



**FINAL INVESTIGATION REPORT ON FUEL EMERGENCY
INCIDENT TO M/S AIR INDIA LTD AIRBUS A320 AIRCRAFT
VT-EDE OPERATING FLIGHT AI-850 (SECTOR: PUNE-DELHI)
ON 25.05.2023**

**Directorate General of Civil Aviation
Government of India
New Delhi**

FOREWORD

In accordance with Annex 13 to the International Civil Aviation Organisation Convention and the Aircraft (Investigation of Accidents & Incidents) Rules 2017, the sole objective of this investigation is to prevent aviation incidents/ accidents in the future. It is not the purpose of the investigation to apportion blame or liability.

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

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Final Investigation Report on Fuel Emergency Incident to M/S Air India Ltd Airbus A320 Aircraft VT-EDE Operating Flight AI-850 (Sector: Pune-Delhi) On 25.05.2023

1	Aircraft	Type	A320-214
		Nationality	Indian
		Registration	VT-EDE
2	Owner	M/s Air India Ltd.	
3	Operator	M/s Air India Ltd.	
4	Pilot-in-Command	ATPL	
	Extent of injuries	Nil	
5	Date & Time of Incident	25.05.2023; 1701 hrs UTC	
6	Place of Incident	Gwalior Airport	
7	Co-ordinates of Incident site	Enroute to Gwalior	
8	Last Point of Departure	Pune International Airport (VAPO)	
9	Intended place of landing	Indira Gandhi International Airport, Delhi (VIDP)	
10	Crew on Board	02+04	
	Extent of injuries	Nil	
11	Passengers on Board	149	
	Extent of injuries	Nil	
12	Type of Operation	Scheduled Operation	
13	Phase of Operation	Diversion	
14	Type of Incident	MAYDAY Fuel (FUEL)	

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

Synopsis

On 25th May 2023, the Air India flight AI-850 from Pune to Delhi operated with Airbus A320-214 aircraft VT-EDE involved in an incident of Fuel emergency landing at Gwalior airport after declaring MAYDAY FUEL while operating flight in the sector Delhi-Pune.

At the time of dispatch, the TAF forecast was for the thunderstorm and rain at the destination airport i.e., Delhi. In view of the same, the flight dispatch should have planned the flight with two destination alternate aerodrome as per DGCA laid down guidelines of CAR Section-8 Series-O Part-II and ASC 03 of 2019.

However, the flight was released with just one alternate as Jaipur. The flight was uneventful till the top of descent. As the descent was commenced, the Delhi ATC informed the crew to expect delay due to weather. Since the Jaipur weather was clear, the flight crew requested and entered in to hold at FL170 near Jaipur at 15:09:47 UTC. Flight stayed in hold for 1 hour 8 minutes and 13 seconds.

The weather at Jaipur was clear with few CB clouds and visibility above 2000 m and trend as can be observed in the VIJP METAR of 1430, 1500 and 1530 UTC had a trend of no significant change in weather for another two hours. Due to the trend of no significant change and no trend in weather at Jaipur, the flight crew decided to divert to Jaipur with FOB 2990 kg at 16:19:00 UTC with planned Minimum Diversion Fuel (MDF) of 2769 kg. Before commencing the diversion, the flight crew missed to obtain the VIJP METAR of 1600 UTC that showed a sudden deterioration of Jaipur weather.

Flight crew contacted Jaipur ATC and advised them about minimum fuel situation. The flight commenced descent into Jaipur to FL100 and further to 3300 feet for approach. At 17:01:00, the flight discontinued approach due to wind shear. Since the weather at Jaipur was further intensifying, the flight crew realized that Jaipur was no longer a viable option. They declared "MAYDAY Fuel" to Jaipur ATC and diverted to Gwalior with FOB 1656 kg. The flight crew made a visual approach at Gwalior on RWY 24 and touched down at 17:32:00 UTC with FOB 464 kg. The aircraft engines were switched off at 17:45:52 hrs UTC with FOB 348 kg.

DGCA-India instituted investigation of the incident under Rule 13 (1) of Aircraft (Investigation of Accidents and Incidents), Rules 2017 by appointing Investigator-In-Charge along with member.

The investigation concluded that Flight crew decision to divert to alternate aerodrome without obtaining the latest weather and attempt to land in deteriorating weather conditions resulted in low fuel and further diversion to unplanned aerodrome led to the situation of emergency landing due to fuel.

1. Factual information

1.1 History of flight

On 25.05.23 M/s Air India, Airbus A-320 aircraft VT-EDE while operating flight AI-850 (Pune-Delhi) was diverted and involved in an incident of landing below “final reserve fuel” at Gwalior airport. This was a training flight wherein the pilot occupying LHS was an ATPL holder and undergoing Supervise Line Flying. The crew occupying the RHS was Line Training Captain. There were a total of 155 persons on board the aircraft including 6 crew members.

Same cockpit crew operated AI-849 (Delhi-Pune) sector before the incident flight on same day. This was also a training flight (SLF) and aircraft landed uneventfully at Pune. The flight was operated by PIC was PF and FO was PM.

The Operational Flight Plan (OFP) for Pune-Delhi sector was generated at 0554hrs UTC at Delhi. The Airline has a system of remote briefing and the crew received flight documents for AI849 (VIDP - VAPO) and AI850 (VAPO- VIDP). Before take-off from Delhi for AI-849, crew took the briefing at 0930hrs UTC for both the flights. Crew received an updated weather for flight AI-850 (Pune Delhi) at Pune and as per the OFP Jaipur (VIJP) was the destination Alternate for Delhi. Refuelling was carried out at Pune and total fuel on board the aircraft was 10500Kgs approx. including additional fuel of 900Kgs as per company policy. The updated weather for the Pune-Delhi Sector including destination alternate was received by the crew at Pune before take-off and the TAF for the destination indicates the visibility of 1500 m with gusting winds upto 25kts.

The aircraft took off from Pune at 1337 UTC. The flight was uneventful till top of descent into Delhi at 1452 UTC. On commencement of descent into Delhi, fuel on board 6184 kgs approx., the flight crew observed adverse weather over Delhi (ATIS reporting FEW CB 035 TEMPO 320/20G50, visibility 1500m in TSRA) and was informed by ATC to expect delay at Delhi. The crew requested to hold close to Jaipur as the weather was clear near Jaipur. Descent was carried out by Pilot Flying in coordination with ATC Delhi to FL170 at 1509UTC. FOB at this time was 5853 kgs. The OFP indicated that the flight crew had updated themselves with weather of VIJP of 1530 UTC, the same was noted on the OFP. The latest weather at that time for VIJP was winds 070/08, visibility 5000, 30/21 Q1005 NOSIG.

Delhi ATC had informed that no aircrafts were landing. The crew discussed among themselves that the weather was clear north of Delhi and requested to hold north of Delhi but was denied by ATC. Thereafter Delhi ATC announced that the runway was being changed, the crew interpreted this as the airfield being open to landing aircrafts. However, aircraft was vectored by ATC and later the flight crew were informed that no landings were taking place.

At 1558 UTC from ATIS, crew recorded the weather on OFP for Jaipur and found deteriorated as FEW CB 035 TEMPO 320/20G50, visibility 2800 m in TSRA.

At 1619UTC, crew decided to divert to Jaipur and FOB was 2990 kgs. Before commencing the diversion, the flight crew missed to obtain the current VIJP METAR of 1600 UTC that showed a sudden deterioration of Jaipur weather. As per OFP, the minimum diversion fuel for Jaipur was 2769 kgs. The crew hold the aircraft at FL170 for about 01 hours 09 min before diverting to Jaipur and consumed about 2800 kgs of fuel.

As per the METAR, while proceeding to Jaipur, the weather was 1600UTC VIJP reported visibility 2500HZ with FEW CB 035 and TEMPO 290/15G25KT 0800M TSRA.

The crew were handed over to Jaipur ATC. At 1638UTC, crew declared “MINIMUM FUEL” to ATC. The aircraft was number three in sequence. The preceding aircrafts carried out missed approaches. At 1652UTC, crew requested ATC to approach for landing at Jaipur. While carrying out the ILS approach for RWY 27, the aircraft encountered wind shear at 10 ILS DME at an Altitude of 3300 FT and discontinued the approach at 1658 UTC. At this time, the FOB was around 1600kgs. The crew observed the weather intensifying and realized quickly that Jaipur was no longer viable. After discontinuing the approach, the crew monitored on RT that another company aircraft is diverting to Gwalior airport. Crew discussed the low fuel condition with ATC and asked for the option to land. Based on discussion, crew decided to divert to Gwalior. At 1701UTC, crew declared MAYDAY FUEL to Jaipur ATC. They diverted to Gwalior and carried out a visual approach for runway 24L and landed at 1732 UTC with 464 kgs on board.

After landing, follow me jeep was provided to park the aircraft on defence apron at Gwalior airport as this was not an operating base for Air India and also the only bay was preoccupied by another aircraft.

Crew shut down the engines and APU was started. APU got tripped off and got auto-shut down shortly after 05 minutes. Three attempts were made to restart the APU however, it was unsuccessful and aircraft was switched to battery mode.

Crew requested ATC to disembark the passengers however, ATC did not allow to disembark as the aircraft was parked in the defence apron. About an hour later, ATC allowed the crew to open the doors for some air circulation and later passengers were allowed to disembark with the help of another airline’s step ladder compatible for B737 type aircraft. Passengers were moved to civil arrival hall.

No damage to aircraft or injury to passengers were reported.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	NIL	NIL	NIL
Major	NIL	NIL	NIL
Minor/None	NIL/06	NIL/149	

1.3 Damage to aircraft

NIL

1.4 Other damage

NIL

1.5 Personnel information

1.5.1 Pilot in Command (PIC)

Age	50 years
License (CPL/ATPL)	ATPL
Valid up to	16.06.2025
Class I medical Valid up to	19.07.2023
FRT0 license valid up to	12.06.2025
Total flying experience	13,400 hrs
Total flying experience on type	13,100 hrs
Total flying experience during last 01 year	819 hrs
Total flying experience during last 06 months	376 hrs
Total flying experience during last 30 days	67 hrs
Total flying experience during last 07 days	24 hrs
Total flying experience during last 24 hours	08 hrs 47 min
Rest before the first flight	24 hrs

On 25.05.2023, PIC operated three sectors prior to incident flight i.e. DEL-UDR-DEL and DEL-PNQ. Before 25.05.2023, he operated his last flight on 23.05.2023.

1.5.2 First Officer (FO)

Age	43 years
License (CPL/ATPL)	ATPL
Valid up to	05.01.2025
Class I medical Valid up to	16.06.2023
FRT0 license valid up to	01.07.2024
Total flying experience	5,250 hrs
Total flying experience on type	250 hrs
Total flying experience during last 01 year	02 hrs 10 min

Total flying experience during last 06 months	02 hrs 10 min
Total flying experience during last 30 days	02 hrs 10 min
Total flying experience during last 07 days	02 hrs 10 min
Total flying experience during last 24 hours	02 hrs 10 min
Rest before the first flight	24 hrs

The FO was on leave due to temporarily medically unfit from 21.04.2022 to 12.03.2023 as he had undergone hip replacement surgery. After medical assessment on 07.03.2023, he was declared 'fit to fly' and subsequently had undergone Extended Ground training refresher course, 04 satisfactory FFS (simulator) checks as part of Non-flying (Gap in flying) recency training and as per company policy requirements. Further, IR/PPC check was completed on 15.05.2023 and performance as per records was satisfactory.

FO reported for his duty on 25.05.2023 in Hyderabad at 0905 Hrs and came to Delhi for his SLF on another flight as SOD. He operated the first sector as SLF from Delhi to Pune which was uneventful. The incident flight i.e., Pune to Delhi was the second sector flown as SLF.

1.6 Aircraft information

1.6.1 Aircraft

Manufacturer	M/s Airbus Industrie, Toulouse, France
Type	A320-214
S. No.	4236
Year of Manufacturer	2010
Airworthiness Review Certificate No. and Validity	AI/ENGG/NR/ARC/2021/17 validity 26/03/2024
Category	Normal
Certificate of Registration no.	4074/4
Owner	Air India Ltd.
Maximum all up weight authorized	73500 Kg
Aircraft Empty Weight	42239.25 Kg
Max fuel capacity	19003 Kg
Maximum Permissible number of Passengers	150
Last major inspection	3A Check on 24/05/2023
Last inspection	Pre-flight Inspection

Air frame Hrs since new	41764:01
Airframe Hrs since last C of A/ARC	606:27

As per the OFP, AMM 56-12-11-200-001 task related to openable window was under MEL. However, no record of the same was found in the techlog.

Also after parking, crew shut down the engines and APU was started. APU got tripped off and got auto-shut down shortly after 05 minutes. Three attempts were made to restart the APU however, it was unsuccessful. Crew did not made an entry of this fault in the techlog.

1.6.2 Engine

Engine Information	No. 1	No. 2
Manufacturer	CFM International	CFM International
Type	CFM56-5B4/P	CFM56-5B4/3
Serial No.	779885	699938
Hours done since new	49833:25	32702:59
Hours done since overhaul	9912:25	7473:38
Average oil consumption	0.24 quarts/hrs.	0.28 quarts/hrs.

Further, all the concerned AD, mandatory SBs, and DGCA mandatory modifications on this aircraft and its engine were complied with as of date of the incident.

1.7 Meteorological information

While the flight was dispatched from Pune and weather taken during flight is appended below:

- **VIDP-Delhi**

202305251200 METAR VIDP 251200Z 29007G17KT 4000 HZ FEW035 FEW040CB SCT100 35/15 Q1004 TEMPO 32030G40KT 1500 TS BLDU

202305251530 METAR VIDP 251530Z 12008KT 2200 TSRA SCT030 FEW035CB OVC080 22/20 Q1005 TEMPO 32030G50KT 0150 TSRA

- **VIJP-Jaipur**

202305251200 METAR VIJP 251200Z VRB03KT 7000 NSC 34/17 Q1006 NOSIG=

202305251430 METAR VIDP 251430Z 2800 R27(A)/R28(D) 2800 TS SCT020 FEW035CB Q1005 TEMPO 32020G40KT 1500

202305251530 METAR VIJP 251530Z 07006KT 3000 HZ SCT030 SCT100 30/21 Q1005 NOSIG=

202305251558 METAR VIJP 27Z 07006KT 2800 HZ SCT025 FEW035CB 30/21 Q1005 TEMPO 29015G25KT TSRA

*202305251600 METAR VIJP 251600Z 09008KT 2500 HZ SCT030 FEW035CB BKN100 29/21 Q1005 TEMPO 29015G25KT 0800 TSRA (*checked from IMD website)

202305251630 METAR VIJP 251630Z 09008KT 2500 TS BKN030 FEW035CB BKN090 29/22 Q1005 TEMPO 29015G25KT 0800 TSRA=

202305251700 METAR VIJP 251700Z 32035G45KT 1000 R27/2000 TSRA BKN030 FEW035CB BKN080 22/17 Q1008 TEMPO 32035G45KT 0800 TSRA=

- **VIGR-Gwalior** (METAR recorded on OFP by crew)

202305251720 (approx,) 24R 060/04 6000 1004 FEW030 SCT100 SCT250 NOSIG

1.8 Aids to navigation

Gwalior airport has VOR/DME with PAPI available on either side of runway 06/24. There were no known navigation aid difficulties reported by the crew.

1.9 Communications

All communication systems were working normal between flight crew and ATC for all the airports.

1.10 Aerodrome information

1.11.1 Delhi Airport

Indira Gandhi International (IGI) Airport, New Delhi is a civil aerodrome. The operations are controlled by GMR and ATC is controlled by Airports Authority of India (AAI). Airport has got ICAO Code VIDP, ARP coordinates are 28°34'07"N, 77°06'44"E and is located 15 KM from Delhi railway station. The elevation is 778 feet and type of traffic permitted is IFR/VFR. Aerodrome category for fire fighting is CAT-10 and Rescue equipment's are available as per category. Delhi airport has three runways with orientation 27/09, 28/10 and 29/11.

1.11.2 Jaipur Airport

Jaipur airport is owned and fully controlled by Airports Authority of India. The co-ordinates of the aerodrome reference point are 26°49'27" N & 07°54'81"E. The elevation of the ARP is 1263 feet. The airfield has a single runway 09/27 which is 2797 meters long and 45 meters wide. The magnetic bearing of the runway are 085°/265° which are same as geographical bearings. The elevation of runway 09 threshold is 1263 feet and that of runway 09 is 1250 feet. The declared distances of TORA, TODA, ASDA and LDA for both runway 09 and 27 are 2797 meters.

1.10.3 Gwalior Airport

Rajmata Vijaya Raje Scindia Airport, Gwalior is a domestic civil enclave airport operated by Airport Authority of India (AAI) and an Indian Air Force base serving the city of Gwalior, Madhya Pradesh, India. It is in Maharajpur, 10 km (6 mi) north-east of the city premises. The Gwalior Air Base is the only operational air force base with two operational parallel runways. The second runway was built in February 2009 and became operational in October 2010.

1.11 Flight recorders

1.12.1 Digital Flight Data Recorder (DFDR)

DFDR data was downloaded and analysed for investigation of the subject event.

The DFDR data was correlated with time and location information to get the flight route undertaken during the incident flight and is plotted on Google map as shown in figure 1.

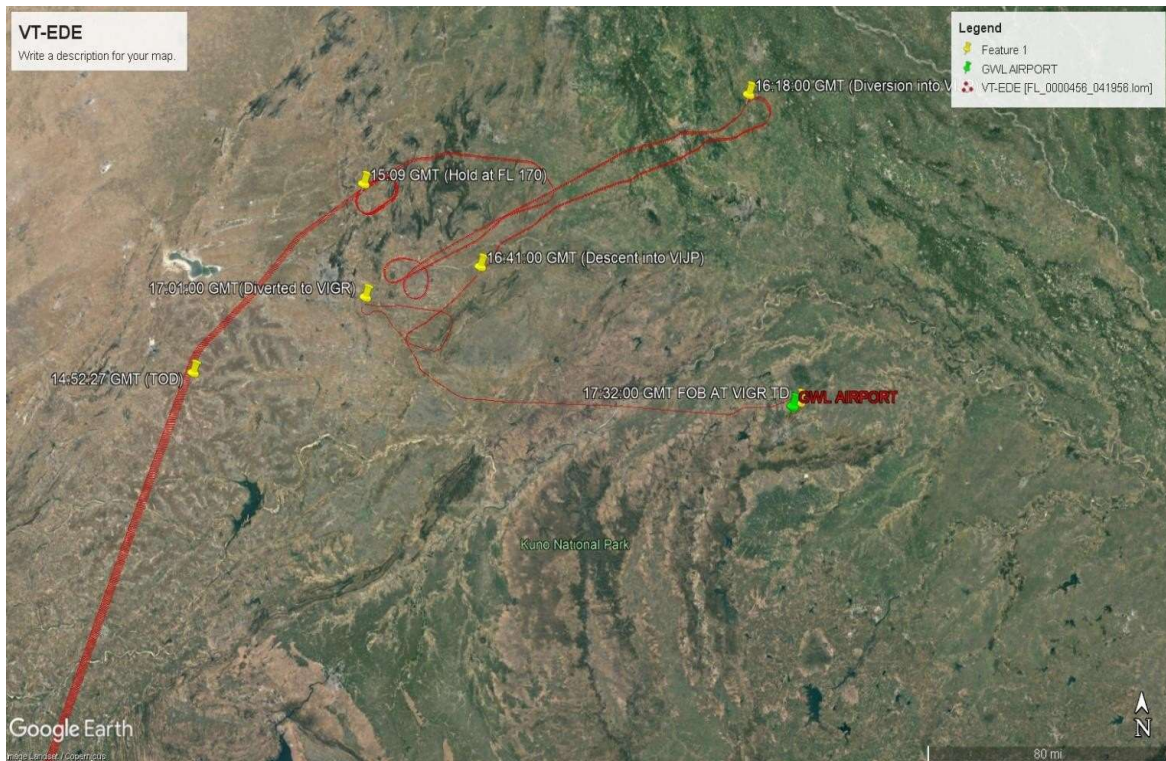


Figure 1: Route followed by flight based on DFDR data points correlated.

As per the DFDR data, the readout is given as below for amount of fuel for the incident flight from planning to the place of landing.

Time (UTC)	Aircraft Phase	Fuel Quantity (Kgs)
	Flight Plan fuel	9544
	Tankering fuel	900
13:23	Ramp	10500
13:37	Take-off	10450
14:52	Top of Descent	6184
15:09 to 16:18	Holding at FL170	Fuel consumed: 5853-3048=2805
16:19	Diverted to Jaipur	2990
16:38	Minimum Fuel declared	2351
16:41	Descent into Jaipur	2208

17:01	Diverted to Gwalior	1659
17:09	MAYDAY Fuel declared	1190
17:32	Touch down at Gwalior	464.5
17:45	Parked	348

*Minimum diversion fuel as per OFP was 2769 Kgs

*Minimum reserve Fuel as per OFP was 1192 Kgs

1.11.2 ATC Tape transcript

Time (UTC)	From	To	Brief
DELHI (AREA)			
145200-145225	AIC 850	Area	Delhi Air India eight five zero
	Area	AIC 850	Air India eight five zero radar
	AIC 850	Area	sir request right heading zero four zero due weather and if possible request lower level
	Area	AIC 850	Descend to level now one five zero and passing three two zero right heading approved sir
150029-150039	Area	AIC 850	Air India eight five zero radar reduce to minimum clean speed stop descend at flight level one seven zero
	AIC 850	Area	Minimum clean and stop descend flight level one seven zero Air India eight five zero
DELHI (RADAR)			
154135-154303	AIC 850	RADAR	Air India Eight Five Zero We Can See Aircraft Maintaining One Seven Zero Forty Miles Ahead Of Us
	RADAR	AI 850	Eight Five Zero Radar Maintain Flight Level One Seven Zero Traffic Aircraft Will Descend To One Five Zero
	RADAR	AI 850	Air India Eight Five Zero Radar Confirm In Hold Now
	AIC 850	RADAR	Negative Sir We Are Just Circumnavigating Sir We Are On A Heading Of Two Three Five Our Situation Is At This Level There Is Lot Of Clouding And It Is Very Bumpy Either We Climb Higher And Hold Otherwise Will Keep Navigating Going Towards Jaipur Sir Hold There Air India Eight Five Zero
	RADAR	AI 850	Roger

154517-154525	AIC 850	RADAR	Delhi Radar Air India Eight Five Zero Any Approach Sequence for Us Sir Any Estimated Approach Time
	RADAR	AI 850	Will advise
160140-160271	AIC 850	RADAR	Sir Estimated Approach Time For Us
	RADAR	AI 850	Stand By Will Air India Eight Five Zero Radar Turn Right Heading Zero Five Zero
	RADAR	AI 850	Roger Fly Heading Zero Six Zero
160904-160916	RADAR	AI 850	Air India Eight Five Zero Turn Left Heading...Turn Left Proceed To Delta Papa Five Zero Seven
	AIC 850	RADAR	Unable Sir Air India Eight Five Zero, We Can Continue On This Heading And Come From The North Sir
161821-161828	RADAR	AI 850	Air India Eight Five Zero Contact One Two Zero Decimal Niner
	AIC 850	RADAR	One Two Zero Niner
DELHI (AREA)			
161937-161954	AIC 850	Area	Delhi Air India Eight Five Zero
	Area	AIC 850	Air India Eight Five Zero Radar Contact
	AIC 850	Area	Diverting To Jaipur Sir Request Further Instructions
	Area	AIC 850	Air India Eight Five Zero Contact Delhi Radar One three Two Decimal Five
DELHI (RADAR)			
161959-162020	AIC 850	RADAR	Request Divert To Jaipur Request Instruction
	RADAR	AI 850	Air India Eight Five Zero Radar Fly Heading One Eight Zero
	AIC 850	RADAR	Heading One Eight Zero.. Unable Sir Request Direct To Juliet Juliet Papa at The Moment Due Weather Air India Eight Five Zero
162652-162700	AIC 850	RADAR	Delhi Air India Eight Five Zero In Contact With Jaipur
	RADAR	AI 850	Air India Eight Five Zero Radar Stand By For Change Due Traffic
163804-163814	RADAR	AI 850	Air India Eight Five Zero Radar Confirm In Contact With Jaipur
JAIPUR CONTROL			
163810-163841	AIC850	Control	Jaipur AIC 850
	Control	AIC850	AIC 850 Jaipur control

	AIC850	Control	Delhi has not released us, we are at minimum fuel sir
	Control	AIC850	Confirm minimum fuel?, AIC Affirmed the same.
163928-164130	Control	AIC850	AIC850 Jaipur confirm released by Delhi?
	AIC850	Control	Affirm sir
JAIPUR (APPROACH RADAR)			
164127-164214	AIC850	RADAR	Jaipur approach AIC850 Good evening
	RADAR	AIC850	AIC850 Radar Identified Confirm FL90
	RADAR	AIC850	Controller given further descend to FL75
164312-164856	RADAR	AIC850	AIC850 Light raining over the field, Same was copied by AIC 850
	AIC850	RADAR	Request latest wind
	RADAR	Other aircraft (1 st)	Roger she is just touching down & Tower observed wind 340 degree 20Kts and winds gusting to 40 Kts
	AIC850	RADAR	Monitored Thank you
	AIC850	RADAR	Confirm aircraft touching down? We are just 6 track mile for descend
	Aircrafts		Arrival aircraft going around. During this time, one more aircraft requested go around due weather
	AIC 850	RADAR	AIC request to maintain FL100
164356-164856	RADAR	AIC 850	Confirm holding at level 100 now
	AIC 850	RADAR	Affirm Sir, Just for a while let us get the latest from the 6638 go around aircraft
	RADAR	Going around aircraft(2 nd)	Report your wind observed, Aircraft conveyed to standby to controller
	Other aircraft (3 rd)	RADAR	Going around due weather turning left
165201-165701	AIC850	RADAR	Jaipur AIC850
	RADAR	AIC850	AIC850 Radar
	AIC850	RADAR	Would like to come for app sir, we are eating up the fuel
	RADAR	AIC850	Roger, AIC, Descend to FL75
	RADAR	AIC850	AIC850 Radar descend to 3300 feet QNH 1006 Transition Level75
	AIC850	RADAR	3300 1006 transition 75 AIC850
	RADAR	AIC850	AIC850 winds 340 degree 22kts gusting to 40kts, Aircraft confirmed
	RADAR	AIC850	AIC850 Radar turn right heading 310 vectoring for ILS app rwy27
	AIC850	RADAR	Will intercept localizer sir on our own, Thereafter controller approved
165851-170238	AIC850	RADAR	Break break AIC 850 turning left discontinuing the approach
	RADAR	AIC850	Roger climb to 5000ft

	AIC850	RADAR	Can we hold at present position sir, right turn, controller approved the right hand pattern orbit
	Other aircraft (3 rd)	RADAR	We are low on fuel, like to divert to Gwalior
	AIC850	RADAR	And we are also low on fuel, we would also like to go and land on some field as soon as possible
	RADAR	AIC850	AIC confirm, would like to divert to Gwalior?
	AIC850	RADAR	Affirm sir, Is it the nearest field?
	RADAR	AIC850	Affirm sir
	AIC850	RADAR	Give us vector sir
DELHI (RADAR)			
170534-170619	AIC 850	RADAR	Passing flight level one zero one for one one zero request vector for Gwalior
	RADAR	AI 850	Air India Eight Five Zero Delhi Radar Roger Turn Left Heading One One Zero
170623-170640	AIC 850	RADAR	Delhi air India eight five zero what type of approach we can expect at Gwalior sir
	RADAR	AI 850	That Gwalior will tell you report in contact with Gwalior and maintain this frequency there is a traffic air India eight five zero contact radar one three two one five
DELHI (AREA)			
170656-170717	Area	AI 850	Roger maintain level one two zero on reaching and vectors to...proceed direct to Gwalior
	AIC 850	Area	Direct to Gwalior Air India eight five zero
170916-170944	AIC 850	Area	Air India eight minimum fuel eight five zero five zero MAYDAY MAYDAY MAYDAY MAYDAY Air India
	Area	AI 850	Air India eight five zero radar roger MAYDAY proceed direct to golf whisky alpha proceed direct to golf whisky alpha
DELHI (RADAR)			
171103-171118	AIC 850	RADAR	Air India eight five zero negative we are in contact with Gwalior may we change over to Gwalior
	RADAR	AI 850	Air India eight five zero roger no traffic with Delhi descend in coordination with Gwalior radar services terminated

Based on the above tape transcript, it is to highlight that:

1. AIC850 was asked to hold over 25NM north of JJP by Delhi ACC SW (132.15 MHz) at time 1503 UTC as there was no landing at that time and aircrafts were holding with Approach Control
2. AIC850 kept holding for about 25 minutes and took an easterly heading towards AKRIB, around 75NM South West of DPN. ACC SW controller instructed AIC850 to commence hold again and changed it over to Area South East Lower (132.5 MHz) at time 1538 UTC.
3. At 1543 UTC, AIC850 advised Area South East Lower it could not hold in the present position due weather and would like to proceed towards Jaipur and hold. Accordingly, the controller approved and AIC850 was made to hold again at around 15NM east of JJP.
4. At 1600 UTC AIC850 left hold and again proceeded in easterly heading for making approach and also asked for Expected Approach time. Given the unpredictable weather and ongoing weather deviations, the controller was not able to provide a landing time. Area South East Lower Controller then changed AIC850 to ACC East (120.9 MHz). At 1619 UTC AIC850 informed ACC E controller that it wanted to divert to Jaipur. Accordingly, Area E controller gave AIC850 heading for Jaipur and changed it back to Area South East Lower Controller. At 1640 UTC Area South East Lower Controller changed AIC850 to Jaipur ATC. During that time other aircraft informed Delhi ATC on RT that there was a weather warning in Jaipur from 1700 UTC and hence that aircraft was diverting to Indore. At 1641 UTC Jaipur ATC informed on landline that AIC850 had declared minimum fuel and was commencing descent with Jaipur ATC.
5. At 1700 UTC Jaipur ACC informed Delhi ACC that there was weather deterioration in Jaipur and three aircrafts diverted from Jaipur. At 1705 UTC Jaipur changed over AIC850 to Delhi ACC SW informing that it was diverting to Gwalior and it had fuel constraints.
6. At 1709 UTC AIC850 reported MAYDAY fuel, the controller acknowledged and changed the aircraft to Gwalior ATC. Planning controller coordinated with Gwalior ATC on landline regarding AIC850 declaring MAYDAY Fuel and diverting to Gwalior.

1.11.3 CVR transcript

Aircraft is equipped with DFDR and a CVR. CVR is capable of recording of data for last 120 minutes of flight.

The estimated total flight duration for Pune-Delhi sector was 02 hrs 15 min. Further due to weather delay and subsequent delay and continuous operation of aircraft, the flight sector (from Jaipur and divert to Gwalior) only a small portion of the CVR recording for the last 02 hours was recorded.

The transcript of the portion available from the CVR i.e. from AI-850 in contact with Delhi being handed over to Gwalior Radar for Approach into Gwalior is placed as under:

ATC to AI-850	Roger sir, will try to accommodate for 06R. Contact Gwalior Radar on 127.5.
Captain	Asks First Officer to calculate the RWY length.
AI-850	Gwalior AI-850, what is the surface wind?
ATC	AI-850, winds are 040/04 kts.

AI-850	Roger ma'am, request RWY 06 and what are the temperature & QNH?
ATC	Temperature 30, QHN1004.
AI-850	30 & 1004 copied. Request vectors ma'am for Visual RWY 06 and request as close as possible to the RWY. I don't have fuel for next approach.
ATC	AI-850 will advise. RWY 06R is a NON-INSTRUMENT Approach runway.
AI-850	That's okay ma'am. We do not have fuel. We have to land.
Captain	Asks First Officer to procure the Lat & Long from Gwalior on 122.7 to create a new RWY in the database through the MCDU. He then asks the PM to prepare RWY 24L on the MCDU.
AI-850	AI-850 requests Lat/ Long for Gwalior. Will appreciate if you could it as fast as possible. FLIGHT SAFETY DEPARTMENT
ATC	AI-850 copy Lat/Long. RWY 24 threshold is 26° 18.00N/ 078° 14.31E. Elevation of 24 is 607 feet.
ATC	AI-850 descend initially FL120. Traffic ahead SpiceJet 8265, left ABM 11 o'clock, 14 miles descending passing FL115 now. AI-850 confirm Squak 0330.
AI-850	Affirm ma'am AI-850. Just 600 kgs of fuel ma'am, we can commence one approach, would appreciate vectors as best as possible for RWY 24 behind Spice Jet and as short vectors as possible.
ATC	Copied. Report your heading.
AI-850	We are on a heading of 095°, AI-850. Continue heading 095. Further descend AI-850.
ATC	AI-850 continue descend FL100.
ATC	Spice 8265, confirm position you behind AI-850.
SpiceJet 8265	Its oaky ma'am. Our endurance is 35 mins and we are able. You can make Air India go ahead of us.
ATC	AI-850 changing RWY to 06R.
AI-850	ILS would be better if you could give us shorter vectors, please
ATC	Roger, then expect RWY 24L for your arrival. Turn left heading 060.
<i>AI-850 continue descend to FL060. Crew reads back the instructions given by ATC.</i>	
Captain	Flap 1----- CM
Speed checked Flap 1	
ATC	AI-850 confirm positioning Right Base for RWY 24L acceptable. Turn Right Heading 090, Reach 2700 feet in the next 15 NMs. Crew reads back the instructions given by ATC.
ATC	AI-850 request POB only.
AI850	148 Roger.
ATC	AI-850 presently aerodrome is approximately 1: 30 to you 11 miles.
AI-850	Could you guide us on the Localizer and Glide also for some time till we sight the RWY visually.
ATC	All assistance will be provided. Continue heading 090 and expect continuous turn for Localizer 24L.
Captain	Flap 2 are extended.
AI-850	What is length of the RWY sir?
ATC	AI-850 10000 feet sir, comfortable for you.
Captain	Approach Checklist ----- Crew carry out the Approach Checklist.

ATC	AI-850 turn left heading 070, for pattern correction and positioning on FINALs. RWY is approximately 2 o'clock to you distance 6 NMs. Report if you have visual with the aerodrome.
AI-850	Airfield is visual sir, but we require vectors for the RWY. The RWY is not yet in sight.
ATC	AI-850 descend to 2700 feet. Reaching 2700 feet expect right turn onto FINALs. Crew reads back the instructions given by ATC.
ATC	AI-850 continue descend to 2400 feet, QNH 1004.
AI-850	I have the RWY in sight but you can continue to vector. Visual is okay sir so 2100 feet is okay.
ATC	Roger, continue descend in that case to 2000 feet at your discretion and advise if you are able to take a right turn now? Continue right heading 180. CM extends the Landing Gear.
ATC	AI-850 confirm visual with the aerodrome beacon & report whenever you have the approach lights in sight.
Captain	Flap 3-----
CM	Speed checked Flap 3. Captain disconnects the Auto Pilot.
ATC	AI-850 continue descend as per discretion and turn right heading 220.
AI-850	AI-850 approach lights in sight, turning FINALs now. Request landing clearance.
ATC	AI-850 cleared to land RWY 24L. Captain
<i>Approach Checklist -----Crew carry out the Landing Checklist.</i>	
ATC	AI-850 after landing expect to vacate the RWY at approximately 3500 feet to the end of RWY. After Touchdown
CM	Ground Spoilers, Reverse Green, Decel ----- 70 kts.
ATC	AI-850 continue on the RWY. You will be vacating via Link Way D2 which 3rd link to your left. Will advise.
<i>AI-850 vacate the RWY on Taxi Way D2 and as per instructions from ATC follow the Follow-ME Jeep to Bay</i>	
Captain	After Landing Checklist-----Crew carry out the Landing Checklist.
ATC	AI-850 check fuel status.
AI-850	Sir we have 420 kgs. on board at the moment.
AI-850	Sir we can Taxi with single engine, request to shut down one engine.
ATC	AI-850 approved.
<i>Captain informed the passengers through the PA that due to weather all around Jaipur & Delhi, they had to divert to Gwalior</i>	

1.12 Wreckage and impact information

NIL

1.13 Medical and pathological information

Both flight crew underwent breath analyser tests on 25.05.2023 and were tested negative. Both flight crew members were fit for undertaking the flight.

1.14 Fire

NIL

1.15 Survival aspects

Incident was survivable.

1.16 Tests and research

NIL

1.17 Organizational and management information

Air India is a scheduled airline owned by Tata Group. Air India operates its flights on domestic and international sectors. Air India operates its flights on domestic and international destinations with a fleet of Boeing 777, Boeing 787, Airbus 319, Airbus 320 and Airbus 321 aircraft. M/s Air India Limited is headquartered at New Delhi. Air India is the largest international carrier of India. Over 40 international destinations are served by Air India spanning cities in Europe, USA, UK, Africa, the Gulf, Asia and Australia. The airline became the member of Star Alliance on 11 July 2014. The company has its corporate office at Gurugram which also houses its centralized flight dispatch and IOCC offices.

1.18 Additional information

1.18.1 Operational Flight Plan (OFP)

Operational flight plan was prepared for operating sector i.e. Pune-Delhi with destination alternate of Jaipur airport. The time of departure was 1320 UTC with arrival time at Delhi was 1535 UTC.

The fuel figure as per OFP is tabulated below:

Standard	Fuel(Kgs)
APU	65
Taxi	200
Sector fuel	5023
Contingency	252
Destination Alternate(Jaipur)	1577
Final Reserve	1192
Arrival (Delhi)	335
Extra	900
As per company Policy of FOD 6.0T	900
Total Fuel	10.5T (approx.)
Minimum Diversion fuel (MDF)	2769

It is observed from OFP that during flight, crew recorded the weather at Delhi airport for 1300 UTC, 1530 UTC. The weather of Jaipur airport was recorded for 1430UTC, 1530 UTC and 1558 UTC before diverting to Jaipur. The weather of Gwalior airport was obtained for 1730 UTC however the aircraft was diverted for Gwalior much before obtaining the Gwalior weather.

1.18.2 Internal Circular on Inflight fuel management

Company had issued an internal circular dated 03.03.2023 applicable for A320/B777/B787 aircraft on Inflight reanalysis of fuel. Same is given below:

TECH CIRCULAR	07/TECH/2023/B787 04/TECH/2023/B777 02/TECH/2023/A320	
	03/03/2023	

TO PILOTS

FLEET A320 B777 B787

SUBJECT IN-FLIGHT FUEL MANAGEMENT

REASON FOR ISSUE Guidelines on Inflight Re-analysis of Fuel

Regulations permit inflight re-analysis of fuel after flight commencement.

If a situation arises due to unanticipated circumstances/delays at the destination aerodrome, wherein the fuel remaining on board is approaching the Minimum Diversion Fuel (**ALTN+FNL RESV**) and a diversion decision is imminent, the PIC shall carry out a re-analysis by using the following method:

- Request and confirm with the ATC for an **EAT (Expected Approach Time)** or Maximum likely delay.
- Assess the prevailing and forecast meteorological conditions.
- Determine, (in consultation with IOCC when practical/possible) if a safe landing at the **DESTINATION** aerodrome is assured with the Final Reserve Fuel remaining (30 min) upon landing.

If it is determined on the basis of the above re-analysis that a safe landing at the **DESTINATION** aerodrome is assured, the PIC **may** decide to use the planned ALTN FUEL to **proceed to, or hold at,** the **DESTINATION** aerodrome.

NOTE 1: A flight crew's assessment of the traffic and meteorological conditions may be more accurate for the destination than for any alternate aerodrome.

NOTE 2: It is important to note that even in case of an actual diversion the flight is committed to land at the alternate without a further alternate aerodrome available. Thus, the decision to **"Commit to DESTINATION"** is nothing unique and may be the safer option as landed fuel at destination would probably be higher than that at the alternate aerodrome.

The following scenarios are for crew guidance:

Scenario 1:

CONT	00:05
ALTN	01:15
FNL RESV	00:30
ARRDL (ARRIVAL DELAY)	00:05

INFLIGHT FUEL RE-ANALYSIS:

- Weather (Prevailing & Forecast) for **DESTINATION** is above minima (Company, Crew, Aircraft)
- Holding fuel available over **DESTINATION:** 10 Mins (CONT+ARRDL)
- ATC Delay: 15 Mins Maximum Delay/ EAT provided.**

PIC may decide to use the ALTN fuel towards holding at **DESTINATION** provided landing at **DESTINATION** is assured with Final Reserve remaining upon landing.

*Note: In this case the **Destination** Aerodrome shall be the "specific aerodrome" for the purpose of declaring "Minimum Fuel/MAYDAY FUEL"*

Scenario 2:

CONT	00:05
ALTN	01:15
FNL RESV	00:30
ARRDL (ARRIVAL DELAY)	00:05

- **Weather (Prevailing & Forecast) for DESTINATION is marginal/below minima.**
- **Holding fuel available over DESTINATION: 10 Mins (CONT+ARRDL)**
- **ATC Delay: Not determined / EAT not provided.**

PIC should divert to ALTN when FOB is at or more than Minimum Diversion Fuel (**ALTN+FNL RESV**) value to ensure Final Reserve is remaining upon landing at the alternate aerodrome.

Note: In this case the Alternate Aerodrome shall be the "specific aerodrome" for the purpose of declaring "Minimum Fuel/MAYDAY FUEL".

It is reiterated that regulations require that under all circumstances the "**Pilot-in-command shall continually ensure that the amount of usable fuel remaining on board is not less than the fuel required to proceed to an aerodrome where a safe landing can be made with the planned final reserve fuel remaining upon landing**".

*NOTE 3: The protection of final reserve fuel is intended to ensure a safe landing at **ANY** aerodrome when unforeseen occurrences may not permit safe completion of an operation as originally planned.*

Company has issued an internal circular dated 03.03.2023 applicable for A320/B777/B787 aircraft, advising pilots to decide to "commit to land" at destination aerodrome and wait till they actually hit MDF. Further, the circular states that "based on the circular's re-analysis that a safe landing at the Destination aerodrome is assured, the PIC may decide to use the planned alternate fuel to proceed to, or hold at the destination aerodrome".

1.18.3 IOCC coordination

Company has integrated operations coordination and control centre and has a SOP i.e. IOCC manual. As per the IOCC manual, it is the duty of the duty manager to monitor delay of flights and clearly states procedures/guidelines to be followed each described scenario wise including diversion due adverse weather. Further crew coordinator is required to monitor flight and report any delay to Duty manager. Extracts of the manual stating above duties are enclosed.

	AIR INDIA IOCC MANUAL	IOCC-OPS-001		
		CHAPTER : 3		
	MOMENT MANAGER & MM WEB	Issue-III	Rev.0	01 ST OCT 2020

3.4 FLIGHT DISPATCHER

Apart from MM, Flight dispatcher is required to keep a watch on the ACARS communication and weather /notams of the network stations. Flight dispatcher is responsible for

1. Populating the MM with the Requirements / Restriction for a particular Flight / Airport / Sector /Aircraft
2. He will communicate with the PIC Via ACARS/SATCOM to apprise IOCC about the flight intention / requirements.
3. Flight Dispatcher needs to update the ETA of all critical flights in particular or for the flights having more than four hours block time.
4. He will take note of CTOT issued for the operating stations and update the same in MM for information of all stakeholders.

3.5 CREW CONTROLLER


Crew controllers need to work on ARMS system as provided by the CMS apart from MM.

In MM they are responsible for

	AIR INDIA IOCC MANUAL	IOCC-OPS-001		
		CHAPTER : 3		
	MOMENT MANAGER & MM WEB	Issue-III	Rev.0	01 ST OCT 2020

1. Crew Action needed in case of any deviation from the planned schedule like diversion, delay, AOG, Change of Equipment etc.
2. In case of flight getting delayed in MM, Controller need to calculate the DTL and advise DM regarding the same.
3. Check with respective roster that all scheduled flights are adequately rostered by the qualified crew.
4. In case of a flight getting delay, liaise with crew scheduling sections regarding the crew swap options to mitigate the delay.

Figure 2 Overall role of crew coordinator

	AIR INDIA IOCC MANUAL	IOCC-OPS-001		
		CHAPTER : 8		
	DISRUPTION MANAGEMENT	Issue-III	Rev.0	01 ST OCT 2020

8.2 PROCEDURE FOR MITIGATION OF DELAY


8.2.1 Duty Manager, IOCC shall monitor and manage delayed flights. Once a delay has occurred IOCC shall take all necessary action for prevention of propagation of delay across the network.

8.2.2 Definition:

1. Day of Operation: 1830-1829UTC (0000-2359IST)
2. Delay: Whenever ETD of a flight leg is revised on the Day of Operation.
3. Re-schedule: Whenever ETD is revised prior to Day of Operation. In cases where revision is done at the last hours of the day of operation, it must be ensured that a minimum 06 hours are remaining for the departure of the flight else it should be treated as "delay".
4. For example: If Time now is 1000 UTC/1530 IST of 01 July 2018 then revision of departures of Flight Legs with STD up to 1829UTC/01 July 2018 (2359 IST/01 July 2018) will be considered as "Delayed".
5. Revision of departures of Flight Legs with STD beyond 1830 UTC/01 July 2018 (0000 IST/01 July 2018) will be considered to be "Re-scheduled".

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SOP to be followed to actively monitor and prevent delay

	AIR INDIA IOCC MANUAL	IOCC-OPS-001		
		CHAPTER : 8		
	DISRUPTION MANAGEMENT	Issue-III	Rev.0	01 ST OCT 2020

aircraft.

4. In case aircraft is likely to remain grounded beyond 03 days, thereby having potential for Further schedule disruption, the Maintenance Coordinator shall inform Planning manager who will liaise with Network Planning and Scheduling department for implementing necessary schedule changes.

8.11.1.5. CREW COORDINATOR


1. To check about any crew related issues or DTL extension that has to be taken.
2. Check for any impact on other flights due crew pattern.
3. To inform the Network Controller about any impact due crew which could affect the proposed recovery plan.

8.11.1.6. PLANNING MANAGER/NETWORK CONTROLLER

1. Explore the feasibility of utilizing the standby aircraft if available. If standby aircraft is unavailable, explore the feasibility of

CH8-15

responsibility of crew coordinator also demands passing of information to another destination bound flights


	AIR INDIA IOCC MANUAL	IOCC-OPS-001		
	DISRUPTION MANAGEMENT	CHAPTER : 8		
		Issue-II	Rev.0	01 ST

2. Make alternate arrangements for the passengers getting delayed / missing connections. Likely critical connections to be noted and appropriate steps to be undertaken.
3. Keep officials of the alternate stations informed in case of a diversion.
4. Send the required messages to the designated officials.
5. If the flight is likely to held up after diversion ,coordinate with station /HCC regarding the possible relief / delay /resked to the affected flight.
6. Inform via email Air India Call Center giving necessary details.

8.13 DIVERSION DUE TO ADVERSEWEATHER /FOG

8.13.1 FLIGHT COORDINATOR

1. PIC must send any diversion message Via ACARS/SATCOM to IOCC Flight Coordinator.
2. Flight Coordinator to check the ETA, expected weather trend and holding fuel with the PIC via ACARS.
3. Must request the PIC of the aircraft to hold the aircraft for maximum

	AIR INDIA IOCC MANUAL	IOCC-OPS-001		
	DISRUPTION MANAGEMENT	CHAPTER : 8		
		Issue-III	Rev.0	01 ST

holding time.

4. In case there is no improving trend, can request the PIC to divert to a station from where passenger disposal can be done easily and standby crew is available otherwise divert to the alternate airport.
5. PIC must inform IOCC Flight Coordinator confirming his diversion.
6. Flight Coordinator to inform the Duty Manager, Crew Coordinator and Ops controller and should make proper log book entry.
7. Flight Coordinator to constantly monitor the weather and any trend in improvement by liaisoning with local ATC and give feedback to Network Controller.

8.13.2 PLANNING MANAGER/NETWORK CONTROLLER

1. Inform the Station Manager/Airport Manager of the station to which flight is going to divert along with its ETA.
2. Inform the RCC/HCC and scheduled airport of arrival about the diversion.
3. Send e-mail message to all concerned and SMS to top management (as per the list).Check with the Flight Coordinator about any improvement and expected departure that can be fixed.

CH8-37

SOP to be followed during adverse weather

1.18.4 Statement of Pilot in Command

Before departure from Pune, weather of take-off alternate, Enroute Alternate, Destination & destination alternate was assessed by the crew. Delhi reported some dust storm and weather activity in TAF. EWAS showed one small patch of mild intensity towards NW of Delhi. Alternate Jaipur METAR was fine too though there was forecast of TSRA in TAF. EWAS current & forecast showed nothing significant over and around Jaipur. Aircraft departed Pune with FOB 10.5T (MSF 8.3T) and more than 6.0 T EFOB (approximately 1:20 hrs of holding fuel) as per the company policy.

Flight crew were advised by ATC to hold at FL170 to commence an approach for landing at Delhi. Aircraft was put into pattern holding by ATC when the aircraft was on TOD due to temporary suspension of landing due weather. At this point, flight crew requested ATC to hold either over or close to Jaipur. There was a discussion between both the pilots to go & land in Jaipur if the delay becomes undetermined for destination irrespective of MDF criteria.

But very soon (around after 02 holds) Delhi ATC started vectoring the aircraft towards Delhi. After reaching close to Delhi, flight crew were advised to hold again. Flight crew complied the ATC instructions and requested for expected approach time and were told to standby by ATC. Keeping in mind that staying closer to Jaipur or at least equidistant from destination & alternate would be a good idea, flight crew again requested ATC to allow to go towards Jaipur & hold. The same was allowed by ATC. All this while, weather was weakening overhead Delhi & moving eastwards.

After sometime ATC Delhi called flight crew and cleared the aircraft to a STAR waypoint. Flight crew requested ATC to go slightly ahead of the STAR waypoint and then turn left to join the STAR to avoid a small weather patch. During the same time, another aircraft asked ATC Delhi about resumption of landing at Delhi which was denied by ATC.

While holding as a procedure, flight crew send message through ACARS to the company that we may divert to Jaipur. Company acknowledged the same but there was no mention of any weather including deteriorating weather at Jaipur.

At this point, flight crew told ATC Delhi about diversion to Jaipur and requested further instructions. At no point, any discussion of Jaipur Weather took place from ATC Delhi and aircraft was handed over to ATC Jaipur. "Minimum fuel" was declared to Jaipur ATC.

At around 1620Z, Flight crew obtained weather of 1558Z from ATIS, which showed a trend for TSRA with strong winds at Jaipur. Aircraft was vectored towards Jaipur and started descent. As the aircraft came closer to Jaipur, the Weather radar picture showed significant weather with Magenta colour covering approach and missed approach path. The only area clear was SE of Jaipur (i.e., Left of Localiser). Aircraft was given heading to intercept localiser and was number 03 in Approach sequence. ATC informed flight crew about the winds (strong head wind component and gusting) however, flight crew requested ATC for their heading to intercept localiser and same was approved. Magenta Weather with severe turbulence, lightning right in front of approach path did not allowed the aircraft to intercept localiser. Jaipur was unviable and unsafe even with fuel remaining (approximately 1.6T). Both aircraft ahead in approach sequence diverted after carrying out Go around. Flight crew also diverted after discontinuing approach based on the assessment of weather and fuel on board.

During this time, flight crew heard about one aircraft diverting to Gwalior. Accordingly, flight crew declared "MAYDAY FUEL" to Jaipur ATC and diverted to Gwalior and landed safely.

Aircraft was told to vacate runway for and were marshalled into the defence apron with instructions to shift to civil apron once another aircraft cleared the occupied apron along with instruction to keep the engines running.

Crew shut down the engines and APU was started. APU got tripped off and got auto-shut down shortly after 05 minutes. Three attempts were made to restart the APU however, it was unsuccessful and aircraft was switched to battery mode.

Crew requested ATC to disembark the passengers however, ATC did not allow to disembark as the aircraft was parked in the defence apron. About an hour later, ATC allowed the crew to open the doors for some air circulation and later passengers were allowed to disembark with the help of another airline's step ladder compatible for B737 type aircraft. Passengers were moved to civil arrival hall.

1.19 New investigation techniques

NIL

2. Analysis

2.1 Serviceability of aircraft

Aircraft was serviceable and flight was operating the last sector of the day. Previous sectors for the day, did not report any malfunction or defect as per available aircraft techlog and defect maintenance reports (DMR).

After landing at Gwalior, as per flight crew statements, aircraft underwent an APU-restart malfunction. APU was switched on to run the air conditioning and turning off the engines. Three attempts were made to restart the APU, however it was unsuccessful. Gwalior being not an operational destination for operator, no company engineer was present. Also, no entry regarding the APU fault was made in the techlog by the Crew.

It is inferred that the maintenance aspect was not the contributory factor to the incident. However, crew did not recorded the APU fault in the techlog.

2.2 Company guidelines on inflight fuel management

As per the company's fuel policy considering the economic aspects, airline advises to bring aboard a minimum of 06 ton of fuel to Delhi to incorporate for long taxi-delays, sequence waiting time etc. Thus the flight from Pune took aboard extra fuel and the FOB was 10500 kg whereas only 8224 kg of fuel would normally be required. This fuel taken aboard is well within airworthiness limits and is chosen based on the fuel economy performance of the aircraft which is part of the OFP.

Company has issued an internal circular dated 03.03.2023 applicable for A320/B777/B787 aircraft, advising pilots to decide to "commit to land" at destination aerodrome and wait till they actually hit MDF. The circular further advises that "MDF fuel may be used to proceed to or for hold at the destination aerodrome". This however fails the purpose of MDF in case of any further unforeseen emergency.

From the above, it is inferred that the based on the content of the circular, it is evident that the company has added addition pressure on the flight crew decision making for commit to land at destination even to use planned alternate fuel to proceed to, or hold at destination with the final reserve fuel remaining upon landing.

2.3 Operational aspect

The pilot on left (PIC) was undergoing SLF as he had returned after being TMU for a period of 11 months and had undergone required training before releasing to supervised line flying. Before the incident flight PIC under-check flown another sector as supervised line flying on 25.05.2023 which was uneventful.

The Operational Flight Plan (OFP) for Pune-Delhi sector was generated at 0554hrs UTC at Delhi. Before take-off from Delhi for AI-849, crew took the briefing at 0930hrs UTC for both the flights. Crew received an updated weather for flight AI-850 (Pune-Delhi) at Pune airport and as per the OFP, Jaipur was the destination Alternate for Delhi. Refuelling was carried out at Pune airport and total fuel on board the aircraft was 10500 Kgs approx. including additional fuel of 900Kgs as per company policy.

The aircraft took off from Pune and flight was uneventful till top of descent into Delhi at 1452 UTC. On commencement of descent into Delhi, fuel on board 6184 kgs approx, the flight crew

observed weather over Delhi and was informed by ATC to expect delay at Delhi. The crew requested to hold near Jaipur as the weather at Jaipur airport was clear at that time. Descent was carried out by Pilot Flying in coordination with ATC Delhi to FL170 at 1509 UTC. FOB at this time was 5853 Kgs.

Further, Delhi ATC had informed the pilot that presently no landing of aircrafts are allowed. The crew discussed among themselves that the weather was clear north of Delhi and requested to hold north of Delhi but was denied by ATC. Thereafter Delhi ATC announced that the runway was being changed, the crew interpreted this as the airfield being open to landing aircrafts. However, aircraft was vectored by ATC and later the flight crew were informed that no landings were taking place.

At 1619 UTC, crew decided to divert to Jaipur. However, the flight crew did not obtain the latest weather update before diverting to Jaipur. At this time, the FOB was 2990Kgs. While maintaining the aircraft at FL170 for about 01 hours 09 min, the aircraft consumed about 2805 kgs of fuel before diverting to Jaipur.

Thereafter crew were handed over to Jaipur ATC. At 1638 UTC, crew declared “MINIMUM FUEL” to ATC. The aircraft was number three in sequence. The preceding aircrafts carried out missed approaches. At 1652 UTC, crew requested ATC to approach for landing at Jaipur and discontinued the approach at 1658 UTC due deteriorating weather. At this time, the FOB was around 1600 kgs. At 1701 UTC, crew declared MAYDAY FUEL to Jaipur ATC. As the preceding aircraft diverted to Gwalior, AI850 also decided to divert to Gwalior Airport. At Gwalior crew carried out a visual approach for runway 24L and landed at 1732 UTC with 464Kgs on board.

From the above, it is inferred that crew decision of prolonged holding in expectation of weather to improve at Delhi further delayed the decision for diversion and the eventually when the decision was taken for diversion, the weather at Jaipur had already deteriorated.

2.4 Weather conditions analysis.

Before the flight from Pune, crew took the weather of Delhi and Jaipur which was within the aerodrome operating minima. During flight, crew obtained the weather of Delhi and recorded visibility 2800m, TEMPO 32020G40Kts 1500. Flight was continued to Delhi, however, due to deteriorating weather, crew initiated holding at FL170 in coordination with ATC. As weather was not improving, hence crew kept holding for about 01 hrs 09 mins. During holding, crew obtained the weather of Jaipur at 1430UTC, 1530 UTC and 1558 UTC. At 1558 UTC, the visibility at rwy 27 Jaipur started dropping to 2800 HZ with tempo of 29015G25Kts TSRA.

The crew initiated diversion to Jaipur at 1619UTC and started descending, however they did not assess the deterioration of weather at Jaipur and continued approach. The aircraft could not land at Jaipur due to deteriorated weather. Aircraft initiated diversion to Gwalior at 1701UTC and declared MAYDAY FUEL to ATC at 1709 UTC. Crew obtain the Gwalior weather at around 1720UTC, visibility 6000m No-sig pattern. Aircraft landed Gwalior at 1732 UTC.

It is inferred that, weather was the contributory factor for prolonged holding over Delhi airspace which further resulted in declaration of MAYDAY fuel.

3. Conclusions

3.1 Findings

- 1 Aircraft was airworthy at the time of flight and had completed 3 sectors for the day. This VAPO-VIDP sector was last sector for the aircraft and crew.
- 2 Crew were tested BA-negative and were fit to undertake the flight.
- 3 The flight plan was remotely briefed and dispatched using centralized facility and was accepted by the crew.
- 4 Weather at Delhi at departure was trend NOSIG with few CB as per METAR of 1230Z.
- 5 OFP was made with one alternate i.e. Jaipur and weather at Jaipur at 1530Z was NOSIG.
- 6 While coming to Delhi, due to company economic considerations and weight availability at take-off, FOB was 10.5 tons and 900 kg of fuel tankering was done from Pune.
- 7 Flight was uneventful till top of descent near Jaipur about 50NM South of Delhi and was in STAR.
- 8 Communication between ATC and flight crew was clear and crew was given hold period. Crew hold over for about 30 minutes and inquired again to Delhi-ATC for further instructions, sequence number but no reply was received. By this time, it was 1530Z and crew took the weather of alternate aerodrome i.e. Jaipur which was NOSIG with a trend TSRA. Crew started to align in direction from South to North to avoid CB clouds and in case to fly to alternate if not possible to land at Delhi and were again called upon by Delhi-ATC to join the STAR.
- 9 At 1558 UTC, crew recorded the weather on OFP for Jaipur and found deteriorated as FEW CB 035 TEMPO 320/20G50, visibility 2800 m in TSRA.
- 10 At 1600UTC, crew heard another flight seeking explicit information “whether landing started at Delhi” to which ATC-Delhi replied “No” and hearing this flight crew confirmed their decision to divert to Jaipur. By this time weather at Jaipur was TSRA.
- 11 The crew held the aircraft at FL170 for about 01 hours 09 min before diverting to Jaipur and consumed about 2805 Kgs of fuel.
- 12 At 1619UTC, crew decided to divert to Jaipur and FOB was 2990Kgs. As per OFP, the minimum diversion fuel for Jaipur was 2769 Kgs.
- 13 Weather was moving with flight towards south and flight crew navigated and spend good amount of time to continue heading to Jaipur. Fuel dispensed in flight path changes was covered due to extra fuel on board.
- 14 As per the METAR, while proceeding to Jaipur, the weather at 1600UTC VIJP reported visibility 2500HZ with FEW CB 035 and TEMPO 290/15G25KT 0800M TSRA.
- 15 At 1638UTC, crew declared “MINIMUM FUEL” to ATC. The aircraft was number three in sequence. The preceding aircrafts carried out missed approaches. Crew requested ATC to approach for landing at Jaipur and carried out ILS approach for RWY 27, the aircraft encountered wind shear at 10 ILS DME at an Altitude of 3300 FT and discontinued the approach at 1658UTC. At this time, the FOB was around 1600kgs.
- 16 The company’s circular i.r.o. using planned alternate fuel to proceed to or hold at destination with the final reserve fuel has added additional pressure on the flight crew decision making for committing to land at destination.
- 17 Crew decision of prolonged holding in expectation of weather to improve at Delhi further delayed the decision for diversion and the eventually when the decision was taken for diversion, the weather at Jaipur had already deteriorated.

- 18 Meanwhile no coordination was being done through IOCC about passing weather information of planned alternate and checking status of flight even after a delay of over an hour from scheduled arrival time.
- 19 The crew observed the weather intensifying and quickly realized that Jaipur was no longer viable for landing. After discontinuing the approach, the crew monitored on RT that another company's aircraft which were preceding AI850 was diverting to Gwalior airport. Crew discussed the low fuel condition with ATC and asked for the option to land. Based on discussion, crew decided to divert to Gwalior which was not an operational station for M/s Air India.
- 20 At 1701UTC, crew declared MAYDAY FUEL to Jaipur ATC. They diverted to Gwalior and carried out a visual approach for runway 24L and landed at 1732 UTC with 464Kgs on board.
- 21 After landing, follow me jeep was provided to park the aircraft on defence apron at Gwalior airport as this was not an operating base for M/s Air India and the only bay was preoccupied by another aircraft.
- 22 Crew shut down the engines and APU was started. APU got tripped off and got auto-shut down shortly after 05 minutes. Three attempts were made to restart the APU however, they were unsuccessful, and aircraft was switched to battery mode.
- 23 Crew requested ATC to disembark the passengers however, ATC did not allow to disembark them as the aircraft was parked in the defence apron. About an hour later, ATC allowed the crew to open the doors for some air circulation and later passengers were allowed to disembark with the help of another airline's step ladder compatible for B737 type aircraft. Passengers were moved to civil arrival hall.
- 24 No damage to aircraft or injury to passengers were reported.

3.2 Probable Causes

Flight crew decision to divert to alternate aerodrome without obtaining the latest weather and attempt to land in deteriorating weather conditions resulted in low fuel and further diversion to unplanned aerodrome led to the situation of emergency landing due to fuel.

Contributory Factors:

1. Company circular on inflight fuel management added additional pressure on the flight crew decision making for commit to land at destination even to use planned alternate fuel to proceed to or hold at destination with the final reserve fuel remaining upon landing.
2. Weather at destination and destination alternate was the contributory factor.

4. Recommendations

1. Air India may revisit/withdraw the tech circular on inflight fuel management as the content of the circular adds confusion to crew decision making process in the critical phases of the flight.
2. M/s Air India may include the incident as case study into the annual refresher training of the crew.

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END
