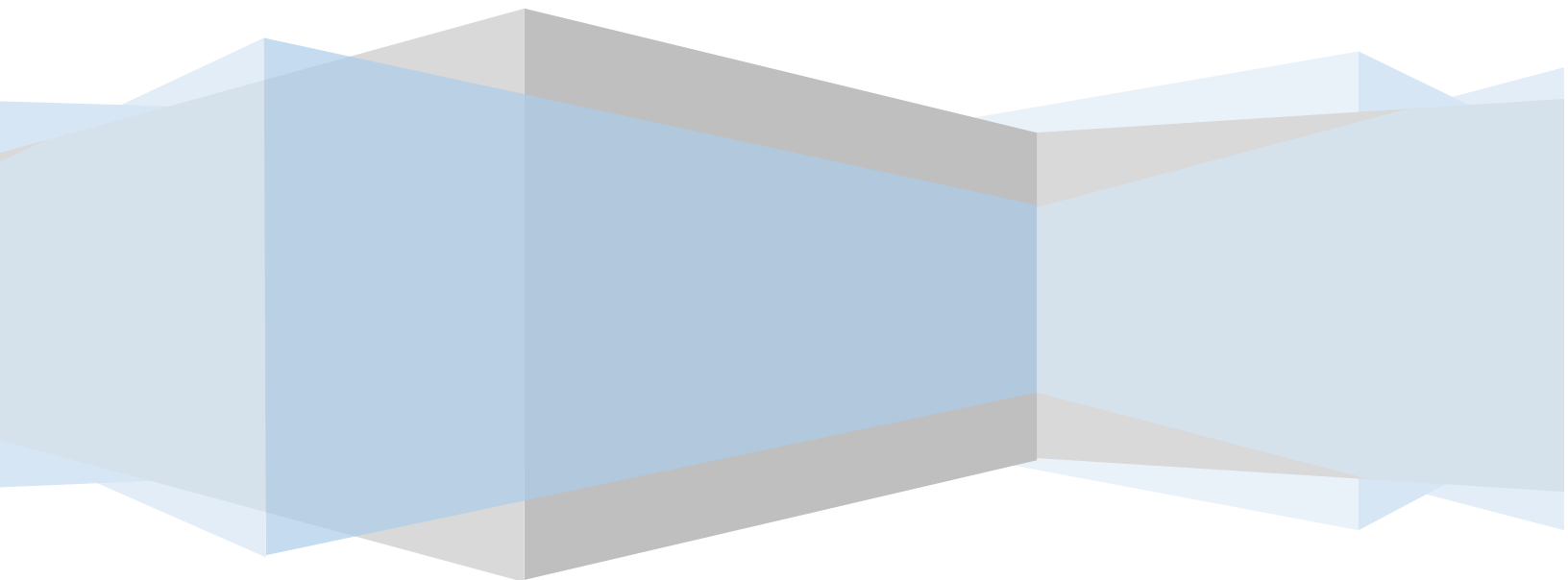


POST OPERATIONS ANALYSIS REPORT

February, 2023

CENTRAL COMMAND CENTER, C-ATFM, DELHI







Contents

A. Executive Summary	4
B. Traffic Analysis	5
I. Air Traffic Movement at Major Airports in India	5
II. Comparison of total ATMs (YoY) and Monthwise	8
III. Flight Operations – Airlinewise	9
C. ATFM Post Operations – CDM Analysis.....	10
I. Introduction	10
II. ATFM Measures Overview.....	11
III. Overall Compliance	12
IV. CTOT Compliance rate – Airportwise	14
VI. Reason For Non Compliance.....	18
VII. Air Delay during the period when ATFM measures were in force.....	19
D. Glossary	22
Annexure-I.....	23



List of Figures

Figure 1: Monthly Traffic Growth.....	4
Figure 2: Average Daily Movements (Jan'23 vs Feb'23)	5
Figure 3: Air Traffic Movement for Delhi – February 2023	6
Figure 4: Air Traffic Movement for Mumbai - February 2023	6
Figure 5: Air Traffic Movement for Bengaluru – February 2023	7
Figure 6: Air Traffic Movement for Hyderabad - February 2023.....	7
Figure 7: Traffic Variation (YoY)	8
Figure 8: Flight Movements –Airlinewise	9
Figure 9: ATFM Measures –February'23	10
Figure 10: Affected Flight Statistics –Feb'23	11
Figure 11: Overall Compliance – Feb'23.....	12
Figure 12: Compliance(Monthwise)	13
Figure 13: Airline wise Compliance –Feb'23	17
Figure 14: Reason for Non-Compliance as provided by FMPs	18
Figure 15: Air Delay distribution during the CDM period.....	19
Figure 16: Average ATFM Delay-Day wise	26
Figure 17: CTOT Compliance- Day wise.....	26
Figure 18: CTOT Compliance- Airline wise	28
Figure 19: Cumulative Air Delay Aero India Show Rehearsals	29
Figure 20: Cumulative Air Delay Aero India Show.....	30



A. Executive Summary

Monthly International air traffic has recorded a growth of 30.5 % whereas the domestic air traffic declined by 27.6 % in the month of February'23 as compared to January'23.

On an average, the Indian Airports in the ATFCM area saw 4758 IFR flights per day in the month of February 2023. The peak day was on 4th February 2023 (4975 IFR flights). Saturday's were the busiest days throughout this month with an average of 4833 domestic IFR flights per day.

Total Twenty Two (22) ATFM measures were applied this month during periods of congestion at Delhi, Mumbai and Bengaluru Airport.

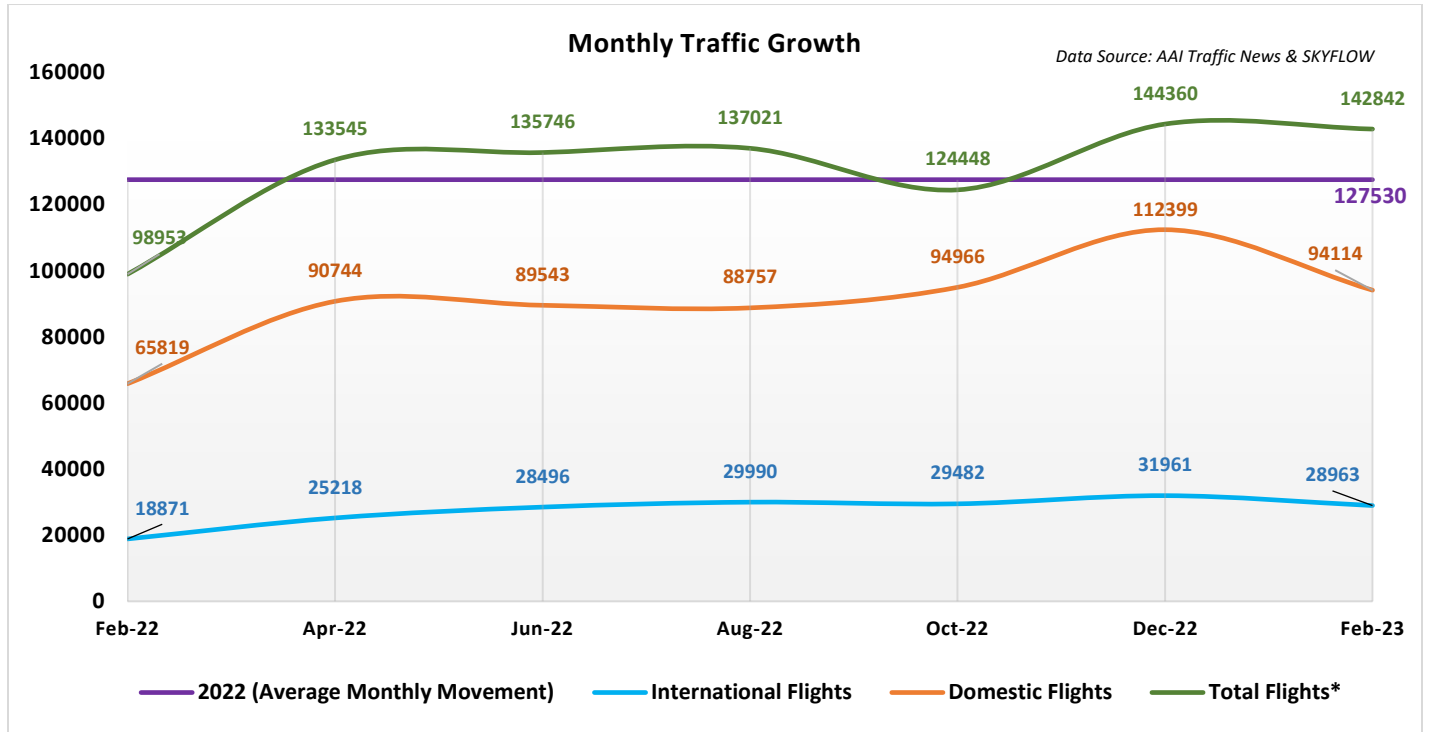


Figure 1: Monthly Traffic Growth

*Total Flights includes flights Overflying Indian Airspace along with Domestic and International traffic landing and taking off from Indian Airports.

The graph above depicts the Domestic and international Air traffic in Indian ATFCM Area during the last 13 months (Feb'2022 to Feb '2023).



B. Traffic Analysis

I. Air Traffic Movement at Major Airports in India

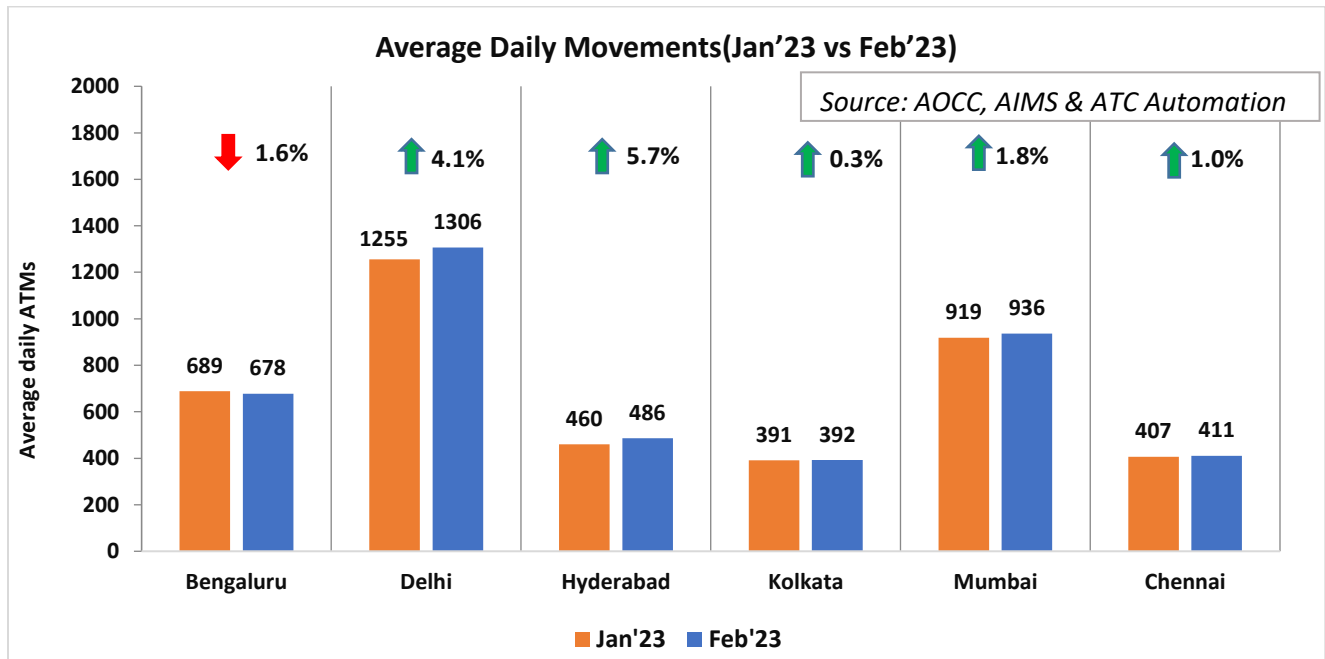


Figure 2: Average Daily Movements (Jan'23 vs Feb'23)

The above chart depicts the percentage change in average daily ATMs at six major Airports in Feb'23 compared to the previous month (Jan'23).

Airports\Year	Avg. Daily ATMs (YoY) for six major airports			
	Feb'20	Feb'21	Feb '22	Feb'23
Bengaluru	681	495	390	678
Delhi	1414	995	1006	1306
Hyderabad	533	357	324	486
Kolkata	485	331	285	392
Mumbai	843	588	604	936
Chennai	502	311	265	411

Major Airports - Bengaluru ,Delhi, Hyderabad, Kolkata, Mumbai and Chennai Airport recorded average daily movements 99.6%,92.4%,91.2%,80.8%,111% and 82% respectively of February 2020 levels(considered here as Pre-Covid level).



Air Traffic Movement for each day in Feb'23 is plotted for Delhi, Mumbai, Bengaluru and Hyderabad Airport along with the percentage change w.r.t. Avg. Daily Movement for the same month.

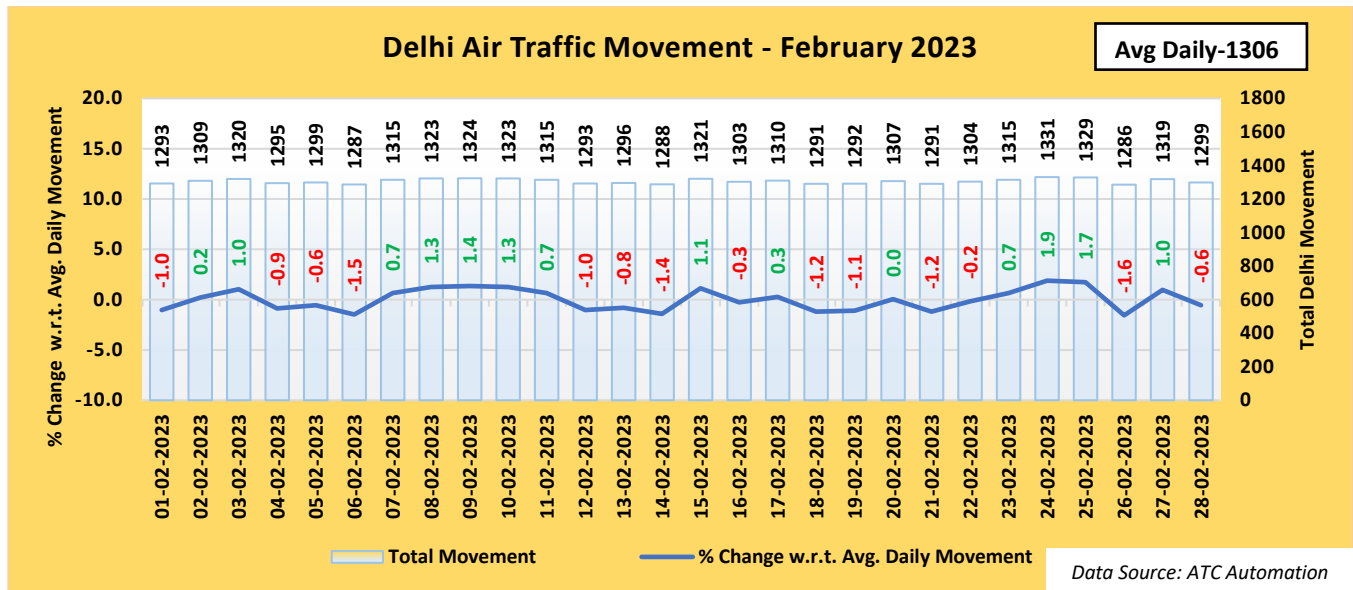


Figure 3: Air Traffic Movement for Delhi – February 2023

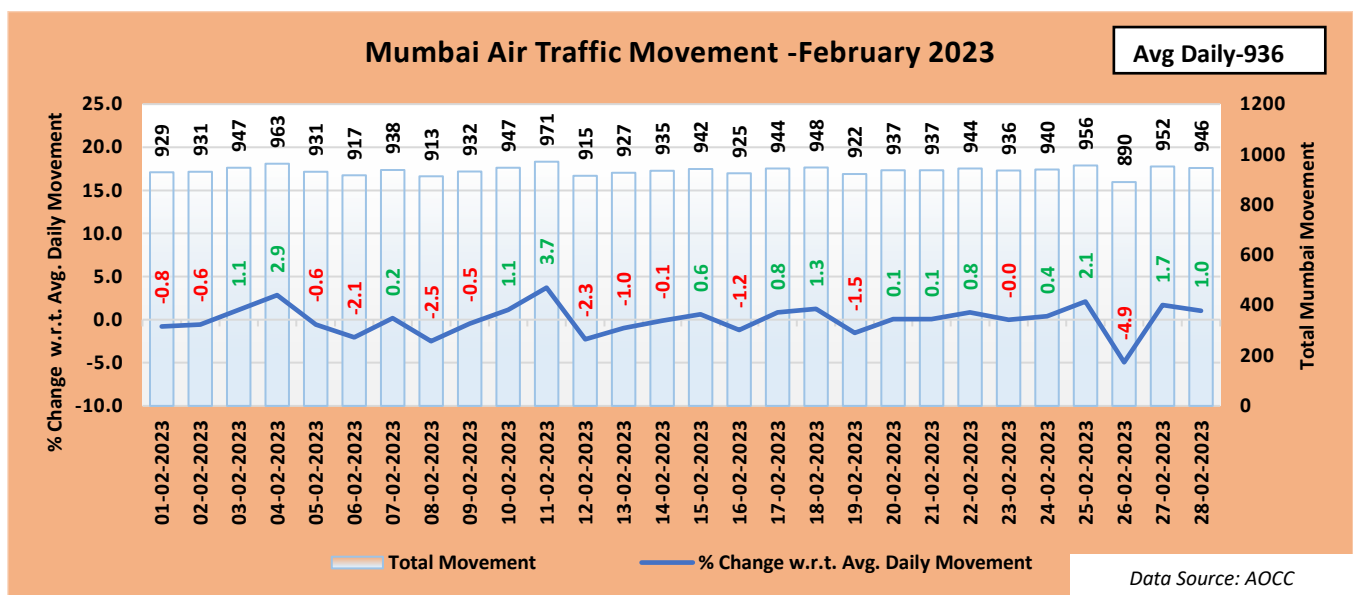


Figure 4: Air Traffic Movement for Mumbai - February 2023

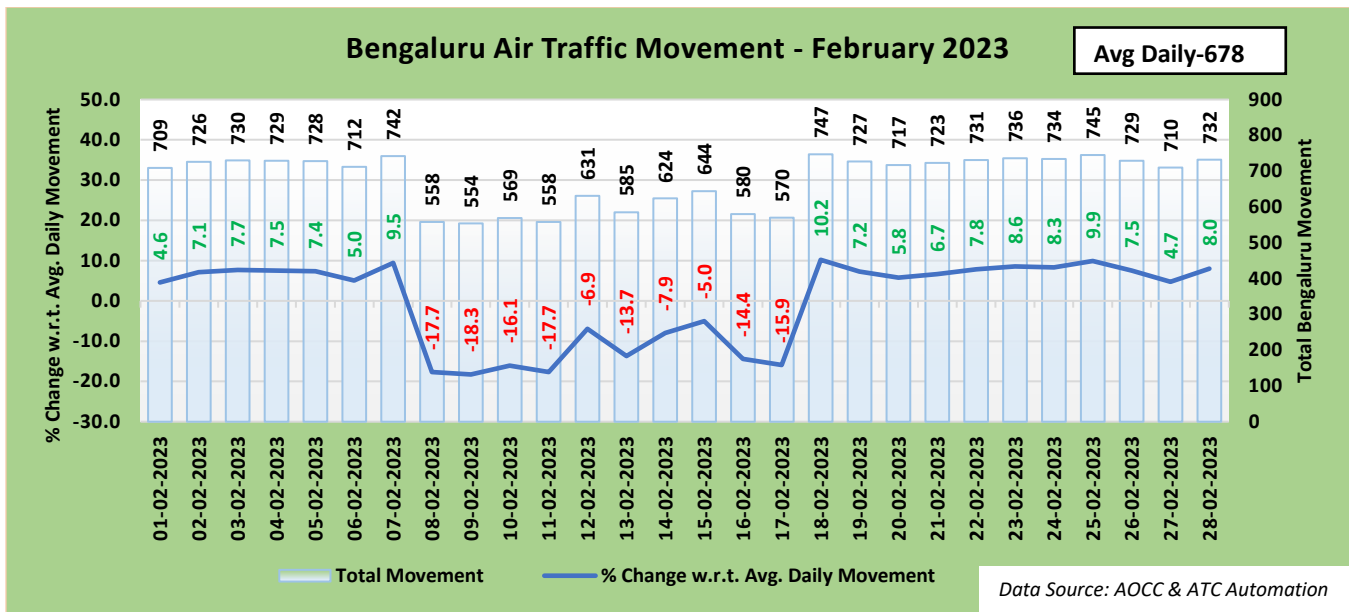


Figure 5: Air Traffic Movement for Bengaluru – February 2023

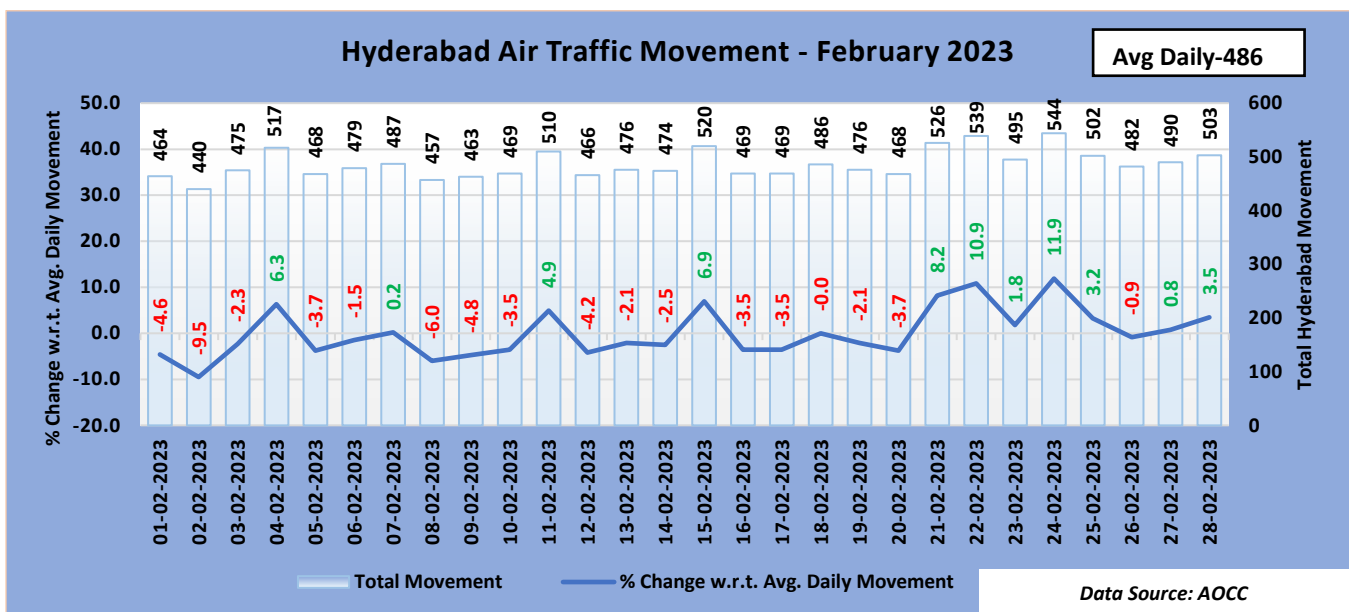


Figure 6: Air Traffic Movement for Hyderabad - February 2023

It is evident from the above charts that on month end(28th February 2023) the ATMs at Delhi decreased by 0.6% while Mumbai, Bengaluru and Hyderabad saw an increase of 1%, 8% and 3.5% respectively as compared to the average daily movement for the month of February'23. The daily movements variation at Bengaluru is more between 8th to 17th Feb'23 due airport/airspace closure associated with Aero India Show.



II. Comparison of total ATMs (YoY) and Monthwise

The total Air traffic movement(ATMS) including Passenger and other flights such as Cargo flights, International scheduled, International non-scheduled, Domestic scheduled, Domestic non-scheduled, Air taxi & commercial business flights at six major Indian Airports namely Delhi, Mumbai, Bengaluru, Hyderabad, Kolkata and Chennai is plotted for the month of February for two consecutive years 2022 and 2023 respectively. Air Traffic movement is also plotted Airline wise for the last six months for the major Scheduled Operators.

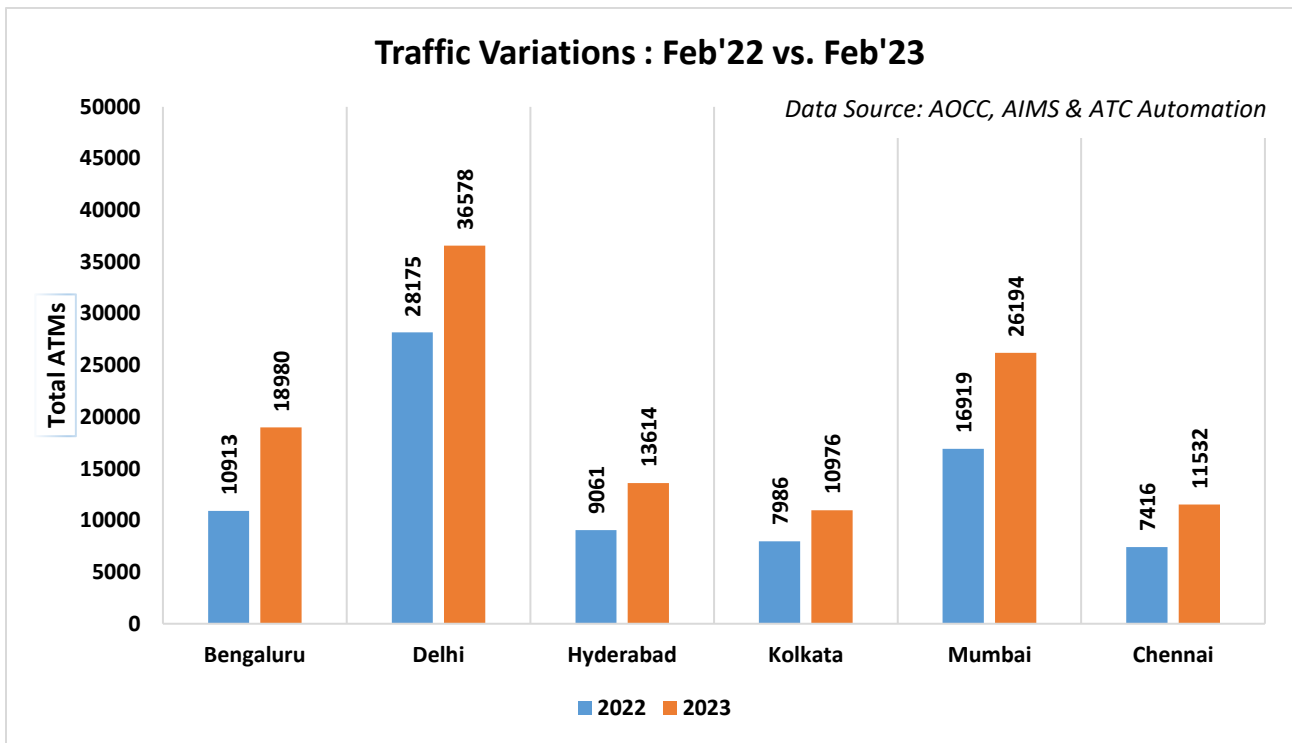


Figure 7: Traffic Variation (YoY)



III. Flight Operations – Airlinewise

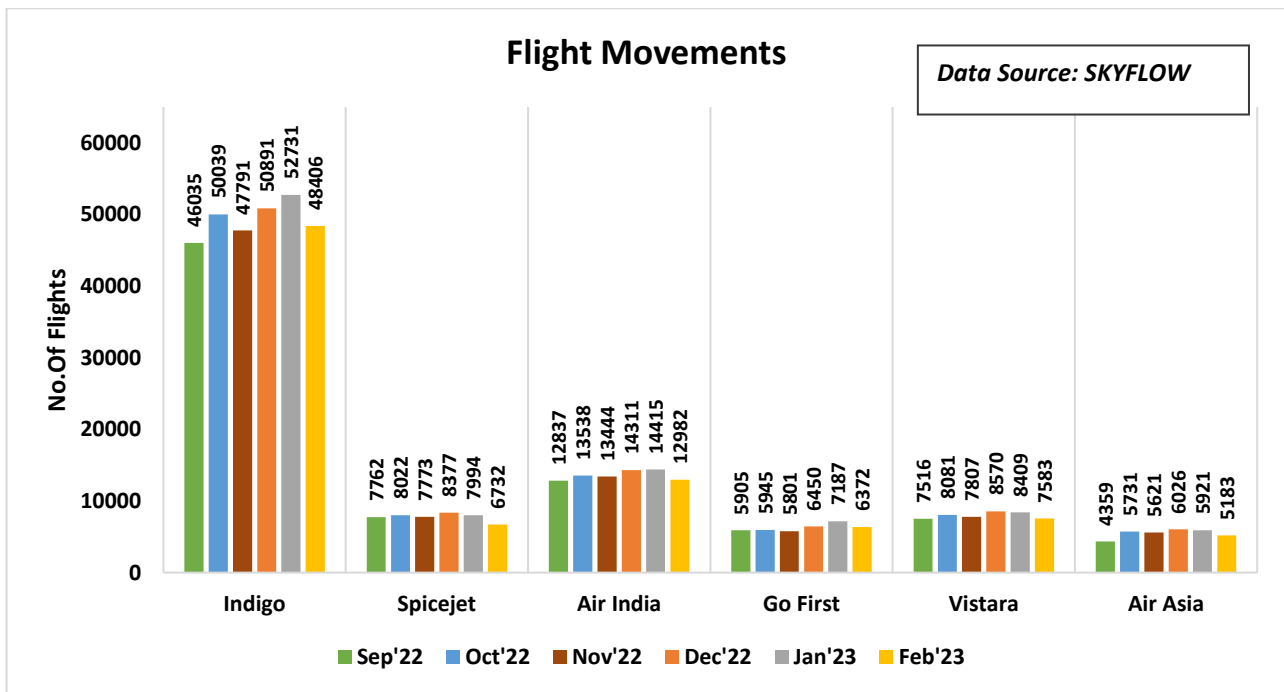


Figure 8: Flight Movements –Airlinewise

Inference:

1. Indigo recorded a higher **average** Flight movements in Feb '23 as compared to Jan'23.



C. ATFM Post Operations – CDM Analysis

I. Introduction

Analysis Period 1st – 28th February'23

Back Ground During the above mentioned period, **six (06)** ATFM measures were applied for **Delhi Airport**, **three (03)** ATFM measures were applied for **Mumbai Airport** and **thirteen (13)** ATFM measures were applied for **Bengaluru Airport** due to the following reasons as illustrated in the bar chart below:-

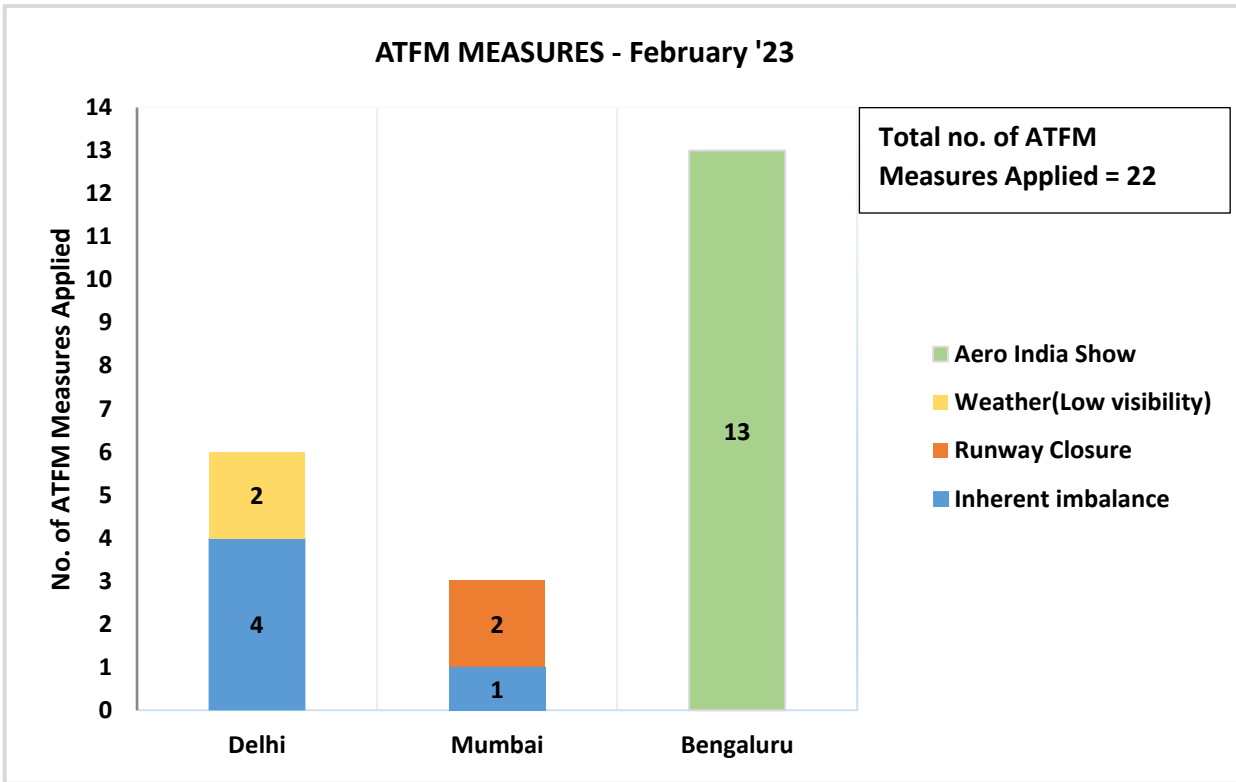


Figure 9: ATFM Measures –February'23



II. ATFM Measures Overview

Constrained Airport	Delhi Airport	Mumbai Airport	Bengaluru Airport
Number of ATFM measures applied	6	3	13
Average ATFM Ground delay(in min) due to measures*	13	12.8	11.4
Maximum ATFM Ground delay(in min) due to measures	52	29	42
% Compliance	74.9	68.3	84.4

Note: * *Average ATFM Delay* = $\frac{\text{Total ATFM Delay}}{\text{Total Domestic Arrivals}}$

Total Arrivals	1071
Total International Arrivals(exempted)	159
Total affected flights in scenario (Domestic Arrivals)	912
Total Domestic Arrivals with zero ATFM delay	140
Total Domestic Arrivals with ATFM delay	772

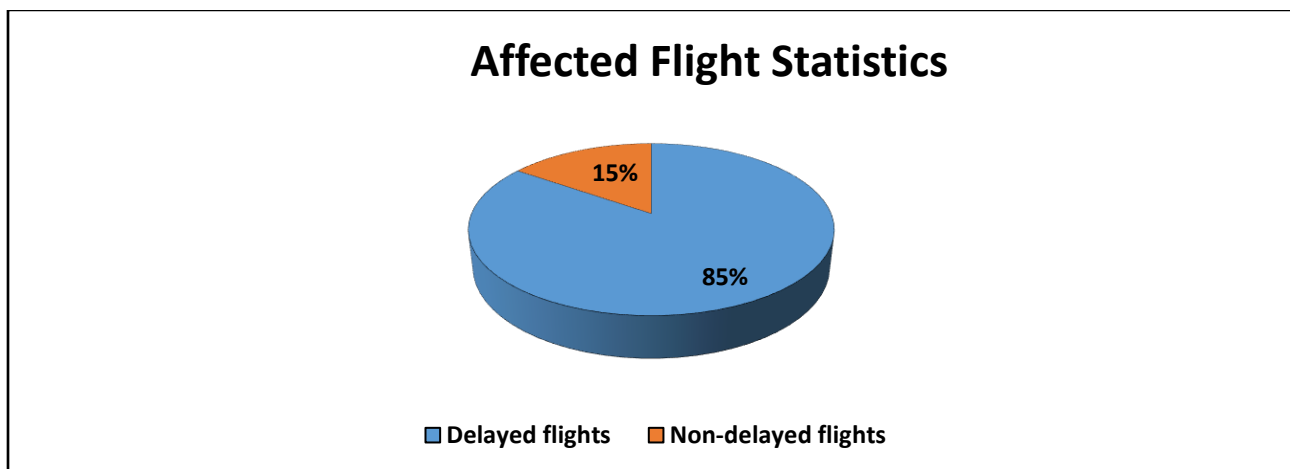


Figure 10: Affected Flight Statistics –Feb'23



III. Overall Compliance

Total arrivals	1071
Domestic arrivals	912
Flights with complete data (ATOT)	896
Flights with incomplete data	8
Flights Not Operated	8
Compliant*	704
Non-Compliant	192

*Total No. of Revised CTOTs issued = 151 (Compliance calculation for flights which were issued revised CTOT is w.r.t. new CTOT issued)

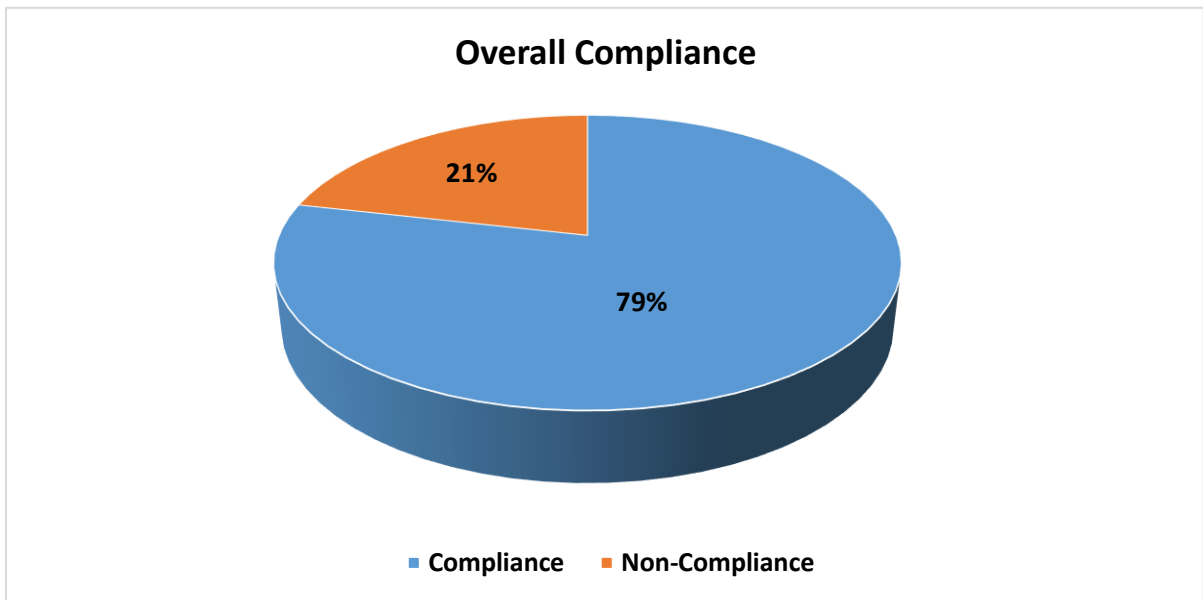


Figure 11: Overall Compliance – Feb’23

NOTE: Flights with required data (i.e. ATOT) are only considered for compliance measurement

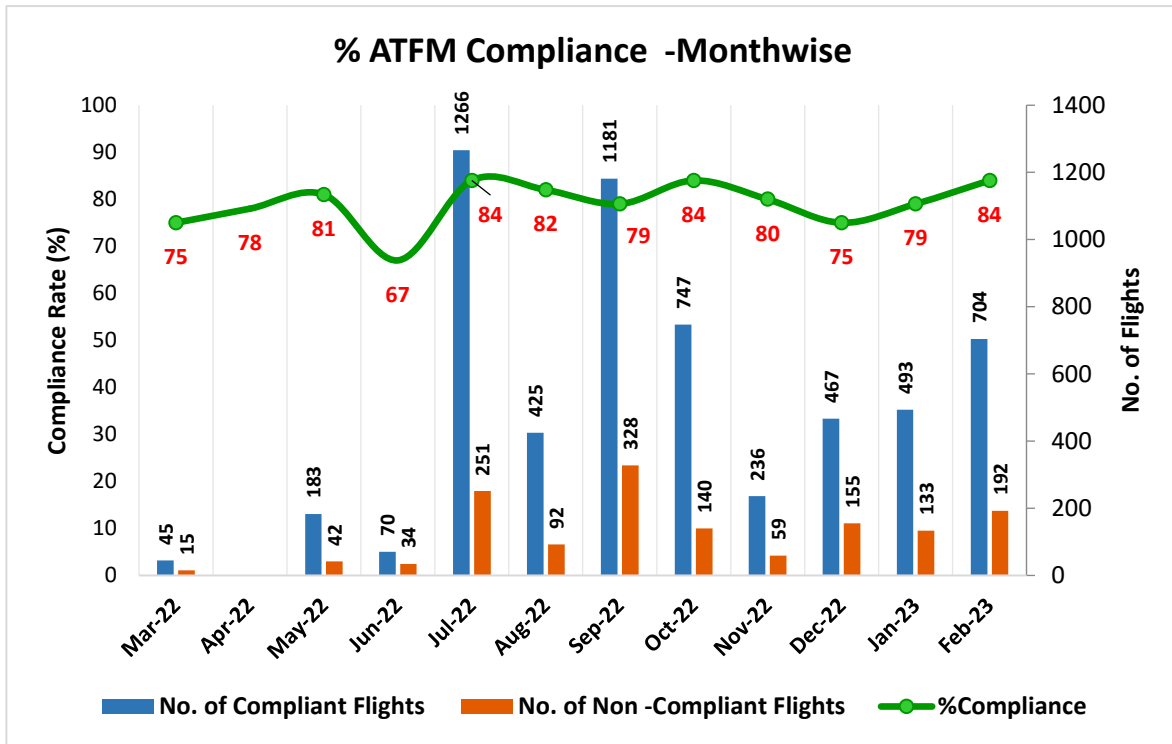


Figure 12: Compliance(Monthwise)

Inference

1. Out of the total arrivals captured(1071 flights) during the CDM scenario for the constrained Airports, 85% of flights i.e. domestic arrivals(912 flights) were candidates for ground delay(participating).
2. Out of these Domestic Arrivals, 85% (772 flights)are assigned ATFM ground delay.
3. Out of the total arrivals captured (1071 flights) to the constrained Airport during the ATFM scenario, only 72% of flights(772 flights) were assigned ATFM Ground Delay.



IV. CTOT Compliance rate – Airportwise

MUMBAI FIR (77%)*	Compliant	Non Compliant	% Compliant
Ahmedabad	15	5	75%
Aurangabad	4	1	80%
Mumbai	55	17	76%
Vadodara	1	0	100%
Bhopal	13	1	93%
Indore	7	2	78%
Jamnagar	3	1	75%
Nagpur	11	2	85%
Pune	13	10	57%
Rajkot	8	1	89%
Shirdi	8	3	73%
Surat	1	1	50%
Udaipur	12	1	92%
KOLKATA FIR (83%)*	Compliant	Non Compliant	% Compliant
Prayagraj	5	4	56%
Agartala	1	1	50%
Siliguri	22	2	92%
Shillong	1	0	100%
Varanasi	17	2	89%
Bhubaneswar	13	0	100%
Kolkata	39	7	85%
Chakeri	2	0	100%
Durgapur	5	1	83%
Gorakhpur	1	3	25%
Guwahati	21	3	88%
Khajuraho	0	1	0%
Dibrugarh	3	1	75%
Patna	22	1	96%
Ranchi	17	6	74%
Raipur	3	2	60%



DELHI FIR (75%)*	Compliant	Non Compliant	% Compliant
Agra	1	2	33%
Amritsar	1	2	33%
Bikaner	0	1	0%
Chandigarh	19	3	86%
Dehradun	9	3	75%
Delhi	47	18	72%
Kangra	1	0	100%
Gwalior	4	2	67%
Jodhpur	9	4	69%
Jaipur	18	0	100%
Jaisalmer	1	2	33%
Jammu	4	2	67%
Leh	1	3	25%
Lucknow	22	3	88%
Pantnagar	1	0	100%
Shimla	1	0	100%
Sarsawa Air Force Station	0	1	0%
Srinagar	8	4	67%
CHENNAI FIR (79%)*	Compliant	Non Compliant	% Compliant
Hal Bangalore	1	0	100%
Bangalore	27	4	87%
Belgaum	7	0	100%
Vijayawada	12	2	86%
Coimbatore	6	0	100%
Kochi	26	2	93%
Calicut	1	0	100%
Kadapa	1	0	100%
MOPA Goa	17	8	68%
Gulbarga	4	1	80%
Goa	20	15	57%
Hubli	11	0	100%
Hyderabad	39	12	76%
Madurai	4	0	100%
Mangalore	0	1	0%
Chennai	31	8	79%



Port Blair	0	2	0%
Sindhudurg	1	1	50%
Tirupati	6	1	86%
Thiruvananthapuram	13	1	93%
Visakhapatnam	7	4	64%

**FIR wise compliance rate*

Note: The above list contains only those airports which had flights to the Constrained Airport and are affected by ATFM measures.

Airports with % compliance less than the average compliance wrt to respective FIRs for the month are highlighted in red.



V. CTOT Compliance rate – Airline wise

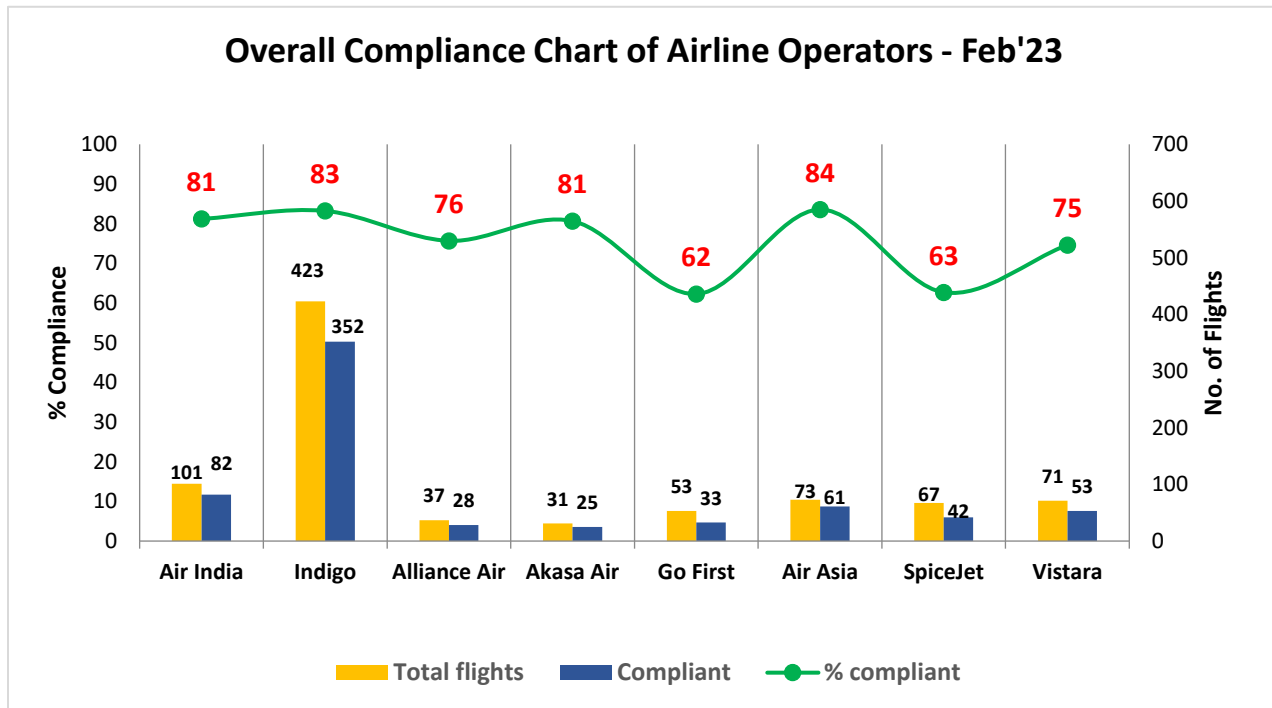


Figure 13: Airline wise Compliance –Feb’23

Inference

1. Out of the total domestic arrivals with complete data in the CDM scenario, 79% arrivals are compliant.
2. Kolkata region has the highest compliance rate of 83% whereas Delhi region has the lowest compliance rate of 75%.
3. Air India, Indigo, Akasa Air and Air Asia Airlines have a CTOT compliance higher than the average recorded compliance for the month of February’23.

VI. Reason For Non Compliance

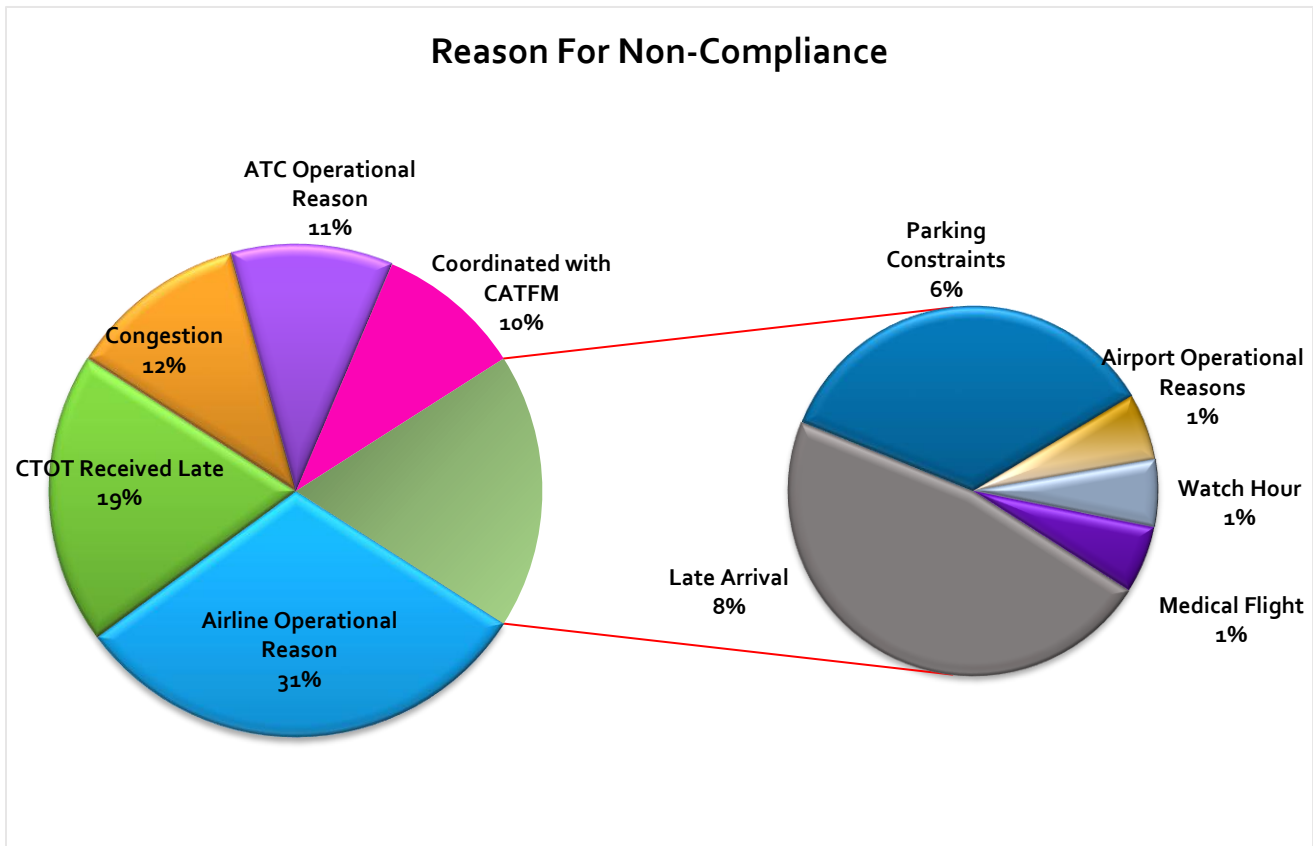


Figure 14: Reason for Non-Compliance as provided by FMPs

Inference:

- 31% of the CTOT Non-compliance was reported by concerned FMP to be because of Airline Operational reason. The revisions in EOBT are initiated very close to the revised departure times, leading to wastage of slots.
- 19% of the CTOT Non-compliance was reported by concerned FMPs due to late receiving of CTOTs and by the time the aircraft had initiated pushed back or startup. Few of the ATFM measures were initiated at short notice resulting in delay in dissemination of CTOTs.



VII. Air Delay during the period when ATFM measures were in force.

Average Air Delay to domestic arrivals* within the CDM Scenario period for Delhi as well as Mumbai Airport was 5 minutes.

*Note: Only calculated for domestic arrivals with both ATOT and ALDT information

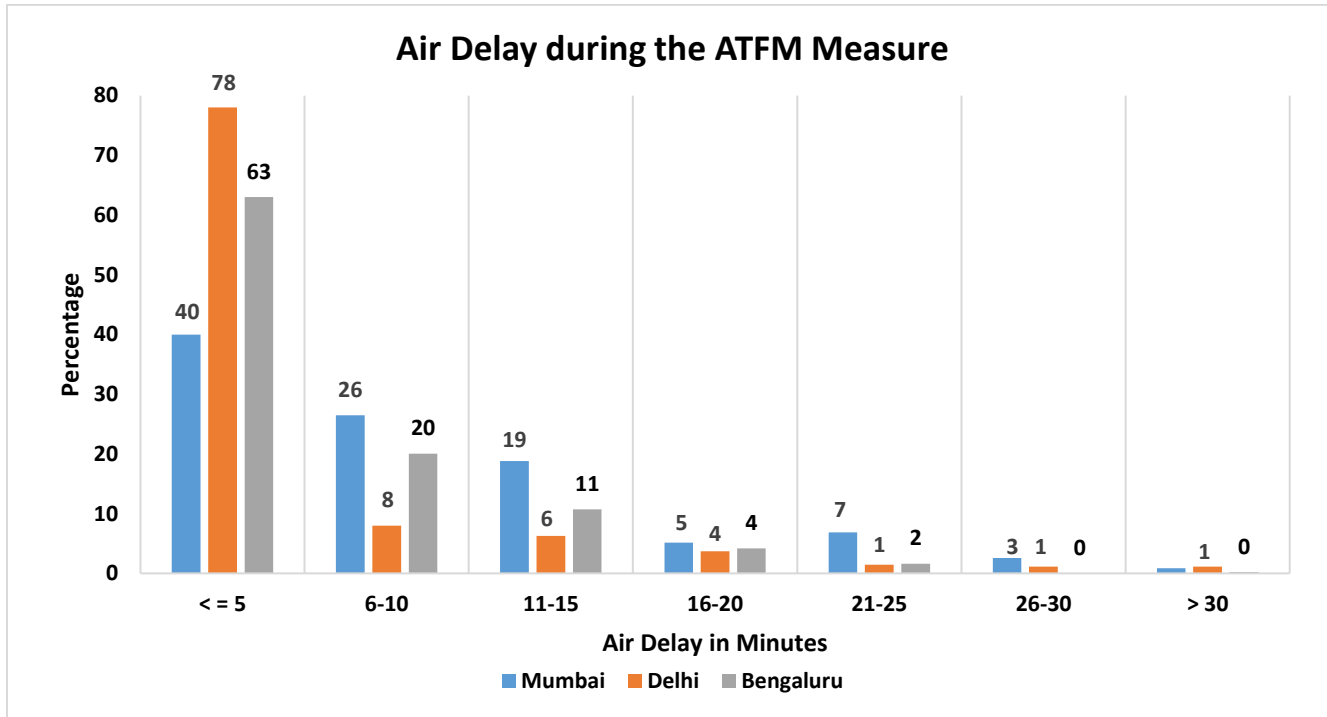


Figure 15: Air Delay distribution during the CDM period

Inference

1. 66% of domestic arriving flights to Mumbai had an Air delay of equal to or less than 10 minutes during the CDM period.
2. 86% of domestic arriving flights to Delhi had an Air delay of equal to or less than 10 minutes during the CDM period.
3. 83% of domestic arriving flights to Bengaluru had an Air delay of equal to or less than 10 minutes during the CDM period.



Tangible Benefits due to ATFM Measures

A modest attempt is made to find out the tangible benefit of ATFM measures applied.

Assumptions:

- When ATFM measures are not in force, all flights take off at their ETOT where Estimated take off time(ETOT)= Estimated off block time(EOBT) + default taxi time
- All flights have an Estimated elapsed time(EET) as calculated by SKYFLOW using the Flight Plan information and Basic Aircraft data.

Methodology:

Air delay (with ATFM measures in force) is calculated during the period when ATFM measures are in force by summing the air delay for all the flights landing at constrained Airport.

i.e. **Total Air Delay = \sum (Actual Flying time – SKYFLOW calculated EET)**

Air delay (with no ATFM measures) is calculated as the sum of Air delay for all the flights during the above said period with no ATFM measures in place and the air delay for each flight is the difference in its ideal landing time and its ideal estimated landing time.

Total Air Delay (with no ATFM measures) = \sum (Ideal LDT - Ideal ELDT)

*Ideal LDT is taken by assuming every flight is landing at a specified interval based on the Arrival acceptance rate(AAR) defined,

*Ideal ELDT = ETOT + SKYFLOW calculated Flying time

Fuel Saving Calculation :

Great Circle Distance(GCD)* was calculated for all the arrivals during the ATFM Measure from the point of origin to destination. Assuming Airbus 320 as reference aircraft for domestic flights (flight distance equal to or less than 3000 nm) and B777 for international flights (flight distance more than 3000nm):

Fuel consumption (Kgs / nm) for each affected flight in the scenario was then calculated using the Reference document: ICAO Carbon emissions calculator methodology, version10, Appendix C: ICAO Fuel Consumption Table.

The Fuel consumed per minute(Kg/min) was calculated for each affected flight.



Total Air Delay(with ATFM Measures)= 2235 mins

Total Air Delay (with no ATFM measures) = 20102 mins

Reduction in Air delay due to ATFM measures= (20102-2235) = **17867 mins**

Fuel Saving Calculation:

Total Fuel saved during the ATFM Measure: **8,63,087.75 Kg**

Total reduction in CO₂ emission : 3.16(KgCO₂/kg fuel)* 8,63,087.75 Kg = 27,27,357.29 Kg

**GCD (Great Circle Distance): The distance between origin and destination airports is derived from latitude and longitude coordinates originally obtained from ICAO Location Indicators database.*

3.16 = constant representing the number of tonnes of CO₂ produced by burning a tonne of aviation fuel.



D. Glossary

ATFM Parameters	Definition
<i>Affected Flight statistics</i>	An insight of participating traffic in the scenario i.e. ratio of the domestic arrivals to the constrained airport affected by ATFM measures (assigned delay by the Ground Delay Program) to the domestic arrivals not affected by ATFM measures (not assigned any delay) within the CDM scenario.
ATFM Ground delay	ATFM ground delay defined as CTOT-ETOT (Calculated take off time – Estimated take off time)
<i>Average ATFM delay</i>	$\frac{\text{Total monthly ATFM delay (in minutes)}}{\text{Total Domestic Arrivals}}$
<i>Maximum ATFM delay</i>	Maximum ATFM delay (in minutes) assigned in the month
<i>Overall compliance rate</i>	Defined as monthly ATFM departure slot adherence rate of regulated flights. Flights having ATOT within the ATFM Slot Tolerance Window (STW) of minus 5 to plus 10 minutes of CTOTs, are considered as compliant flights
<i>CTOT Compliance rate of Airline operators</i>	An overview of CTOT compliance rate of various Airline operators
<i>CTOT Compliance rate of Airports within different Regions</i>	An overview of CTOT compliance rate of Airports within 4 FIRs
Air delay statistics	<p>Air delay defined as difference between AET & EET, where AET (actual elapsed time) can be obtained from (ALDT-ATOT) and estimated elapsed time (EET) can be obtained from FPL/RPL or (CLDT-CTOT). Therefore, Air delay = AET-EET</p> <p>Average Air Delay is calculated as:</p> $\text{Average Air Delay} = \frac{\text{Total Air Delay to domestic arrivals (with values greater than zero)}}{\text{Total Domestic Arrivals}}$ <p>CLDT: Calculated Landing Time CTOT: Calculated Take off Time ALDT: Actual Landing Time ATOT: Actual Take off Time</p>



Annexure-I

CASE STUDY
Bengaluru Aero India show (2023)



A. Introduction:

The biennial air show and aviation expo, Aero India 2023, was scheduled for February 13–17 at Yelahanka Air Force Station in Bengaluru. Due to rehearsals, the Airport and Airspace around Bengaluru Airport was closed from 8th Feb'23 to 17th Feb'23 during various periods of the day as per the NOTAM below:

(A0234/23 NOTAMN

Q) VOMF/QFALC/IV/NBO/A/000/999/

A) VOBL B) 2302080330 C) 2302171130

D) 08-11 0330-0630 0830-1130

12-13 0330-0630

14-15 0630-0900

16-17 0400-0630 0830-1130

E) AS A CONSEQUENCE OF AIRSPACE CLOSURE IN CONNECTION WITH AERO INDIA SHOW 2023 KEMPEGOWDA INTERNATIONAL AIRPORT, BENGALURU WILL REMAIN CLSD FOR ACFT OPS)

(A0233/23 NOTAMN

Q) VOMF/QRALW/IV/NBO/W/000/150/

A) VOMF B) 2302080330 C) 2302171130

D) 08-11 0330-0630 0830-1130

12-13 0330-0630

14-15 0630-0900

16-17 0400-0630 0830-1130

E) AIRSPACE BOUNDED BY 130100N0773300E TO 131156N0771401E ALONG WITH CLOCKWISE ARC CENTERED AT HAL AP VOR BBG TILL 131143N0780737E-130100N0774800E-130100N0773300E CLSD DUE AERO INDIA SHOW 2023

F) GND G) FL150)



B. Executive Summary

A virtual meeting was conducted on 7th Feb'23 with Bengaluru ATC and AOCC to decide on the possible strategy to handle the upcoming event. Operational planning by Bengaluru ATC was shared well in advance with CCC.

Bengaluru AOCC promptly shared the scheduled approved for the days of the exercise. Since the AOCC data captured scheduled off block and in block time of flights departing and arriving to/from Bengaluru, all domestic airlines were also requested to share their flight intent.

The flight data received from the Airlines was updated in the SKYFLOW system. CCC officers also cross-checked the flight intent on the "D" day against the schedule received from AOCC each morning.

Bengaluru WSO was appointed as the nodal officer for effective coordination with CCC along with different coordinators for different units. The coordinator was responsible for communicating the Airport acceptance rate, the availability of Airport/Airspace and any other operational matter impacting efficiency and capacity.

Operations were observed to be smooth on most days of the exercise with slight airborne holdings on one day.

On all days of the Aero India Show a representative from Indigo and Air India Airlines were present in CCC. •

CCC had planned to apply ATFM measures 'pre-closure', 'in between the closures' and 'post closure' subject to any demand capacity imbalance.

No exercise was conducted on 12th Feb'23. ATFM measures for the afternoon closure (0830-1130 UTC) were withdrawn after application of CDM measures on 11th and 16th Feb'23 due to early availability of Airspace.

C. Salient Points:

As informed by the Bengaluru operations, following points were to be kept in mind by CCC officers while planning ATFM measures for the closure.

- The last arrival was planned to land at least ten (10) minutes before the start of closure timings. This was to accommodate any unforeseen missed approach and subsequent clearing of the designated airspace. In case any arrival was not able to meet this criterion, the aircraft was not be allowed to enter the designated airspace.
- First arrival after closure was to be planned after 10 minutes of availability of Airport/Airspace.

D. Challenges:

1. Non-compliance of CTOT was observed from Delhi, Mumbai, Pune, Agra, Gwalior ,MOPA etc on initial days of the show.
2. Few flights which were scheduled to operate post-closure were observed to be operating before the Airspace closure and had to be manually allotted a CTOT.
3. Conflicting reports were received from different officers appointed as coordinators from Bengaluru ATC.



E. Overview:

The data for the period during which ATFM measures were applied in Bengaluru on 8th, 9th, 10th, 11th, 13th, 14th, 15th, 16th & 17th February 2023 was analyzed for following ATFM parameters.

(Flights with complete data i.e. ATOT, ALDT etc. are only taken into consideration. ATOT was obtained from all concerned airports for verifying CTOT compliance.)

I. Average ATFM Delay – Day wise:

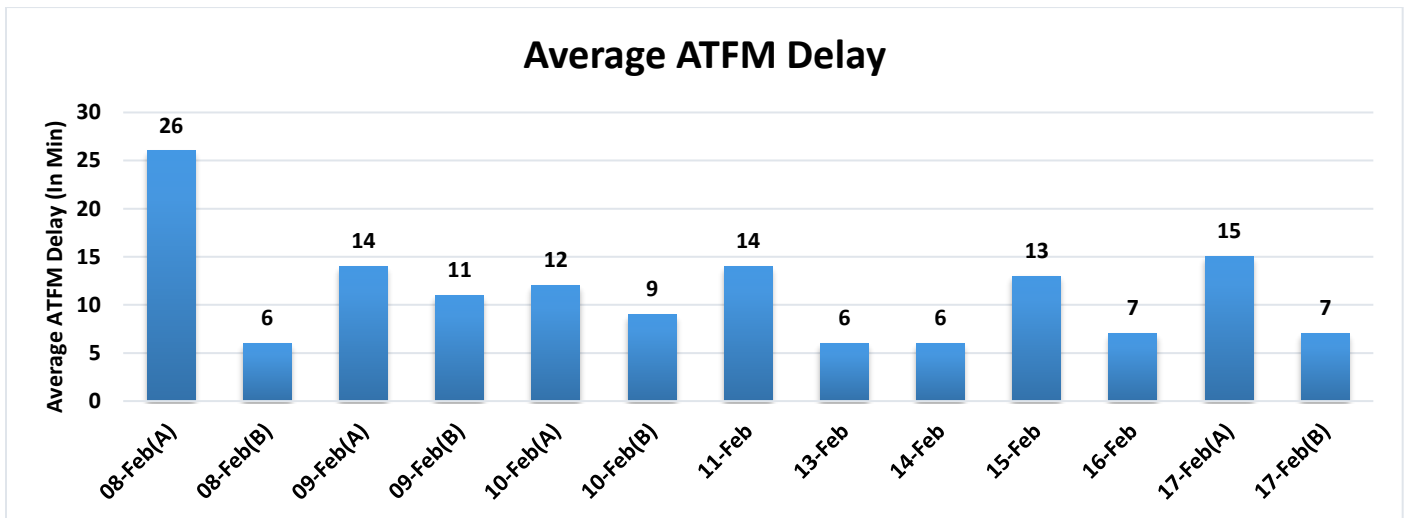


Figure 16: Average ATFM Delay-Day wise

II. CTOT Compliance – Day wise:

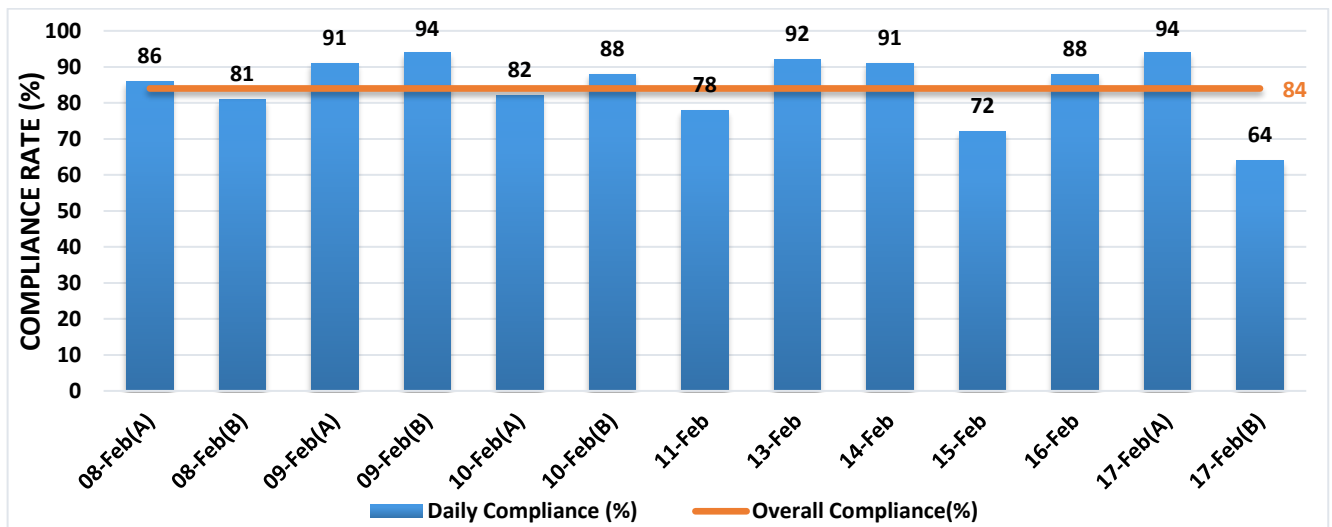


Figure 17: CTOT Compliance- Day wise



III. CTOT Compliance – FIR wise:

MUMBAI FIR (83%)*	Compliant	Non Compliant	%Compliant
Ahmedabad	10	0	100%
Mumbai	26	5	84%
Bhopal	7	0	100%
Indore	5	1	83%
Jamnagar	1	1	50%
Nagpur	3	1	75%
Pune	4	3	57%
Rajkot	3	0	100%
Shirdi	2	2	50%
Udaipur	4	0	100%
KOLKATA FIR (91%)*			
Prayagraj	3	1	75%
Siliguri	14	1	93%
Varanasi	9	0	100%
Bhubaneswar	9	0	100%
Kolkata	21	3	88%
Chakeri	2	0	100%
Durgapur	1	1	50%
Guwahati	7	1	88%
Patna	11	0	100%
Ranchi	12	2	86%
DELHI FIR (78%)*			
Agra	1	2	33%
Chandigarh	10	1	91%
Delhi	38	15	72%
Gwalior	4	1	80%
Jodhpur	6	0	100%
Jaipur	8	0	100%
Lucknow	9	2	82%
CHENNAI FIR (85%)*			
Belgaum	7	0	100%
Vijayawada	11	2	85%
Kochi	20	1	95%
Kadapa	1	0	100%
MOPA Goa	13	8	62%
Gulbarga	3	1	75%
Goa	6	3	67%



Hubli	9	0	100%
Hyderabad	25	1	96%
Chennai	15	1	94%
Port Blair	0	2	0%
Tirupati	6	1	86%
Thiruvananthapuram	9	0	100%
Visakhapatnam	7	4	64%

Inference

- Kolkata FIR had the highest compliance rate of 91% whereas Delhi FIR had the minimum compliance rate of 78%.

IV. CTOT Compliance – Airline wise:

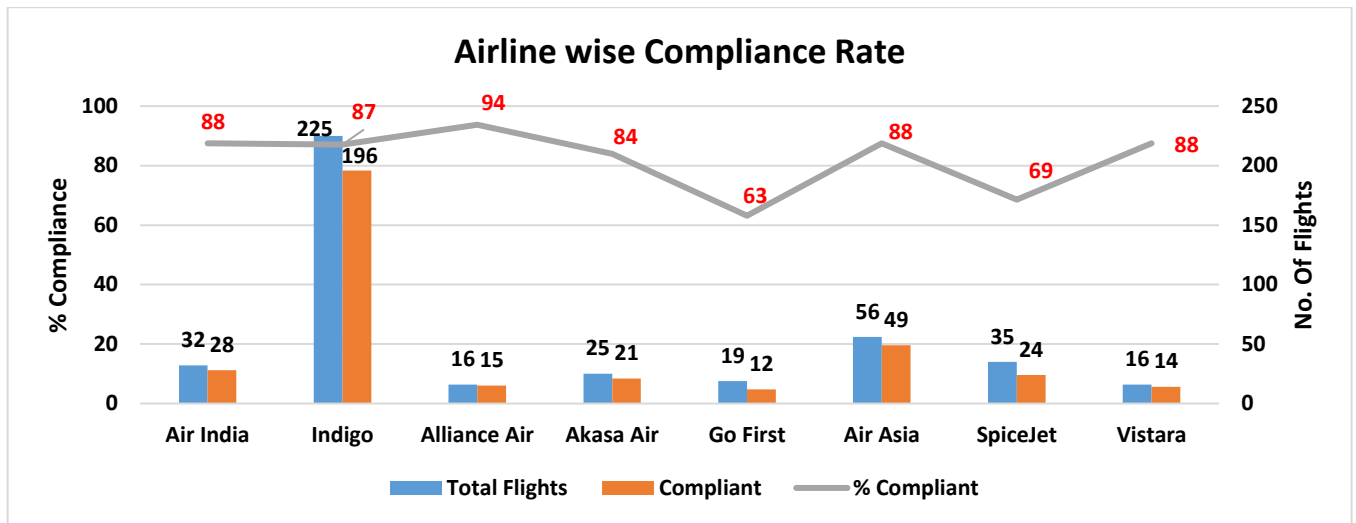


Figure 18: CTOT Compliance- Airline wise

Inference

- Go first and Spicejet airlines have a compliance lower than the average recorded percentage compliance.



V. Cumulative Air Delay:

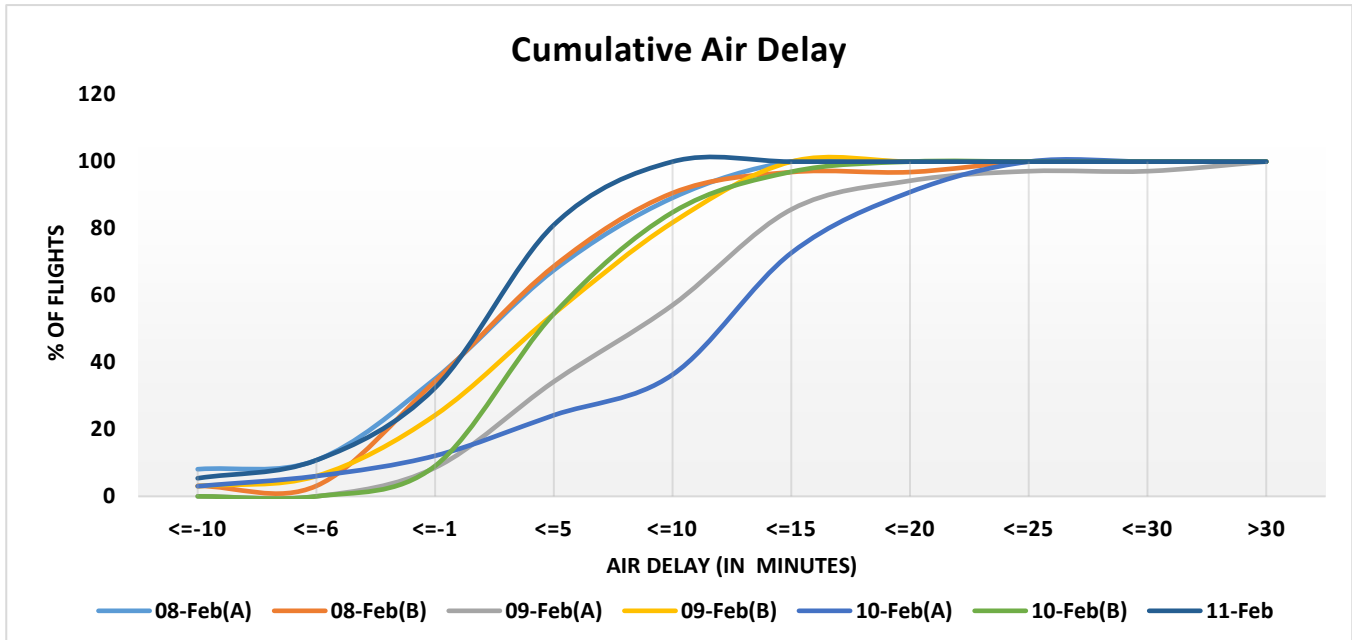


Figure 19: Cumulative Air Delay Aero India Show Rehersals

Inference:

1. 89% of arriving flights to Bengaluru had an Air delay of equal to or less than 10 minutes during the first CDM period on 08th Feb'23.
2. 91% of arriving flights to Bengaluru had an Air delay of equal to or less than 10 minutes during the second CDM period on 08th Feb'23.
3. 57% of arriving flights to Bengaluru had an Air delay of equal to or less than 10 minutes during the first CDM period on 09th Feb'23.
4. 82% of arriving flights to Bengaluru had an Air delay of equal to or less than 10 minutes during the second CDM period on 09th Feb'23.
5. 36% of arriving flights to Bengaluru had an Air delay of equal to or less than 10 minutes during the first CDM period on 10th Feb'23.
6. 85% of arriving flights to Bengaluru had an Air delay of equal to or less than 10 minutes during the second CDM period on 10th Feb'23.
7. 100% of arriving flights to Bengaluru had an Air delay of equal to or less than 10 minutes during the CDM period on 11th Feb'23.

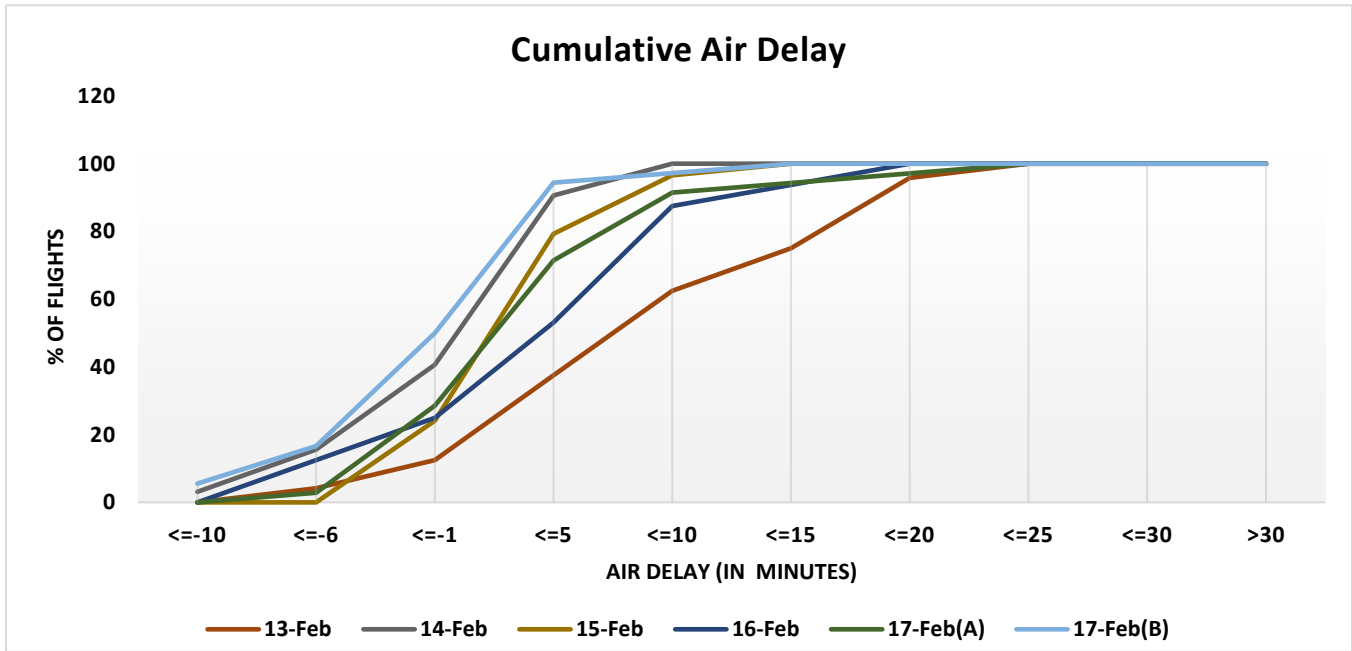


Figure 20: Cumulative Air Delay Aero India Show

Inference:

1. 63% of arriving flights to Bengaluru had an Air delay of equal to or less than 10 minutes during the CDM period on 13th Feb'23.
2. 100% of arriving flights to Bengaluru had an Air delay of equal to or less than 10 minutes during the CDM period on 14th Feb'23.
3. 97% of arriving flights to Bengaluru had an Air delay of equal to or less than 10 minutes during the CDM period on 15th Feb'23.
4. 88% of arriving flights to Bengaluru had an Air delay of equal to or less than 10 minutes during the CDM period on 16th Feb'23.
5. 91% of arriving flights to Bengaluru had an Air delay of equal to or less than 10 minutes during the first CDM period on 17th Feb'23.
6. 97% of arriving flights to Bengaluru had an Air delay of equal to or less than 10 minutes during the second CDM period on 17th Feb'23.

**F. Fuel Saving due to ATFM Measures during the Aero India Show closure:**

The Fuel consumed per minute(Kg/min) was calculated for each affected flight.

Total Air delay (with ATFM measures) = **1402 min**

Total Air delay (with no ATFM measures) = **11494 min**

Total amount of Air delay reduced due to ATFM measures= 11494-1402= **10092 min**

Fuel Saving Calculation:

Total Fuel saved during the ATFM Measure: **479538.08 Kgs**

Total reduction in CO₂ emission : 3.16(KgCO₂/kg fuel)* 479538.08 Kgs= 15,15,340 Kg

3.16 = constant representing the number of tonnes of CO₂ produced by burning a tonne of aviation fuel.

Date	ATFM Ground Delay (in mins)	Time Saving (in mins)	Fuel Saving (in Tons)	Reduction in CO ₂ emission (in Tons)
08-Feb-23(A)	26	835	41.111	129.911
08-Feb-23(B)	6	845	42.442	134.117
09-Feb-23(A)	14	878	40.708	128.637
09-Feb-23(B)	11	815	37.053	117.087
10-Feb-23(A)	12	490	18.315	57.875
10-Feb-23(B)	9	999	44.237	139.789
11-Feb-23	14	1154	46.503	146.949
13-Feb-23	6	522	27.794	87.829
14-Feb-23	6	253	13.279	41.962
15-Feb-23	13	505	23.023	72.753
16-Feb-23	7	567	31.865	100.693
17-Feb-23(A)	15	1311	59.263	187.271
17-Feb-23(B)	7	918	53.945	170.466
Total	146	10092	479.538	1515.340

-X-