*International Civil Aviation Organization*

**Thirteenth Meeting of the Asia/Pacific Air Traffic Flow Management Steering Group (ATFM/SG/13)**

Bangkok, Thailand, 03 – 07 April 2023

**Agenda Item 4: Review of Current ATFM Operations and Problem Areas**

# ATFM POST OPERATIONS ANALYSIS

(Presented by India)

**SUMMARY**

This paper presents a set of performance metrics captured for applied ATFM measures in the year 2022.It highlights the challenges faced in data assimilation and lessons learnt.

## 1. INTRODUCTION

1.1 Doc9971 has emphasized the need of developing a methodology to balance demand and capacity for minimizing the effects of ATM system constraints. This can be accomplished through the application of an "ATFM planning and management" process, wherein airport operators, ANSPs, AUs, military authorities, and other stakeholders work together to improve the performance of the ATM system.

1.2 The final step in the ATFM planning and management process is the post-operations analysis phase. The analytical process is aimed at measuring, investigating and reporting on operational processes and activities identifying best practices and lessons learnt meant for further improving the ATFM operations.

1.3 Since the commencement of ATFM operations in India in 2017, various performance indicators aligned with DOC9971 and Asia Pacific post operations analysis recommended framework such as 'Demand Analysis', 'ATFM Measure Metrics and Analysis' and 'Case studies' are captured, reviewed and shared regularly with all concerned stakeholders.

1.4 Post operations analysis is also conducted following an application of ATFM measures for evaluating the planned outcome versus actual ATFM operations, Flight data accuracy, Airlines, Airport &ATC participation, reason for non-compliance, reduction in Air delay due to application of ATFM measures leading to Fuel saving and reduction in CO2 emissions etc.

## 2. DISCUSSION

Post Operations Analysis Process

2.1 Various ATFM parameters used for Post operations analysis for the calendar year 2022 are presented below:

a) **Traffic Analysis:** The graph below depicts the Domestic and international Air traffic month-wise in the Indian ATFCM Area for the year 2022. The total monthly traffic (domestic, international including overflying) surpassed the average monthly movement of 2019 in March 2022 whereas the Domestic flight movement recorded a 4.6% increase in Dec'22 against the same reference(Pre-Covid levels)

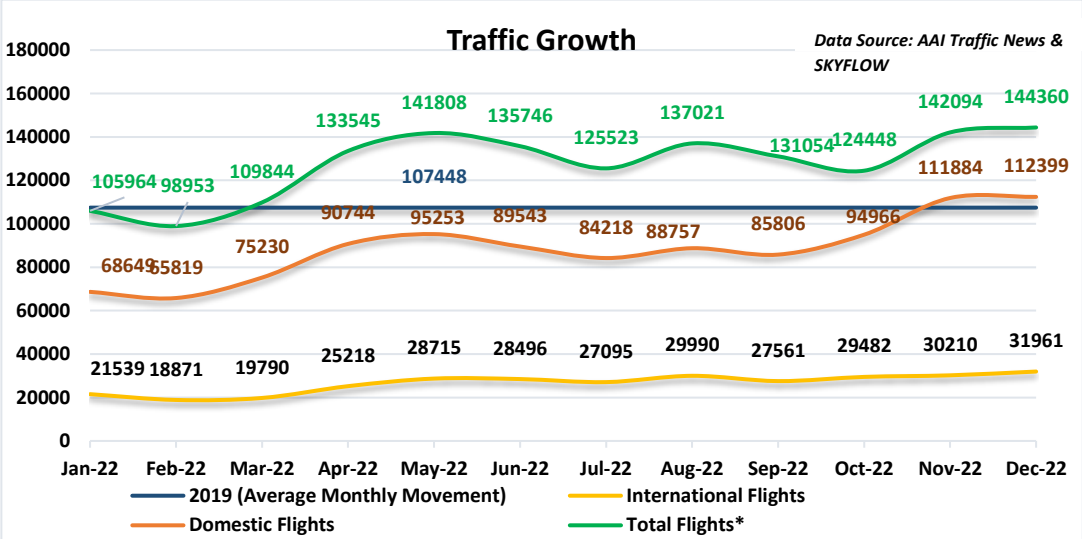


**Figure 1:** Traffic Growth

b) **Monthly Average Air Traffic Movement:** The graph below tracks the Monthly average Air Traffic Movements for three major Airports- Delhi, Mumbai and Bengaluru in India from January'20 to December'22. The Average Monthly ATMs in Delhi, Mumbai and Bengaluru stands at a deficit of 6, 1 and 4 percent respectively than the Average Monthly ATM recorded in January 2020 for the same Airports.

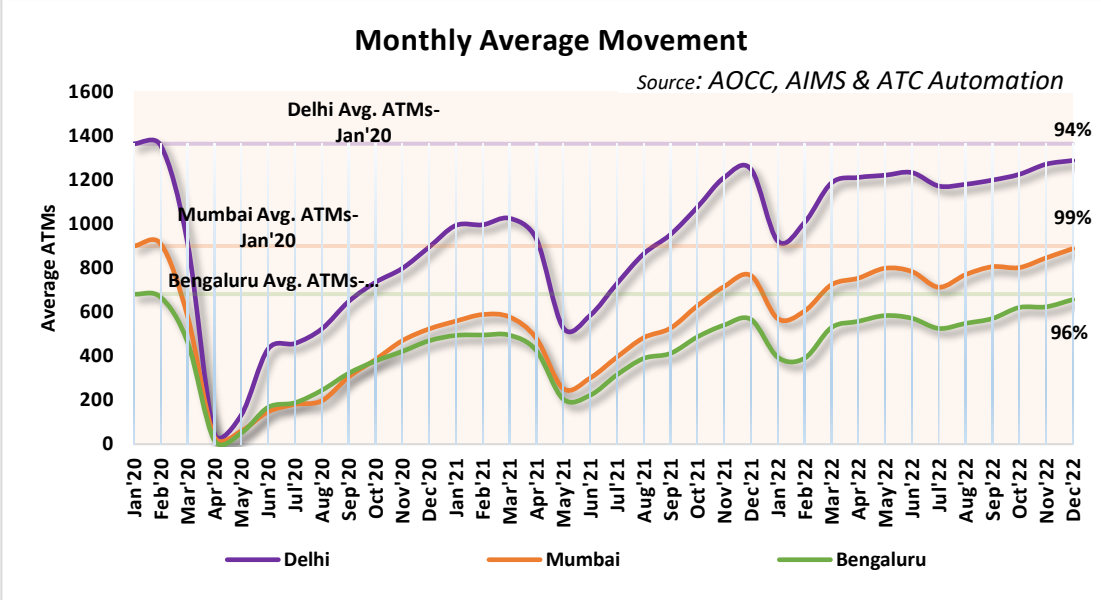


**Figure 2:** Monthly Average Air Traffic Movement for Three Major Airports

c) **ATFM Post Operations – CDM Analysis**

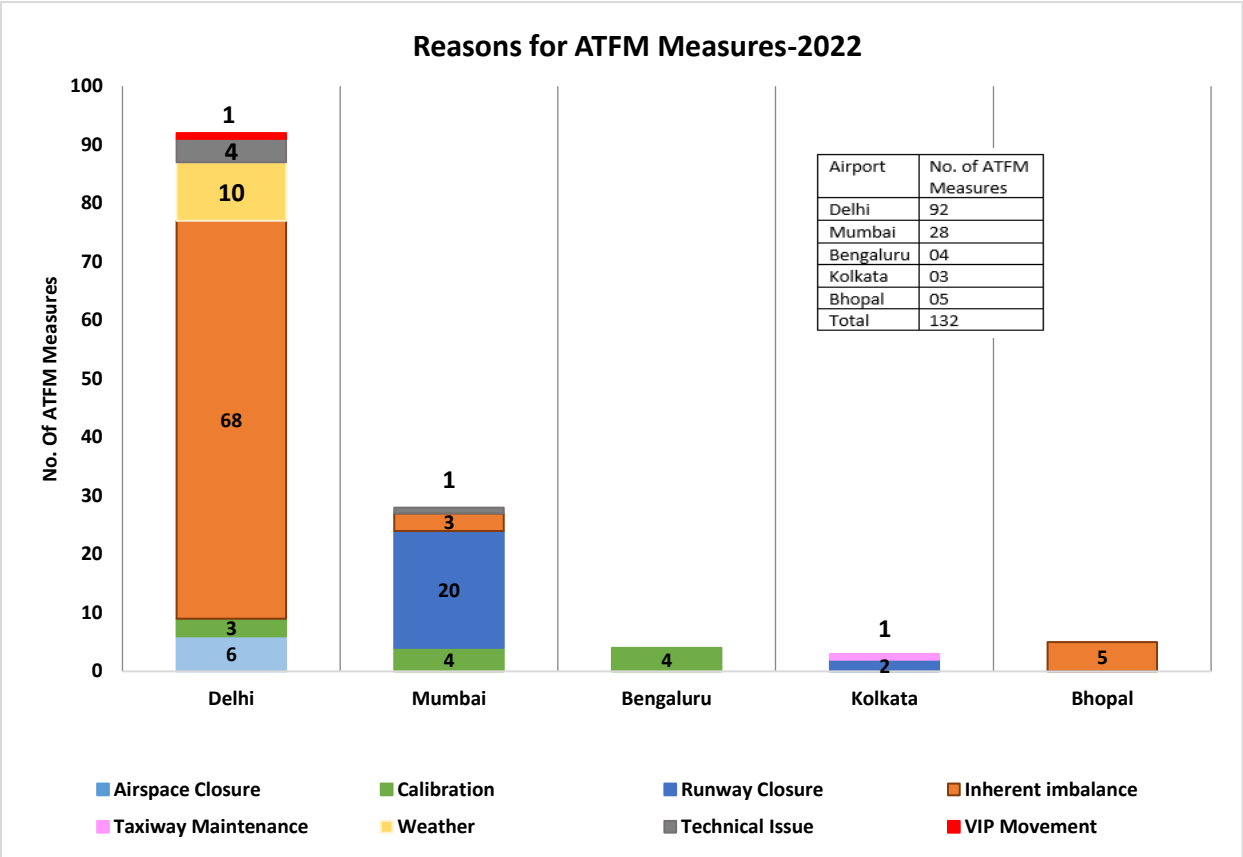


**Figure 3:** ATFM Measures – 2022

d) **Affected flight Statistics:**

| | |
|---|---|
| Total affected flights in scenario (Domestic Arrivals) | 6447 |
| Total Domestic Arrivals with zero ATFM delay | 1084 |
| Total Domestic Arrivals with ATFM delay | 5393 |

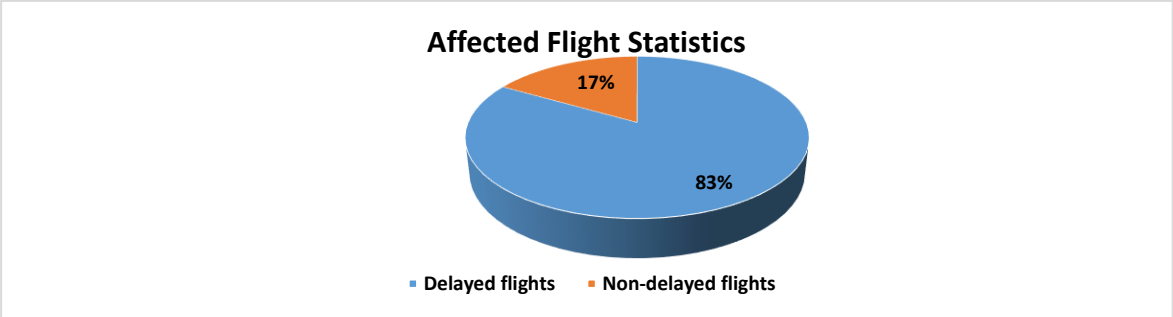


**Figure 4:** Affected flight statistics

| | Delhi | Mumbai | Bengaluru | Kolkata | Bhopal |
|---|---|---|---|---|---|
| **Average ATFM Ground delay due to measures** | 8.3 min | 14.5 min | 16 min | 16.5 min | 12 min |
| **Maximum ATFM Ground delay due to measures** | 121 min | 55 min | 49 min | 43 min | 35 min |
| **% Compliance** | 76.6% | 82.4% | 82% | 80% | 80% |

e) **Percentage Compliance:** CTOT compliance of the flights is measured Airport and Airlines wise and shared through monthly post operation analysis Report.

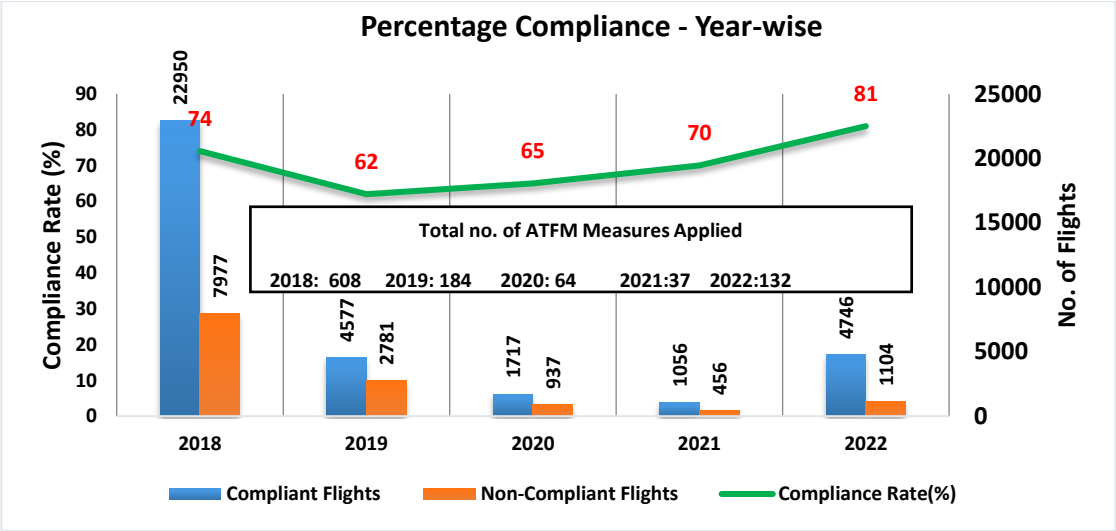


**Figure 5:** Compliance (%) Year-wise

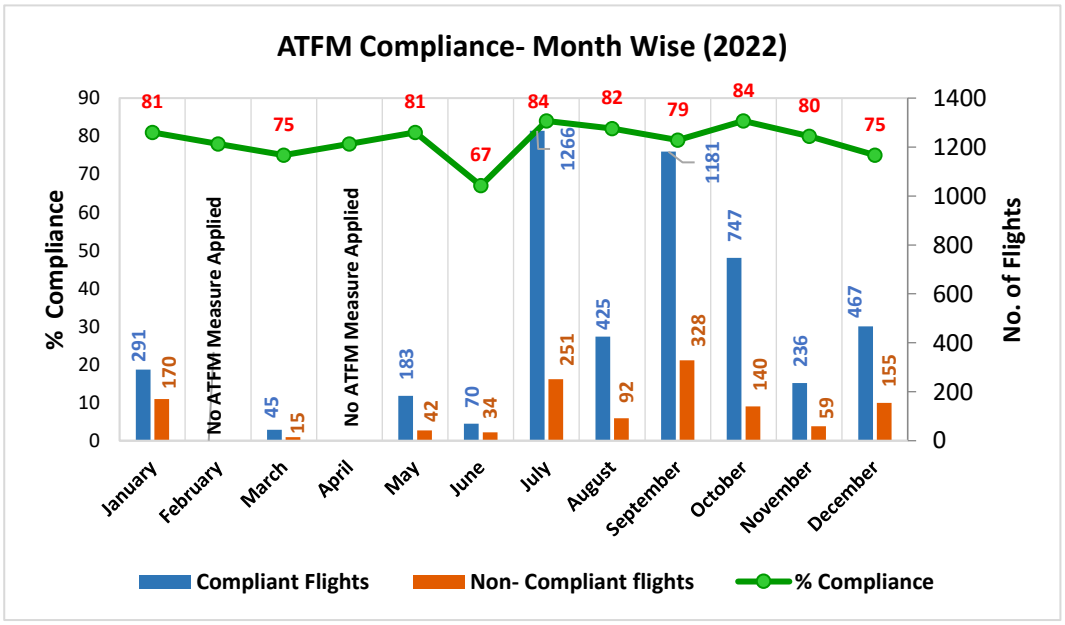


**Figure 6:** Compliance (%) month-wise 2022

f) **Reason for Non-Compliance (2022)**

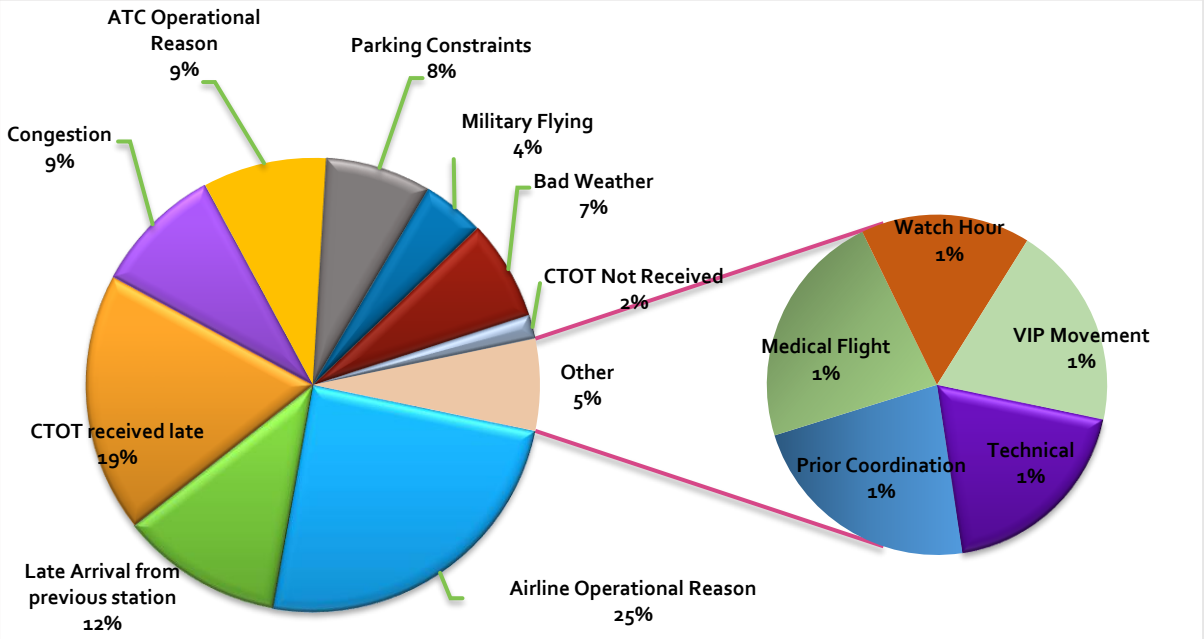


**Figure 7**: Reason for Non-Compliance for year 2022

g) **Air Delay during the period when AFM measures are in force:**

Average Air Delay to domestic arrivals* during the period when ATFM measures were in force for Delhi, Mumbai, Bhopal, Kolkata and Bengaluru are 6 min, 9 min, 11 min,11 min and 10 minutes respectively.

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

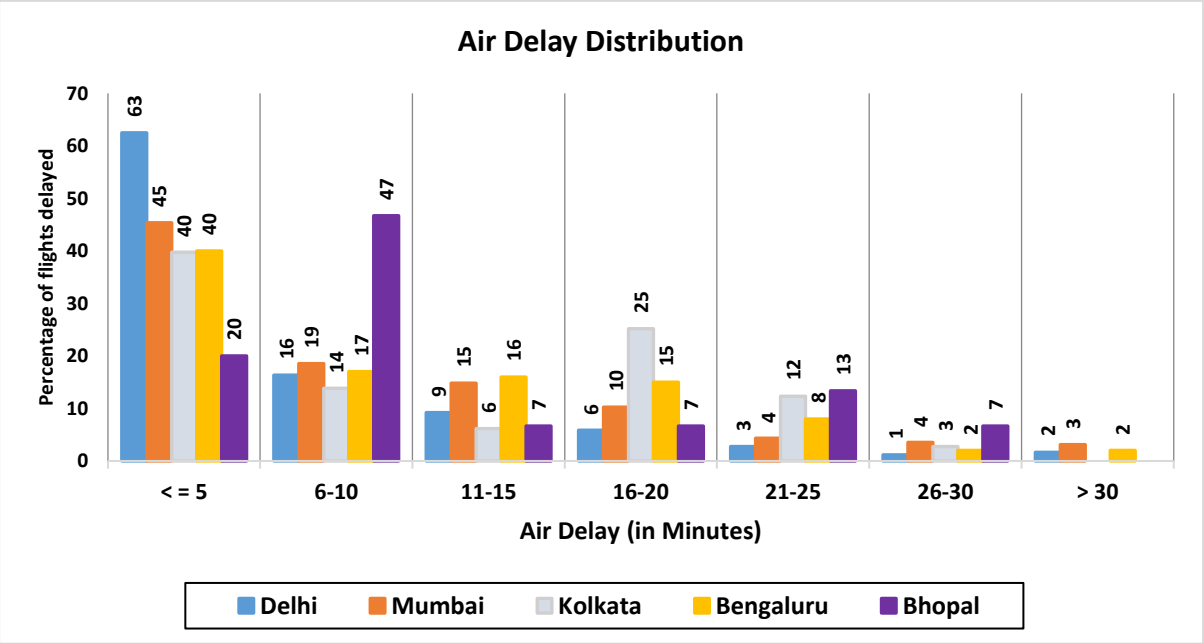


**Figure 8:** Air Delay during ATFM Period

h) **Fuel Saving & Reduction in CO2 Emissions per flight during the period when ATFM measures are in force:** The chart below shows fuel saved per flight and reduction in CO2 emissions per flight due to ATFM measures on monthly basis.

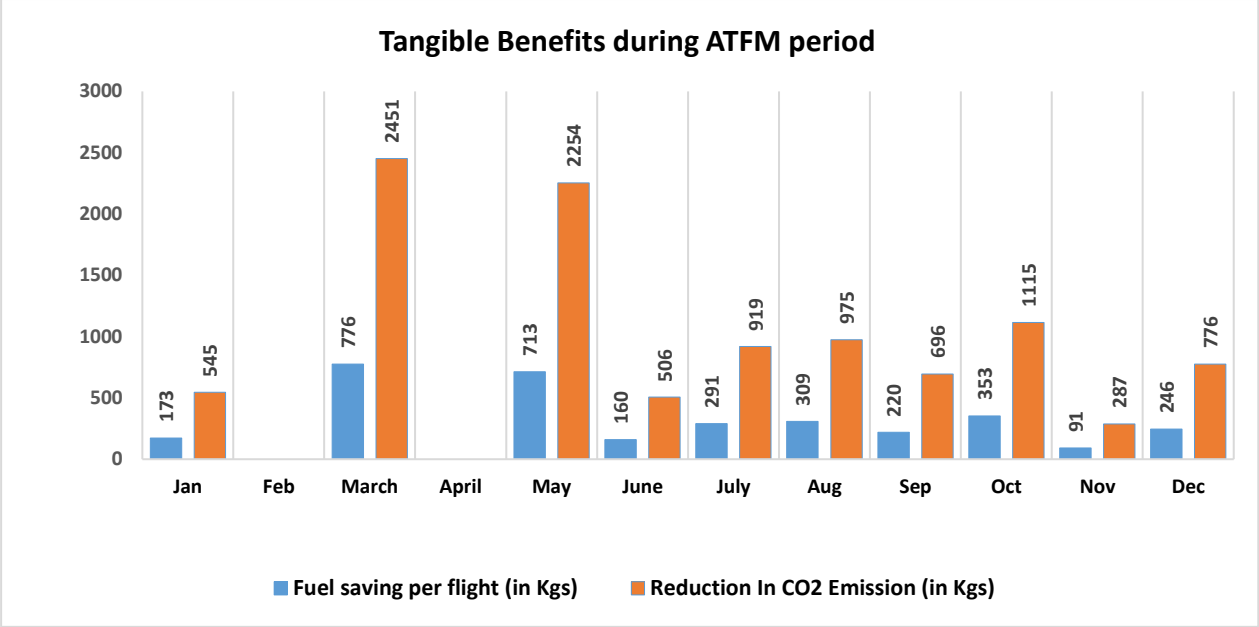


**Figure 9:** Fuel Savings & CO2 Emissions reduction

No ATFM measures were applied for the month of February & April for the year 2022. Total 2016.92 tonnes of fuel was saved during the period when ATFM measures were in force, which translated into 6373.46 tonnes of reduction in $CO_2$ emission in the calendar year 2022.

2.2 Analysis is done manually by assimilating data from various sources such as ATFM system (SKYFLOW), AOCC, ATC automations and A-CDM systems.

2.3 Flight plan information captures the flight's estimated off block time (EOBT) and estimated elapsed time (EET). Data from ATFM System (SKYFLOW) is used to capture calculated take off time (CTOT), Calculated landing time (CLDT), system EET (aircraft profile as calculated by SKYFLOW system), Actual take off time (ATOT), Actual elapsed time (AET) and Actual landing time (ALDT). AOCC and ATC automation data are used for missing flights and checking the captured data accuracy.

2.4 A google compliance sheet is created by CCC to help Flow Management Positions (FMP)

record the relevant ATOT and ALDT information for flights departing from their Airport to the constrained Airport. The FMP logs the flight's compliance status along with the reasons for non-compliance, if any, to help CCC identify and address the constraints.

<u>Challenges in data collection and need for analytical tool:</u>

2.5 Data collected from various agencies often leads to mismatch. The process of assimilating data and converting it into the desired format is also cumbersome and may lead to inaccuracies in the analysis.

2.6 The Compliance sheet is filled manually by Flow Management position (FMP) adding to their workload and may be subject to inadvertent mistake. Other internet-based flight tracking apps are also used to update data for missing flights.

2.7 Revised CTOTs are issued manually through an excel sheet for flights that missed the earlier issued CTOT. There have been instances of unused slots and wrong entries.

2.8 The calculation of tangible benefits of ATFM such as reduction in Air Delay, fuel saving and reduction in CO2 emission is based on guidance provided in ICAO carbon emissions calculator methodology version 11 with several assumptions.

2.9 The amount of operational data stored in the ATFM system for historical analysis and case study is huge. Data is also available in various other formats from different agencies which necessitate efforts to be undertaken to develop the data harmonization processes as part of uniform data repository process. AAI is planning to develop a data dashboard for easier access, performance measurement and data visualization.

Lessons Learnt

2.10 Many instances of non- compliance due to 'delay in dissemination of CTOT' or 'CTOT not received' at the place of departure have been reported.

2.11 'CTOT' is the time calculated and issued by an ATFM unit, because of tactical slot allocation, at which a flight is expected to be airborne. Most Airspace users & ATC misunderstand the compliance window while planning their flight to be ready for take-off at the at the holding point which leads to Non-Compliance.

2.12 ATFM measures applied with less lead time (less prior notice to stakeholders) have been observed to be less effective.

2.13 The strategic schedule planning at slot coordinated Airports in India has not worked tactically at several occasions, as Airlines resort to schedule buffers and such airports experience demand capacity imbalance even in absence of any external stimuli.

2.14 Ground Stop Programs followed by Ground Delay Programs have helped recover from heavy congestion and grid lock experienced during Bad weather conditions.

2.15 ATFM measures for planned closures have been more effective with better and timely coordination with Airline representatives physically present in ATFM operational floor.

2.16 During tactical ATFM operations, with rapidly evolving demand –capacity situations, allocation of new/revision of allotted CTOTs is a frequently encountered scenario. It is one of the important takeaways that the ATFM system should be flexible and capable of a dynamically updating demand-capacity scenario.

## 3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper; and

b) discuss any relevant matters as appropriate.

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