سلطنة عُمان
وزارة النقل والاتصالات وتقنية المعلومات
Sultanate of Oman
Ministry of Transport, Communications and Information Technology

Oman Transport Safety Bureau

Preliminary Report

OTSB Case File No: AIFN-001/01/2024

Singapore Airline B777 Flight Level Bust during Cruise over MCT FIR

Operator: Singapore Airline
Make and Model: Boeing 777-312 (ER)
Nationality and Registration Marks: Singaporean, 9V-SWY
Location of the Occurrence: Muscat FIR, Radial 100, Distance 290 nm from MCT
State of Occurrence: Sultanate of Oman
Date and Time of Occurrence: 13th January 2024, 23:21 UTC
Date of Publication: 12 Feb 2024

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Purpose of the Investigation

The investigation was conducted by Oman Transport Safety Bureau pursuant to Civil Aviation Law 76/2019 Chapter 10, and in compliance with the Civil Aviation Regulation CAR-13 -, Sub Part CAR 13.070: Instituting and Conducting of Investigations as State of Occurrence, Accidents or Incidents in the Sultanate of Oman.

The sole objective of the investigation is to prevent future aircraft accidents and incidents and not to apportion blame or liability. Oman Transport Safety Bureau issued this preliminary Report in accordance with the National and International standards, and Industry best practice.

Unless otherwise mentioned, all times in this Report are UTC time. Local Time in The Sultanate of Oman is UTC plus (+) 4 hours. Photos and figures used in this report were taken from different sources and adjusted from the original for the sole purpose of improving clarity of the report.

This Report will be publicly available at: - http://www.mtcit.gov.om

Abbreviations

AAIS	Air Accident Investigation Section
AFL	Actual Flight Level
AIP	Aeronautical Information Publication
APW	Area Proximity Warning
ATC	Air Traffic Control
ATCO	Air Traffic Controller
AWY	ATC Airway
CAA	Civil Aviation Authority
CFL	Cleared Flight Level
CR	Central Radar
CVR	Cockpit Voice Recorder
FL	Flight level
FMS	Flight Management System
FPL	Flight Plan
FPM	Feet Per Minute
ICAO	International Civil Aviation Organization
IIC	Investigator-in-charge
MATSOP	Manual of Air Traffic Services Operational Procedures
MCT	Muscat
NM	Nautical Mile
NTSB	National Transportation Safety Board
OOMS	Muscat International Airport

OTSB	Oman Transport Safety Bureau
PF	Pilot Flying
PM	Pilot Monitoring
RA	Resolution Advisory
RDR	Radar
ROC	Rate of climb
ROD	Rate of descent
RVSM	Reduced Vertical Separation Minima
RPA	Radioactive Protection Advisor
SEP	Separation
SIA	Singapore Airline
SOP	Standard Operating Procedures
TCAS	Traffic Collision Avoidance System
TAT	Total Air Temperature
TSIB	Transport Safety Investigation Bureau
UTC	Universal Time Coordinated
VOR	Omnidirectional Range Navigational aid (VOR)
VHF	Very High Frequency
WAY	ATC way point

Synopsis

Oman Transport Safety Bureau (OTSB) was notified of the occurrence by the Sultanate of Oman CAA Air Navigation Service Incident Coordination (ANSIC) through OTSB email on 14th of January 2024 at 08:36 UTC. The OTSB instituted an investigation and classified the occurrence as an Incident requiring investigation. The following parties were notified: -

- State of Occurrence (Sultanate of OMAN CAA)
- State of Operator, and Registry (Singapore TSIB)
- State of Design and Manufacturer United States of America (NTSB)
- International Civil Aviation Organization (ICAO)

In line with OTSB Investigation procedures, the Director of OTSB appointed an Investigator-In-Charge (IIC) and an investigation team to assist the IIC with the investigation. The following parties are involved in the investigation by appointing accredited representatives and advisor to the investigation: -

- National Transportation Safety Board (NTSB) of United State of America
- Boeing: Organization responsible for type design and final assembly of the aircraft.
- Transport Safety Investigation Bureau (TSIB) of Singapore
- Singapore Airlines (SIA)

After the investigation is completed, OTSB will release and publish the final report, the Final Report will be made public at the below link: http://www.mtcit.gov.om.

The incident involved Singapore Airline aircraft with registration marks 9V-WSY, Boeing 777-312 (ER) that departed at 17:10 UTC from Singapore Changi International Airport (WSSS) on an international scheduled flight SIA306 with 2 flight deck crew to London - Heathrow Airport (EGLL). The aircraft entered Muscat Flight Information Region (FIR) via Way Point (WAP) PARAR at Flight Level (FL) 320. After about 2 minutes of passing a reciprocal traffic (Airbus 380) which was at FL330 on the same airway (bidirectional airway) SIA306 encountered wake turbulence resulting in rolling the aircraft to the right and climbing to FL325. The crew regained control of the aircraft with no injuries to both

the crew and the passengers. Thereafter, the aircraft continued to its destination and landed safely without any further incident.

1. Factual Information.

1.1. History of the Flight.

1.1.1. On the 13th January 2024 Singapore Airline aircraft with registration marks 9V-SWY, Boeing 777-312 ER took off from Changi International Airport (WSSS) at 17:10 on an international scheduled flight SIA306 with intended destination airport London Heathrow Airport (EGLL).

1.1.2. The aircraft took off from Runway 02C of WSSS with 2 cockpit crew. The Pilot In Command (PIC) was the Pilot Flying (PF) and the First Officer (FO) was the Pilot Monitoring (PM).

1.1.3. The flight crew flight plan was to depart from Changi airport, then to fly airways over Indonesia, India and then to enter Oman through way point PARAR and to maintain airway P307. After that to inter IRAN through way point VAXIM, then to continue its way to EGLL flying over different countries.

1.1.4. SIA306 contacted Muscat Air Traffic Control (ATC) over WAP PARAR at time 23:12. The Air Traffic Controller (ATCO) instructed SIA306 to maintain FL320 and to continue on Flight Plan Route with Squawk 3256.Meanwhile, UAE414 (Airbus 380) was on the same airway P307 at FL330, crossed over SIA306 which was at FL320 on AWY P307 at time 23:19:30 as per the below ATC radar screen (Figure 1)

Figure 1 ATC Radar screen showing flight levels and details of SIA306 and UAE 414

1.1.5. B777-312 ER (SIA306) had encountered wake turbulence produced by the A380 (UAE414) that affected the aircraft by rolling to the right and climbing. Autopilot is re-engaged at 23:20:50Z, 19 seconds after it disconnected. At 23:20:30Z, Vertical G force indicates a sudden spike in positive G force. 1 second later, at 23:20:31Z, the Autopilot disconnected, and Autopilot Disconnect Warning Aural Alert sounded.

1.1.6. The Autopilot was disconnected, aural warning was heard and the autopilot caption was observed and the flight crew started to recover the situation by flying the aircraft manually applying roll to the left and descending gently.

1.1.7. The PF reported that while applying the input on control column, it was observed to be mild on back pressure for 5 seconds before gradually lowered to forward pressure to achieve a shallow nose down pitch towards 2.5°.

1.1.8. The highest altitude reached while in manual flight was 32500ft. Total duration the altitude excursion occurred was for 28 seconds. The flight crew tried hard to switch on the seat belt sign “ON” due to the G force that was produced by the aircraft climb.

1.1.9. There was no cabin service ongoing at the time of the incident as it was already completed, and most passengers were asleep during the lull period.

1.1.10. At time: 23:21:07, the ATCO noticed that SIA306 had climbed to FL325 on the AWY P307 and immediately called the flight crew for verifying the reason of the climb however there was no response from SIA306 flight crew.

Figure 2 is from ATC radar screen showing SIA306 at flight level 325

1.1.11. There was no response from the SIA306 flight crew to the ATCO even after trying to contact the aircraft many times until 23:23:07. Moreover, the aircraft recovered from the situation and maintained FL320 on AIW P307 during that period.

1.1.12. The ATCO made calls on same frequency 135.6 to another 2 aircraft call sign AIC946 and DLH779 to verify if the frequency was readable and both replied. Then the ATCO made several calls to SIA306 on guard frequency 121.5. SIA306 responded to the call after AIC946 relayed the message. After that SIA306 was able to exchanged calls with MCT ATC on frequency 135.6 at 23:23:44. The detailed radio calls in para 1.9 clarifies the statement.

1.1.13. The ATCO inquired from SIA306 for the reason of climbing to FL325 and not replying to the calls as the ATCO tried to contacting SIA306 for the past 2 minutes and 38 seconds. SIA306 crew advised the ATCO that the aircraft encountered wake turbulence from other traffic passing above and they were recovering the situation. Also, the ATCO advised SIA306 flight crew that there was traffic on airway N881 that had crossed WAP SETSI left to right at FL330.

1.1.14. According to the ATC radar screenshot in Figure 3, in case of any deviation there was a possibility to trigger the SIA306 TCAS alert with a minor deviation as there was traffic AIC946 at FL330 on distance of 5.72 Nautical Mile (NM). As there was traffic on opposite direction 5.72nm to the right of SIA306 FL330

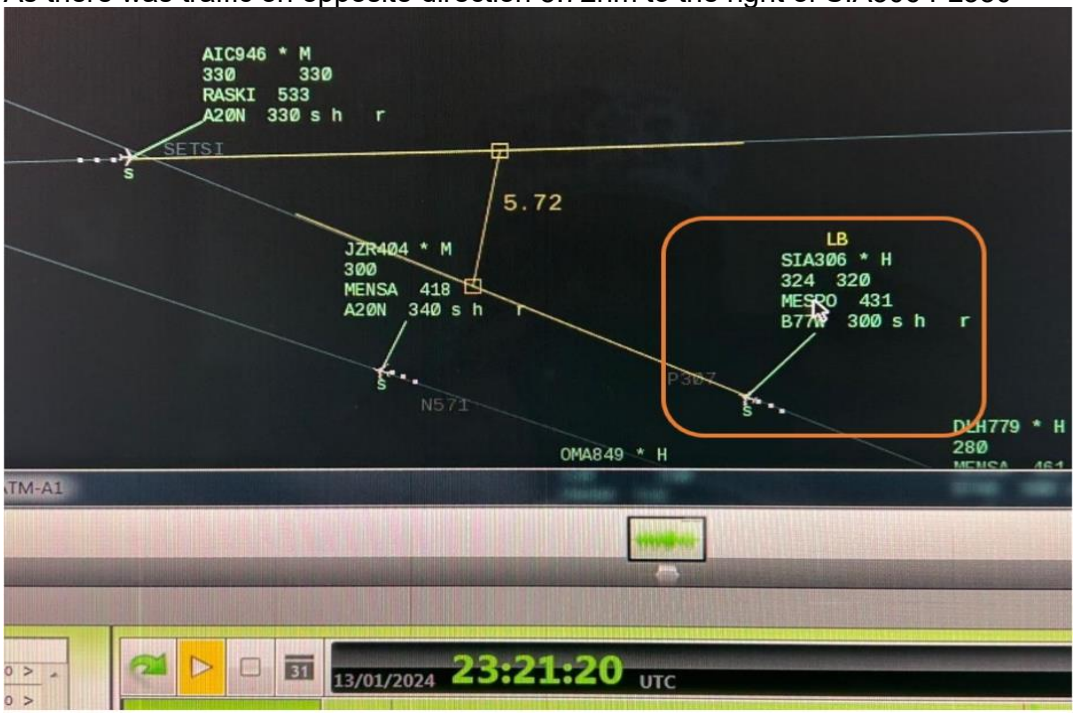


Figure 3 shows ATC radar screen shot of SAI306 during the recovery phase

1.1.15. The SIA306 aircraft continued its flight to destination EGLL and landed safely with no further incident.

1.2. Injuries to Persons.

Injuries	Pilot	Cabin Crew	Passengers	Total on Board	Other
Fatal	-	-	-	-	-
Serious	-	-	-	-	-
Minor	-	**-**	-	**-**	-
No Injuries	**2**	**ALL**	**ALL**	**ALL**	-
Total	**2**	**ALL**	**ALL**	**ALL**	-

Note: Other, means people on ground.

1.3. Damage to Aircraft.

1.3.1 No damages were reported.

1.4. Other Damage.

1.4.1 No other damages were reported

1.5. Personnel Information:

1.5.1. **Pilot-in-command (Pilot Flying)**

Nationality	Singaporean	Gender	Male	Age	53
Medical validity	Expiry: 30/11/2024	Licence type	Airline Transport		
Licence validity	Expiry: TBA	Type endorsed	Yes		
Ratings	Instrument rating, Multi-Engine				
Latest LPC	TBA	Latest OPC	TBA		

Flying experience:

Total hours	TBA
Last 24 hrs	06:08
Last 7 days	09:47
Last 30 days	58:46
Last 90 days	248:35

1.5.2. **First officer (Pilot Monitoring)**

Nationality	Singaporean	Gender	Male	Age	29
Medical valid	Expiry: 31/12/2024	Licence type	Airline Transport		
Licence valid	Expiry: TBA	Type endorsed	Yes		
Ratings	Instrument rating, Multi-Engine				
Latest LPC	TBA	Latest OPC	TBA		

Flying experience:

Total hours	TBA
Last 24 hrs	06:08
Last 7 days	13:49
Last 30 days	80:33
Last 90 days	244:46

1.5.3. **Cabin Crew Director**

Nationality	TBA	Gender	TBA	Age	TBA
Medical valid	TBA	Licence type	Cabin crew		
Licence valid	TBA	Type endorsed	TBA		
Ratings	CRM, First Aid, Security, Safety Emergency Procedures, Dangerous Goods				

1.6. Aircraft Information:

1.6.1 Airframe:

Manufacturer/Model	Boeing/B777-312ER	
Serial Number	42238	
Year of Manufacture	2014	
Total Airframe Hours (At Time of Accident)	33,344 FH	
Last Inspection (Date & Hours (TSN))	18 Jan 2023	28,799 TSN
Last Inspection Airframe Cycles (CSN)	18 Jan 2023 at 3,609 CSN	
Hours Since Last Inspection	4,728 FH	
Type of inspection preformed	C-Check	
CRS Issue Date	18 Jan 2023	
C of A (First/initial Issue Date)	16 November 2023	
C of A (Expiry Date)	23 November 2024	
C of R (Issue Date) (Present Owner)	24 November 2014	
Type of Fuel Used	Jet A / Jet A-1 / No.3 Jet Fuel / RT Fuel / Synthetic Fuels	
Operating Category	Transport (passenger)	
Previous Accidents	NIL	

Engine 1:

Manufacturer/Model	GE90-115B
Serial Number	906-434
Part Number	2115M10G06
Hours Since New	63,852 FH
Hours Since Overhaul	4,310 FH
Hours since last shop visit	4,310 FH
Cycles Available Before Next Shop Visit	3,450 FC
Oil type	Mobil Jet 387

Engine 2:

Manufacturer/Model	GE90-115B
Serial Number	906-282
Part Number	2115M10G06
Hours Since New	67,245 FH

Hours Since Overhaul	4,415 FH
Hours since last shop visit	4,415 FH
Cycles Available Before Next Shop Visit	3,435 FC
Oil type	Mobil Jet 387

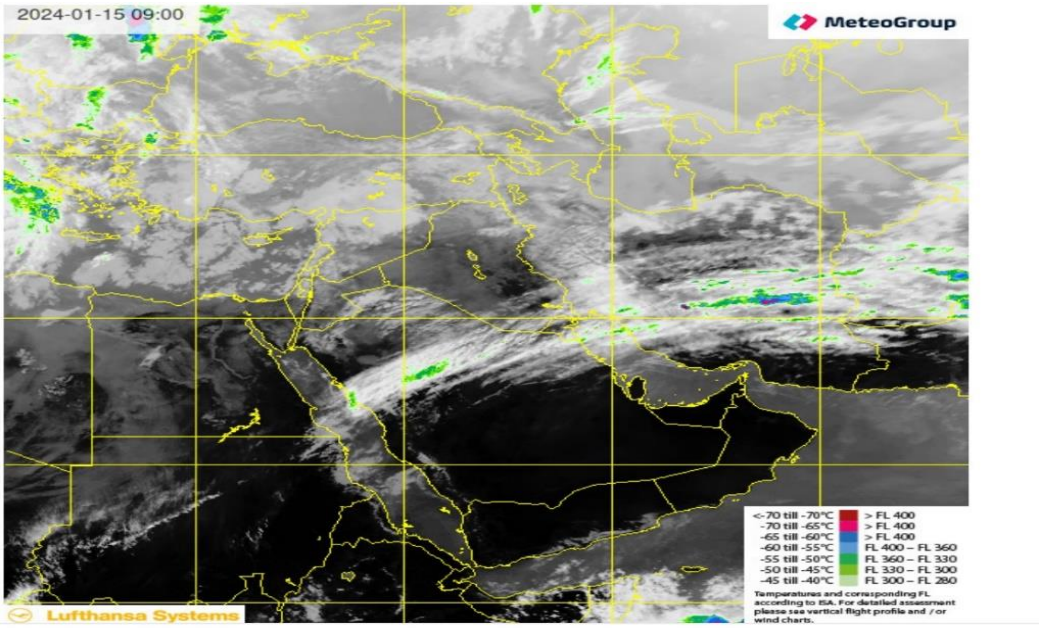
1.7. Meteorological Information:

1.7.1 The weather information below was obtained from the Crew flight Plan which was issued by the Singapore Weather prior to the flight.

Wind Direction	290	Wind Speed	60 Kts	Visibility	CAVOK
Temperature	-33	Cloud Cover	Sky Clear	Cloud Base	Sky Clear
Dew Point	N/A	QNH	1013		

1.7.2 **Clouds:**

The Satellite image of time of the occurrence shown below, indicates it was a clear sky and this is could indicate that no turbulence can be associated at the time of the occurrence.



.Figure 5: Clouds around the area where the aircraft experienced wake turbulence

1.7.3 **Upper winds and Air Temperature (TAT):**

At the time of the occurrence the wind was 290 degrees 60 knots which indicate exactly head wind for the aircraft. The outside air temperature indicates continuous about -33°C During the occurrence.

1.8. Aids to Navigation.

1.8.1 The aircraft was equipped with standard navigational equipment as approved by the Singapore CAA. There were no records indicating that the navigation system was unserviceable prior to the serious incident.

1.9. Communications.

1.9.1 The aircraft was equipped with a standard communication system as approved by the Singapore CAA. No defects that could render the communication system unserviceable were recorded before the flight.

1.9.2 The transcript communication below is the radio communication that was established during the incident between the ATCO, starting with UAE414 that had caused the wake turbulence indicting the word super which means heavy aircraft. Also, SIA306 which had the incident, DHL779 and AIC946 for the radio check.

ALPHA TRANSCRIPT (135.6):

23:05:29 UAE414: MCT hello UAE414 Super level 330

23:05:32 ALPHA: UAE414 MCT control radar contact

23:12:52 SIA306: MCT control hallo SIA306 position PARAR FL320

23:13:00 ALPHA: SIA306 squawk 3526

23:13:02 SIA396: Standby squawking 3526 SIA306

23:13:53 ALPHA: SIA306 identified clear FPL route

23:13:57 SIA306: FPL route SIA306

23:21:08 ALPHA: SIA306 MCT

23:21:21 ALPHA: SIA306 MCT

23:21:27 ALPHA: SIA306 MCT

23:21:36 ALPHA: SIA306 MCT

23:21:46 ALPHA: SIA306 MCT

23:21:55 ALPHA: DLH779 radio check

23:21:57 DLH779: DLH779 go ahead

23:22:01 ALPHA: Radio check

23:22:03 DLH779: DLH779 read you eh… 3 to 4

23:22:07 ALPHA: Roger thank you

23:22:09 ALPHA: SIA306 MCT

23:22:18 ALPHA: SIA306 MCT

23:22:33 ALPHA: SIA306 MCT on guard

23:23:05 ALPHA: UAE414 radar services terminated Mumbai on HF or CPDLC مع السلامة

23:23:07 AIC946: SIA306 this is AIC946 on guard

23:23:10 UAE414: Mumbai HF or CPDLC مع السلامة

23:23:19 AIC946: SIA306 this is AIC946 on guard

23:23:28 AIC946: Calling SIA306 on guard

23:23:42 ALPHA: SIA306 MCT

23:23:44 SIA306: Go ahead SIA306

23:23:46 ALPHA: Confirm you are monitoring your frequency

23:23:52 SIA306: SIA306 say again

23:23:54 ALPHA: Confirm you monitor this frequency

23:23:57 SIA306: We are on this frequency 135.6

23:24:00 ALPHA: Roger I tried to call you before 3 minutes now

23:24:05 SIA306: Ah ok SIA306 on 135.6 level 320

23:24:11 ALPHA: Roger before range 15 miles confirm you climbing eh FL325 and descend again FL320

23:24:22 SIA306: Yes, we faced a turbulence and then eh… aircraft went into eh climb momentarily and we returned back to 320

23:24:33 ALPHA: Roger because you have crossing traffic at SETSI from left to right separation under radar was 3 eh… 5 miles

23:24:41 SIA306: Yes, I think we faced someone's eh…wake turbulence and momentary the aircraft eh autopilot

23:24:48 ALPHA: Roger copied, because I tried to call you no answer

23:24:52 SIA306: Roger I was trying to recover the aircraft

23:24:55 ALPHA: Roger copied

23:32:33 ALPHA: SIA306 MCT

23:32:36 SIA306: Go ahead SIA306

23:32:38 ALPHA: 128.15

23:32:40 SIA306: 128.15 SIA30

1.10. Aerodrome Information.

1.10.1. Departure Aerodrome:

ICAO designation	WSSS (Changi International Airport)		
Aerodrome co-ordinates	1°21'33"N by 103°59'21"E		
Aerodrome elevation	22ft above mean sea level (AMSL)		
Runway designations	02L / 20R	02C/20C	02R / 20L
Runway dimensions	4000 x 60 M	4000x60 M	4000 x 60 M
Runway used	02C		
Category for Rescue Fire Fighting	10		
Approach facilities	ILS, VOR, RNP, PAPI's, runway lights		
Aerodrome status	Licensed Airport		

1.10.2. Destination Aerodrome:

ICAO designation	EGLL (London Heathrow Airport)	
Aerodrome co-ordinates	51°28'38"N by 000°27'41"W	
Aerodrome elevation	83ft above mean sea level (AMSL)	
Runway designations	09L / 27R	09R / 27L
Runway dimensions	3902 x 50 m	3660 x 50 m
Category for Rescue Fire Fighting	10	
Approach facilities	ILS, RNP, PAPI's, runway lights	
Aerodrome status	Licensed Airport	

1.11. Flight Recorders.

1.11.1 The aircraft was fitted with both the Flight Data Recording (FDR) and the Cockpit Voice Recording (CVR) however, since they were over-written, none were downloaded for this investigation. OTSB will be relying on other flight information data such as Flight Data Management (FDM), Air Traffic Services (ATC) communication records to assist in the investigation

1.12. Wreckage and Impact Information.

1.12.1 Not applicable.

1.13. Medical and Pathological Information.

1.13.1 Not applicable.

1.14. Fire.

1.14.1 There was no evidence of pre or post fire.

1.15. Survival Aspects.

1.15.1 To be discussed in the final report

1.16. Tests and Research.

1.16.1 To be discussed in the final report.

1.17. Organizational and Management Information.

1.17.1 To be discussed in the final report.

1.18. Additional Information

1.18.1 To be discussed in the final report.

1.19 Useful or Effective Investigation Techniques.

1.19.1 To be discussed in the final report.

2. Analysis

To be discussed in the final report.

3 Conclusions

3.1 General

The investigation is on-going and we will be looking into other aspects of this incident investigation which may or may not have safety implications.

3.2 Findings

To be discussed in the final report.

3.3 Causes and Contributing Factors

To be discussed in the final report.

4 Safety Recommendations

The Investigation is on-going and should at any stage OTSB identify any safety issues, OTSB will issue the safety recommendations to address any safety concerns or risk identified.