Air Accident Investigation Unit Ireland

SYNOPTIC REPORT

SERIOUS INCIDENT

Boeing 737-8AS, EI-DLI
Over the Irish Sea
20 May 2011

An Roinn Iompair Turasóireachta agus Spóirt

Department of Transport, Tourism and Sport

Foreword

This safety investigation is exclusively of a technical nature and the Final Report reflects the determination of the AAIU regarding the circumstances of this occurrence and its probable causes.

In accordance with the provisions of Annex 13[1] to the Convention on International Civil Aviation, Regulation (EU) No 996/2010[2] and Statutory Instrument No. 460 of 2009[3], safety investigations are in no case concerned with apportioning blame or liability. They are independent of, separate from and without prejudice to any judicial or administrative proceedings to apportion blame or liability. The sole objective of this safety investigation and Final Report is the prevention of accidents and incidents.

Accordingly, it is inappropriate that AAIU Reports should be used to assign fault or blame or determine liability, since neither the safety investigation nor the reporting process has been undertaken for that purpose.

[1] **Annex 13**: International Civil Aviation Organization (ICAO), Annex 13, Aircraft Accident and Incident Investigation.

[2] **Regulation (EU) No 996/2010** of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation.

[3] **Statutory Instrument (SI) No. 460 of 2009**: Air Navigation (Notification and Investigation of Accidents, Serious Incidents and Incidents) Regulations 2009.

AAIU Report No: 2014 – 009
State File No: IRL00911043
Report Format: Synoptic Report
Published: 08 July 2014

In accordance with Annex 13 to the Convention on International Civil Aviation, Regulation (EU) No 996/2010 and the provisions of SI 460 of 2009, the Chief Inspector of Air Accidents on, 20 May 2011, appointed Mr Paul Farrell as the Investigator-in-Charge to carry out an Investigation into this Serious Incident and prepare a Report.

Aircraft Type and Registration:	737-8AS, EI-DLI	
No. and Type of Engines:	2 x CFM56-7B26	
Aircraft Serial Number:	33591	
Year of Manufacture:	2005	
Date and Time (UTC[4]):	20 May 2011 @ 20.57 hrs	
Location:	Over the Irish Sea	
Type of Operation:	Scheduled Passenger	
Persons on Board:	Crew - 6	Passengers – 50
Injuries:	Crew - Nil	Passengers - Nil
Nature of Damage:	None	
Commander's Licence:	Air Transport Pilot Licence issued by the UK Civil Aviation Authority (CAA)	
Commander's Details:	Male, aged 53 years	
Commander's Flying Experience:	13,000 hours, of which 6,000 were on type	
Notification Source:	Duty Manager, Dublin Airport (EIDW)	
Information Source:	Verbal report from EIDW Duty Manager, AAIU Report Forms submitted by Captain and First Officer, AAIU Field Investigation	

[4] **UTC**: Universal Time Co-ordinated. All timings in this report are quoted in UTC; to obtain the local time add one hour.

SYNOPSIS

During a scheduled passenger flight between Liverpool (EGGP) and EIDW, while in the cruise at FL180, the Cabin Altitude Warning Horn sounded. The Flight Crew identified that both air-conditioning pack switches were in the OFF position. The packs were then selected to AUTO. Subsequently, the crew doubted the operation of the pressurization system and an emergency descent was carried out. The aircraft entered a hold at 6,000 ft to allow the Flight Crew to review and confirm their understanding of events and the status of the aircraft. The aircraft landed without further incident. No injuries were reported.

1. FACTUAL INFORMATION

1.1 History of the Flight

The aircraft, with 50 passengers and 6 crew on board, was on a scheduled passenger flight from EGGP to EIDW and took off at 20.40:59 hrs. The Captain was the Pilot Flying (PF) and the First Officer was the Pilot Monitoring (PM).

After a few minutes at the flight's cruising altitude (18,000 ft), the Cabin Altitude Warning Horn sounded in the cockpit. The crew immediately donned their oxygen masks and quickly realised that both air conditioning pack switches were in the OFF position. Both packs were selected to AUTO. The crew subsequently came off oxygen. Shortly after coming off oxygen, the PM became concerned that the pressurization system was not functioning correctly.

A MAYDAY call was broadcast and the aircraft made an emergency descent to 10,000 ft. Passenger emergency masks were deployed throughout the cabin. The aircraft then descended to 6,000 ft and entered a hold. The aircraft subsequently landed without further incident at EIDW.

1.2 Description of the pressurization system

The pressurization system is designed so that the cabin altitude does not exceed 8,000 ft at any time during flight. The system includes a (visual and aural) warning system that alerts the flight crew when the cabin altitude exceeds 10,000 ft (requiring the flight crew to use oxygen masks). Cabin oxygen masks automatically deploy if and when the cabin altitude exceeds 14,000 ft.

Bleed air from stages 5 and 9 on each engine compressor is sent through two air conditioning packs and then distributed throughout the cabin. **Figure No. 1** shows the Bleed Air Control and Indicator Panel with the Pack control switches outlined in orange.

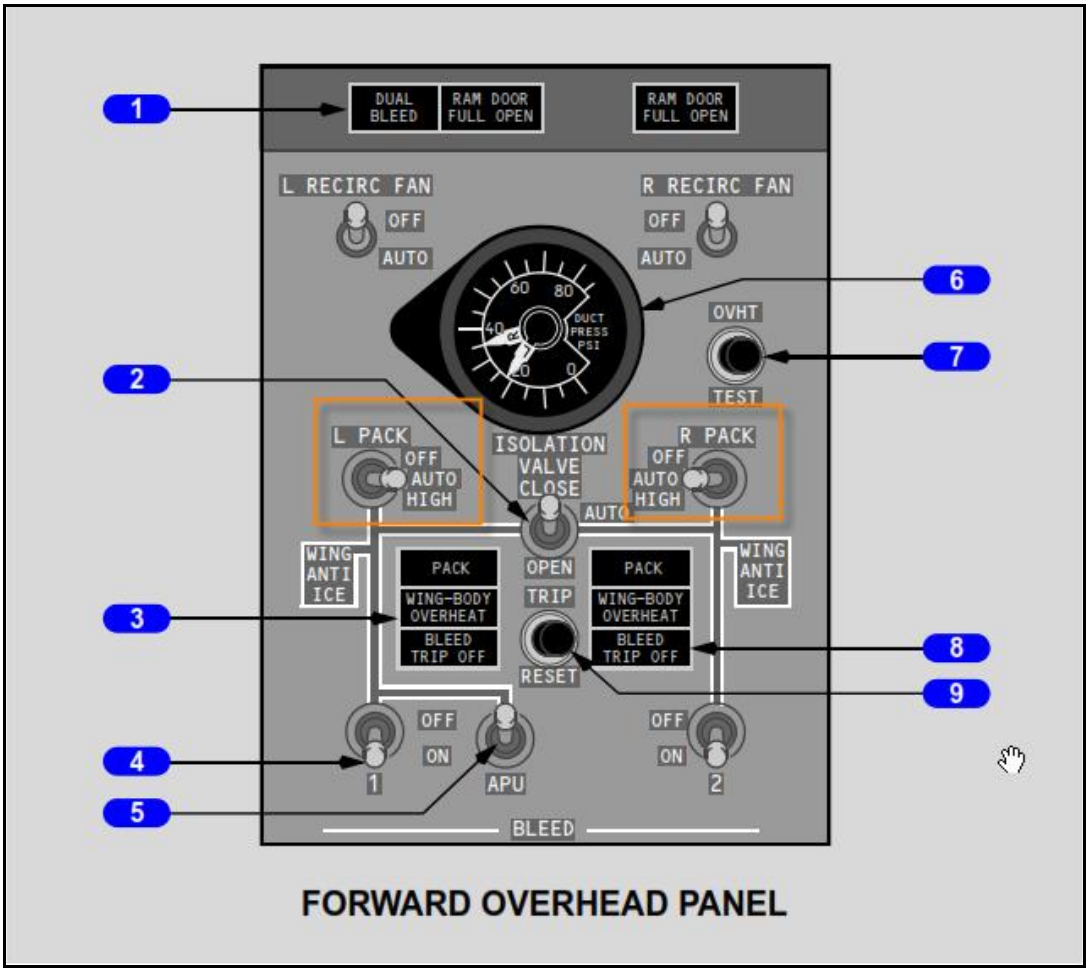

Figure No. 1: Bleed Air Controls and Indicators

Cabin pressure is controlled by a system that includes two Digital Cabin Pressure Controllers (DCPCs). Each DCPC alternates as the main controller on successive flights, with the other DCPC remaining in stand-by in case it is needed. System faults are annunciated by means of a light on the pressurization panel (**Figure 2**, item 1).

Ventilation and pressurization is normally controlled by adjusting the opening of the outflow valve (OFV) either automatically by the active controller when the system is in automatic (AUTO) mode, by the alternate controller if set by the flight crew (ALTN) or manually (MAN) if the flight crew selects manual operation (**Figure No. 2**, item 11)

In AUTO, with the aircraft on the ground and the engines below takeoff thrust, the OFV opens and the aircraft is depressurized (ground mode). As the engine fan rotor speed increases to take-off thrust levels, the OFV begins to close and the cabin begins pressurizing (take-off mode).

In flight, the automatic controller adjusts the differential pressure depending on the applicable law for the phase of flight (climb, cruise or descent mode). The pressurization system uses the planned flight level and the elevation of the destination airport (as selected by the flight crew using the pressurization panel FLT ALT and LAND ALT controls, **Figure No. 2** items 3, 4, 5 and 6).

Manual operation activates the associated green indicating light (**Figure No. 2,** item 7). During manual operation, the flight crew directly controls the movement of the OFV (item 10) and monitors its position (item 9).

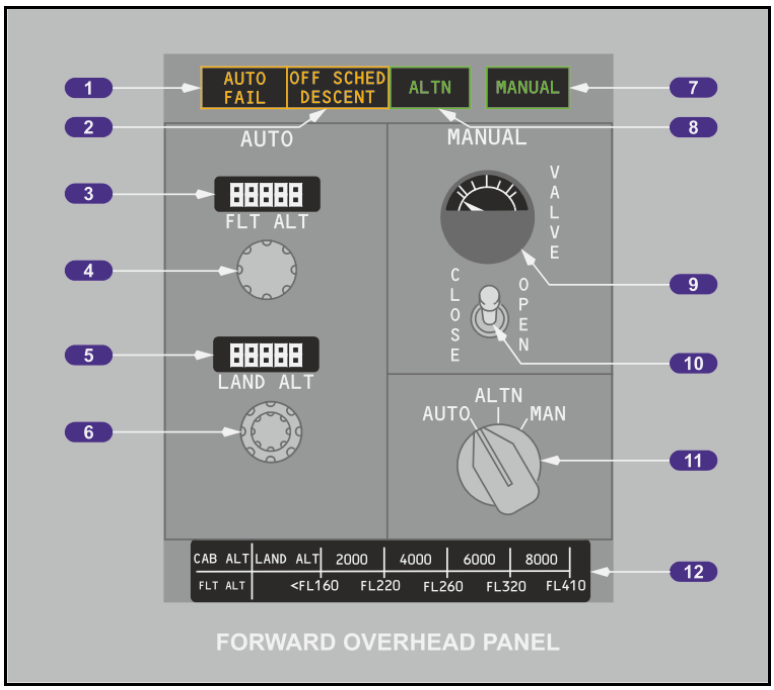

Figure No. 2: Pressurization system control panel

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Flight crew can monitor the cabin altitude in feet, its climb/descent rate (in ft/min) and the differential pressure in pounds per square inch (psi), all of which are shown on instruments on the cabin altitude panel (**Figure No. 3**). This panel also has a button to silence the cabin altitude alarm (item 3).

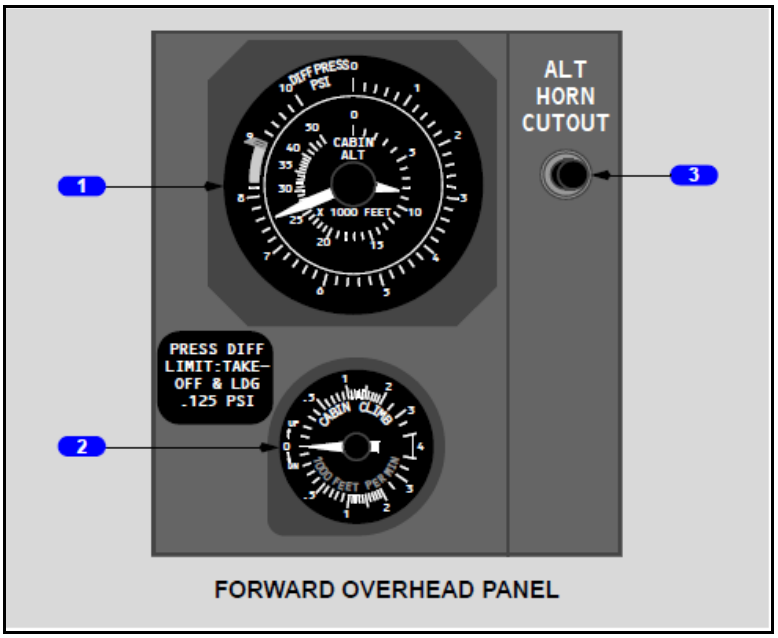

Figure No. 3: Cabin altitude panel

1.3 Operator Procedures

The Operator's procedures require the PF to complete a "*Preflight Procedure*" which involves a detailed cockpit set-up. This "*Preflight Procedure*" includes a check "*Air Conditioning PACK switches – Both AUTO or HIGH*". The flight crew is also required to complete a "*Before Start*" check, a challenge and response checklist which includes a check "*AIR COND & PRESS …..PACKS AUTO, BLEEDS ON, SET*". Later in the "*Before Start*" checklist the flight crew completes a check "*AIR COND PACKS …. OFF*". Subsequent to engine starting the flight crew completes an "*After Start*" checklist which includes the check "*AIR COND ……. PACKS AUTO, BLEEDS ON*"

1.4 Flight Crew Interviews

The Flight Crew stated that they were not rushed during their flight preparations.

The Flight Crew informed the Investigation that they were aware of a recent ground event at EGGP involving a tow-bar that had not been clear of another aircraft. Consequently, the PF was concerned to ensure that the tug and tow-bar were properly clear of his aircraft. The Flight Crew believed that this concern led to an interruption of the after-start checklist resulting in them not recognising that the packs were not selected to AUTO.

The Flight Crew said that during the climb they completed further checks at 3,000 ft and 10,000 ft but these checks did not identify any anomaly with the pressurization configuration. They subsequently informed the Investigation that they thought that confirmation bias may have contributed to this as they believed the system was properly configured before take-off. ATC informed the aircraft that there was no speed restriction in effect below FL100 and as a result the Flight Crew increased the thrust to "*Max Available Thrust*" causing the aircraft to climb rapidly. They stated that the pressurization panel indications may have appeared normal to them because the aircraft was climbing rapidly.

The Flight Crew stated that when the Cabin Altitude Warning Horn sounded they quickly went on Oxygen and followed the Cabin Altitude Warning checklist. The Captain said that he noticed that the packs were selected to OFF and that he selected both packs to AUTO. He explained that, as the Quick Reference Handbook (QRH) of checklists is predicated on systems being correctly configured, he was satisfied that it was appropriate to restore both packs before continuing with the Cabin Altitude Warning checklist.

The Flight Crew said that they did not cancel the Cabin Altitude Warning Horn and stated that they elected to allow it to continue to sound so that its eventual ceasing would provide them with confirmation of correct functioning of the pressurization system.

The Flight Crew said that they moved the Pressurization mode selector between the AUTO and MAN positions during the event due to concerns that the aircraft could over-pressurize following the selection of both packs to AUTO.

Shortly after removing their oxygen masks, the PM became concerned that the pressurization system was not working correctly. The Flight Crew stated that an "*Emergency Descent*" cabin announcement was made by the PF and that the PM deployed the oxygen masks throughout the cabin. The PF said that he manually descended the aircraft to 10,000 ft because he felt that this would give a less aggressive profile than the automatic systems would have provided.

Following landing at EIDW, one member of the Flight Crew and two Cabin Crew Members (CCMs) presented themselves to paramedics at the airport.

1.5 Cockpit Voice Recorder (CVR)

The CVR was downloaded by the Investigation and the recording provided the following details.

During the "*After Start*" checklist the PF responded "*Packs off, Bleeds on*" when challenged by the PM regarding air conditioning settings. Subsequently, during the "*Take-off Briefing*" the PF said "*Packs Auto, Bleeds on*".

At 20.57:14 hrs the Cabin Altitude Warning Horn sounded in the cockpit. The Flight Crew immediately donned their oxygen masks and quickly realised that both air conditioning packs were selected to OFF. Both packs were selected to AUTO (on) and the Flight Crew followed the Cabin Altitude Warning checklist. Thirty nine seconds after initial warning activation the Cabin Altitude Warning Horn ceased sounding.

Just as the Flight Crew were coming off oxygen the Senior Cabin Crew Member (SCCM) contacted the cockpit to check on the status of the Flight Crew and to advise that all CCMs were reporting ear problems and he himself had some stomach upset. The Captain explained that there had been a pressurization problem but that it was now back to normal and that he would speak with the CCMs about it after the flight.

The Flight Crew had a short discussion about the problem before commencing their brief for the approach into EIDW.

The CVR records that three and a half minutes after removing his oxygen mask, the PM became concerned that the pressurization system was not working correctly:

PM	Mate there's something wrong with pressurization because it's still at fifteen thousand cabin alt it's not high enough is it
PF	It is what
PM	Cabin altitude five thousand
PM	It's not going back to auto
Sound of PM donning his oxygen mask	
PM	Can you hear me can you hear me
PM	I recommend oxygen
PM	It's going again
PM	Mate I suggest we put oxygen on and descend

A Mayday call was made requesting an emergency descent and a heading deviation, which was immediately acknowledged and facilitated by Dublin ATC. An "*Emergency Descent*" cabin announcement was made by the PF who also went on oxygen.

On reaching 10,000 ft the Flight Crew removed their Oxygen masks and decided that it would be prudent to take some time to assess the aircraft configuration. They requested a descent to 6,000 ft and to enter the hold at ROKNA. ATC immediately acknowledged and facilitated this request. At the same time the PM expressed continued concern due to a tingling sensation in his lips. The SCCM contacted the cockpit to ascertain if it was safe for CCMs and passengers to cease using oxygen. The PF told him that it was safe to do so and that he would speak to the passengers shortly. This was 6 minutes and 32 seconds after the emergency descent announcement.

The Flight Crew then set about assessing the configuration of the aircraft to ensure that everything was in order for the approach into EIDW. The PF contacted the SCCM for a report on the cabin status. The SCCM reported that nobody was injured but that many passengers were upset and crying. He said that he had spoken to each passenger personally and that the passengers' principal concern was to know when they would land. The PF said that they could have landed already but felt that it was safer to enter the hold to assess the situation.

Following a NITS (Nature, Intentions, Time & Special Instructions) briefing with the SCCM, the PF made an announcement to the passengers (PA) outlining the nature of the problem which they had experienced, re-assuring them that the problem was resolved, explaining why they had entered the hold, apologising for the upset/inconvenience and said that they would be on the ground in Dublin shortly. This announcement was made fifteen minutes after the emergency descent announcement.

Eight minutes after this announcement, having completed their checks and having received a report that the cabin was secure, the Flight Crew contacted ATC to cancel their emergency status and requested to leave the hold at ROKNA for an approach to Dublin. ATC immediately facilitated this request and the aircraft was transferred to Dublin Approach. The remainder of the approach and landing was uneventful.

On the taxi in, the Flight Crew consulted with the SCCM regarding the status of the passengers. The SCCM said that whilst all passengers appeared to be OK it would be prudent to request the presence of paramedics at the stand in case passengers required medical attention. A request for paramedic presence on stand was passed to the Operator's handling department. The handling department advised the Flight Crew to request paramedic assistance from EIDW ATC because they would be able to get the assistance faster than the Operator's handling department could. The request was then passed to ATC and paramedic assistance was available at the stand.

Although paramedic assistance was requested, neither the nature of the emergency, nor the level of passenger distress, were communicated to the Operator's Duty Supervisor (according to the CVR recording).

Following arrival on stand, the CVR does not contain any passenger announcement that paramedic assistance was available if required.

1.6 Flight Data Recorder (FDR)

The FDR was downloaded and analysed by the Investigation. The FDR does not record cabin altitude but it does have a discrete parameter designated "*Cabin Altitude > 10 kft*" which activates when the cabin altitude exceeds 10,000 ft.

The FDR recording shows that the aircraft took off at 20.47:59 hrs and reached its cruising altitude of 18,000 ft at 20.54:09 hrs, giving an average rate of climb of the order of 2,850 feet per minute (fpm).

At 20.57:14 hrs the cabin altitude exceeded 10,000 ft and the associated discrete parameter, "*Cabin Altitude > 10 kft*", activated. At 20.57:53 hrs, thirty nine seconds after initial activation, the "*Cabin Altitude > 10 kft*" discrete parameter de-activated.

The descent from 18,000 ft to 10,000 ft took 3 minutes and 19 seconds, an average rate of descent of approximately 2,200 feet per minute (fpm). During the first 2 minutes of the descent the rate of descent exceeded 3,000 fpm.

1.7 Other recordings

The Investigation also obtained the event records from the non-volatile memory (NVM) within the DCPCs. The DCPC does not support continuous recording but instead snapshots specific events within the pressurization system control. Such events are termed "*fault codes*" although the code does not necessarily refer to a fault condition and may simply refer to an atypical operating condition.

NVM data for both DCPCs shows that with the aircraft at an altitude of 18,007 ft, the DCPCs declared Fault Code (FC) 17 when cabin altitude was 10,013 ft on DCPC #1/ 10,015 ft on DCPC #2. The system configuration at the time was:

- Both packs were selected to OFF
- The OFV was fully closed
- There were no system failures present
- The pressurization system was set to the AUTO mode and the #2 DCPC was in control

DCPC NVM data shows that approximately one minute after the packs were selected to AUTO, the pressurization mode selector was moved to MAN. The pressurization mode selector was moved twice more (to AUTO or ALTN and back to MAN) prior to landing.

The DCPCs on the aircraft were configured to record a "*fault code*" if the cabin altitude exceeded 13,500 ft, but this "*fault code*" was not recorded.

1.8 Manufacturer's Assessment

The Investigation asked the aircraft Manufacturer to comment on the appropriateness of selecting both pack switches from the OFF position to the AUTO position simultaneously in flight. The Manufacturer advised:

- *In general, selecting a single A/C* [air conditioning] *pack on and allowing a time for stabilization before selecting the second A/C pack on will minimize the magnitude and duration of cabin rates that may result from the configuration change and in some scenarios could be preferable for passenger comfort. However, the 737NG pressurization system is designed to sense and respond to cabin rates, including those that may result from selecting both A/C packs on simultaneously, and moderate the cabin rate to within the allowed limits, which are based on SAE ARP 1270's threshold for human detection.*

- *The Boeing FCOM preflight procedure does not call for a hesitation between selecting the first and second A/C pack on. However, in our AUTO FAIL and Unscheduled Pressurization Change checklist, we do have steps to verify the bleeds and A/C packs are all on and notes that allow for stabilization between selecting the first and second A/C Pack on. These steps were added in 2001 in response to a Canadian TSB recommendation, but their addition does create a conflict with the FCOM procedure philosophy which assumes that the airplane is in the correct configuration. The procedure is currently under review for standardization.*

- *In this incident, it was appropriate for the crew to select the A/C packs on simultaneously in order to minimize passenger exposure to high altitude conditions. The CPC NVM data shows that the pressurization system was in the automatic mode at the time of the A/C pack restoration and that the differential pressure was not at or near the max or min limits, which means that the pressurization system would have acted to control the cabin rate to within the allowed limits.*

1.9 Passenger Input

A passenger contacted the Investigation to provide a perspective on the event as it unfolded. This passenger provided detailed information on a number of aspects of the event. The principal concerns identified related to communication with the passengers regarding the nature of the event, CCM actions/demeanour and the support of distressed passengers after landing. Concern was expressed that one CCM had become visibly distressed during the event which may have caused increased passenger anxiety.

1.10 Interviews with Cabin Crew

The Investigation spoke with the four CCMs regarding the event. The CCMs all reported that they had experienced ear discomfort and pain after take-off. The SCCM raised the issue with the Flight Crew and was advised that there had been a pressurization system problem but that it had been resolved. All CCMs reported that they were taken by surprise when the emergency descent announcement was made.

The issue of one CCM becoming distressed during the event was discussed. The CCM in question accepted that this was the case but maintained that assigned duties had still been carried out. This CCM also pointed out that one passenger had taken out a mobile phone and began videoing cabin events during the emergency descent. The CCM shouted at the passenger to desist and other passengers also took exception to this passenger's actions, at which point the videoing ceased. Following landing the distressed CCM was tasked by ground staff to marshal passengers across the ramp to the terminal building. When asked about these events, the SCCM did accept that this CCM's reaction was upsetting for the passengers.

The SCCM informed the Investigation that after landing he was contacted by crew control and the Crew was stood down. In addition, over the next few days all CCMs were contacted by management and advised that counselling was available to them if they wished to avail of it. The Investigation asked if there was any support from the Operator provided for the passengers on their arrival. The Investigation was informed that emergency services and paramedics were in attendance but no specific Operator response was provided. Two of the CCMs were treated for shock in the paramedic ambulance.

All CCMs were asked to what extent their training had prepared them to deal with the event. They expressed the view that a practical training session on a de-pressurization, to include a full drill, use of masks, etc., would be a valuable addition to their training.

11 **1.11 Dealing with Distressed Passengers**

The Investigation asked the Operator what procedures were in place to deal with distressed passengers such as those involved in this incident. The Operator stated "*In the event of any such incident, the duty supervisors will direct all necessary resources to handle the affected customers. In addition to staff on duty in Dublin, additional resources if required can be drawn from management, administration and head office.*"

1.12 Changes to Operator procedures post-event

The Operator informed the Investigation that on 31 August 2012, following extensive consultation and approval from Boeing, Ryanair sought IAA approval to introduce an amended after take-off and 10.000 ft check. This amended check, which is now Operator Standard Operating Procedure (SOP), requires the PM to verbalise the reading on the cabin differential pressure gauge rather than call 'check'. The purpose of this procedure is to aid crew in the early detection of an improperly configured Air Conditioning/Pressurisation panel or system malfunction and was in follow up to this and other pressurisation incidents that occurred with the Operator and other B 737 operators.

2. ANALYSIS

The air conditioning packs are required to be switched off as part of the "*Before Start*" checklist. The Operator's "*After Start*" checklist includes the check "*AIR COND ……. PACKS AUTO, BLEEDS ON*". The CVR records that during the "*After Start*" checklist the PF responded "*Packs off, Bleeds on*" when challenged by the PM regarding air conditioning settings. The response "*Packs off*" was not queried by the PM.

This is the point at which the incorrect configuration of the pressurization system should have been identified and remedied. Whilst the possibility of lapses can never be eliminated, flight crew must always strive to maintain a high level of attention and awareness to minimise the possibility of lapses. The Flight Crew believed that this lapse was due to an interruption during the after-start checklist, although the CVR recording does not indicate this.

Required checks at 3,000 ft and 10,000 ft did not detect the actual configuration of the pressurization system. The Flight Crew believed that this was due to "*confirmation bias*" on their behalf. The Investigation notes that the high rate of climb associated with the low take-off weight and high power setting could have masked a non-normal indication on the differential pressure gauge.

Once the cabin altitude warning horn sounded, the Flight Crew quickly donned their oxygen masks, diagnosed/remedied the incorrect system configuration and the aircraft began pressurizing. They then removed their oxygen masks. It is not possible to determine the maximum cabin altitude reached because neither the FDR nor the DCPC NVM continuously records cabin altitude. However, there was no DCPC "*fault code*" to indicate that the cabin altitude exceeded 13,500 ft. The Investigation is satisfied that the cabin altitude, although exceeding 10,000 ft, did not exceed 13,500 ft. Consequently, the cabin oxygen masks did not automatically deploy as the cabin altitude automatic deployment threshold is 14,000 ft.

Minutes later, the PM became concerned that the pressurization system was not functioning correctly. The Flight Crew again donned their oxygen masks and commenced an emergency descent which the PF elected to fly manually and during which the PM manually deployed the cabin oxygen masks.

The Investigation notes that all but one of the CVR comments immediately prior to the emergency descent decision were made by the PM. The CVR recording contains no evidence of consultation between the PM and PF before the PM deployed the cabin oxygen masks. The nature of these communications and the lack of consultation suggests sub-optimal Cockpit Resource Management (CRM) and a flat authority gradient.

Due to the nature of the available recorded cabin altitude data, the Investigation was not able to determine the cabin altitude at which the masks were deployed. However, as the cabin altitude warning horn and FDR discrete for a 10,000 ft cabin altitude exceedence were no longer activated at the time, it is probable that the cabin altitude was below 10,000 ft.

In the cabin, the CCMs were taken by surprise when the emergency descent announcement was made. One of the CCMs became distressed and this may have increased passenger anxiety.

The CVR indicates that the PF made a passenger announcement fifteen minutes after the emergency descent commenced. The issue of timely communication from the Flight Crew to the passengers regarding nature of the emergency, the need to enter the hold and the associated delay in getting to EIDW, is a matter of judgement for the Flight Crew. Although their primary responsibility is the safety of the flight the importance of flight crew keeping passengers informed must also be recognised. The Investigation believes that it is prudent to remind flight crew of the desirability of timely communication with passengers in such situations and a Safety Recommendation is made to the Operator in this regard.

The CCMs' comments about the desirability of including a de-pressurization drill in their training are noted. The Investigation is cognisant of the practical difficulties which may attend such training. Accordingly, a Safety Recommendation is made to the Operator to review cabin crew training for emergency descent and de-pressurization events.

The Operator's procedure for handling distressed passengers was not activated in this instance. From the passenger input and the SCCM's report that many passengers were upset and crying, the Investigation believes that the procedure should have been activated. The CVR recording shows that the nature of the emergency and the level of passenger distress were not communicated to the Duty Supervisor who should "*direct all necessary resources to handle the affected customers.*" The Investigation believes that it is prudent for the Operator to remind flight crew of the procedure and to clearly set out responsibility for activating the procedure. The Investigation makes a Safety Recommendation to this effect.

The Investigation notes the procedural change which the Operator introduced in the wake of this event which requires the PM to verbalise the reading on the cabin differential pressure gauge rather than call 'check'. The Investigation believes that this change is worthy of consideration for use by all operators and accordingly, a Safety Recommendation is made to the Manufacturer to consider introducing this change into the After Take-Off and 10,000 ft checklists for all operators of this aircraft type.

3. CONCLUSIONS

(a) Findings

1. Following engine start both air conditioning pack switches remained in the OFF position.

2. "*After Start*" checks, checks at 3,000 ft and checks at 10,000 ft did not detect that the packs were switched to OFF.

3. When the Cabin Altitude Warning Horn sounded the crew donned their oxygen masks, diagnosed the problem and selected both packs to AUTO.

4. When the Cabin Altitude Warning Horn ceased and cabin altitude was below 10,000 ft, the Flight Crew removed their oxygen masks.

5. The Cabin Crew were concerned about the symptoms of de-pressurization and alerted the Flight Crew.

6. Subsequent concern about the operation of the aircraft pressurization system prompted the Flight Crew to again don their oxygen masks, make a MAYDAY transmission to ATC, broadcast an "*Emergency Descent*" alert to the cabin and manually fly an emergency descent to 10,000 ft.

7. The PM manually deployed the cabin Emergency Oxygen Masks without consulting the PF.

8. The nature of the comments on the CVR recording immediately prior to the emergency descent decision suggests sub-optimal CRM and a flat authority gradient.

9. The Flight Crew elected to enter a hold to review the aircraft configuration.

10. Fifteen minutes after the emergency descent, the PF made an announcement to the passengers.

11. Once satisfied with the aircraft configuration the Flight Crew cancelled their emergency status and made an uneventful approach and landing into EIDW.

12. Following the flight, the entire Crew were stood down by the Operator.

13. The Operator's procedure for handling distressed passengers was not activated.

14. Dublin ATC dealt with the aircraft throughout the emergency and all requests were immediately acknowledged and facilitated.

(b) Probable Cause

1. The Air Conditioning Packs were not selected to AUTO following engine start.

(c) Contributory Cause(s)

1. The "*After Start*" checks and the checks at 3,000 ft and 10,000 ft did not identify the mis-configuration or that the aircraft was not pressurising.

2. Concern about the effectiveness of the pressurization system after both packs had been selected to AUTO caused an emergency descent to be initiated and the manual deployment of the cabin oxygen masks.

3. Sub-optimal CRM and a flat authority gradient.

4. SAFETY RECOMMENDATIONS

No.	It is Recommended that:	Recommendation Ref.
1.	Ryanair Ltd. should remind Flight Crew of the desirability of timely communication with passengers in emergency situations, as and when the circumstances permit.	IRLD2014019
2.	Ryanair Ltd. should review cabin crew training for emergency descent and de-pressurization events.	IRLD2014020
3.	Ryanair Ltd. should ensure that Flight Crew are aware of the procedure for dealing with distressed passengers and that responsibility for invoking this procedure is clearly prescribed.	IRLD2014021
4.	The Boeing Aircraft Company should consider amending the After TakeOff and 10,000 ft checklists for B 737 operators to require the PM to verbalise the reading on the cabin differential pressure gauge.	IRLD2014022

View Safety Recommendations for Report 2014-009

- END -

In accordance with Annex 13 to the Convention on International Civil Aviation, Regulation (EU) No. 996/2010, and Statutory Instrument No. 460 of 2009, Air Navigation (Notification and Investigation of Accidents, Serious Incidents and Incidents) Regulation, 2009, the sole purpose of this investigation is to prevent aviation accidents and serious incidents. It is not the purpose of any such investigation and the associated investigation report to apportion blame or liability.

A safety recommendation shall in no case create a presumption of blame or liability for an occurrence.

Produced by the Air Accident Investigation Unit

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An Roinn Iompair Turasóireachta agus Spóirt
Department of Transport, Tourism and Sport

Air Accident Investigation Unit,
Department of Transport Tourism and Sport,
2nd Floor, Leeson Lane,
Dublin 2, Ireland.
Telephone: +353 1 604 1293 (24x7): or
+353 1 241 1777
Fax: +353 1 604 1514
Email: info@aaiu.ie
Web: www.aaiu.ie