



Air Accident Investigation Sector

Accident

- Final Report -

AAIS Case File N° AIFN/0009/2015

Cabin Crew Serious Injury Due to Turbulence

Operator:	Emirates
Make and Model:	Airbus A380-800
Nationality and Registration:	The United Arab Emirates, A6-EEF
Place of Occurrence:	In-flight (OEJN –OMDB)
State of Occurrence:	The United Arab Emirates
Date of Occurrence:	13 September 2015



Occurrence Brief

Name of the Operator	:	Emirates
Manufacturer	:	Airbus
Aircraft model	:	Airbus A380-800
Nationality	:	The United Arab Emirates
Registration	:	A6-EEF
State of Occurrence	:	The United Arab Emirates
Date	:	13 September 2015
Injuries	:	one

Investigation Objective

This Investigation is performed pursuant to the UAE *Federal Act No. 20 of 1991*, promulgating the *Civil Aviation Law, Chapter VI – Aircraft Accidents*, Article 48. It is in compliance with the UAE *Civil Aviation Regulations, Part VI, Chapter 3*; in conformity with *Annex 13* to the Convention on International Civil Aviation; and in adherence to the *Air Accidents and Incidents Investigation Manual*.

The sole objective of this Investigation is to prevent aircraft accidents and incidents. It is not the purpose of this activity to apportion blame or liability.

Investigation Process

The Accident was notified to the Air Accident Investigation Sector (AAIS) Duty Investigator (DI), Hotline +971 50 641 4667, on 13 September 2015 at 0625 UTC.

The DI received a call from Emirates Cabin Safety informing that flight number EK806, Airbus A380-800, A6-EEA, from Jeddah to Dubai, had experienced turbulence causing injuries to 10 cabin crewmembers.

The Aircraft State of Manufacture (France) and the International Civil Aviation Organization (ICAO) were notified. The State of Manufacture appointed an Accredited Representative in accordance with *Annex 13*. The AAIS led the Investigation and issued this Final Report as the United Arab Emirates is the State of Occurrence, State of Registry, and State of the Operator.

The AAIS Reports are made publicly available at:

<http://www.gcaa.gov.ae/en/epublication/pages/investigationReport.aspx>



Notes:

1. Whenever the following words are mentioned in this Report with first Capital letter, they shall mean the following:
 - (Aircraft)- the aircraft involved in this accident;
 - (Investigation)- the investigation into the circumstances of this accident;
 - (Accident)- this investigated accident;
 - (Commander)- the commander of the accident flight;
 - (Co-pilot)- the co-pilot of the accident flight;
 - (Report)- this accident investigation Final Report.
2. Unless otherwise mentioned, all times in this Report are UTC
3. Photos and figures used in this Report are taken from different sources and are adjusted from the original for the sole purpose to improve the clarity of the Report. Modifications to images used in this Report are limited to cropping, magnification, file compression, or enhancement of color, brightness, contrast, or addition of text boxes, arrows or lines.



Abbreviations

AAIS	Air Accident Investigation Sector
AIFN	Accident/incident file number
ATC	Air traffic control
ATPL	Airline transport pilot license
CRM	Crew resource management
CVR	Cockpit voice recorder
DI	Duty Investigator
FDR	Flight data recorder
GCAA	General Civil Aviation Authority of the United Arab Emirates
ICAO	The International Civil Aviation Organization
MSN	Manufacturer serial number
No.	Number
SOP	<i>Standard operating procedures</i>
UAE	The United Arab Emirates
UTC	Coordinated Universal Time



Synopsis

On 13 September 2015, an Emirates Airbus A380 Aircraft, registration A6-EEF, operated flight EK806 from King Abdulaziz International Airport (OEJN), Jeddah, Saudi Arabia, to Dubai International Airport (OMDB), Dubai, the United Arab Emirates.

Twenty minutes before landing, the cabin crew were securing the cabin in accordance with the Operator's *standard operating procedures (SOP)*. The seat belt sign was switched on as the Aircraft descended through FL300 in order to ensure that cabin preparation for landing were completed in time.

The cabin crew were securing the cabin/galley in preparation for landing at the time of the event and the cabin service had finished. The Aircraft entered the cloud and encountered localised turbulence for three to four seconds and experienced a g-load.

Following the turbulence encounter, the Commander checked the passenger cabin status and was informed by the senior cabin crewmember that one cabin crewmember had sustained injuries. The injured cabin crewmember who was at the upper right door 1 (UR1) location was removed from duty and was seated in a passenger seat for the remainder of the flight in accordance with Emirates *SOP*. The Aircraft landed normally.

Following a medical examination, the injured cabin crewmember was found to have sustained a fracture to the right ankle. Nine other cabin crewmembers reported minor injuries.



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1. Factual Information

1.1 History of the Flight

On 13 September 2015, an Emirates Airbus A380 Aircraft, registration A6-EEF, operated flight EK806 from King Abdulaziz International Airport (OEJN), Jeddah, Saudi Arabia, to Dubai International Airport (OMDB), Dubai, the United Arab Emirates.

Twenty minutes before landing, the cabin crew were securing the cabin in accordance with the Operator's *standard operating procedures (SOP)*. The seat belt sign was switched on as the Aircraft descended through FL300 in order to ensure that cabin preparation for landing were completed in time.

The crew established two-way communication with Dubai air traffic control (ATC) when inbound to waypoint BUBIN at FL180 while descending and requested the track-miles to OMDB, and Dubai ATC gave the track distance as 108 nm.

The flight crew were operating the weather radar in AUTO mode and it did not display any returns. The crew stated that there was a thin layer of scattered clouds and after descending through this layer, they observed a small single cloud ahead of the Aircraft. The Commander as pilot monitoring, estimated this cloud to be less than one mile in diameter.

Due to the proximity of the cloud, the Commander instructed the Co-pilot to start a turn to the right and requested a weather deviation from ATC. The Co-pilot selected HDG mode and commanded a right turn and speed reduction to 300 knots. The weather deviation request was denied by ATC due to an airspace conflict causing the Co-pilot to re-engage NAV mode.

The Commander stated that after replying to ATC, he looked up and saw that NAV mode was re-engaged. With the cloud straight ahead and at a short distance, the Commander considered that a drastic manoeuvre would have been required for avoidance and that due to the visual appearance of the cloud and lack of weather radar returns, he judged that passing through it was the safest course of action.

The cabin crew were securing the cabin/galley in preparation for landing at the time of the event and the cabin service had finished. The Aircraft entered the cloud and encountered localised turbulence for three to four seconds and experienced a g-load.

The autopilot remained engaged and all parameters remained within the Aircraft limitations.

Dubai ATC asked the flight crew if they were clear of the weather, the crew replied they were clear and were "BUBIN turning inbound." Dubai ATC controller observed that the Aircraft commenced a left turn.

Following the turbulence encounter, the Commander checked the passenger cabin status and was informed by the senior cabin crewmember that one cabin crewmember had sustained injuries. The injured cabin crewmember who was at the upper right door 1 (UR1) location was removed from duty and was seated in a passenger seat for the remainder of the flight in accordance with Emirates *SOP*. The Aircraft landed normally.

Following a medical examination, the injured cabin crewmember was found to have sustained a fracture to the right ankle. Nine other cabin crewmembers reported minor injuries.



1.2 Injuries to Persons

Table 1. Injuries to persons

Injuries	Flight Crew	Cabin Crew	Other Crew On-board	Passengers	Total On-board	Others
Fatal	0	0	0	0	0	0
Serious	0	1	0	0	1	0
Minor	0	9	0	0	9	0
None	3	14	0	159	176	0
TOTAL	3	24	0	159	186	0

One cabin crewmember sustained a serious injury of ankle fracture.

At the time of the Accident, the injured cabin crewmember was wearing high heel shoes¹ in accordance with the Operator's procedure that cabin crew should change into high heels prior to conducting the pre-landing duties.

1.3 Damage to the Aircraft

The Aircraft was undamaged.

1.4 Other Damage

There was no damage to property and/or the environment.

1.5 Personnel Information

The following tables illustrate the Commander, Co-pilot and the cabin crewmember details at the time of the Accident.

Table 2. Commander information	
Age	44 years
Gender	Male
License	ATPL
Valid to	3 June 2022
Issuing State	UAE
Rating	CA
Total flying time with the Operator (hours)	5388:18
Medical class	Class 1
Medical valid to	15 August 2016
Medical limitation	Nil

Table 3. Co-pilot information	
Age	40 years

¹ The Operator issues three types of shoes to female cabin crew with differing heel heights



Gender	Male
License	ATPL
Valid to	16 July 2021
Issuing State	UAE
Rating	FO
Total flying time with the Operator	1205:21
Medical class	Class 1
Medical valid to	12 March 2017
Medical limitation	Nil

Table 4. Cabin crewmember information

Age	28 years
Gender	Female
License	Cabin Crew
Valid to	1 July 2023
Issuing State	UAE
Rating	B777 / A380
Medical limitation	NIL

1.5.1 The Commander

The 44-year old male Commander held a valid airline transport pilot license (ATPL) issued by the GCAA and valid at the time of the Accident.

The Commander held ratings for the A330, A340, and A380.

1.5.2 The Co-pilot:

The 40 year old male Co-pilot held a valid ATPL issued by the GCAA which was valid at the time of the Accident.

The Co-pilot held ratings for the A330, A340 and A380 Aircraft.

1.6 Aircraft Information

Table 5. Aircraft general data

Type	Airbus A380-800
Nationality and Registration	The United Arab Emirates, A6-EEF
MSN	108
State of Registry	The United Arab Emirates
Certificate of Registration	Issued by the GCAA on 19 December 2012
Certificate of Airworthiness	Issued by the GCAA on 19 December 2012
Last check and date	7 June 2015
Time since new (hours)	1978:00

Cycles since new	1594
Engines	Four

1.7 Meteorological Information

According to the weather report issued by the United Arab Emirates National Center of Meteorology and Seismology, there was a weak easterly surface pressure gradient covering the southern Arabian Gulf with fine weather in general.

1.7.1 General situation

Around 0900 UTC, scattered low clouds started to develop over the western part of the UAE to Abu Dhabi city (bases about 4,000ft and tops about 7,000ft) and towering clouds started to develop along the mountains with a base of about 3000ft.

1.7.2 Dubai International METAR & SPECIS (Times in UTC):

MET Report: METAR OMD
130800Z 11006KT 050V210
CAVOK 41/09 Q1009 BECMG
35012KT

MET Report: METAR OMD
130830Z 06008KT 340V100
CAVOK 41/07 Q1008 BECMG
35012KT

MET Report: METAR OMD
130900Z 04005KT 320V090
CAVOK 41/15 Q1008 BECMG
35012KT

MET Report: METAR OMD
130930Z 09006KT 360V160
CAVOK 38/24 Q1007 BECMG
35012KT

MET Report: SPECI OMD 130931Z 34013KT 8000 NSC 38/23 Q1007 NOSIG

MET Report: METAR OMD 131000Z 35014KT 8000 NSC 38/20 Q1007 NOSIG

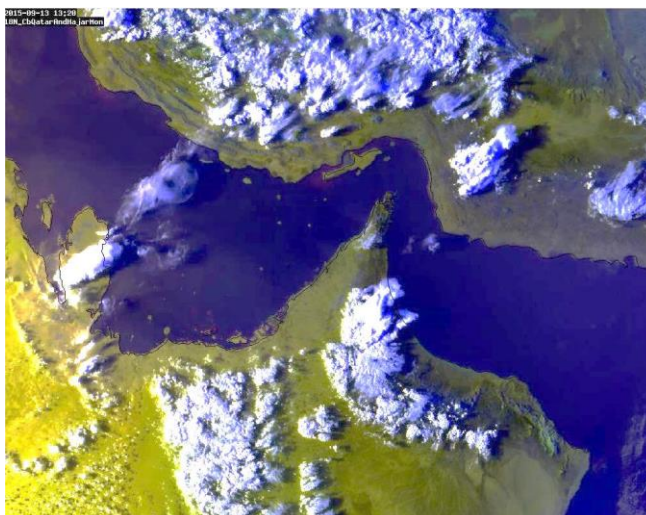


Figure 1. UAE weather at 0900 UTC

The summary of the weather at around 0900 UTC, was scattered low clouds starting to develop over the western part of the UAE to Abu Dhabi city (bases about 4,000ft and tops about 7,000ft) and towering clouds started to develop along the mountains with a base of about 3,000ft.

The Commander stated that he was not informed by ATC about any significant weather conditions and he confirmed that no significant weather was seen or indicated on the weather radar during the descent to Dubai.

1.8 Aids to Navigation

The ground-based navigation aids, on-board navigation aids, aerodrome visual ground aids were serviceable at the time of the Accident.

1.9 Communications

All radio communications between the Aircraft and ATC were normal.



1.10 Aerodrome Information

Not applicable.

1.11 Flight Recorders

All of the data was downloaded successfully and all parameters were captured. The flight data recorder analysis was conducted in the AAIS flight data recorder laboratory.

1.12 Wreckage and Impact Information

There was no damage to the Aircraft as a result of this Accident.

1.13 Medical and Pathological Information

One cabin crewmember sustained a serious injury, and was admitted to hospital for treatment of a fractured ankle. The cabin crewmember was hospitalised for about one week.

1.14 Fire

There was no fire.

1.15 Survival Aspects

Wearing of inappropriate cabin crew footwear has been identified in a previous AAIS accident Final Report as a contributing factor that can lead to serious injury.

1.16 Tests and Research

No tests or research was carried out in this Investigation.

1.17 Organizational and Management Information

1.17.1 General structure

Emirates Airline is a subsidiary of the Emirates Group, which is wholly owned by the Investment Corporation of Dubai.

1.17.2 The Operator's Cabin Safety Management

During all phases of the operation, the purser is responsible for the conduct of the cabin crew in relation to all required safety procedures.

The Operator's policy for cabin safety management during turbulence is that the flight crew will advise the Cabin Crew Manager of any possible turbulence and a requirement to change the service level or to secure the cabin, if required.

The crew resource management (CRM) procedure is that the flight crew and the cabin crew will coordinate in accordance with the Operator's *SOP*. The *operations manual-part e- standard operating procedures, revision 3*, states:

"Cabin Crew Safety Duties Checklist

- In-Flight – Flight Crew When turbulence is expected during the flight, the Flight Crew must advise the Cabin Crew how much time is available to secure the cabin, the level of turbulence and the expected duration.

- In-Flight – Purser It is the Purser's responsibility to ensure that all passengers and if required Cabin Crew are secured, and to advise the Flight Crew.”

OME Ref 1.20.1.14 – CRM Training

“Emphasis is placed on the importance of effective communication between Cabin Crew and Flight Crew including technique, common language and terminology. The Initial CRM course combines the regulatory requirements of the Introductory and Operator’s CRM courses.

Turbulence is covered in Combine Practical CRM this Recurrent Cycle.”

OME Ref 4.3.1

“The flight crew must inform the Purser and the rest of the Cabin Crew about expected areas of Turbulence (if forecast) during the flight as part of the pre-flight briefing.”

1.18 Additional Information

1.18.1 Operator’s cabin footwear health and safety evaluation

The Operator considered no further risk evaluation was required, when the uniform footwear was changed for the A380 cabin crew in 2007 and 2009.

The Operator’s departmental safety risk register as at August 2015 included various turbulence related hazard scenarios including the specific operational situation where the seat-belt sign was on and cabin crew movement in the cabin still authorised. This hazard was classified with a ‘hazardous’ residual severity and a remote probability, resulting in a tolerable risk.

In a safety risk management executive summary titled *Female Cabin Crew Uniform (Court shoes/skirt)*, issued in May 2016, the Operator classified the risk of *wearing high heel shoes during the critical phases of the flight*, as minor risk severity and remote risk probability.

1.18.2 Female cabin crewmembers uniform shoes

Referring to appendix 1, Reference Material – Extracts from the Image and Uniform Standards Manual, Appendix 3 to this Report, the Operator’s policy stated that the standard issue court shoes (high/medium heels) must be worn by a CCM during passenger boarding, disembarkation and in flight, prior to conducting the pre-landing duties.

There are three different types. Wedge style – 1.7 inches (4.5cm), Flat style 1 – 1.5 inches (3.5cm), Flat style 2 – 1 inch (2.5cm) for the inflight service.

Female cabin shoe options (flatter heeled shoes)



Figure 2. Cabin crew shoes

Female uniform court shoe options (high heeled shoes)

At the time of the event the cabin crewmember was wearing the heel high shoes below, 7.5cm, 3 inches high.



Figure 2. Cabin crew high heeled shoes

1.18.3 The Operator's OME Reference 1.8.1.1- *Compliance with Regulations and Orders in order to make Emirates flights safe:*

An abbreviated version of the manual is below:

"State that expected that all Company personnel will closely comply with all regulations, instructions, procedures, and orders issued which are relevant to their duties.

Under routine conditions strict compliance is required with all policies, rules, regulations and procedures laid down in the Emirates manuals."

1.18.4 The Operator's OME Reference 4.3.4 - *Procedures during Turbulence Post Turbulence Management:*

1. Cabin Crew check colleagues and passengers – render first aid if necessary.
2. Check for cabin damage.
3. Report to Purser/Cabin Supervisor passenger injuries and/or cabin damage.
4. Purser to report passenger and crew injuries and/or cabin damage to Flight Crew."

1.19 Useful or Effective Investigation Techniques

Standard investigation techniques were applied.

2. Analysis

The Investigation into this Accident collected data from various sources for the purpose of determining the causes and contributing factors.

2.1 Cabin Crew Footwear Selection Normalised Behaviour

The Investigation determined, based on in-service feedback, that it was accepted practice by the cabin crew to change their shoes from the low heel to mid/high heel shoes before touchdown to save time during door opening and passenger disembarkation. This was in accordance with the Operators' *standard operating procedures (SOP)*.

The injured cabin crewmember was wearing high heel shoes during the approach phase of the flight which did not provide stable support in turbulent conditions.

The injured cabin crewmember was standing at the time of the turbulence encounter completing pre-landing tasks and fell over sustaining a fracture to her ankle.

The injured cabin crewmember lost her balance due to the unexpected high g-force, combined with the lack of support provided by the footwear that she wore for that phase of the flight.

2.2 Aircraft Turbulence

The analysis of the flight data recorder indicated that the Aircraft vertical acceleration during the turbulence encounter varied between +2.2g to +0.07g when the Accident occurred, with a corresponding minor speed fluctuation.

All parameters stayed within Aircraft limitations during the turbulence encounter.

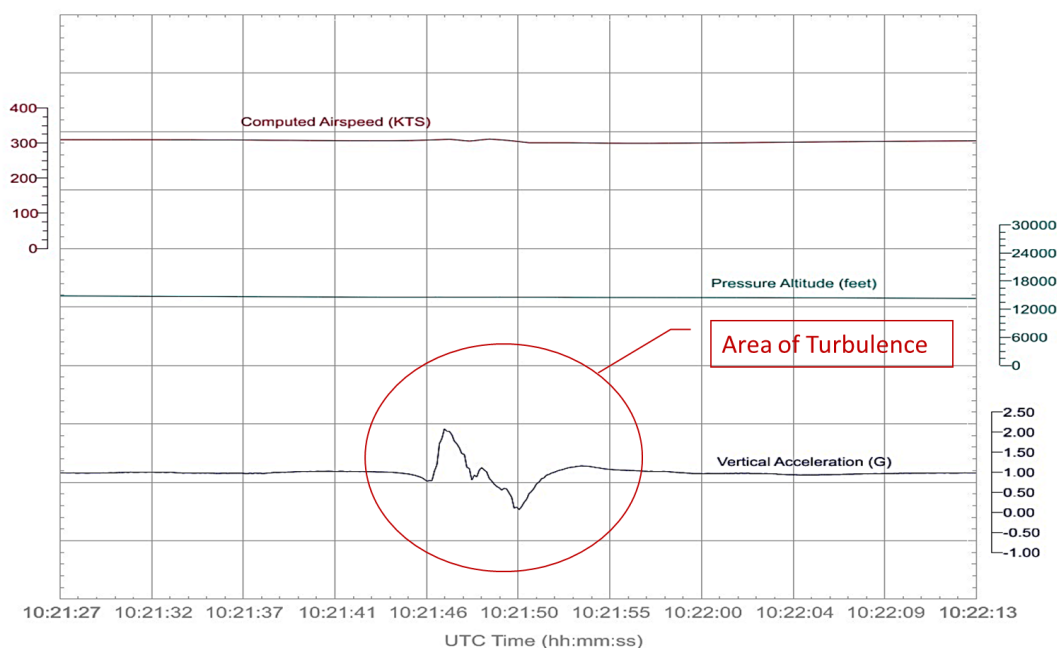


Figure 3. Vertical acceleration loads during the turbulence encounter [Source: FDR]



2.3 Cabin Safety Management

The cabin crewmember had changed from her flat sole footwear prior to conducting her pre-landing duties in accordance with the Operator's *SOP*.

The cabin crewmembers' change from flat sole footwear to high heel footwear resulted in insufficient support to enable her to maintain her balance during the turbulence encounter.

In the safety risk assessment that was carried out by the Operator in May 2016 (after the Accident), the Operator classified the risk of *wearing high heel shoes during the critical phases of the flight*, as minor risk severity and remote risk probability, whereas the safety risk register, that had last been reviewed in Aug 2015, under turbulence related events, had classified the high-level consequence of a cabin crew movement while seat belts were On, in the 'hazardous' severity category.

Comparing the risk assessment carried out in May 2016 to the safety risk register of May 2015, and given the consequences of wearing high heel footwear to the injury level of the Accident cabin crewmember, the Investigation believe that the risk register was more accurate than the later risk assessment.



3. Conclusions

3.1 General

From the evidence available, the following findings, causes and contributing factors were made with respect to this Accident. These shall not be read as apportioning blame or liability to any particular organisation or individual.

To serve the objective of this Investigation, the following sections are included in the conclusions heading:

- **Findings-** are statements of all significant conditions, events or circumstances in this Accident. The findings are significant steps in this Accident sequence but they are not always causal or indicate deficiencies.
- **Causes-** are actions, omissions, events, conditions, or a combination thereof, which led to this Accident.
- **Contributing factors-** are actions, omissions, events, conditions, or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of this Accident, or mitigated the severity of the consequences of the Accident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil or criminal liability.

3.2 Findings

3.2.1 Findings related to the flight operations

- (a) The flight crewmembers and cabin crewmembers were licensed and qualified for the flight in accordance with the current requirements of the *Civil Aviation Regulations* of the United Arab Emirates.
- (b) The Aircraft was certificated, equipped and maintained in accordance with the current requirements of the *Civil Aviation Regulations* of the United Arab Emirates.
- (c) The Aircraft was airworthy.
- (d) During the descent, no weather returns were stated to have been displayed on the weather radar.
- (e) On descending below cloud, the flight crew requested a deviation to the right of track to avoid an isolated weather formation. This request was refused by ATC due to an airspace conflict.
- (f) The flight crew did not advise the cabin crew manager of a potential weather encounter.
- (g) In the time available the flight and cabin crewmembers were not able to comply with the Operator's CRM turbulence procedure (*OME Reference 4.3.4*).
- (h) The Aircraft was observed on radar commencing a left turn and ATC asked the crew if they were clear of the weather.
- (i) From Dubai ATC perspective, the Aircraft appeared to land without incident.
- (j) The Commander did not advise Dubai ATC of any emergency state, or any injuries to cabin crew that required assistance on the ground.



3.2.2 Findings related to cabin safety

- (a) The seatbelt sign was ON at the time of the Occurrence.
- (b) The injured cabin crewmember was wearing high heel shoes.
- (c) Emirates cabin crew procedure for the use of appropriate footwear was followed according to the operator's *SOP*.
- (d) The injured cabin crewmember lost her balance due to the high g-force combined with the *SOP*-required high heel footwear being worn for that phase of the flight.
- (e) The Operator had classified the risk severity as hazardous in the *safety risk register* of August 2015 but had reduced this to minor in the risk assessment of May 2016.

3.3 Causes

The Air Accident Investigation Sector determines that the causes of the Accident were:

- 3.3.1 The Aircraft encounter with unanticipated turbulence during descent which resulted in a sudden aircraft vertical acceleration.
- 3.3.2 The cabin crew were not advised of the potential turbulence.

3.4 Contributing Factors

The seriously injured cabin crewmember was wearing high heel footwear which was inappropriate in this phase of flight.

The high heel footwear provided insufficient support to enable the cabin crewmember to maintain her balance during the turbulence encounter and led to her falling and sustaining a serious injury to her ankle. The serious injury changed the classification of the occurrence from an incident to an accident by raising the severity of the consequence.



4. Safety Recommendations

4.1 General

The safety recommendations listed in this Report are proposed according to paragraph 6.8 of *Annex 13 to the Convention on International Civil Aviation*, and are based on the conclusions listed in heading 3 of this Report; the AAIS expects that all safety issues identified by the Investigation are addressed by the receiving States and organizations.

4.2 Safety Actions Taken

The following safety actions were taken by the Operator after the Incident occurred.

4.2.1 Safety Actions taken by the Operator

- 4.2.1.1 A safety risk assessment of the existing female cabin crew uniform policy in relation to the risk of injury from wearing high heel shoes during the Operator's critical phases of flight was completed in May 2016 and shared with the GCAA.
- 4.2.1.2 A review of the safety risk assessment was undertaken in Nov 2016 to incorporate the consideration of information from the Operator's operational experiences.

4.3 Final Report Safety Recommendations

The Air Accident Investigation Sector recommends that Emirates-

SR51/2017

The AAIS find that the risk assessment that was carried out by Emirates in May 2016 underestimated the severity of the risk and classified it as "minor" whereas the Investigation believes that the severity classification should have been "hazardous". Therefore it is recommended that the safety risk assessment be revised.

This Report is issued by:

**The Air Accident Investigation Sector
General Civil Aviation Authority
The United Arab Emirates**

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