS 1.210 defines the normal procedures for each type of airplane (currently OPS 1.210).

The JAR regulations likewise state, in article JAR OPS 1.175, Appendix 2 3(i), on line supervision, that the objective of this supervision shall be «... to ensure the attainment of the standards specified in the OM» (currently Appendix 2 OPS 1.175).

The JAR regulations also include the following information on the training required for crews newly hired at a company:

> *The operator shall ensure that:*
>
> *(2) a flight crew member completes an operator's conversion before commencing unsupervised line flying:*

(ii) When changing operator

(6) Each member of the flight crew undergoes the checks required by JAR-OPS 1.965 (b) (Operator proficiency check) and the training and checks required by JAR-OPS 1.965 (d) (Emergency and Safety Equipment training and checking) before commencing line flying under supervision.

(7) Upon completion of line flying under supervision, the check required by JAR-OPS

1.965(c) (Line Check) is undertaken (currently OPS 1.965)

(8) Once an operator's conversion course has been commenced, a flight crew member does not undertake flying duties on another type or class until the course is completed or terminated; and

(9) Elements of CRM (Crew Resource Management) training are integrated into the conversion course

1.10.2. *Summary of interview held with Check Line Pilot of both crewmembers*

The interviewee, who conducted both the captain's and the copilot's line checks, was hired after the captain operating OE-LMM on the day of the incident was, and underwent the same selection process as the pilot and the copilot who was with the captain on the day of the incident. The process consisted of:

- simulator session used to simultaneously test the applicant and as adaptation training on company operations
- ground courses.

He stated that during the captain's line check, Shannon-Faro-Shannon, he did not note anything unusual and graded him as "qualified". Throughout the interview he admitted that during the check, the copilot initiated the actions corresponding to the checklists without being requested to do so by the captain.

The interviewee had studied the NTSB report on a misconfigured wing takeoff/disabled TOWS accident involving a Northwest MD82 at the Detroit (USA) airport (NTSB/AAR-88/05). In the Detroit accident, the problem occurred because the TOWS did not annunciate due to the loss of power to the airplane's Central Aural Warning System (CAWS) which was related to circuit breaker P40. The TOWS itself received proper inputs that the airplane was on the ground but the warning was disabled by the absence of power to the CAWS.

He also noted that he was aware of six others cases connected with the improper operation of the "LEFT GROUND CONTROL RELAY" cb (K33).

He noted that the practice of pulling the K-33 cb to check the proper operation of the strobe lights during the "Service Check" was common to the operator's MD fleet, and that in fact the white area on the breaker handle was very dirty, presumably from being routinely manipulated.

The design of the checklists seemed appropriate to him and he thought the incident was not due to inadequate checklists, but rather to a lack of operational discipline in not adhering to the SOPs.

2. ANALYSIS

2.1. Analysis of the flight

Analysis of the incident data shows that the airplane took off with the slats retracted and 0° flaps, a non approved takeoff configuration. This was caused by not selecting takeoff flaps, which resulted from a procedural omission by the crew. On top of this error was the lack of protection offered by the TOWS, which the crew did not check prior to engine start at either Madrid or Lanzarote as required by their checklist, and which was disabled by an open K-33 circuit breaker (Left ground control relay) (which was not reset as required by standard maintenance practices, and was not checked by the flight crew as required prior to engine start), so some of the airplane systems were in the flight mode while the airplane itself was still on the ground during the Madrid-Lanzarote and Lanzarote-Barcelona flights.

2.1.1. *Takeoff from Barajas*

On the first flight of the day, the Madrid-Lanzarote leg, on performing the cockpit preparation, the crew should have checked that all the cb's were closed, as required by the cockpit preparation checklist. Noticing a circuit breaker in its open position could have been difficult with the naked eye, however, since the white strip on the breaker that would have made this position visible was very dirty due to routine manipulation since it was probably open on every "Service Check" to verify the operation of the strobe lights.

In addition to the cb's, the crew should have checked the following items on the "cockpit preparation" checklist, among others:

29. Pitot heaters
52. Thrust rating indication

57. Take off warning system
68. EPR limit

A check of any of these four items would have alerted the crew that the airplane's ground-air system was in the wrong mode.

It seems clear that the pre-flight check of the cockpit was not performed rigorously. The copilot himself admitted to omitting some checks, such as of the TOWS. Added to this was the fact that captain did not ask for the normal checklists to be read, the result being that the possibility of detecting errors or omissions in the preparation of the cockpit was systematically removed. Additionally the lax requirements concerning procedural compliance undoubtedly made them relax in their execution and perform the checklists from memory.

What is more, the series of cockpit warnings and faults associated with the airplane being in air mode received by the crew while taxiing at Barajas should have been investigated by both pilots before taking off for Lanzarote. They tried, according their statement, to reset the warnings but it can't be done but reseting the cb K33, so whatever they tried to do it was in vain.

The flight was not delayed and the crew did not return to parking despite the numerous cockpit warnings and indications: stall indication failure, FD, cooling fan, elevated RAT temperature indication, EPR target flag, left engine idle RPM higher than the right engine, and AHRS basic mode.

Lastly, during the takeoff run, the throttle levers retarded with the autothrust system engaged. This was because the EPR target was very low since the aircraft computer interpreted the temperature provided by the temperature probe as being heated. This abnormal indication was also not investigated by the crew. All of these circumstances point to a substandard level of professionalism in the cockpit.

2.1.2. *Takeoff from Lanzarote*

On the incident flight (Lanzarote-Barcelona) the crew should have completed the "transit cockpit preparation" which, as specified on the checklist itself, is to be performed "on normal transit stops...". This checklist requires that, among others, the following items be checked:

1. Position of all the cb's
20. Thrust rating indication
23. Take off warning system
25. EPR limit

Again, a check of any of these four items would have alerted the crew to the fact that the airplane's ground-air system was in the wrong mode.

According to eyewitness accounts and to the evidence collected, the sequence of events was as follows: after start-up, the copilot requested taxi and a conversation ensued with the control tower and other traffic on who had priority. Once this was clarified, the MD83 started to taxi, but by then the copilot had lost the "cue" that makes him select takeoff flaps, since the captain did not request said action.

The taxi from the parking stand to the runway 03 header took just five minutes. That was the time available for the copilot to perform the steps from memory corresponding to that phase of flight (after start, taxi, before takeoff), handle communications with ground control, aid the captain with the taxiing and read any associated normal checklists.

While taxiing a new conversation was held between traffic on final and the control tower which once again distracted the copilot, who was already carrying a heavy workload, causing him to lose another chance to remember the tasks he had to perform, in the absence of a request for the checklist and of reading said checklist. Therefore, both opportunities to select takeoff flaps were lost. The last safeguard against taking off without flaps would have been the captain's takeoff briefing, which on this occasion was either not completed or done so inadequately.

By analyzing the specific flight that is the object of this incident report, the error can be broken down into at least six successive partial errors, keeping in mind that the cb was already open:

- the "transit cockpit preparation" checklist is not performed or is done incorrectly, and the associated list is not read;
- the captain does not request a flap/slat position after start-up of both engines, or the request is not heard by the copilot, who therefore does not take actions to extend the flaps;
- despite the captain not requesting takeoff flaps, the copilot remains passive and does not question him on this point;
- when checking the "after engine start" checklist (item 15), the note to check the position of the flaps/slats handle is omitted and the corresponding checklist is not read;
- during the taxi checklist, step 8 on "flaps/slats position, take-off speeds" is once again omitted or ignored and the associated checklist is not read;
- during the takeoff briefing the position of the flaps/slats is not checked or the takeoff briefing was not conducted.
- The cautions and warnings in the cockpit were ignored.

2.1.3. *Crew action after rotation*

As soon as the aircraft rotated, the stall warning was activated and the aircraft started to roll sharply. The crew advanced the thrust levers to their mechanical stop and held the

aircraft's pitch angle. These actions allowed them to gain speed and altitude until the aircraft exceeded 200 kt. With each roll there was a loss of altitude, and once the rolls stopped they were able to gradually gain height and regain control of the aircraft. They also raised the landing gear[16], which initially increased drag due to the opening and closing of gear doors during the retraction cycle, reducing acceleration and climb performance for several seconds until the gear was fully retracted and the doors were fully closed.

2.2. Checklists

Backing up cockpit work through the use of procedural checklists is a classic response to a human factors problem: the possibility of having the crew omit a procedural item due to a distraction, fatigue, excessive workload or complacency. Therefore, instead of having to rely on the pilot's memory, a crewmember reads the required steps for a procedure from a written checklist.

In order for the checklists to be an effective defensive barrier against mistakes, however, the pilots need to be disciplined and to adhere to certain well-defined operational procedures.

Distractions, interruptions, task overload, misprioritization, a lack of attention, excessive reliance on memory, deficient training, incorrect checklists and a lack of emphasis on adherence to procedures are the weak links in this line of defense against mistakes and are evident in this case.

Studies have shown, as was the case in this incident, that the crew is most vulnerable to distractions and interruptions during the following phases of flight:

- before start
- push back
- start engines
- taxi
- before take-off

Therefore, by re-emphasizing the importance of rigorous compliance with the checklists during initial and refresher training, by demanding compliance during evaluations and checks and by having adequate interaction between the crewmembers, the effectiveness of the checklists can be enhanced.

In this case a lack of adherence to company procedures was noted on the part of the flight crew, very probably because these points were not adequately stressed during the initial training, which resulted in the checklists themselves being ineffective.

[16] The windshear recovery procedure indicates not change the aircraft configuration until terrain separation is assured.

The checklists provide an important interface between the crew and its aircraft. What is more, they aid the crew to remain focused on the performance of their specific duties by eliminating the possibility for deviations, as could occur during periods when the crew's attention is divided or when they are under the effects of stress or fatigue.

In addition, company policy on the use of and compliance with procedures must be clear and based on CRM and on the leadership of the pilot in command. The above notwithstanding, if the captain or PF forgets the order to initiate a checklist, the PNF must suggest the initiation of the corresponding list to the captain or PF. This should be conveniently included in the OM and in the SOPs. No references were found in the documentation analyzed concerning the execution of standard procedures and task assignments to each member of the flight crew. What is more, the expanded checklists and the remaining documentation were not provided to the crew, which translated into a non-standard operational routine among the different crews that was based on each crewmember's personal experience. This information shortage is the first step toward deviations from standard procedures that results in them being performed from memory.

To avoid procedural shortcuts, it must be very clear which crewmember does what item and who reads the checklist and who checks it. Likewise, the times at which each checklist is requested should also be defined, along with who performs it and who checks each item. A deficiency was detected concerning the management of the checklists and a safety recommendation is issued in this regard.

Independently of any potential improvements in the OM and checklists, it is obvious that the system for selecting, training and supervising pilots at the operator of MD-83 OE-LMM is ineffective in light of the incident in question.

2.3. Selection, Instruction and Supervision

In an airline with an established operational culture, the assimilation of new pilots and their incorporation into the company is done by immersion and through the operator's initial courses. The individual tends to assimilate the culture of the company he is joining as a new member of the community.

However, when these additions take place en masse, or the corporate culture is not firmly rooted, the possibility for such an immersion is made non-existent by the distribution of the required work with respect to the main base and companies must look for other systems to guarantee the effectiveness of this necessary operational immersion.

In the case at hand, the mechanisms envisioned by the EU OPS[17] regulations are ground instruction, line instruction and the line check, all of this supported through the documentation in the Operations Manual (OM) and the SOPs.

[17] Since 16 July 2008 the applicable law has been EU OPS (Annex III EC Regulation no. 1899/2006 of 12 December 2006)

As made evident by the information provided by the operator, the crew's training phase was unevenly distributed. First, the evaluation exercise was used as a simulator session to familiarize them on company procedures, at which time they were given the checklists.

They then received ground instruction, which in the captain's case was limited to one day and did not include the company SOPs. Nor was any CRM training included as indicated in the JAR OPS regulations. There was also no course on the JAR OPS regulations themselves to instruct them on the differences with the regulations of the State issuing the license.

It should be noted that there is no record of any of the flight crew members having taken the ground courses listed in the OM-D, and in particular those involving familiarization with all aspects of the limitations and of the normal/abnormal and emergency procedures.

The supervised line training in the captain's case was less than that theoretically required by the company, as evidenced by the information provided by the company itself.

In the copilot's case, the information concerning his supervised line training was contradictory, since both crewmembers testified that during the period when he was supposedly doing his supervised line training he was in fact flying with the incident captain, who is not on record as being an instructor. He must then have performed other duties before finishing the conversion course, contrary to regulations.

Lastly, and as mentioned in the previous section, the documentation given to the crew was incomplete.

These training irregularities result in the training not fulfilling its purpose of having new crews adhere to the procedures established by the company they have joined. This brings about a lack of discipline in the cockpit, with each crew doing the procedures as they were learned at their previous company and from memory, resulting in cases, like the one involving this incident, where systems checks are ignored.

There are mechanisms in place, such as supervision, intended to avoid such deviations from standard procedures.

The line check required by JAR OPS 1.965 for both crewmembers was conducted a few days before the incident by a very experienced MD80 pilot, but who was also working for the company intermittently. In fact, his hiring for the 2007 season was subsequent to that of the two pilots evaluated and who were involved in the incident in question.

The basis for supervision (JAR OPS 1.175) is contained in the operator's OM, which is the basic reference. Compliance with the OM must be ensured by the crew.

It is obvious that if the supervisor does not have a solid knowledge of OM and SOPs specific to the operator, he may be able to perform generic procedures and SOPs and display basic airmanship, but never those specific to the company, as intended by regulations.

As a result, no deviation from the company's standard procedures could be detected in the supervisory process. We believe it is necessary to reinforce the company's selection, instruction and supervisory processes, and a safety recommendation is issued in this regard.

On the other hand, the competent Authority for the issuance of the AOC, Austrocontrol, should have verified that the required training programs were being complied with, as specified in JAR-OPS 1.175. The Authority should also have checked the contents of the OM, which contained references to another company. This fact highlights a shortcoming on the company's part in its compliance with the requirements needed for obtaining and maintaining an AOC, as well as deficiencies in the Authority's control and supervisory methods. A safety recommendation is issued to Austrocontrol and EASA in this regard.

2.4. Cockpit leadership

It is an established fact that the captain of an aircraft, through his attitude, motivation and personality, is the one who sets the professional tone for the cockpit. This personality influences on the team, and therefore on the efficiency of the duties discharged, and it is even greater when the regulatory and cultural environment at the airline is weak or not firmly rooted.

In the Flight Safety Foundation's study "Killers in Aviation" (January of 1999), poor leadership is mentioned as the third leading factor in accidents. This same phenomenon was noted with the same prevalence in the LOSA observations conducted during actual operations.

In this incident the captain's inhibition regarding the performance of the checklists is flagrant. In this specific setting, where the corporate culture is not rooted and where the operational documentation was not distributed through consolidated training processes, and was not even distributed to the crews for their personal study, a copilot ended up succumbing to the operational tone set by his captain. As a result there is a transition from the systematic reading of checklists and their verifications to doing checklists from memory, with the propensity for errors that it implies.

The company's check pilot stated that on the check flight for the copilot and in which he was graded as qualified as PF and PNF (Shannon-Faro-Shannon), he observed the copilot's tendency to initiate the checklist actions on his own, without being prompted by the captain.

Lastly, it is interesting to keep in mind that in this case, under identical operational circumstances, the captain who had flown on OE-LMM, the incident aircraft, the day before went back to the stand when faced with the same problems as those encountered by the incident captain. He also made the appropriate entries in the airplane's logbook and did not depart for his destination until the malfunction was solved, which involved a delay of several hours.

Therefore, from the known facts it cannot be concluded that the incident captain felt a company pressure different from that of the other captains, or that this pressure was so intense that it drove him to operate in a way that was different from his own usual practice.

2.5. Flight crew scheduling

For reasons of operational convenience, crews with similar language skills or nationalities were paired together. For the same reason both crewmembers were scheduled to work together, and by the day of the incident they had been flying together for some 15 days.

Having crewmembers fly together makes them more prone to relax when it comes to applying standard operations, and to adapt procedures to their previous experience. In situations of this nature, therefore, it is necessary that more stringent supervision be set in place.

2.6. Maintenance practices

The information available underscores the operator's routine nature of opening the K-33 circuit breaker for checking the proper operation of the strobe lights. This action was completed on every service check every three days (and even every day in some cases).

Although Boeing informed that it was never its intention that these lights be checked on every "Service Check", it could have been interpreted based on the information listed on the associated task card that the strobe lights were external lights, and thus had to be checked for proper operation. However, it should be noted that the task card did not call for the opening of the K-33 circuit breaker to perform a check of the external lights.

Boeing has since revised and reformatted the "Service Check" task card as part of normal industry upgrade practices,, eliminating any reference to a check of external lights. The only requirement to check the strobe lights is found on card 33-042-01-01, which indicates that it be done solely during the 1A check, every 450 h (MSG-3). The task card was also revised to include instructions to tag and collar the left ground control relay circuit breaker. The comparable MSG-2 task card was also revised.

Consequently, the actions taken by Boeing are considered to have properly clarified and documented the fact that the strobe lights do not need to be checked on every "Service Check". No additional measures are considered necessary.

On a different note, on two consecutive occasions (3rd June night and 4th June night) personnel forgot to reset the circuit breaker after the strobe light check, which indicates that maintenance personnel were not informed about what had happened the previous day and that personnel were not following AMM-recommended standard practices.

The entry made in the Technical Logbook concerning the damaged wires found near the "Left ground control relay" masked the real problem that had taken place the day before, that it was an oversight, and resulted in the problem being repeated.

3. CONCLUSIONS

3.1. Findings

- No malfunctions were detected in the aircraft.
- The flight crew held the appropriate licenses and ratings to conduct the flight.
- The crew had been hired for that year's summer season.
- The information provided by the company concerning the training was contradictory and in some cases does not comply with the OM or with JAR regulations in effect at the time of the incident.
- A "Service Check" of the aircraft was performed the night before the incident.
- During this check the K33 circuit breaker, "Left ground control relay", was opened so the strobe lights could be tested
- Maintenance did not close the K33 circuit breaker after performing the Service Check and releasing the aircraft to the flight crew, as per standard practices.
- When the flight data recorder was started on the day of the incident, the information revealed that the aircraft was in flight mode.
- The crew did not check the circuit breaker panels or the TOWS prior to engine start, as per checklist procedure.
- Some aircraft systems were operating in flight mode while on the ground.
- During the taxi at Barajas, various warnings were received in the cockpit.
- The cautions and warnings in the cockpit were ignored.
- Another crew went back to the parking area the day before when the same warnings appeared. It involved a delay of several hours.
- The airplane took off from Barajas with a required system inoperative (TOWS) and with a caution (stall ind failure) light on which required maintenance action before taking off.
- The discipline in the cockpit regarding the performance of operational procedures was deficient.
- The thrust levers retarded automatically during the takeoff run at Barajas.

- The crew continued with the flight to Lanzarote and did not warn of any anomalies at their destination.
- The same warnings were received while taxiing in Lanzarote.
- Before taking off in Lanzarote takeoff flaps/slats were not selected.
- No takeoff warning system (TOWS) warnings were received during the takeoff run in Lanzarote since the aircraft systems interpreted the aircraft to be in flight mode already.
- The aircraft stalled after rotation, resulting in very pronounced rolls.
- The crew regained control of the aircraft and returned to the field.
- The passengers disembarked normally after the landing at Lanzarote airport.

3.2. Causes

The crew lost control of the aircraft after the rotation (stall) due to the stall of the aircraft just after the takeoff, because it was performed in a non approved configuration, that is, with the slats retracted and 0º flaps. This was caused by a lack of discipline of the crew in complying with standard operating procedure and, specifically, with the checklists.

The following factors contributed to the incident:

- The shortage of training received by the crew once hired, and which did not allow them to gain sufficient knowledge of company procedures; the irregularities that took place during the supervised training flights; and the poor oversight of the flight crew.
- The maintenance practices to check the strobe lights and which were performed due to ambiguity in the task cards issued by Boeing for doing the "Service Check".
- Both maintenance and flight crews failed to follow written procedures (AMM and FCOM, respectively) since they didn't reset the left ground control relay c/b prior to flight;
- The lack of cleanness that made more difficult to identify the cb condition.
- The failure of the operator to determine why the left ground control relay circuit breaker tripped repeatedly.
- Improper supervision by Austrocontrol of the processes at the AOC and which resulted in the lack of compliance with OM and training requirements going unnoticed.

4. SAFETY RECOMMENDATIONS

REC 26/2009. It is recommended that MAP more accurately define the tasks to be performed by each flight crew member with regard to flight procedures and checklists, the method for executing them and the phases of flight during which they must be executed, in keeping with

the principles of CRM, such that they fulfill their function as a deterrent to mistakes.

REC 27/2009. It is recommended that MAP review its training and supervisory programs for newly-hired crews so as to ensure that new crews receive adequately documented information and that their training leads to an in-depth knowledge of the company's standard practices and to their proper execution.

REC 28/2009. It is recommended that Austrocontrol verify compliance by charter company operators with EU OPS regulations, particularly in reference to obtaining and maintaining their AOCs with regard to training, especially during periods of heightened demand for flights, where there is an increase in the hiring of technical personnel.

REC 29/2009. It is recommended that the EASA evaluate the methods and procedures used by Austrocontrol to issue AOCs and to track the conditions in place at operators required to maintain the AOC.