

FINAL REPORT

**AIRBUS A380-800, REGISTRATION 9V-SKI
TURBULENCE ENCOUNTER
18 JUNE 2015**

AIB/AAI/CAS.113

**Transport Safety Investigation Bureau
Ministry of Transport
Singapore**

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The Transport Safety Investigation Bureau

The Transport Safety Investigation Bureau (TSIB) is the air and marine accidents and incidents investigation authority in Singapore. Its mission is to promote aviation and maritime safety through the conduct of independent and objective investigations into air and marine accidents and incidents in accordance with international standards and recommended practices.

The TSIB conducts air safety investigations in accordance with the Singapore Air Navigation (Investigation of Accidents and Incidents) Order 2003 and Annex 13 to the Convention on International Civil Aviation, which governs how member States of the International Civil Aviation Organization (ICAO) conduct aircraft accident investigations internationally.

In carrying out the investigations, the TSIB will adhere to ICAO's stated objective, which is as follows:

"The sole objective of the investigation of an accident or incident shall be the prevention of accidents and incidents. It is not the purpose of this activity to apportion blame or liability."

Accordingly, it is inappropriate that TSIB reports should be used to assign fault or blame or to determine liability, since neither the investigation nor the reporting process had been undertaken for those purposes.

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GLOSSARY OF ABBREVIATION

ATC	Air Traffic Control
CIC	Cabin Crew-in-charge
CU	Cumulus Cloud
CVR	Cockpit Voice Recorder
FDR	Flight Data Recorder
FSS	Flight Stewardess
LS	Leading Steward
PIC	Pilot-in-command
SFO	Senior First Officer

SYNOPSIS

On 18 June 2015, an Airbus A380-800 was operating a scheduled flight from Hong Kong to Singapore when it encountered turbulence on its approach into Singapore.

As a result of the turbulence encounter, three cabin crew members were injured and one of them suffered a fracture on her right foot.

The occurrence was classified as an accident by the then Air Accident Investigation Bureau of Singapore.

AIRCRAFT DETAILS

Aircraft type	: Airbus A380-800
Operator	: Singapore Airlines
Aircraft registration	: 9V-SKI
Numbers and type of engines	: 4 x Rolls Royce Trent 900
Type of flight	: Scheduled passenger flight
Persons on board	: 460

1 FACTUAL INFORMATION

All times used in this report are Singapore times. Singapore time is eight hours ahead of Coordinated Universal Time (UTC).

1.1 History of the flight

- 1.1.1 On 18 June 2015, an Airbus A380-800 was operating from Hong Kong to Singapore. The flight crew comprised a Pilot-in-Command (PIC) on the left seat and a Senior First Officer (SFO) on the right seat. A Check Captain was on an observer seat. He was conducting a line check on the PIC.
- 1.1.2 Before initiating the descent into Singapore, the flight crew checked on the Automatic Terminal Information Service and noted that there was no significant weather on arrival into Singapore. For the descent, the SFO was the pilot flying and the PIC the pilot monitoring.
- 1.1.3 When the aircraft reached 18,000 feet during its descent to Singapore, the flight crew switched on the seat belt sign and announced through the Passenger Announcement (PA) system for the cabin crew to commence the before-landing cabin checks to prepare the aircraft for arrival¹.
- 1.1.4 During the descent from 16,000 feet to 7,000 feet, the weather radar detected the presence of at least one wet turbulence area² within a radius of 30 nm of the aircraft³. The flight crew did not notice the magenta colour corresponding to the wet turbulence area(s) that would appear on the navigation displays (NDs) of the PIC and SFO.
- 1.1.5 During the descent from 7,000 to 3,000 feet, the flight crew saw isolated cumulus (CU) clouds ahead, but no thunderstorm cells. The flight crew observed from the ND that the return on their weather radar was mainly black with spots of green⁴ which suggested that there was no significant weather around their approach path.

¹ Typically the preparation will start at 10,000 feet. But as the aircraft was quite full, the PIC had in his pre-flight instructions told the Cabin Crew-in-charge (CIC) that he would ask the cabin crew to commence the before-landing cabin checks at 18,000 feet to allow the cabin crew more time to prepare the cabin for arrival.

² Wet turbulence area refers to turbulence area involving rainfall.

³ This information was provided by the aircraft manufacturer by analysing the weather radar data. The FDR system would not record information as regards the number, extent or location of the wet turbulence area(s). However, considering a typical ground speed of 260 knots at the time of the descent, the 7-minute descent from 16,000 feet to 7,000 feet would cover a distance of 30 nm (260 knots x 7/60). Thus the deduction that there was at least one wet turbulence area within a radius of 30 nm.

⁴ The display of the weather returns captured by the aircraft's weather radar system is colour-coded in accordance with the intensity of the return which is proportional to the amount of precipitation.

Colour	Return strength	Rainfall rate
Black	Very light or no returns	Less than 0.7 mm/hr
Green	Light returns	0.7 - 4 mm/hr
Yellow	Medium returns	4 - 12 mm/hr
Red	Strong returns	Greater than 12 mm/hr
Magenta	Turbulence	N/A

- 1.1.6 The SFO intended to fly through clear spaces between the clouds instead of deviating around the clouds. This would entail a series of heading changes. He requested and the Air Traffic Control (ATC) gave the clearance for the series of heading changes.
- 1.1.7 The SFO noticed a CU cloud in the aircraft's path just before 6,000 feet and flew a parallel track about 3 to 4 nm to the left to avoid the CU cloud. As the aircraft passed abeam the CU cloud, the aircraft encountered turbulence⁵ for about two seconds and the descent then continued smoothly. The flight crew made a remark about the encounter but did not think much of it. They were not aware that a Leading Steward (LS) and two Flight Stewardesses (FSSs) had fallen because of the turbulence and landed sitting on the floor of the aft galley of the upper deck⁶.
- 1.1.8 After the aircraft had landed in Singapore and arrived at the gate, the flight crew was notified by the Cabin Crew-in-charge (CIC) that three cabin crew members had fallen at the upper deck aft galley. Once the flight crew had completed all the after-landing checks and paperwork, they went to check on the conditions of the injured cabin crew members. Subsequently, the three injured cabin crew members received medical treatment.
- 1.1.9 The flight crew subsequently filed an incident flight report, providing the description of the turbulence and the cabin crew injuries.

1.2 Injuries to persons

- 1.2.1 The breakdown of the injuries is as shown in the table below:

Injuries	Flight	Cabin crew	Passengers	Total
Fatal	-	-	-	-
Serious	-	1*	-	1
Minor	-	2	-	2
None	3	21	433	457
Total	3	24	433	460

*left foot fracture

- 1.2.2 The three cabin crew who fell realised that they had sustained injuries when they had got seated. The LS felt pain at his left hip joint and right knee⁷. One FSS injured her left knee while the other FSS injured her right foot and hip. This latter said that she hit her back on the sales cart that was in the galley and fell on her hip and that, at the same time, the LS fell and landed on her right foot.

⁵ The aircraft's rate of descent decreased momentarily and resumed subsequently. The momentary decrease in the rate of descent lasted about two seconds.

⁶ The LS and FSSs had completed their cabin check routine fairly early but they had spent time assisting one passenger in locating her missing credit card. After that, they went to the aft galley of the upper deck (adjacent to the stairway leading to the main deck) and were about to proceed to their seats for the landing when the turbulence occurred. (The LS's seat was at the left side of the aft upper deck area while the two FSSs' seats were on the main deck aft area – which required the FSSs to go down the stairway.)

⁷ The LS has indicated that it was an old knee injury.

1.2.3 The LS and FSSs eventually sought medical treatment after the passengers disembarked. Only the FSS with the foot injury was diagnosed as having suffered a serious injury in the form of a fracture at the area between the toes and the heel.

1.3 **Flight recorders**

1.3.1 The aircraft was installed with a Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR).

1.3.2 The operator's operations manual required its flight crews to report significant flight incidents. The operations manual provided a list of reportable incidents (examples included severe turbulence, injuries that render the crew members unfit for duties) which required a flight crew to submit a report to the operator and where applicable:

- make an entry in the technical log for a reportable incident, so as to allow its Engineering Department to carry out the necessary checks before the aircraft's next flight;
- indicate in the technical log when the FDR/CVR should be removed for preservation; and
- file a report.

The operations manual stated that the FDR/CVR recordings should be preserved for accidents and serious incidents.

1.3.3 Following this incident, the flight crew did not indicate in the technical log for the FDR/CVR to be removed as they had assessed that the turbulence lasted only a couple of seconds and it did not occur to them that the turbulence was severe, and as they did not know the extent of the injuries to the cabin crew members immediately after the event.

1.3.4 Nevertheless, the FDR was later removed and successfully read out. However, the cockpit voice recorder (CVR) was not available for analysis by the investigation team as it was over-written⁸.

⁸ The FDR had a 25 hours recording duration whereas the CVR had only two.

2 **DISCUSSION**

2.1 **Avoidance of bad weather**

2.1.1 During the descent from 7,000 to 3,000 feet, the flight crew saw isolated cumulus (CU) clouds ahead, but no thunderstorm cells, both outside the aircraft through the window as well on the NDs. To avoid the CU clouds, the SFO elected to fly through clear spaces between the clouds, attempting only a parallel track of about 3 to 4 nm to the left of the clouds. In the end, such a deviation did not prove sufficient.

2.1.2 The weather radar is a useful tool for detecting, analysing and avoiding adverse weather and turbulence. This occurrence serves as a reminder that flight crews should constantly monitor the weather radar information and deviate the flight path from any adverse weather by as much as practicable.

2.2 **Preservation of recorders**

2.2.1 The flight crew did not indicate in the technical log for the FDR/CVR to be removed as they had assessed that the turbulence lasted only a couple of seconds and it did not occur to them that the turbulence was severe, and as they did not know the extent of the injuries to the cabin crew members immediately after the event. The CVR data for the incident flight was overwritten in the subsequent flight and was not available to the investigation team for analysis.

2.2.2 The importance of airline operators ensuring a robust procedure to prevent flight recordings from being overwritten cannot be over emphasised.

3 **SAFETY ACTION**

During the course of the investigation and through discussions with the investigation team, the following safety action was initiated by the operator.

- 3.1 The operator has issued a Flight Operations Notice (FON) to all flight crews in September 2016 to share the lessons learnt from this occurrence and reiterate the requirement for flight crews to make an entry in the technical log for flight recorders to be removed whenever there is a turbulence event that resulted in injuries to a crew member that render him/her unfit for duty.

4 **SAFETY RECOMMENDATION**

A safety recommendation is for the purpose of preventive action and shall in no case create a presumption of blame or liability.

- 4.1 In view of the safety action already taken by the airline operator, no further safety recommendation is proposed.