FINAL REPORT ON ACCIDENT INVOLVING BOEING 737-800 AIRCRAFT VT-TGE BELONGING TO M/s VISTARA ON 07.06.2021 WHILE OPERATIGN SECTOR MUMBAI KOLKATA.

Dinesh Kumar
Investigator

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Investigation-In-Charge

FOREWORD

In accordance with Annex 13 to the Convention on International Civil Aviation Organization (ICAO) and Rule 3 of Aircraft (Investigation of Accidents and Incidents), Rules 2017, the sole objective of the investigation of an accident shall be the prevention of accidents and incidents and not to apportion blame or liability.

This document has been prepared based upon the evidences collected during the investigation, opinion obtained from the experts and laboratory examination of various components. Consequently, the use of this report for any purpose other than for the prevention of future accidents or incidents could lead to erroneous interpretations.

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GLOSSARY	
AAIB	Aircraft Accident Investigation Bureau, India
AFM	Airplane Flight Manual
AME	Aircraft Maintenance Engineer
AMSL	*Above Mean Sea Level*
ARC	Airworthiness Review Certificate
ARP	Aerodrome Reference Point
ATC	Air Traffic Control
ATPL	Airline Transport Pilot License
AUW	All Up Weight
C of A	Certificate of Airworthiness
CB	Cumulonimbus Cloud
CAP	Crew Alerting Panel
CAR	Civil Aviation Requirements
CPL	Commercial Pilot License
CVR	Cockpit Voice Recorder
DCU	Data Collection Unit
DFDR	Digital Flight data Recorder
DME	Distance measuring equipment
DGCA	Directorate General of Civil Aviation
EMM	Engine Maintenance Manual
F/O	First Officer
FCOM	Flight Crew Operating Manual
FCTM	Flight Crew Training Manual
FRTOL	Flight Radio Telephone Operators License
FL	Flight Level
hrs	hours
ICAO	*International Civil Aviation Organization*
IFR	Instrument Flight Rules
JSPL	Jindal Steel & Power Plant
JSW	Jindal South West
LLZ	Localizer
MEL	Minimum Equipment List
NDB	Non-Directional Beacon
NSOP	Non-Scheduled Operator
Nm	Nautical Miles
OEM	Original Equipment Manufacturer
OM	Operations Manual
PAPI	Precision Approach Path Indicator
PIC	Pilot in Command
PM	Pilot Monitoring
QRH	Quick Reference Handbook
SB	Service Bulletin
SEP	Safety and Emergency Procedures Manual
TAF	Terminal Aerodrome Forecast

TSN	Time Since New
VFR	Visual Flight Rules
VOR	*VHF Omnidirectional Range*
UTC	Coordinated Universal Time

FINAL INVESTIGATION REPORT ON ACCIDENT TO M/S VISTARA B737-800 AIRCRAFT VT-TGE ON 07 JUNE 2021 WHILE OPERATING FLIGHT FROM MUMBAI TO KOLKATA

1.	Aircraft Type	B737-800
2.	Nationality	INDIAN
3.	Registration	VT - TGE
4.	Operator	M/s Vistara
5.	Pilot – in –Command	ATPL Holder
6.	Extent of Injuries	None
7.	Co-Pilot	CPL Holder
8.	Extent of Injuries	None
9.	Place of accident	Enroute
10.	Last point of Departure	Mumbai
11.	Intended place of Landing	Kolkata
12.	Date of accident	07.06.2021
13.	Persons on Board	120
14.	Extent of Injuries	Serious Injury – 02 passengers Minor Injury - 02 passengers
15.	Phase of Operation	Descent

Synopsis

On 07.06.2021 M/s Vistara B737-800 aircraft VT-TGE was involved in an accident while operating a flight from Mumbai to Kolkata. The aircraft was under the command of ATPL holder, who was Pilot Monitoring (PM) along with a CPL holder, who was Pilot Flying (PF) as Co-Pilot. There were total 120 persons on board including 06 crew members. There was minor damage to the aircraft however, 02 passengers onboard received serious injuries and other 02 passengers received minor injuries.

The aircraft took off from runway 14 at Mumbai and flight was uneventful throughout climb and cruise phase. Kolkata ATIS issued weather warning of TSRA & gusty winds at the time of arrival of the aircraft at Kolkata. PF made a PA informing passenger about the expected turbulent weather during descent and advised to keep the seat belt fastened. PF also informed the SCC to secure the cabin.

The aircraft was on the right of the assigned track as there were CB's & Line squalls along the route and also to the left hand side of the route. Further to this deviation, there were similar line squalls and thunderstorms. As per the flight crew, during descent at FL390, they identified a 20 NM gap between two CB's and decided to fly through it. While passing through the gap aircraft started experiencing light to moderate turbulence. This moderate turbulence lasted for 10-15 seconds and ended with a huge bump of severe turbulence, which lasted for 1-2 seconds. A total of 04 passengers were injured during the flight.

The occurrence was classified as Accident as per Rule 2(1)(ii)(a) of Aircraft (Investigation of Accidents and Incidents) Rules, 2017. Director General, AAIB appointed Ms. Shilpy Satiya, Assistant Director, AAIB as Investigator – In – Charge & Sh. Dinesh Kumar, Assistant Director, AAIB as Investigator to investigate into the probable cause(s) of the accident, vide Order No. INV.11011/5/2021-AAIB dated 11th June 2021.

1. Factual Information

1.1 History of Flight

Aircraft was scheduled to depart from Mumbai at 0900 UTC. Flight crew stated that, they reached dispatch section of the operator at 0800 UTC and signed the Breath Analyzer declaration form. Both crew went through the flight papers such as NOTAMs, Weather Charts, SAT Images etc for the route from Mumbai to Kolkata. As per the PIC, the SAT images for the route showed Clouds and CB's in and around Kolkata. TAF reports also showed gusty winds and CB's at the time of arrival of the aircraft at Kolkata. As per the flight plan, extra fuel for 15 minutes was provided due to weather at Kolkata.

F/O was Pilot Flying (PF) and PIC was the Pilot Monitoring (PM) for this flight. Walk around inspection was carried out by the F/O and he did not observe any abnormality. Enroute, destination and alternate weather was discussed among the crew and accordingly, Senior Cabin Crew (SCC) was also briefed about the weather.

Aircraft took off from runway 14 at Mumbai and the flight was uneventful throughout climb and cruise phase. At 1022 UTC, flight crew obtained weather for Kolkata through ACARS. Guwahati (1st) and Bhubaneshwar (2nd) were the planned alternate for the flight as per the flight plan therefore, at 1023 UTC weather for Guwahati and Bhubaneshwar were also obtained through ACARS. Kolkata ATIS had issued a weather warning of TSRA & gusty winds at the time of arrival (1100 UTC) of the aircraft at Kolkata. PF made a descent PA and informed passengers about the expected turbulent weather during descent, also he advised passengers to keep the seat belt fastened. PF also informed the SCC to secure the cabin earlier than usual due to turbulent weather.

Aircraft commenced descent from cruising altitude FL390 and the fasten seat belt signs were put ON. As per the information the aircraft was on the right of the assigned track (20 NM deviation) as there were CB's & Line squalls along the entire route and also to the left hand side of the route. Further to this 20 NM deviation, there were similar line squalls and thunderstorms. As per the flight crew, they identified a 20 NM gap between two CBs and decided to fly through it.

Shortly after the aircraft commenced descent, SCC informed the cockpit crew that one passenger wants to use the lavatory. The PM turned off the seat belts sign since the aircraft was clear of weather for few minutes. At approx. FL260, the seat belts sign was put ON again as a precaution, as the aircraft was approaching near the 20 NM gap through which the flight crew planned to fly. As per the PIC, once the seat sign was put ON, SCC made the passenger announcement regarding the turbulent weather and asked the passengers to put the seat belt. Thereafter, the cabin crew started the process of seatbelt compliance & securing the cabin. Meanwhile PIC advised the Cabin Crew (R1) over the inter phone to be seated due to weather/turbulence expected. Hearing the buzz of the interphone, SCC (who was doing the seat belt compliance) came back in the galley. Cabin Crew (R1) informed SCC that pilot has advised crew to be seated. SCC informed the aft crew as well to be seated immediately and thereafter made a PA for the seat belt compliance. Galley area was secured but due to PIC instructions of “crew to be seated”, seat belt compliance check of entire cabin could not be completed by the cabin crew.

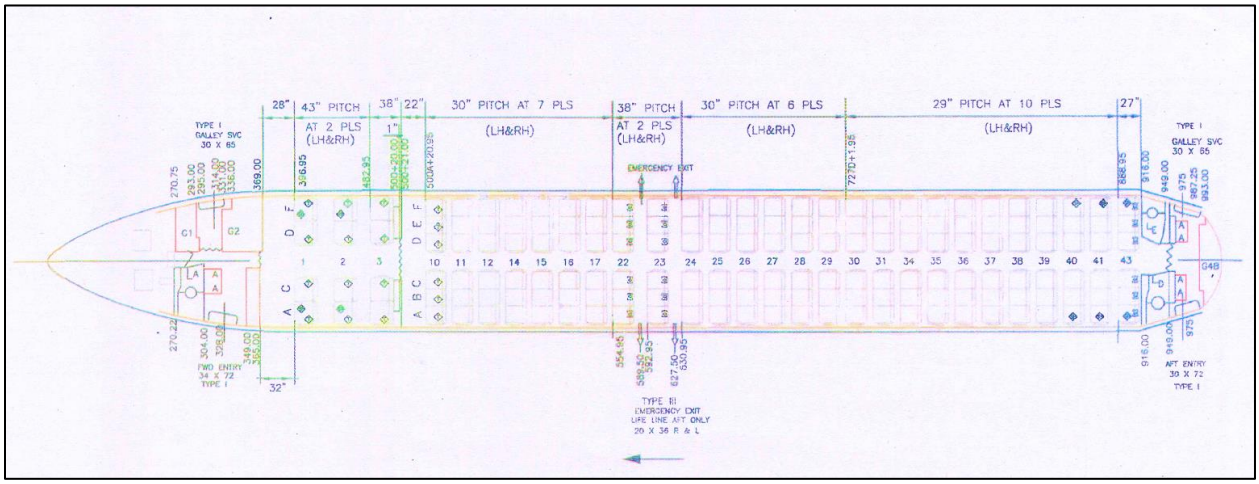
After about 02 minutes from the time cabin crew were advised to be seated, aircraft started experiencing light to moderate turbulence. Moments after that, the aircraft encountered some mild level cumulous clouds while passing through FL200. This moderate turbulence lasted for 10-15 seconds and ended with a huge bump of severe turbulence, which lasted for about 1-2 seconds. The aircraft instruments did not show any exceedances except a momentary bank angle warning. While passing through the turbulence, the auto-pilot also got dis-engaged, which was re-engaged by the flight crew.

After the heavy bump, the aircraft did not encounter any turbulence and was clear of adverse weather. Thereafter, the PM inquired from SCC about the cabin and she informed that she can see some injured passengers. The seat belts signs were put OFF and SCC was advised to help the injured passengers. A doctor who was onboard the aircraft attended the injured passengers. The Kolkata ATC was informed about the injured passengers and a medical priority landing was requested. Kolkata ATC was also requested to provide ambulance and medical care for the injured passenger upon arrival the aircraft at Kolkata. Before landing, PIC took over the control of the aircraft and F/O started the duties of Pilot Monitoring. Aircraft landed

safely at runway 19R at Kolkata. A total of 04 passengers were injured during the flight.

1.2 Injuries to persons

INJURIES	CREW	PASSENGERS	OTHERS
FATAL	Nil	Nil	Nil
SERIOUS	Nil	02	Nil
MINOR	Nil	02	Nil



LOPA of the aircraft B737-800

Passengers sitting on the Seat 39D & 26A received serious injuries and passengers sitting on the seat 26B and 30B received minor injuries.

1.3 Damage to Aircraft

Two ceiling panel and two overhead center distribution duct (nozzle/plenum duct) were damaged at multiple location due to the passengers hitting the ceiling panel during the turbulence.

1.4 Other Damage

Nil

1.5 Personnel Information

1.5.1 Pilot – in – Command

Age	39 years
License	ATPL holder
Date of Issue	28.07.2011
Valid up to	24.06.2025
Class	Multi Engine Land
Category	Aeroplane
Endorsements as PIC	Cessna 172, Duchess 176, B737
Med. Exam valid upto	17.11.2021
FRTO License.	Valid
Total flying experience	9300 hours
Total Experience on Type	9050 hours
Experience on Type as PIC	5600 hours
Total flying experience during last 180 days	150 hours
Total flying experience during last 90 days	70 hours
Total flying experience during last 30 days	03:30 hours
Total flying experience during last 07 Days	Nil
Total flying experience during last 24 Hours	Nil
Rest Before Duty	>24 hours

1.5.2 Co-Pilot

Age	30 years
License	CPL holder
Date of Issue	19.10.2012
Valid up to	18.10.2022
Class	Multi Engine Land
Category	Aeroplane

Endorsement as PIC	Cessna 172, P-68C
Date of Med. Exam.	02.06.2020
Med. Exam valid upto	23.06.2021
FRTO License	Valid
Total flying experience	2725hours
Total flying experience on type	2459 hours
Total flying experience during last 180 days	217 hours
Total flying experience during last 90 days	71 hours
Total flying experience during last 30 days	07 hours
Total flying experience during last 07 Days	Nil
Total flying experience during last 24 Hours	Nil
Rest before duty	>48 hours
Last flown on type	15.05.2021

1.6 Aircraft Information

Aircraft Model	B737-800
Aircraft S. No.	39061
Year of Manufacture	2013
Name of Aircraft Owner	BOC AVIATION LTD (IRELAND)
C of R	# 5111 Valid up to 25 JUNE 2023
C of A	# 7214 Issued on 08/07/2019
Category	Normal (Pax/Mail/Goods)
A R C issued on	06/07/2020
ARC valid up to	07/07/2021
Aircraft Empty Weight	41558 Kgs
Maximum Take-off weight	70533 Kgs
Date of Aircraft weighment	18th July 2018
Max Usable Fuel	20446 Kgs
Max Payload with full fuel	7633 Kgs

Empty Weight CG	16.758 m from datum 20.956 (%of MAC)
Next Weighing due	17th July 2023
Total Aircraft Hours	22176:40 as on 07/06/21
Engine Type	CFM 56-7B
Last major inspection (LH Engine)	A check on 21 Feb 21 Shop Release Date: 12-Mar-2020; Engine Installed on: 18-May-2020
Total Engine Hours/Cycles LH	20652/14226
Last major inspection (RH Engine)	A check on 21 Feb 21 Shop Release Date: 12-DEC-2019; Engine Installed on: 29-Dec-2019
List of Repairs carried out after last major inspection till date of accident	NIL
Total Engine Hours /Cycles (RH Engine)	20313/14182
Aero mobile License	A-139/026/RLO(NR) Valid up to 25/06/2023
AD, SB, Modification complied	Complied

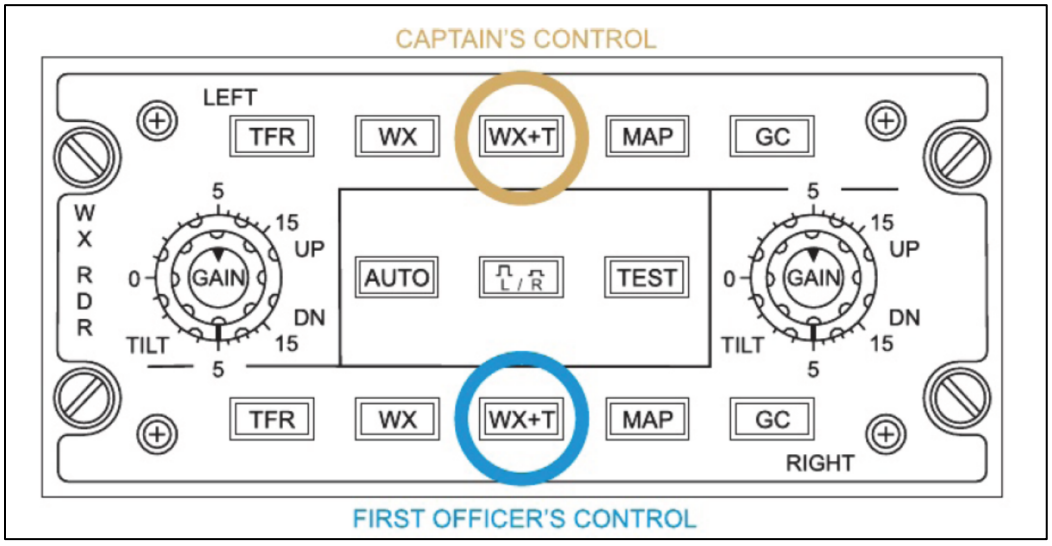
1.6.1 Weather Radar (As per B737 FCOM)

The weather radar system detects and locates various types of precipitation bearing clouds along the flight path of the airplane and gives the pilot a visual indication in color of the clouds' intensity. The radar antenna sweeps a forward arc of 180 degrees.

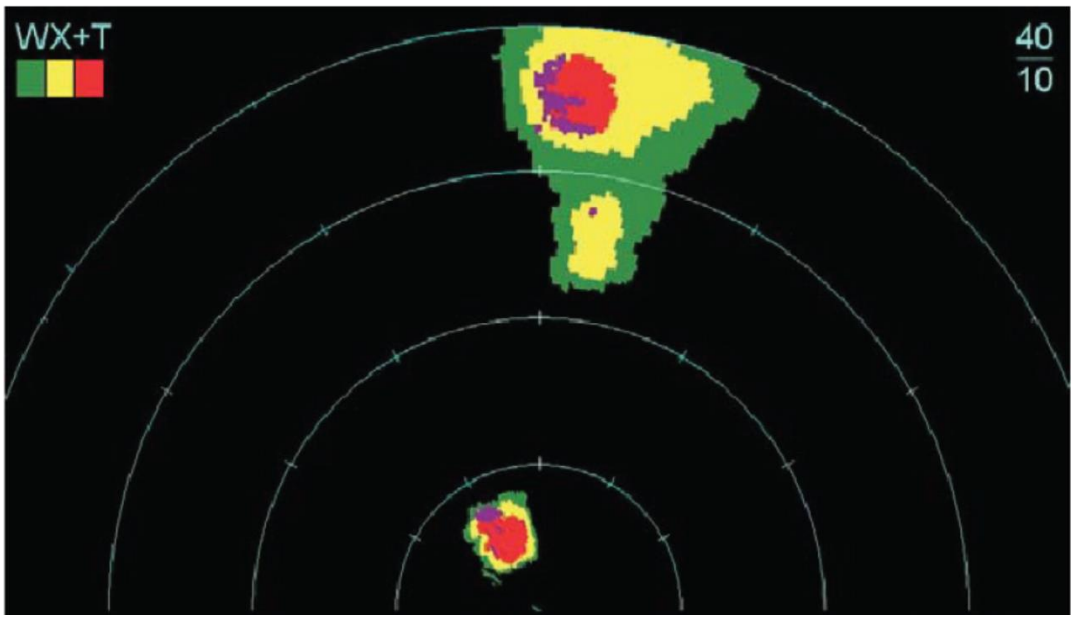
The radar indicates a cloud's rainfall intensity by displaying colors contrasted against a black background. Areas of heaviest rainfall appear in red, the next level of rainfall in amber, and the least rainfall in green.

In map mode, the radar displays surfaces in red, amber, and green (most reflective to least reflective).

These displays enable identification of coastlines, hilly or mountainous regions, cities, or large structures. Ground mapping mode can be useful in areas where ground–based navigation aids are limited. The radar system performs only the functions of weather detection and ground mapping. It should not be used or relied upon for proximity warning or anti-collision protection.



Weather Radar Control Unit



Weather plus Turbulence (WX+T) Mode

The turbulence mode displays normal precipitation and precipitation associated with turbulence. When the radar detects a horizontal flow of precipitation with velocities of 5 or more meters per second toward or away from the radar antenna, that target display becomes magenta. This magenta area is associated with heavy turbulence. The detection of turbulence is automatically limited to a 40 nautical mile range, regardless of the selected range.

Multiscan Radar

A MultiScan weather radar emulates an ideal radar beam by taking information from different radar scans and merging the information into a total weather picture. Ground clutter suppression algorithms are then used to eliminate ground clutter. The result is the ability for flight crews to view all significant weather from 0 to 320 NM on a single display that is essentially clutter free. With the multiscan process two scans are taken, each optimized for a particular region in front of the aircraft. In general, the upper beam detects intermediate range weather while the lower beam detects short and long range weather by automatically adjusting the beams tilt and gain settings. The information is then stored in a temporary database.

When the captain or first officer selects a range, the computer extracts the appropriate portions of the desired information, merges the data, then eliminates the ground clutter. The result is an optimized weather display for whichever range scale the flight crew selects. During automatic operation, multiscan uses variable gain that is based on atmospheric temperature profiles to compensate for variations in geographic location, time of day, and altitude in order to optimize weather returns in all phases of flight. Gain is thus adjusted to suit the environment in which the aircraft is flying and provide the optimum weather picture in the prevailing conditions.

1.7 Meteorological Information

The following METARs were issued for Kolkata Airport.

Time (UTC)	Visibility (meter)	Wind (kts)	Clouds	Temp C)	Trend
0930	3600	180/09	SCT 1800 ft FEW CB 3000 ft	37	TEMPO Till 1200 30020G30KT 1500 TSRA
1000	3600	160/12	SCT 1800 ft FEW CB 3000 ft BKN 10000 ft	36	TEMPO Till 1200 30020G30KT 1500 TSRA
1018 (SPECI)	3000	160/12	SCT 1800 ft FEW CB 3000 ft BKN 10000 ft	35	TEMPO Till 1200 30020G30KT 1500 TSRA
1030	2900	180/14	SCT 1800 ft FEW CB 2500 ft BKN 10000 ft	35	TEMPO Till 1230 30020G30KT 1500 TSRA
1100	2000	270/15 G25KT	SCT 1800 ft FEW CB 2500 ft BKN 9000 ft	34	TEMPO Till 1300 30020G30KT 1500 TSRA
1110 (SPECI)	1800	300/20 G30KT	SCT 1500 ft FEW CB 2500 ft BKN 9000 ft	33	TEMPO Till 1200 30020G30KT 1500 TSRA
1120 (SPECI)	1200	300/20 G30KT	SCT 1500 ft FEW CB 2500 ft BKN 9000 ft	28	TEMPO Till 1200 30020G30KT 800 TSRA
1130	1200	300/20 G30KT	SCT 1500 ft FEW CB 2500 ft BKN 9000 ft	28	TEMPO Till 1200 30020G30KT 800 TSRA

A TSRA warning was also issued for Kolkata airport at 0950 UTC which was valid from 1000 UTC to 1400 UTC.

Weather for Guwahati (1st Alternate)

Time: 1000 UTC

Visibility: 5000 m

Trend: NOSIG

Winds: 020/03 kt

Clouds: SCT 1800 ft, BKN 10000 ft

Weather for Bhubaneshwar (2nd Alternate)

Time: 1000 UTC

Visibility: 3000 m becoming 5000 m

Trend: TSRA

Winds: 120/11 kt

Clouds: BKN 1800 ft, Few CB 3000 ft, BKN 8000 ft

Below is the TAF sheet issued by India Meteorological Department for Kolkata and 100 NM around Kolkata from 0600 UTC to 1400 UTC on 07.06.2021:

INDIA METEOROLOGICAL DEPARTMENT
METEOROLOGICAL OFFICE VECC AIRPORT
LOCAL FORECAST FOR VECC AND 100NM AROUND
FROM 2021/06/07 06:00UTC TO 2021/06/07 14:00UTC

TIME OF ORIGIN: 2021/06/07 05:30UTC
SURFACE WIND: 210/08KT PROB40 TEMPO 0707/0711 340/15KT MAX 25KT=

UPPER WINDS

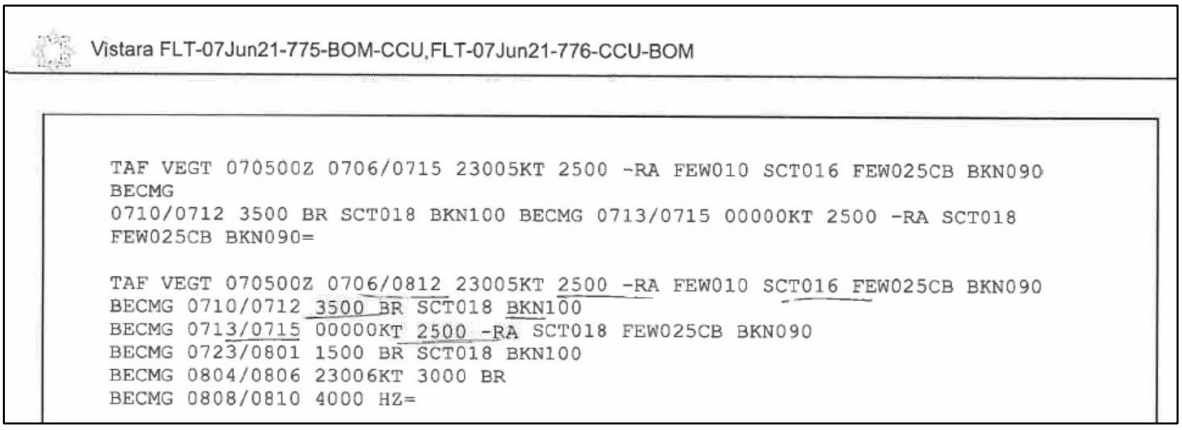
16000M	090/15	-77	4500M	290/25	+02
13500M	080/10	-64	3000M	310/25	+11
12000M	210/05	-50	2100M	290/25	+20
10500M	270/05	-37	1500M	270/20	+23
9000M	290/10	-27	900M	250/25	+27
7500M	310/05	-13	600M	230/25	+28
5500M	330/15	-04	300M	220/15	+28

WEATHER	HZ PROB40 TEMPO 0707/0711 TSRA=
VISIBILITY	4000M IN HZ PROB40 TEMPO 0707/0711 2000M IN HZ=
CLOUDS	SCT SC 0600/0800M SCT AC 3000/3300M PROB40 TEMPO 0707/0711 SCT SC 0450/0600M ISOL CB 0750/7500M OVC AS 2700M/XXXX=
FREEZING LEVEL	5100M
ADDITIONAL NOTES	PROB40 TEMPO 0707/0711 MOD TURB/ICING IN CB=
WARNING	PROBABILITY 40 PERCENT VISIBILITY LIKELY REDUCE TO 1500M BETWEEN 0707/0711 IN MOD TSRA WHEN BASE OF LOW CLOUD BE 0450M OR BELOW WITH 3 OKTA OR MORE LIKELY=

SUNRISE	08/04:51 IST	SUNSET	07/18:20 IST
MOONRISE	--	MOONSET	--

MOONPHASE
ALL HEIGHTS ARE ABOVE MSL
METEOROLOGICAL OFFICER: P GHOSH, MET-A
07/06/21

TAF information provided to the crew in the briefing folder for Guwahati


Vistara FLT-07Jun21-775-BOM-CCU,FLT-07Jun21-776-CCU-BOM

TAF VEGT 070500Z 0706/0715 23005KT 2500 -RA FEW010 SCT016 FEW025CB BKN090
BECMG
0710/0712 3500 BR SCT018 BKN100 BECMG 0713/0715 00000KT 2500 -RA SCT018
FEW025CB BKN090=

TAF VEGT 070500Z 0706/0812 23005KT 2500 -RA FEW010 SCT016 FEW025CB BKN090
BECMG 0710/0712 3500 BR SCT018 BKN100
BECMG 0713/0715 00000KT 2500 -RA SCT018 FEW025CB BKN090
BECMG 0723/0801 1500 BR SCT018 BKN100
BECMG 0804/0806 23006KT 3000 BR
BECMG 0808/0810 4000 HZ=

1.8 Aids to Navigation

All Navigational Aids available at Kolkata airport were serviceable.

1.9 Communications

There was always two-way communications between the aircraft and ATC. The CVR replay has not indicated any problems faced by the flight crew regarding communication.

1.10 Aerodrome Information

Not Applicable as the accident occurred enroute.

1.11 Flight Recorders

The Cockpit Voice Recorder (CVR) data and the Digital Flight Data Recorder (DFDR) data were downloaded for investigation purpose. Relevant portion of CVR is given below: (Time is relative time starting 00:00 on CVR)

TIME (RLT)	SOURCE	TRANSMISSION
		WB channel
01:02:10	P1 (PIC)	Kolkata, Vistara 775, Level 390, namaskar
01:02:12	Kolkata Radar	Vistara 775, Kolkata radar, namashkar, report position
01:02:16	P1	Position is abeam DADSO and we require 20 mile right due weather
01:02:19	Kolkata Radar	approved
01:02:26	P1	Dekh abhi thoda aur (unclear) hoyega. Abhi yahan pe aa raha nai hai..

01:02:32	P2 (F/o)	Main isko hi pakad k chalta hun..heading 090 ke aas paas.
01:04:04	P1	Mein na belt ON kar raha hai..
01:04:05	P2	Abhi?
01:04:06	P1	Haan kya ho gaya..Belts ON hai bas shaanti se
01:04:07	P2	Theek hai
01:04:08	P1	Hilega toh..might as well do it a little before only naa..
01:05:28	P1	Han ekdum clear hai, koi tension nahi
01:05:30	P2	Han, yeh gap se bas nikal jayengey
01:06:56	P1	Aa gaya tha naa?.. thik hai?
01:07:00	P2	Sir, abhi toh thik hai, basically at 1000hrs..weather 160/12 knots, 2600 in HZ, SCT 1800, CB 3000, BKN 100, CB is north-north west 998 Q.NH and TEMPO till 1200hrs. from 300 wind 20 gusting 30, 1500 TSRA
01:07:18	P1	Ooh, it is going to get bad..
01:07:19	P2	It will.
01:08:15	P1	TEMPO kitne tak bola 1100..1200?..1200
01:08:18	P2	Starting now..upto 1200?
01:08:23	P1	Upto 1200 haan..kabhi na kabhi to aayega hi
01:08:26	P1	Hum logon k saamne hi aayega..yahan to hum ground pe rahenge ya take/off kar rhe honge..
01:08:45 to 01:10:00	P1 & P2	Discussing weather avoidance and way to negotiate.
01:11:07	P1	This one is quite bad
01:11:09	P2	Quite very bad
01:11:10	P1	You wouldn't enter na
01:11:11	P2	No no
01:11:14	P1	Koi bhi aise cell hota hai na, jisme ki beech mein red hai, aur surrounded by amber and green, u can’t enter the red,……
01:11:24	P2	Haan aur iska almost saara amber hi hai..green toh hai hi nahi..
01:11:28	P2	Haan thoda strong hai
01:11:29	P1	Fully developed thunderstorm..
01:11:32	P1	…….cant enter that cell at all, yeh bhi bohot kharab hai, see how dark it is inside……. like a black hole....
01:11:48	P2	pura dark hai yaar, kuch dikh nahi raha hai, aisa lag raha hai ki night ho gaya hai
01:11:56	P1	Jaan hai toh..yahan se yahan pe
01:12:28	P2	Sir, Ek PA kar lete hai
01:12:45 to 01:13:15	PA	passenger announcement
01:13:52	P2	Vistara 775, request decent
01:13:56	Radar	Vistara 775, CCU radar, decent to FL 350

01:13:58	P2	Decent 350, Vistara 775
01:14:20	Cc	Sir, pax needs to go to washroom, chalega na?
01:14:22	P1	Han go go, chalega,belt "OFF"
01:16:01	P2	Further decent, Vistara 775
01:16:04	Radar	Vistara 775, standby due traffic
01:16:21	P2	Vistara 775, sir we would like to maintain the present heading for the next 60 miles
01:16:27	Radar	Vistara 775, roger, decent to FL210
01:16:28	P2	Decent 210, Vistara 775
01:17:21	P2	BRIEFING COMPLETED
01:19:21	P2	Idhar se cut karke matlab hi nahi hai
01:19:23	P1	Haan idhar se hi aa raha hai
01:19:32		DESCENT CHECKLIST
01:19:42	P1	Laga du belts
01:19:45	P2	I've told her to secure cabin early
01:19:50	Radar	Vistara 775, descent to flight level 190
01:19:51		BELTS ON CHIME
01:19:52	P1	Descent to FL 190
01:20:15	P2	Iske peeche dikh nahi raha..gap toh hogi naa?
01:20:16	P1	Hona hi chaiye..
01:20:19	P2	Yeh magenta bohot kharab hai. idhar se hi right aa jau kya
01:20:23	P2	idhar se hi right aa jaye kya
01:20:25	P1	Hoyega na, gap hoyega.. Nahi hoyega toh red mein le lenge, koi tension nahi hai
01:20:36	P2	Left mein na, magenta toh bohot kharab hai
01:20:38	P1	Magneta mein toh jana hi nahi hai. Yeh red mein jayega toh koi tension hi nahi hai
01:20:50	P2	Itna toh weather radar mein bharosa karne padega. Belts ON hai haa..
01:21:00	P1	Bohot kam gap hai. Kuch bhi kar sakta hai, left se toh lag raha hai
01:21:05	P2	Right mein aa sakte hain abhi bhi……
01:21:09	P1	Nahi, thik hai thikhai……. Dikha raha hai clearly udhar gap dikha raha hai..
01:21:41	P2	Yeh chotte mote toh hain hi. Bank angle badhake turn maru na
01:21:48	P1	Bank angle badhake turn maarde
01:21:58	P1	Cabin crew ko boldo baith jao
01:22:08	To Cc	Mam just be seated for sometime
01:22:29	P1	…… Left le lu?
01:22:30	P2	Han left lelo. mat jao isme. Bohot kharab hai
01:22:32	P1	Han bohot kharab hai. jayenge red mein, this is very very bad
01:22:44		AUTOPILOT TRIPPED
01:22:49	Radar	Vistara 775, continue decent FL150
01:22:50	P1	Decent 150, Vistara 775

01:22:52	P1	What degree? 40 degree?
01:23:13	Aural alert	BANKING. BANKING.
01:23:25		AUTOPILOT TRIPPED (aural alert BANKING BANKING along with that)
01:23:38		TURBULENCE NOISE IN THE BACKGROUND
01:23:43	P1	Oh my God!!
01:23:43		AUTOPILOT TRIPPED
01:23:55	P1	Request lower..
01:23:56	P2	Request lower..vistara 775
01:25:02	P2	All ok na? I see lightening up here
01:25:20	P1	How can the passenger fall? Belt nahi pehna hua hoga
01:25:33	P1	Doctors on board
01:37:00	P1	ATC being informed of medical emergency, type of emergency, no of injured passengers and medical requirements upon landing

1.12 Wreckage and Impact Information

Not Applicable as the aircraft received minor damages during turbulence and the damage is confined to the cabin.

1.13 Medical and Pathological Information

The crew did not undergo Breath Analyzer (BA) test however, signed a declaration as per DGCA Order No. DGCA-15031/4/2020-DAS dated 29.03.2020 before operating the flight from Mumbai.

1.14 Fire

There was no fire.

1.15 Survival Aspects

The accident was survivable.

1.16 Tests and Research

Nil

1.17 Organizational and Management Information

M/s TATA SIA Airlines Limited (Vistara) is a scheduled airline which is a joint venture between Tata Sons Private Limited and Singapore Airlines Limited (SIA). The Airlines Head Quarter is located at Gurgaon. The Company is headed by the Chief Executive Officer who is assisted by a team of professionals from various departments. The Flight Safety Department is headed by Chief of Flight Safety approved by the DGCA.

The airline has a fleet of 50 aircraft, including 39 Airbus A320, four Airbus A321neo, five Boeing 737-800NG, and two Boeing 787-9 Dreamliner aircraft.

1.17.1 Operations Manual of M/s Vistara

For circumnavigating through weather followings procedures are mentioned in Operations Manual Part A

1.17.1.1. Weather Deviation Procedure Para 22.4 of Operations Manual states that

"With prior permission of ATC a pilot deviate from an ATC clearance to avoid turbulent weather in his flight path. When the pilot initiates communications with ATC, a rapid response may be obtained by stating "**WEATHER DEVIATION REQUIRED**" to indicate that priority is desired and for ATC response when necessary, the pilot should initiate communications using the urgency call "PAN-PAN" (preferably spoken three times).

The pilot shall inform ATC when weather deviation is no longer required, or when a weather deviation has been completed and aircraft has returned to its cleared route."

1.17.1.2 Classification of Turbulence Intensity Para 17.3.6.3.1 of Operations gives classification of turbulence intensity which is appended below :-

Intensity	Aircraft Attitude	Cabin Conditions	Operating
Light Turbulence	Light turbulence momentarily causes slight, rapid and rhythmic bumpiness without noticeable Changes in the Aircraft altitude or altitude.	-Passengers may feel a slight strain against their seat belts. -Liquids are shaking but are not splashing out of cups. -Trolleys can be manoeuvred with little difficulty	Crew Awareness
Moderate Turbulence	Moderate turbulence Causes rapid bumps or jolts.	-Passengers feel definite strain against their seat belts. -Liquids are splashing out of cups. -Trolleys difficult to manoeuvre	-Avoid flying through. -Passenger Seated. -Crew seated if necessary -Service suspended
Severe Turbulence	Severe turbulence Causes large abrupt Changes in the aircraft Altitude and attitude.	-Passengers are forced Violently against their seat belts. Items fall or lift Off the floor. -Loose items are tossed about the Cabin. -Impossible to walk	-Avoid flying through. -Passenger Seated and Crew seated -Service suspended
Extreme Turbulence	Turbulence in which the aircraft is violently tossed about and is practically impossible to control. It may cause structural damage		Avoid flying through.

1.17.1.3 Operating Procedure while Encountering Enroute Weather: Para 17.3.6.3.2 of Operations Manual states that

a. whenever possible, avoid areas with known or forecast turbulence. If turbulence is unavoidable, the operation procedures given in the relevant aircraft type FCOM should be followed.
b. If the weather conditions and route forecast indicate that turbulence is likely, the cabin crew should be pre-warned;
c. During the welcome PA, the Pilot in command should advise passengers to keep their seat belts fastened during the entire flight whilst seated;
d. To avoid disturbing passengers during night flights, at Pilot in commands discretion and after briefing the cabin crew, it may be advisable to have Seat belt signs ON, whenever turbulence prevails or is anticipated for an extended period of time;
e. Whilst in-flight, the flight crew should inform the cabin crew members if turbulence is expected or encountered.
f. Cabin crew members should then prepare the cabin according to the level of the turbulence anticipated;
g. When the “fasten seat belt” sign is illuminated, cabin crew shall secure their respective cabin area and secure themselves;
h. If cabin crew are allowed to continue in-flight services, crew shall ensure that no hot beverages to be served until completely cleared of air turbulence;
i. During flight, in absence of any instruction from the Pilot in command, the SCC shall discontinue no-safety related duties and advise the Pilot in command of the level of turbulence being experienced and the need to switch ON the FASTEN SEAT BELT signs. This should be followed by the cabin crew securing the passenger cabin and other application areas.
j. If a reasonable amount of time has elapsed with no turbulence and the FAST SEAT BELT signs remain ON, the SCC should contact the Pilot in command in order to determine if is safe to resume duties. When encountering turbulence, pilots are urgently requested to report such conditions to ATC as soon as practicable.

1.17.2 FCOM Procedure for Turbulence Penetration

Turbulence

During flight in light to moderate turbulence, the autopilot and/or autothrottle may remain engaged unless performance is objectionable. Increased thrust lever activity can be expected when encountering wind, temperature changes and large pressure changes. Short–time airspeed excursions of 10 to 15 knots can be expected.

Passenger signs ..... ON

Advise passengers to fasten seat belts prior to entering areas of reported or anticipated turbulence. Instruct the cabin crew to check that all passengers' seat belts are fastened.

Severe Turbulence

Yaw Damper ..... ON

Autothrottle ..... Disengage

AUTOPILOT ..... CWS

A/P status annunciators display CWS for pitch and roll.

Note: If sustained trimming occurs, disengage the autopilot.

ENGINE START switches ..... FLT

Thrust ..... Set

Set thrust as needed for the phase of flight. Change thrust setting only if needed to modify an unacceptable speed trend.

PHASE OF FLIGHT	AIRSPEED
CLIMB	280 knots or .76 Mach whichever is lower.
CRUISE	Use FMC recommended thrust settings. If the FMC is inoperative, refer to the Unreliable Airspeed page in the Performance–Inflight section of the QRH for approximate N1 settings that maintain near optimum penetration airspeed.
DESCENT	.76 Mach/280/250 knots whichever is lower. If severe turbulence is encountered at altitudes below 15,000 feet and the airplane gross weight is less than the maximum landing weight, the airplane may be slowed to 250 knots in the clean configuration.

1.17.3 Flight Dispatch Desk (Flight Operations)

The relevant job functions of the Flight Dispatch Desk (Flight Operations) covered in The Flight Dispatch Manual of the Operator are:

- Shall support, brief and assist the PIC regarding risk tolerability with respect to safe conduct of each flight in the TSAL network.
- Assist the PIC in flight preparation and providing required information.
- Shall be responsible for preparation of the Operational and ATS flight plan and any amendment as required by PIC
- Filing the ATS flight plan with the appropriate ATS unit and signing the operational and ATS flight plan when applicable.
- Providing the PIC, while in flight, with appropriate information that may be necessary for the safe conduct of the flight
- **Shall analyse the Weather, NOTAM's and Performance restrictions for the flights assigned to him**
- **Shall carry out Flight Watch at periodic intervals, on all TSAL aircraft, on the progress of the flight. Thus, provide timely support to the crew for decision making.**
- **Shall monitor the conditions on the route and keep the PIC informed of any adverse developments which may necessitate the aircraft to return to origin or land safely at the closest airfield**
- Shall keep the Shift in charge abreast of all developments in the shift
- **Shall alert all internal stakeholders of any local aerodrome weather warnings**
- **Furnish the pilot-in-command with all latest available information on the route to be flown**

1.18 Additional Information

Nil

1.19 Useful or Effective Investigation Techniques

Nil

2.0 ANALYSIS

2.1 Aircraft

- The aircraft had valid Certificate of Airworthiness/ Airworthiness Review Certificate at the time of accident. The aircraft held valid Certificate of Release to Service.
- Airworthiness Directives, Service Bulletins, DGCA Mandatory Modifications had been complied with. Transit inspections were carried out as per the approved transit inspection schedules and all higher inspection schedules including checks/inspection as per the manufacturer's guidelines as specified in Maintenance Programme and approved by the Quality Manager.

2.2 Crew Qualifications

Both operating flight crew were appropriately licensed and qualified to operate the flight. Their ratings were current. They had undergone all refresher trainings. The PIC had a total flying experience of 9300 hrs and the co-pilot had a total flying experience of around 2725 hrs. Both had valid class I medical and have undergone proficiency checks as per the requirements. The crew did not undergo Breath Analyzer test however, signed a declaration as per DGCA Order DGCA-15031/4/2020-DAS dated 29.03.2020 before operating the flight that they were not under the influence of alcohol.

2.3 Securing of Cabin by the Cabin Crew

As per the operators Operation's Manual, if the weather conditions and route forecast indicate that turbulence is likely, the cabin crew should be pre-warned. In the present case, SCC was informed by the flight crew about the weather conditions and expected turbulence enroute. As the flight crew observed weather on the designated flight path, they took a deviation of 20 NM to the right to avoid the weather and as a precaution switched on the seat belt sign.

Shortly after the aircraft commenced descent, SCC informed the cockpit crew that one passenger wants to use the lavatory. The PM turned off the seat belts sign and

allow the passenger to use the lavatory as they did not encounter any weather. Again at approx. FL260, the fasten seat belts sign was put ON.

As per the procedure, when the “fasted seat belt” sign is illuminated, cabin crew shall secure their respective cabin area and secure themselves. As soon as, the fasten seat belt sign was put ON, SCC made the announcement regarding the turbulent weather and started the process of seatbelt compliance & securing the cabin. SCC was doing the seatbelt compliance of the front cabin and R1 was securing the galley and lavatory.

While the seatbelt compliance process was going on, PIC instructed the Cabin Crew (R1) over the inter phone to be seated. Hearing the buzz of the interphone, SCC (who was doing the seat belt compliance of the front cabin) came back in the galley. Cabin Crew (R1) informed SCC that pilot has advised crew to be seated. SCC informed the aft crew as well to be seated immediately. The aft crew also came back from the cabin and secured themselves. Thereafter SCC made another PA informing passengers about the turbulent weather and requested them for the seat belt compliance. Galley area was secured but due to PIC instructions of “crew to be seated”, seat belt compliance of entire cabin could not be completed by the cabin crew.

As the seat belt compliance check could not be completed by the cabin crew, it is most probable that the 04 passengers who received injuries did not fasten their seat belt even after instructions of fasten seat belt was given by the cabin crew. As the aircraft encountered severe turbulence, 02 of them received serious injuries and other 02 passengers received minor injuries.

2.4 Operations Manual

The organization has formulated an “Operations Manual” which was duly approved by DGCA. Scrutiny of the “Operations Manual” revealed that there was no specific procedure formulated regarding circumnavigating through enroute weather (weather avoidance) for the crew to follow in case crew is encountering enroute weather. As per the operations manual, flight crew is advised to avoid areas with known or forecast turbulence whenever possible. Also, if turbulence is unavoidable, the

operation procedures given in the relevant aircraft type FCOM should be followed. The procedure mentioned in the FCOM only talks about the operational procedure in case aircraft is encountering enroute weather.

In the present case, as there was no specific procedure to circumnavigate the enroute weather (weather avoidance), the crew used the onboard weather radar as weather penetration tool rather than weather avoidance tool. Hence, a specific procedure formulated in this regard will help the crew to take necessary actions to ensure overall safety of the aircraft.

2.5 Role of Flight Dispatch

The operator is required to provide operations control and monitor the flights progress as per DGCA requirements. Especially once the aircraft is airborne, the Flight Dispatcher is required to monitor the en-route, Destination and Alternate weather along with the Radar and Satellite pictures. Based on radar pictures, it was very clear that the en-route weather to Kolkata is becoming very bad and Bhubaneshwar would have been clear of any significant weather.

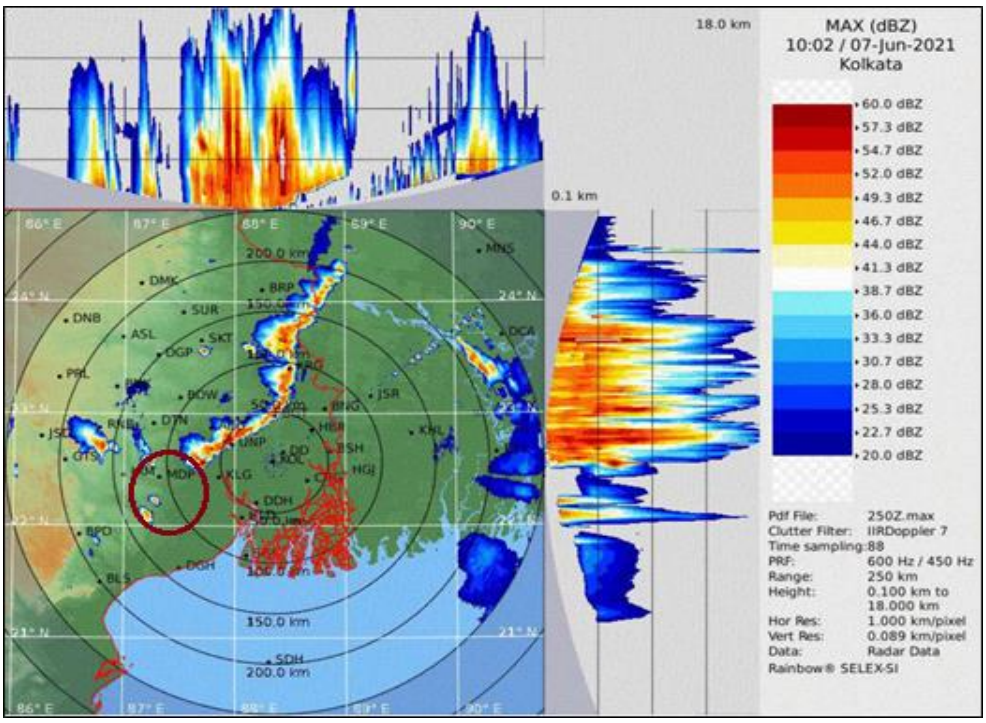
The Operators Flight Dispatch Manual Para 1.3.3 requires that the Flight Dispatcher should analyze weather & maintain a flight watch till the completion of the flight. He should support the PIC regarding Risk Tolerability with respect to safe conduct of each flight. The flight dispatch in spite of having access to the latest Doppler Radar and Satellite pictures did not gave any advice to the flight crew in this regard. The flight dispatch gave weather update for Guwahati & Bhubaneshwar only when it was asked by the flight crew.

Adequate support from the flight dispatch in this regard could have made the flight crew to think otherwise and discontinue the flight and divert to alternate aerodrome safely.

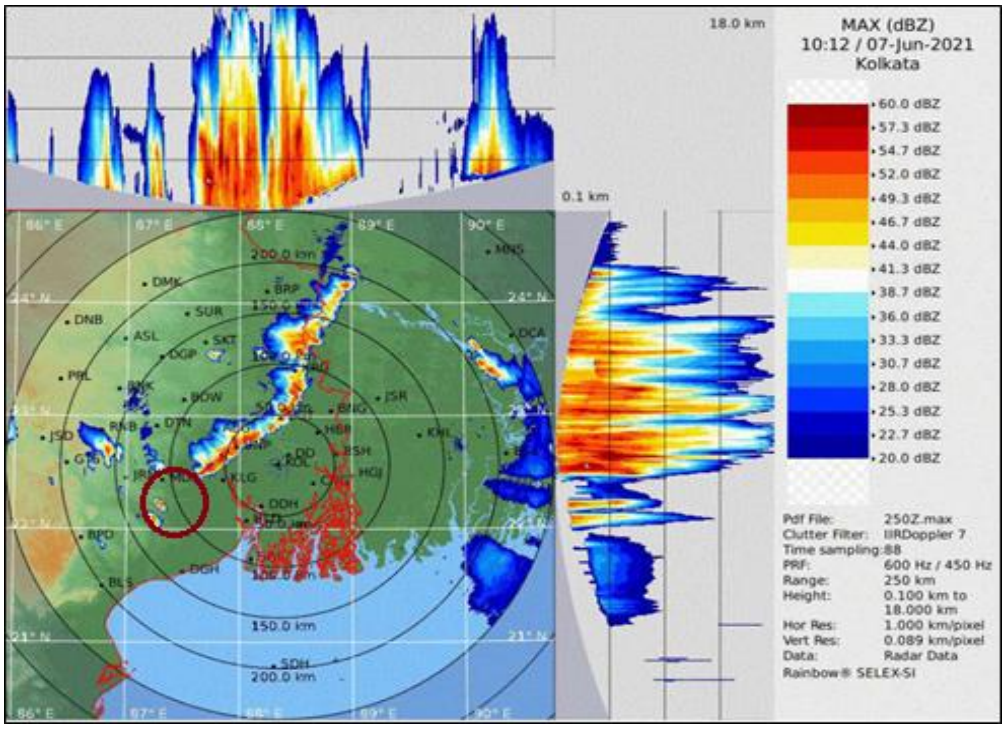
2.6 Weather and Flight Crew Actions

The weather for the route from Mumbai to Kolkata showed Clouds and CB's in and around Kolkata. Kolkata ATIS issued weather warning of TSRA & gusty winds at the time of arrival of the aircraft at Kolkata.

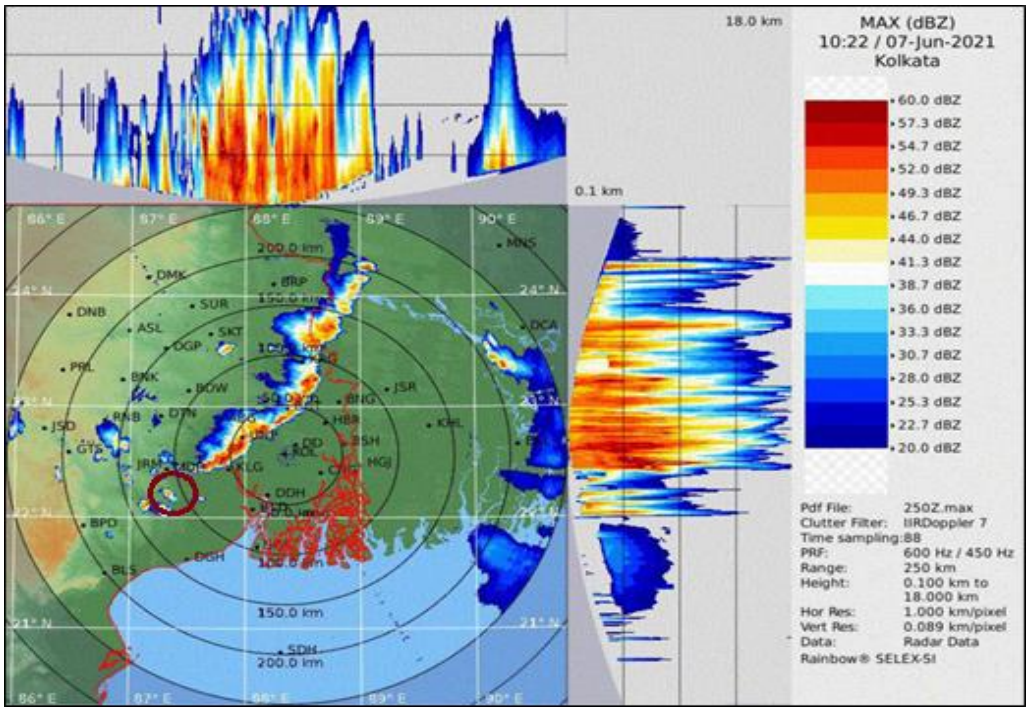
The Radar images provided below were obtained from Kolkata MET office around the time of the accident. As per the images, area around the Kolkata was surrounded by the line squalls and only a small gap is visible (Refer the red circle in the figures below).



Weather Radar Snapshot of Kolkata and around at 1002 UTC on 07.06.2021

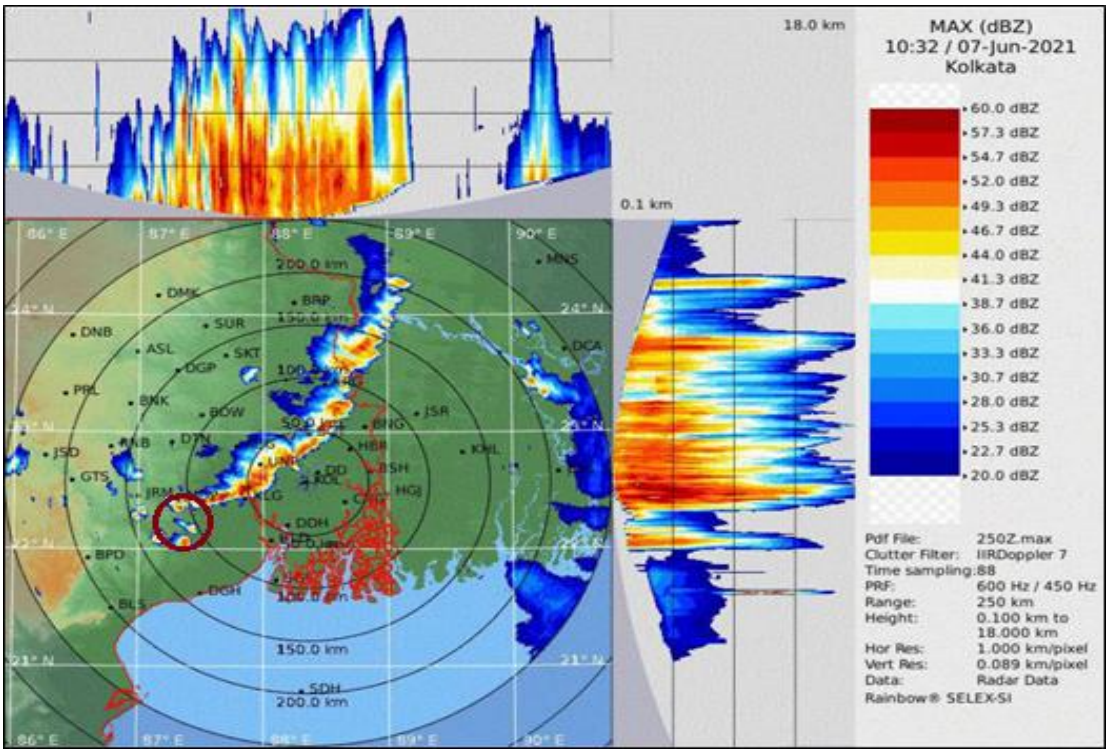


Weather Radar Snapshot of Kolkata and around at 1012 UTC on 07.06.2021



Weather Radar Snapshot of Kolkata and around at 1022 UTC on 07.06.2021

As the aircraft was approaching near Kolkata, it is clearly evident from the radar images (from 1002 UTC to 1032 UTC) that the gap chosen by the flight crew to enter into Kolkata was also converging with passage of time.



Weather Radar Snapshot of Kolkata and around on 07.06.2021 at 1032 UTC

In the present case, the flight crew was well aware about the deteriorating weather at and around Kolkata as all the relevant information regarding the weather was available with the flight crew before the start of flight from Mumbai. Also, the flight crew was provided with an extra fuel for 15 minutes due weather at Kolkata.

The aircraft came in contact with Kolkata ATC at around 1007 UTC while cruising at FL390. As per the procedure, the crew requested ATC for 20 miles diversion to the right of the route due weather ahead on the designated path. The same was approved by Kolkata ATC. The on board weather radar was in weather and turbulence (Wx+t) mode. The turbulence mode displays normal precipitation and precipitation associated with turbulence. The weather radar display was showing line squalls (thunderstorm) around Kolkata. The flight crew identified a 20 NM gap between two CB's (the small gap discussed earlier between line squalls) and were discussing

about the way to negotiate the CB's and fly through that gap. At 1022 UTC, the crew requested through ACARS for the current weather at Kolkata and same was provided to the crew by the dispatch. Thereafter, crew also requested and obtained the current weather for alternate destinations i.e., Guwahati and Bhubaneshwar from the dispatch. However, they did not discuss about diverting to alternate aerodrome.

The area ahead on weather radar display was largely in magenta which is associated with severe turbulence. However, the flight crew did not consider at any point of time diverting to alternate aerodrome even though they were not sure whether the small gap will be clear of weather once they enter into it which was evident from the discussions between the crew. This was also corroborated with the radar images during that time. Further the flight crew did not adhere to the procedure mentioned in the operations manual of the operator which states that if the intensity of the turbulence is severe, the flight crew should avoid flying through as severe turbulence causes large abrupt changes in the aircraft Altitude and attitude. The flight crew decision to continue the fight through the small gap resulted in aircraft encountering severe turbulence and serious injuries to passengers.

3 CONCLUSION

3.1 Findings

1. The Certificate of Airworthiness, Certificate of Registration and Airworthiness Review Certificate of the aircraft were valid on the date of accident.
2. Both pilots were qualified to operate the flight.
3. The flight crew signed the Breath Analyzer declaration form as per DGCA order issues in the wake of COVID-19 pandemic.
4. Both crew were provided with NOTAMS, Weather Charts, SAT Images etc for the route from Mumbai to Kolkata.
5. The SAT images for the route showed Clouds and CB's in and around Kolkata. TAF reports also showed gusty winds and CB's at the time of arrival of the aircraft at Kolkata.
6. As per the flight plan, extra fuel for 15 minutes was provided due to weather at Kolkata.

7. Aircraft took off from runway 14 at Mumbai and the flight was uneventful throughout climb and cruise phase.
8. At 1022 UTC, flight crew obtained weather for Kolkata through ACARS. Guwahati and Bhubaneshwar were the planned alternate for the flight as per the flight plan therefore, at 1023 UTC weather for Guwahati and Bhubaneshwar were also obtained through ACAR.
9. Apart from updating them with latest METARs for Guwahati and Bhubaneshwar in spite of having access to the latest Doppler Radar and Satellite pictures, no advice was given by the flight dispatch to the flight crew.
10. Kolkata ATIS had issued a weather warning of TSRA & gusty winds at the time of arrival of the aircraft at Kolkata at around 1100 UTC.
11. PF made a descent PA and informed passengers about the expected turbulent weather during descent and advised passengers to keep the seat belt fastened.
12. Aircraft commenced descent from cruising altitude FL390 and the fasten seat belt signs were put ON.
13. The aircraft was on the right of the assigned track (20 NM deviation) as there were CB's & Line squalls along the entire route and also to the left hand side of the route.
14. The flight crew identified a 20 NM gap between two CB's and decided to fly through it.
15. There is no procedure regarding circumnavigating through enroute weather (weather avoidance) in the operations manual of the operator.
16. Shortly after the aircraft commenced descent, SCC informed the cockpit crew that one passenger wants to use the lavatory. The PM turned off the fasten seat belts sign.
17. At approx. FL260, the seat belts sign was put ON again as a precaution, as the aircraft was approaching near the 20 NM gap through which the flight crew planned to fly.
18. As soon as the seat sign was put ON, SCC made the announcement regarding the turbulent weather and the cabin crew started the process of seatbelt compliance & securing the cabin.

19. PIC advised the Cabin Crew over the inter phone to be seated. SCC informed the aft crew as well to be seated immediately and thereafter made a PA for the seat belt compliance.
20. Galley area was secured but due to PIC instructions of “crew to be seated”, seat belt compliance of entire cabin could not be completed by the cabin crew.
21. After about 02 minutes from the time seat belts signs were put ON, aircraft started experiencing light to moderate turbulence. Moments after that, the aircraft encountered some mild level cumulous clouds around passing FL200.
22. The moderate turbulence lasted for 10-15 seconds and ended with a huge unexpected bump of severe turbulence, which lasted for about 1-2 seconds.
23. As per the Radar images, it is evident that weather was shifting to the right and the gap identified by the crew was converging.
24. The aircraft instruments did not show any exceedances except a momentary bank angle warning. While passing through the turbulence, the auto-pilot also got dis-engaged, which was re-engaged by the flight crew.
25. After a heavy bump, the aircraft was finally clear of weather. Thereafter, the PM inquired from SCC about the cabin and she informed about the injured passengers.
26. The seat belts signs were put OFF and SCC was advised to help the injured passengers.
27. It is most probable that the 04 passengers who received injuries did not fasten their seat belt even after instructions of fasten seat belt was given by the cabin crew. 02 of them received serious injuries and other 02 passengers received minor injuries.
28. The Kolkata ATC was informed about the injured passengers and a medical priority landing was requested.
29. Aircraft landed safely at runway 19R at Kolkata. A total of 04 passengers were injured during the flight.

3.2 Probable Cause of the Accident

The accident occurred as the aircraft entered into a severe turbulence instead of circumnavigating it. This resulted in serious injuries to passengers who presumably did not comply with" fasten seat belt" sign and instructions given by cabin crew.

Contributory factors to the accident were: -

- The flight crew was well aware about the deteriorating weather at and around Kolkata. Notwithstanding this, they continued the flight in severe weather conditions.
- Operator's Operations Manual does not provide clear cut guidance to flight crew regarding circumnavigation through the enroute bad weather (weather avoidance).
- At any point during the flight, the flight crew did not consider diverting to an alternate airfield even though they were not sure whether the gap is clear of any clouds.
- Flight Dispatch did not provide any guidance to flight crew, while they were negotiating enroute weather which was not in line with the company Flight Dispatch Manual.
- As the aircraft was approaching the identified gap, PIC instructed cabin crew to be seated due to which the process of seatbelt compliance and securing the cabin could not be completed.

4. SAFETY RECOMMENDATIONS

1. It is recommended that DGCA may instruct all scheduled operators to include the procedure for circumnavigating through enroute weather (weather avoidance) in their respective Operation Manual.
2. It is recommended that the operator may ensure that during the period of inclement weather, IOCC/ Flight Dispatch should relay (positive) latest weather for Destination & Alternate to the flight crew.
3. It is recommended that after reviewing the enroute weather as per the latest satellite picture and airfield METAR etc. and in consultation with the Pilot on duty in IOCC/OCC; Dispatch must advise the flight crew about the weather

trends and where the airplane should divert to. However, the final decision rests with the PIC of the flight.

4. It is recommended that Operator should advise the flight crew to always put the seat belt sign in ON condition whenever the flight crew is anticipating/encountering enroute weather.
5. The recommendation of previous Serious Incident “Every airline must have a qualified Met Officer on duty (24 x 7) to assist the flight crew and dispatcher” should be implemented by all operators.

(Shilpy Satiya)
Investigator-in-Charge

(Dinesh Kumar)
Investigator

Date: 30th Dec 2021

Place: New Delhi