GOVERNMENT OF INDIA

CIVIL AVIATION DEPARTMENT

FINAL INVESTIGATION REPOR

INCIDENT TO M/s AIR INDIA BOEING 787-800 AIRCRAFT VT-ANI ON 19/04/2018 IN AMRITSAR AIRSPACE

OFFICE OF DIRECTOR AIRSAFETY (NORTHERN REGION)
SAFDARJUNG AIRPORT, NEW DELHI-110003

FOREWORD

This document has been prepared based upon the evidences collected during the investigation, opinion obtained from the experts and laboratory examinations of various components. The investigation has been carried out in accordance with Annex 13 to the convention on International Civil Aviation and under Rule 13 (1) of Aircraft (Investigation Accidents and Incidents) Rules, 2017.

The investigation is conducted not to apportion blame or to asses individual or collective responsibility. The sole objective is to draw lessons from this incident which may help to prevent future accident or incident.

ABBREVIATIONS

Abbr.	Expanded form
AMSS	Automatic Message Switching System
ARC	Airworthiness Review Certificate
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Services
ATPL	Airline Transport Pilot license
CB	Cumulonimbus
DME	Distance Measuring equipment
DWR	Doppler Weather Radar
FL	Flight Level
ICAO	International Civil Aviation Organization
IFR	Instrument Flying Rule
ILS	Instrument Landing System
IMD	Instrument Metrological Department
INSAT	Indian National Satellite System
IR	Infrared
KT	Knots
METAR	Metrological Aerodrome Report
OLBS	Online Briefing System
PAPI	Precession Approach Path Indicator
PF	Pilot Flying
PM	Pilot Monitoring
TAF	Terminal Aerodrome Forecast
UTC	Universal Coordinated Time
VFR	Visual Flying Rule
VIAR	Amritsar Airport
VIS	Visible
VOR	Very High Frequency Omni Range

FINAL INVESTIGATION REPORT OF SEVERE TURBULENCE INCIDENT TO M/S AIR INDIA BOEING 787-800 AIRCRAFT VT-ANI IN AMRITSAR AIRSPACE ON 19.04.2018

a)	Aircraft	Type	Boeing 787-800
		Nationality	Indian
		Registration	VT-ANI
b)	Owner and Operator		Air India
c)	Pilot – in –Command		ATPL Holder
	Extent of injuries		Nil
e)	Date & Time of Incident		19.04.2018, 0929 UTC
f)	Place of Incident		Amritsar Airspace
g)	Co-ordinates of Incident site		Latitude 31^0 39' 34.128"N Longitude 74^0 47' 11.688"E
h)	Last point of Departure		Amritsar
i)	Intended place of landing		Delhi
j)	Passengers		244
k)	Type of Operation		Schedule (Passenger) Flight
l)	Phase of Operation		Climb
m)	Type of Incident		Severe Turbulence

(All timings in the report are in UTC unless otherwise specified)

SYNOPSIS:

On 19/04/2018, M/s Air India B-787-800, VT-ANI was operating a schedule passenger flight AI-462 from Amritsar to Delhi. The aircraft encountered turbulence while climbing out from Amritsar between FL160 and FL190. As a result of turbulence, autopilot got disengaged and after couple of attempts Flight Crew re-engaged the autopilot, however the aircraft climbed almost 600 feet above the cleared level momentarily. Flight crew informed the ATC and subsequently descended to assigned flight level.

The aircraft experienced vertical accelerations from +1.778 G to -1.307 G in flight as result of the turbulence. Due turbulence three passengers were injured, several passenger service units dropped and an interior window panel got separated. Cabin crew remounted the window panel in flight, the aircraft continued flight to Delhi and landed safely. Post landing, the three injured passengers were taken to Medanta medical facility at IGI Airport New Delhi for the treatment and were released on the same day.

The severe turbulence encountered during climb was the cause of the passenger injuries and damage to the cabin furnishing.

DGCA appointed inquiry officer under Rule 13(1) of the Aircraft (Investigation of Accidents and Incidents) Rule 2017 to investigate into the cause of the incident.

1. FACTUAL INFORMATION:

1.1 History of flight:

1.1.1 On 19/04/2018, M/s Air India B-787-800 VT-ANI was operating a schedule passenger flight AI-462 from Amritsar to Delhi. The flight was under the command of duly licensed PIC on type along with the duly qualified First Officer. First Officer was operating this sector as pilot flying (PF) and the PIC was the pilot monitoring (PM). There were 08 cabin crew and a total 244 passengers on board the aircraft.

1.1.2 According to the Flight Crew the weather reports, which were reviewed (ATIS/TAFS/METAR/Flight Plan) prior to departure, did not indicate the presence of any turbulent weather conditions. As a result, no special instructions were relayed to the Cabin Crew by the Flight Crew. Though light rain/drizzling was prevalent over the airfield hence wet take-off performance was calculated and applied for departure by the flight crew. However prior to departure, flight crew did not take the latest weather updates from ATC they also did not download the Met Briefing folder/IMD products of DWR/INSAT/OLBS before takeoff.

1.1.3 The aircraft took off from runway 34 at 09:23 UTC. ATC clearance was "after departure runway 34, climb straight ahead 4000 feet, turn right on track and climb to FL150". After turning right passing FL 60 rapid weather build up was observed by the flight crew ahead and left of their flight path. The PM discussed with the PF to avoid the weather. According to the flight crew the weather built up on the left was quite extensive while the weather on the right had only scattered spots of clouds with clear areas for the aircraft to pass through. So they decided and deviated 10 nautical miles right of cleared track navigating aircraft through green colour display on weather radar which was area of least expected turbulence. The flight conditions until then had been smooth and the seatbelt signs were ON.

1.1.4 According to the flight crew while flying at the periphery of the weather and while passing from FL 80 to FL 210, light to moderate turbulence unexpectedly grew severe; severe turbulence was encountered between FL160 and FL190 which was unexpected as per the visible weather radar display. Once in severe turbulence, while passing through FL 180 auto pilot got disengaged. At this point controls were handed over by PF to PM. After couple of attempts PIC re-engaged the autopilot, however the aircraft climbed almost 600 feet above the cleared level momentarily. Flight crew informed the ATC that due to severe turbulence they had an altitude burst and descended to assigned FL 190 and thereafter climbed to FL 230 in coordination with ATC.

1.1.5 Once clear of turbulence announcements were made from the cockpit assuring passengers of safe operations and aircraft continued to destination without further occurrence. The aircraft experienced vertical accelerations from +1.778 to -1.307 in flight because of turbulence. Due to the severity of the turbulence encountered, three passengers were injured and one of them suffered a cut on his right eyebrow as he had bumped his head on the ceiling. There was apparent damage to the cabin furnishings due to the severity of the event. ATC was informed and priority landing due medical was requested. The aircraft landed safely at Delhi around 10:18 UTC and the injured passengers were taken to Medanta medical facility at IGI Airport New Delhi for treatment and were released on the same day.

1.1.6 Post flight walk around checks were carried out by the flight crew and no visible damage or abnormalities were observed.

1.2 Injuries to persons:

Injuries	Crew	Passengers	Others
Fatal	Nil	Nil	Nil
Serious	Nil	Nil	Nil
Minor	Nil	03	Nil
None	10	241	Nil

1.3 Damage to aircraft: Passenger Service Unit near seat no. 12 E got damaged. Several Passenger Service Units also dropped and window decorative panel on seat no. 18 A got separated during turbulence.

1.4 Other damages: There were no other damages.

1.5 Personal Information:

1.5.1 Pilot-in-Command

Age	:	43 Years /Male
License	:	ATPL
Date of issue	:	11/12/2003
Valid up to	:	10/12/2020
Category	:	ATPL
Date of medical Exam	:	29/08/2017
Exam valid up to	:	29/08/2018

Date of issue of FRTO license	:	02/12/2000
FRTO license valid up to	:	18/12/2022
IR rating and instructor rating	:	N/A
Total flying experience	:	5646 Hrs
Total flying experience on type	:	3393 Hrs
Total flying experience during last 1 year	:	675 Hrs
Total flying experience during last 6 months	:	300:11 Hrs
Total flying experience during last 30 days	:	64:36 Hrs
Total flying experience during last 07 days	:	20:47 Hrs
Total flying experience during last 24 hours	:	03:35 Hrs
Duty time last 24 hours	:	03:35 Hrs

1.5.2 Co- Pilot

Age	:	36 Years/ Female
License	:	ATPL
Date of issue	:	06/06/2013
Valid up to	:	05/06/2020
Category	:	ATPL
Date of medical Exam	:	20/08/2017
Medical Exam valid up to	:	31/08/2018
Date of issue of FRTO license	:	28/11/2017
FRTO license valid up to	:	27/11/2022
IR rating and instructor rating	:	N/A
Total flying experience	:	4976 Hrs
Total flying experience on type	:	3126 Hrs
Total flying experience during last 1 year	:	850 Hrs
Total flying experience during last 6 months	:	379:08 Hrs
Total flying experience during last 30 days	:	51:13 Hrs
Total flying experience during last 07 days	:	11:07 Hrs
Total flying experience during last 24 hours	:	04:42 Hrs
Duty time last 24 hours	:	04:42 Hrs

1.6 Aircraft Information:

1.6.1 Technical Information

Manufacturer	M/s BOEING	
Type	BOEING 787-8 AIRCRAFT	
Sr. No.	36277	
Year of manufacturer	2012	
Certificate of airworthiness, date of issue and validity	ISSUE DATE: 04/10/2012 VALIDITY: UNLIMITED	
Category	NORMAL	
Certificate of registration	04/10/2012	
Owner	SUMMIT MERIDIAN AIRCRAFT LLC (USA)	
Maximum all up weight authorised	227930 Kgs	
Last major inspection	PHASE CHECK (15/04/2017) C CHECK (23/12/2015)	
Last inspection	CHECK A (23/02/2018)	
Airframe Hrs since new	17976 hrs (as on 30/04/2018)	
Airframe Hrs since last C of A/ARC	844 HRS	
ENGINE INFORMATION	No.1	No.2
Manufacturer	GENERAL ELECTRIC	GENERAL ELECTRIC
Type	GENx-1B67/P1	GENx-1B67/P1
Serial No.	956-212	956-479
Hrs done since new	16891 hrs (as on 30/04/2018)	11290 hrs (as on 30/04/2018)
Hrs done since overhaul	--	--
Last major inspection carried out	PHASE CHECK (15/04/2017)	PHASE CHECK (17/07/2016)
Last inspection	CHECK A (23/02/2018)	CHECK A (23/02/2018)
Average oil consumption	0.281	0.281
Type of fuel used	JET A1	JET A1

1.7 Metrological Information:

1.7.1 <u>METARS of Amritsar dated 19.04.2018 (0800 to 1100 UTC):</u>

METAR VIAR 190800Z VRB05KT 5000 HZ FEW040 SCT100 35/11 Q1005 NOSIG=

METAR VIAR 190830Z 20004KT 5000 HZ SCT040 SCT100 35/11 Q1005 NOSIG=

METAR VIAR 190900Z VRB02KT 5000 TS SCT030 FEW035CB SCT100 34/12 Q1004 TEMPO 31020G32KT 1200 DS=

METAR VIAR 190930Z 30008KT 3000 -TSRA SCT030 FEW035CB BKN100 31/12 Q1004 TEMPO 31020G32KT 1200 DS=

METAR VIAR 191000Z 34012KT 3000 -TSRA SCT030 FEW035CB SCT090 26/22 Q1004 NOSIG=

METAR VIAR 191030Z VRB02KT 3500 HZ SCT035 SCT090 28/20 Q1003 NOSIG=

METAR VIAR 191100Z 08005KT 3500 HZ SCT035 SCT090 29/20 Q1003 NOSIG=

The above MET report indicates weather deteriorating to thunderstorms with rain and cumulonimbus cloud.

1.7.2 Issue of TAF and SIGMET:

2018-04-19 01:41:26+00 | VIAR 190200Z 1903/1912 VRB02KT 4000 HZ SCT100 BECMG 1908/1910 27008KT 6000 FEW040 SCT100

2018-04-19 04:48:42+00 | VIAR 190500Z 1906/1915 00000KT 4000 HZ FEW100 BECMG 1908/1910 27008KT 5000

2018-04-19 04:49:33+00 | VIAR 190500Z 1906/2012 00000KT 4000 HZ FEW100 BECMG 1908/1910 27008KT 5000 BECMG 1917/1919 VRB02KT 3500 HZ BR FEW035 SCT100 BECMG 1920/2003 11008G18KT 1000 DS/TSRA FEW035CB OVC080 BECMG 2004/2006 15005KT 4000 BR HZ SCT100

2018-04-19 07:39:42+00 | VIAR 190800Z 1909/1918 VRB02KT 5000 HZ FEW040 SCT100 BECMG 1914/1916 32008KT 3000 HZ

2018-04-19 12:03:52+00 | VIAR 191101Z 1912/1921 07006KT 3500 HZ SCT035 SCT090 BECMG 1917/1919 VRB02KT 3500 HZ BR FEW035 SCT100

2018-04-19 12:01:52+00 | VIAR 191101Z 1912/2018 07006KT 3500 HZ SCT035 SCT090 BECMG 1917/1921 VRB02KT 3500 HZ BR FEW035 SCT100 BECMG 1922/2003 11008G18KT 1000 DS/TSRA FEW035CB OVC080 BECMG 2006/2008 15005KT 4000 BR HZ SCT100

2018-04-19 17:17:02+00 | VIAR 191700Z 1918/2003 VRB02KT 3200 HZ SCT030 SCT090 TEMPO 1918/1924 32010G20KT 1500 TSRA FEW035CB BKN090 BECMG 2005/2007 09006KT 5000 HZ BKN100

2018-04-19 17:08:31+00 | VIAR 191700Z 1918/2024 VRB02KT 3200 HZ SCT030 SCT090 TEMPO 1918/1924 32010G20KT 1500 TSRA FEW035CB BKN090 BECMG 2005/2007 09006KT 5000 HZ BKN100 TEMPO 200

3/2009 27010G20KT 2000 TSRA FEW035CB BKN090 BECMG 2020/2022 VRB02KT 3000 BR HZ FEW040 SCT100

2018-04-19 20:01:40+00 | VIAR 192000Z 1921/2006 07005KT 3000 BR SCT030 SCT100 TEMPO 1923/2005 34010G25KT 1500 TSRA FEW035CB BKN090

2018-04-19 23:16:17+00 | VIAR 192300Z 2000/2009 09006KT 2500 BR SCT030 SCT100 TEMPO 2000/2006 34010G25KT 1500 TSRA FEW035CB BKN090 BECMG 2006/2008 03005KT 4000 HZ BKN100 TEMPO 200

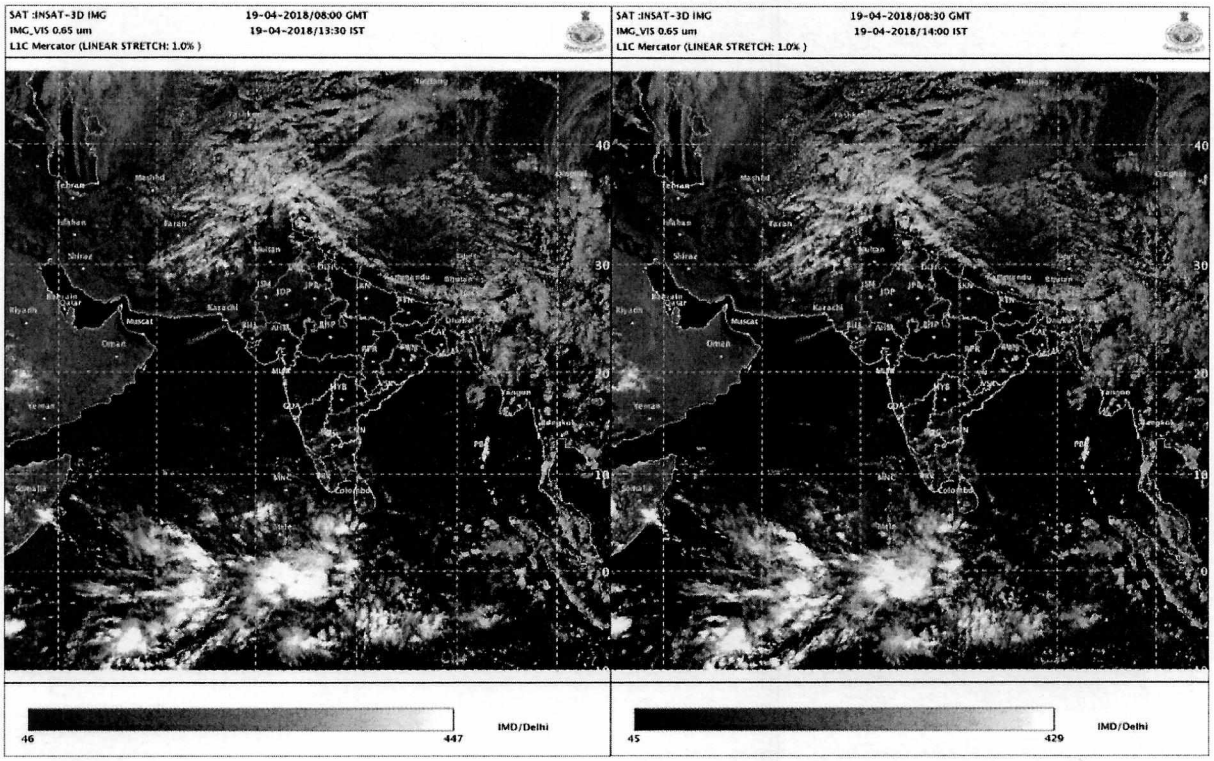
9/2015 1500 TSRA FEW035CB BKN090

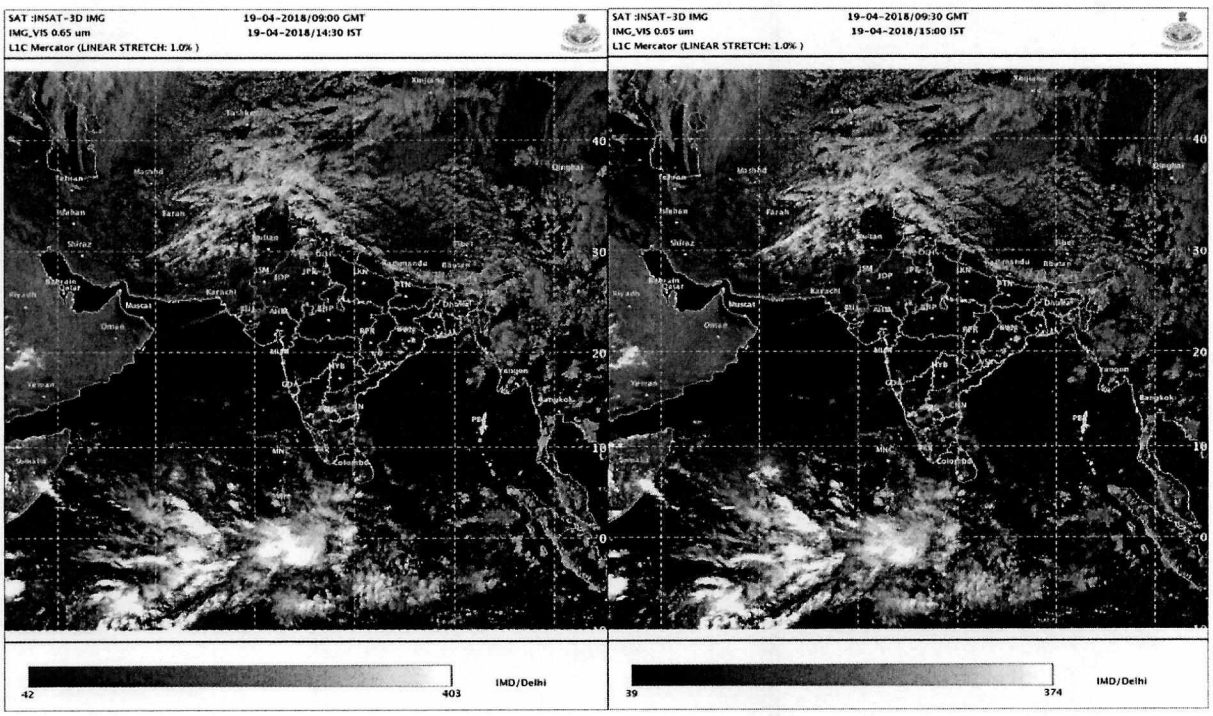
2018-04-19 22:53:38+00 | VIAR 192300Z 2000/2106 09006KT 2500 BR SCT030 SCT100 TEMPO 2000/2006 34010G25KT 1500 TSRA FEW035CB BKN090 BECMG 2006/2008 03005KT 4000 HZ BKN100 TEMPO 200

9/2015 1500 TSRA FEW035CB BKN090 BECMG 2021/2023 VRB02KT 2500 BR FEW040 SCT100 BECMG 2103/2105 27006KT 3500 HZ

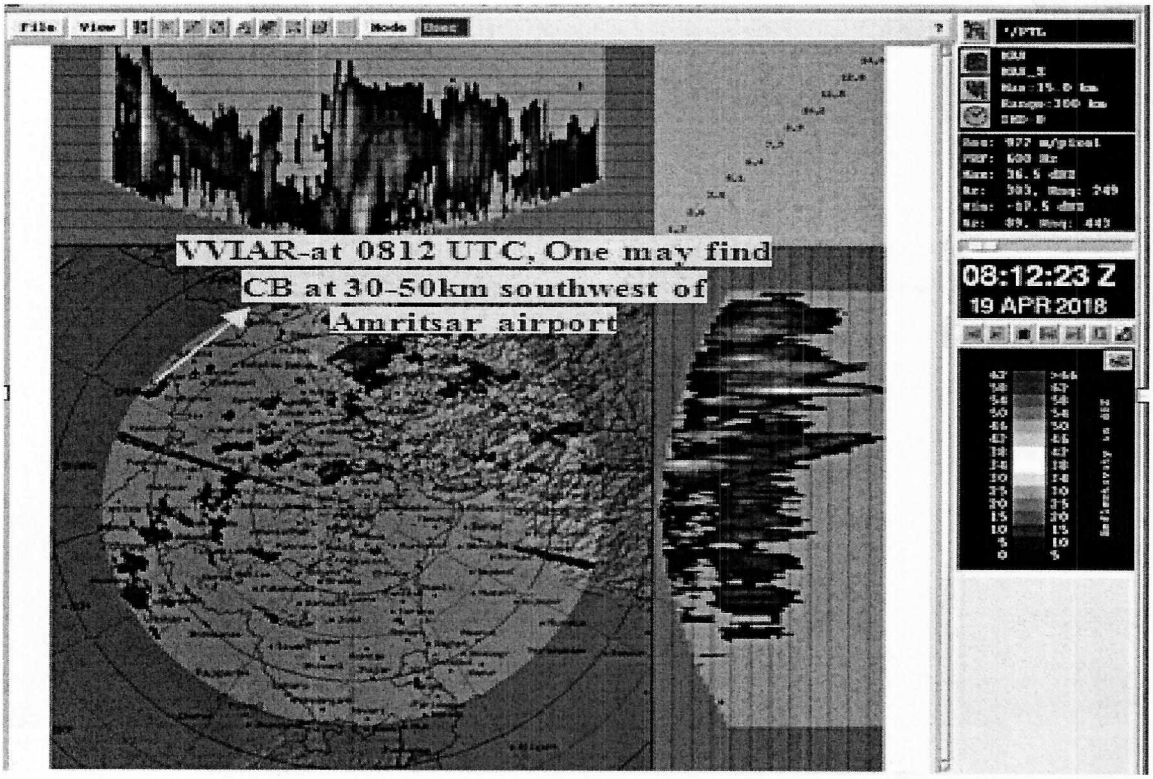
SIGMET: Conditions were not there for the Delhi region and hence NO SIGMET issued by MWO Palam, New Delhi on 19.4.2018.

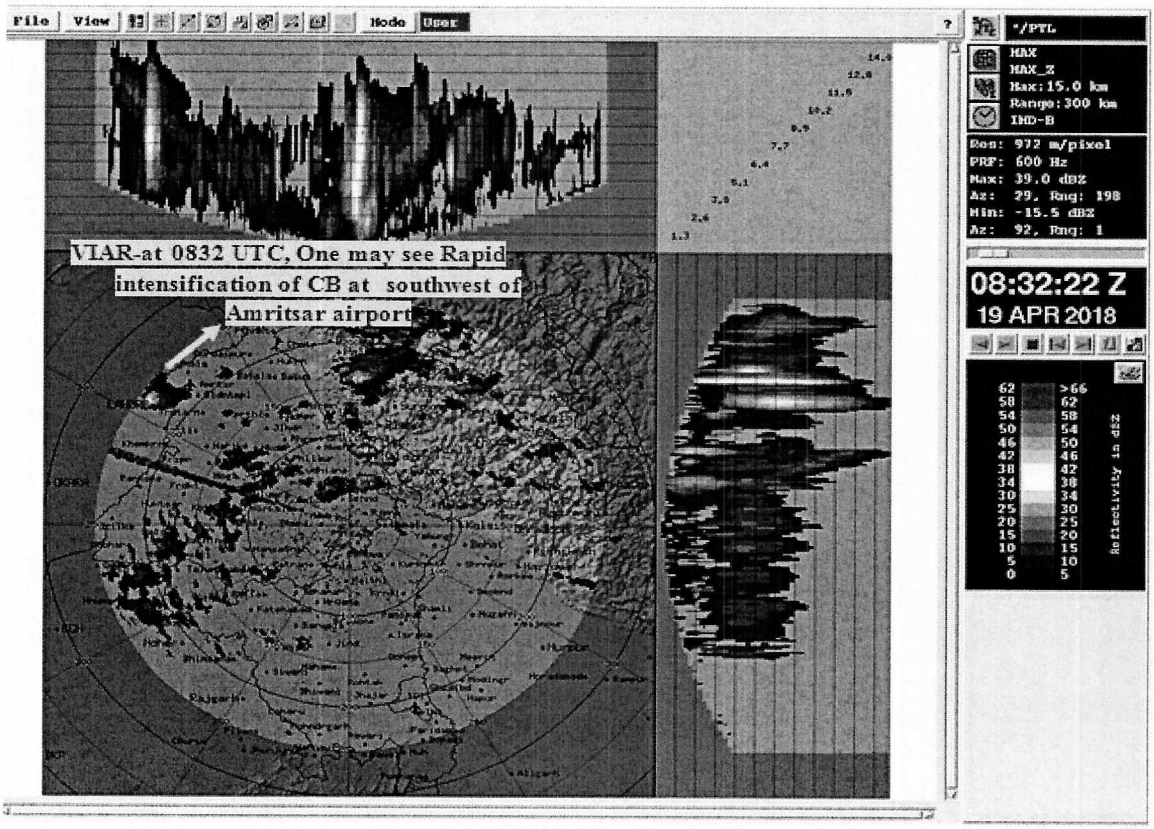
1.7.3 <u>Weather situation at Amritsar:</u> As per Satellite Images on 19 April 2018 from 0800 UTC to 0930 UTC confirms the formation of CB clouds at and around the airport.

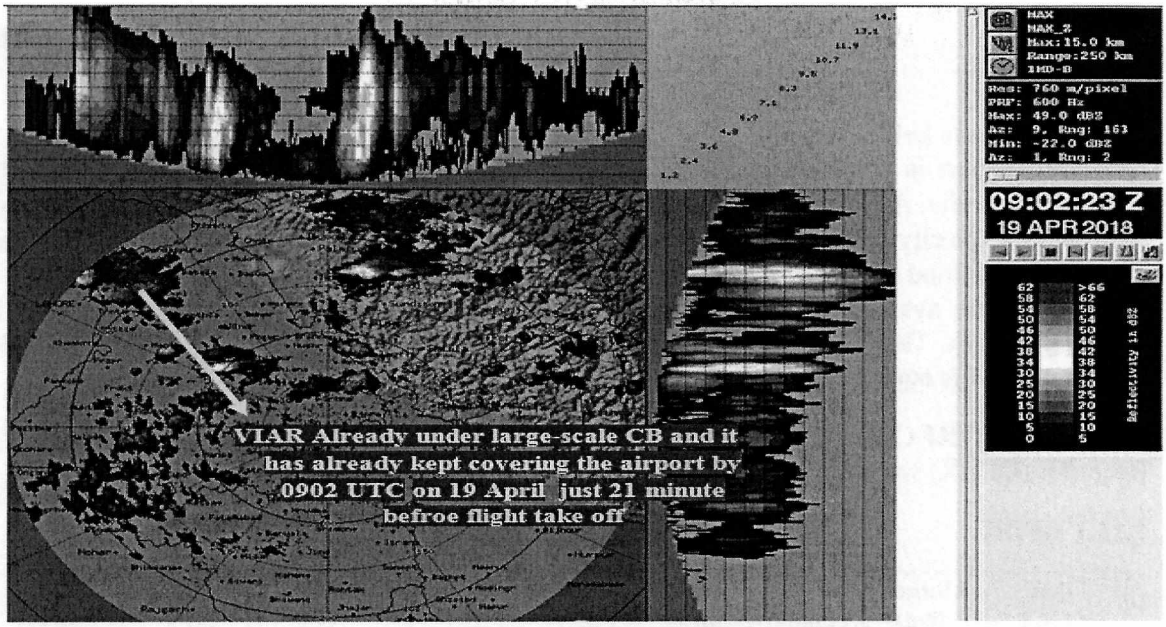


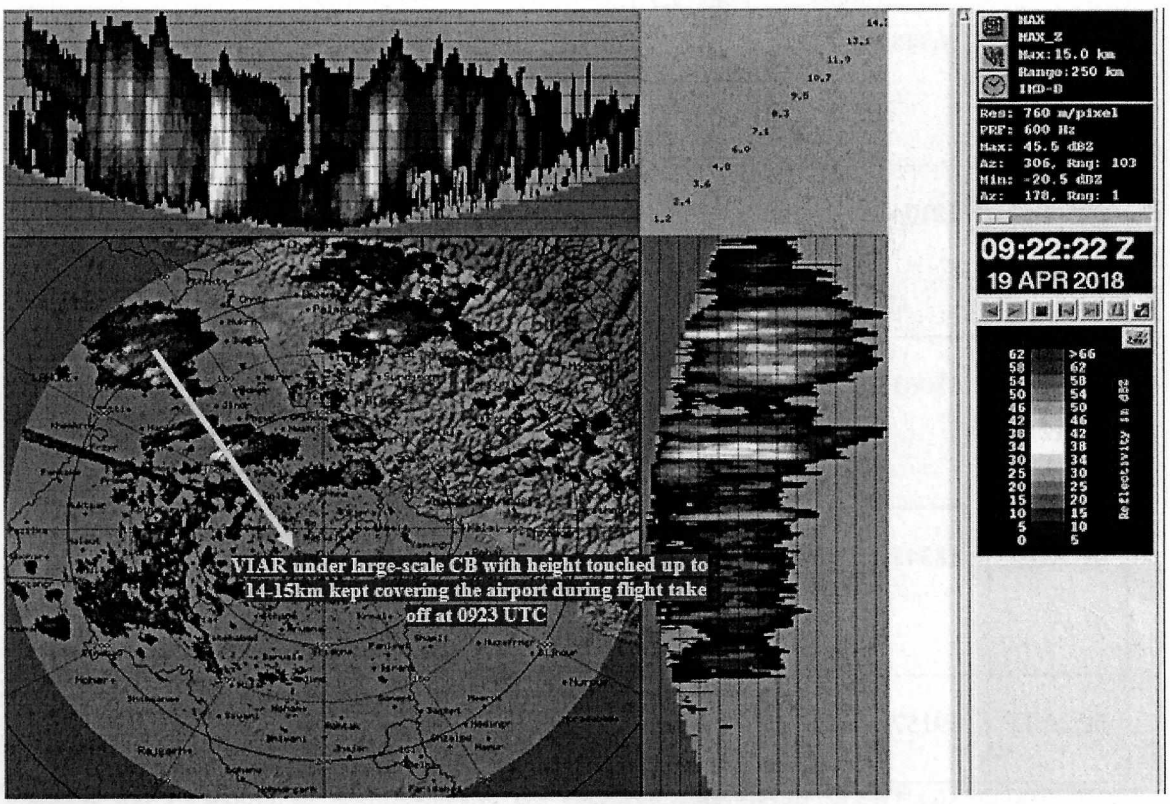


DWR pictures from 0812 UTC to 0922UTC also confirm formation and intensification of large scale CB.









1.8 Aids to Navigation: On-board navigation aids, Ground-based navigation aids VOR, ILS, DME and aerodrome visual ground aids like, PAPI at Amritsar Airport were available & serviceable.

1.9 Communication: There was always two ways communication between the ATC and the aircraft.

1.10 Aerodrome Information:
Amritsar Airport is a civil aerodrome. The operations and ATC are controlled by Airports Authority of India. Amritsar Airport ICAO Code VIAR, 314217N, 0744807E, is located 11KM northwest of the city centre near by the village of Raja Sansi. The elevation is 758 feet and type of traffic permitted is IFR/VFR. Aerodrome category for fire fighting is Cat 8 and Rescue equipment's are available as per category. The airport has single runways 16-34 having 3658 meters in length. The airfield is equipped to provide VOR/DME approach on runway 16 side and runway 34 is equipped with CAT II ILS. PAPI is also available for both the runways.

1.11 FLIGHT RECORDER: The Cockpit Voice Recorder (CVR) and the Digital Flight Data Recorder (DFDR) were downloaded and the following information was available from them.

1.11.1 DFDR:

TIME (UTC)	Altitude (feet)	CAS (knots)	SEL SPD (knots)	AUTO PILOT	AUTO THRUST	LAT ACC	LONG ACC	NORM ACC
09:29:21	16348	273.9	277	ENGD	ENGD	-0.071 -0.092 0.053 0.069	0.198 0.187 0.191 0.202	1.615 1.734 1.778 1.769
09:29:51	18104	268.8	260	ENGD	ENGD	-0.037 -0.069 -0.204 -0.277	0.055 0.061 0.134 0.132	-1.184 -1.307 -1.134 -0.7
09:29:53	18063	270.4	260	NOT ENGD	ENGD	-0.053 -0.079 -0.086	0.086 0.077 0.123	0.744 0.903 1.305
09:30:02	18343	266.9	260	NOT ENGD	NOT ENGD	0.017 0.054 0.041	0.137 0.141 0.139	1.139 1.107 1.094
09:30:14	19157	252.6	260	ENGD	ENGD	-0.036 -0.01 -0.017	0.139 0.142 0.146	0.912 0.926 0.909

The review of the DFDR parameters explains the chronological sequence of the events as below:

- At 09:29:21 UTC, Vertical acceleration was 1.778 G when aircraft altitude was 16348 feet
- At 09:29:51 UTC, Vertical acceleration was -1.307 G when aircraft altitude was 18104 feet
- Thus the variation in vertical acceleration was from +1.778 G to -1.307 G during a period of 30 seconds.
- Auto Pilot got disengaged at 09:29:53 UTC and after 09 seconds at 09:30:02 Auto thrust was also disengaged.
- Auto Pilot and Auto Thrust got reengaged after 21 seconds at 09:30:14 UTC
- Aircraft encountered severe turbulence between FL160 and FL190 and the average speed maintained during this period was approximately 270 knots.

1.11.2 CVR:

ATC	AIC462 TOWER CLEARANCE
AIC 462	GO AHEAD AIC462
ATC	AIC462 TOWER CLEARANCE, CLEARED TO DELHI VIA W30E FL150 AFTER DEPARTURE RUNWAY 34 CLIMB STRAIGHT AHEAD 4000 FEET TURN RIGHT CLIMB ON TRACK, SQUAWK 3327
AIC462	ACKNOWLEDGED
ATC	AIC 462 HEAVY AMRITSAR LINEUP RUNWAY 34 AND WAIT
CAPT	DRIZZLING OVER THE AIRFIELD
FO	WE WILL TAKE WET TAKE OFF PERFORMANCE
AIC462	ACKNOWLEDGED
ATC	AIC462 TOWER RUNWAY 34 CLEARED FOR TAKE OFF WIND 300 DEGREES 08 KNOTS
AIC462	ACKNOWLEDGED
ATC	AIC462 TOWER AIRBORNE 23, REPORT TURNING RIGHT AND CONTINUE CLIMB FL 190
AIC462	ACKNOWLEDGED
ATC	AIC462 CONFIRM LEVEL
AI-462	OUT OFF 112 FOR 190
CAPT	CAPT WHAT WILL HAPPEN IF YOU TAKE IT AROUND
ATC	CONFIRM ABLE TO CROSS 210 AT 25 MILES
AIC462	STAND BY SIR WE HAVE WEATHER WILL CALL YOU BACK
ATC	AI462 TOWER
AI462	STAND BY SIR SEVERE TURBULENCE
ATC	CONFIRM ANY DEVIATION REQUIRED
CAPT	ARE YOU OK OR WILL TAKE A WHILE
FO	OK I WILL TAKE 180 ON HEADING
CAPT	OHH, OHH
CAPT	I HAVE GOT IT, I HAVE GOT IT,
FO	U HAVE CONTROLS, U HAVE CONTROLS
CAPT	I HAVE GOT IT, I HAVE GOT IT
FO	U HAVE CONTROL, U HAVE CONTROL
CAPT	OK MAM LETS NOT WORRIED
FO	U HAVE CONTROL
CAPT	I HAVE CONTROL
ATC	AI462 TOWER
CAPT	JUST SELECT THE FLIGHT CONTROL PAGE , JUST TELL THIS GUY STAND BY
AI462	STAND BY STAND BY AI462
CAPT	AUTO PILOT DISCONNECT AUTO THROTTLE---. TELL HIM WE HAVE AN ALTITUDE BURST
FO	AI462 DUE TO SEVERE TURBULENCE WE HAD AN ALTITUDE BURST COMING TO FLIGHT LEVEL 190.
ATC	COPIED MAM CONFIRM ANY HIGER REQUIRED
CAPT	AFFIRM
ATC	AI 462 CLIMB LEVEL 230
AI462	CLIMB 230 AI 462
CAPT	HOW'S THE CABIN? ANY INJURY, JUST TAKE A ROUND JUST CHECK PASSENGRES INJURY, I AM WORRIED ABOUT CABIN YA YA I WILL JUST MAKE AN ANNOUNCEMENT
CABIN CREW	REALLY BAD, 2 – 3 PEOPLE HAVE GOT INJURED, 1 SEAT BELT IS COME OFF

Once clear of turbulence announcements were made from the cockpit assuring passengers of safe operations. Thereafter, aircraft continued to destination without further incident and ATC was informed and priority landing due medical was requested. The aircraft landed safely at Delhi at around 10:18 UTC.

CVR recording reveals that at the time of severe turbulence there was no standard call out for positive handing /taking over of the controls by the flight crew.

1.12 Wreckage & Impact Information: Nil

1.13 Medical & pathological information: Both the flight crew had undergone pre-flight Breath Analyser check at Delhi before the first flight i.e Delhi -Amritsar and the BA test result were negative.

1.14 Fire: There was no fire.

1.15 Survival Aspects: The incident was survivable.

1.16 Tests & Research: Nil

1.17 Organisational & Management Information:

1.17.1 Air India:
Air India has its corporate offices in Delhi and Mumbai. It has airbus A-319, A-320, A-321, B-747-400, B-777, B-787, ATR-72 & ATR-42 aircrafts in its fleet. Air India is the member of Star Alliance network.

1.17.2 India Metrological Department:
IMD provides a crucial service to the national and international civil aviation sector in fulfilment of the requirements prescribed by the International Civil Aviation Organisation and the Director General of Civil Aviation of India. These services are provided through 18 Aerodrome Metrological Offices and 54 Aeronautical Metrological Stations located at various national and international airports of the country.
Aerodrome metrological offices functioning at Mumbai, Kolkata, Delhi and Chennai Airports also serve as metrological offices catering to flights in respective Flight Information Reasons (FIR).One ICAO designated Tropical Cyclone Advisory Centre (TCAC) is also functioning at New Delhi. It is this centre's responsibility to monitor the development of tropical cyclone in its area of responsibility, using geostationary and polar-orbiting satellite data, radar data and other metrological information and provide advisory information on tropical cyclones to Metrological Watch Offices in India and neighbouring countries. The technical coordination and overseeing of the functions of the Aviation metrological offices is done by Central Aviation Metrological Division (CAMD) at New Delhi. Metrological Training Institute, Pune takes care of the training requirements of the Aeronautical Metrological Personnel. The installation and maintenance of Airport Metrological Instruments are done by the Surface Metrological Division at Pune. The guide lines for meteorological service to aviation in India are given in "Manual on Procedures for Metrological Services for Aviation in India." published by CAMD. It is essentially the Annex 3, incorporating national practices.

The briefing and documentation to the airline operator is provided either through manual or automated means. The web based information dissemination system known as Online Briefing

System (OLBS) of IMD is being maintained by the metrological offices functioning at the international airports at Chennai and New Delhi, through which the registered users can directly download the forecast products as desired including Satellite Images and DWR scan updates. Apart from the primary communication channels of AAI, the department has all advance communication modes for the dissemination of Aviation Metrological Information.

1.18 Additional Information: Nil

1.19 Useful or Effective Investigation Techniques: Nil

2. ANALYSIS:

2.1 Weather:

2.1.1 As per weather report of Amritsar airport from 0800 UTC to 0830 UTC, there was light wind, few clouds at 4000ft, scattered clouds at 10,000ft and Visibility was reported as 5000M with Trend forecast issued as NOSIG. In METAR of 0900 UTC, Few CB at 3500 ft was included with light wind, visibility 5000m and weather Thunderstorm with Trend forecast issued as TEMPO 310220G32KT 1200 DS. In METAR of 0930 UTC, It was a feeble thunderstorm with rain and wind from 300 DEG direction, visibility 3000M, SCT clouds at 9000ft, Few CB at 1050ft, Broken clouds at 10000ft with Trend forecast as TEMPO 31020G30KT 1200 DS. In METAR of 1000UTC, current weather was reported as FBL TSRA with SCT and Broken clouds with FEW CB , Visibility 3000M with Trend forecast as NOSIG. In METAR of 1030 UTC to 1100UTC, weather was reported as HAZE; Visibility 3500M and SCT clouds at 1050 FT and SCT clouds at 2700ft.

2.1.2 INSAT 3D images for both VIS (VISIBLE)/IR (INFRARED) for 19.4.2018 from 0800 UTC to 0930 UTC confirms the formation and intensification of convective and CB clouds from 0800 UTC onwards at and around Amritsar aerodrome during the period.

2.1.3 DWR (Doppler Weather Radar) pictures of Patiala from 0812 UTC to 0922UTC confirms that CB cells already observed in the DWR at south-southwest sector of Amritsar as early as 0812UTC of 19 April 2018 and by 0832 to 0902UTC, it had intensified into a very big CB cell with a bubble type sudden growth type and formation of large-scale CB. The TS occurred as per current weather and as per DWR of 0922UTC, it is observed that the associated CB had vertical altitude of 14-15km and hence must have created very high wind shear or a CB cloud caused moderate to severe updraft/downdraft over the airport which have caused moderate/severe turbulence at and around the airport.

2.1.4 From the above it is inferred that the flight took off from Amritsar at 09:23 UTC in adverse weather condition (CB/thunderstorm). During climb due to presence of CB aircraft encountered severe turbulence.

2.2 Pilot handling of the situation:

2.2.1 The previous flight (Delhi-Amritsar) was operated by the same set of operating crew and the flight was uneventful.

2.2.2 During return sector (Amritsar-Delhi) according to the flight crew while passing from FL 80 to FL 210 aircraft encountered light to moderate turbulence which unexpectedly grew into severe turbulence. Due to the severity of the turbulence the aircraft experienced vertical accelerations from +1.778 G to -1.307 G. Once in severe turbulence, while passing through FL 180 autopilot got disengaged and the aircraft climbed almost 600 feet above the cleared level momentarily at this point controls were handed over from PF to

PM. Flight crew informed the ATC about the altitude burst and descended to assign FL 190. Thereafter aircraft continued to Delhi for a safe landing in coordination with ATC. CVR recording reveals that at the time of severe turbulence there was no standard call out for positive handing /taking over of the controls by the flight crew.

2.2.3 Severe turbulence from Thunderstorm/tall active CB clouds observed over the airport had caused the aircraft to face this incident. The aircraft had taken off from RWY 34 at a time when the airport was under bad weather condition for which there was a Trend forecast and weather warning by 0900 UTC. It was summer season and the CB with Thunderstorms/ dust storms were already in peak occurrences at various airports of north India. The pilot did not refer DWR based CB detection system for live updates for all cloud products (reflectivity/max z) through the IMD and OLBS web page.

2.2.4 METAR issued at Amritsar Airport from 0800 UTC to 1100 UTC indicates presence of CB cloud at 3500 feet. Flight crew did not take into account the bad weather at VIAR by timely weather updates. As per records in IMD AMSS (Automatic Message Switching System), the Met Briefing folder/IMD products of DWR/INSAT/OLBS for this flight was not downloaded prior to the flight.

2.3 Circumstances leading to the incident:

As per weather report of Amritsar airport weather deteriorated to thunderstorms with rain and cumulonimbus cloud. The aircraft took off from Amritsar airport at 09:23 UTC under adverse weather condition. During initial climb passing FL 60 rapid weather build up was observed by the flight crew ahead and left of their flight path. While passing from FL 80 to FL 210 the light to moderate turbulence grew sever, the severe turbulence was encountered between FL160 and FL190. Once in severe turbulence, while passing through FL 180 auto pilot got disengaged. After couple of attempts PIC re-engaged the autopilot, however the aircraft climbed almost 600 feet above the cleared level momentarily. Due to the severity of the turbulence encounter the aircraft experienced vertical accelerations from +1.778 G to -1.307 G and three passengers were injured and there was apparent damage to the cabin furnishings. Once clear of turbulence the aircraft continued to Delhi and landed safely.

3. CONCLUSION:

3.1 FINDINGS:

3.1.1 The flight crewmembers were appropriately licensed and qualified to operate the flight.

3.1.2 FDTL for the flight crew was within the limits

3.1.3 The Certificate of Airworthiness and the certificate of flight release were valid on the day of incident.

3.1.4 All the concerned Airworthiness Directive, Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engines were found complied with.

3.1.5 As per Amritsar MET report between 0830 UTC to 1100 UTC, weather was deteriorating to thunderstorms with rain and cumulonimbus clouds. Satellite Images from 0800 UTC to 0930 UTC confirms the formation of CB clouds at and around the airport and DWR pictures from 0812 UTC to 0922UTC also confirm formation and intensification of large scale CB.

3.1.6 Light rain/drizzling was prevalent over the airfield at the time of departure and wet take-off performance was calculated and applied by the flight crew. However prior to departure, flight crew did not take the latest weather updates and also did not download the Met Briefing folder/IMD products of DWR/INSAT/OLBS before flight.

3.1.7 Once in severe turbulence, while passing through FL 180 auto pilot got disengaged and the aircraft climbed almost 600 feet above the cleared level.

3.1.8 Due to the severity of the turbulence encounter the aircraft experienced vertical accelerations from +1.778 G to -1.307 G.

3.1.9 Three passengers were injured, several passenger service units dropped and an interior window panel got separated.

3.1.10 Seat belt signs were ON at the time turbulence hit the aircraft.

3.2 PROBABLE CAUSE OF THE INCIDENT:

Flight crew did not appropriately assess the weather conditions before departure from Amritsar and encountered severe turbulence during climb which resulted into passenger injuries and damage to the cabin furnishing.

4. SAFETY RECOMMENDATIONS:

M/s Air India may re-emphasise instructions that the flight crew shall use all resources to analysis of the weather situation prior to the flight operations in inclement weather conditions.

28/05/19

(Vishal Yadav)
Asst. Director Air Safety
Investigator in-Charge-VT-ANI
DGCA (NR), New Delhi

Place: New Delhi
Date: 28/05/2019