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AIRPORTS AUTHORITY OF INDIA



# CENTRAL AIR TRAFFIC FLOW MANAGEMENT ( C-ATFM ) – INDIA



- Topics ....
  - The Need
  - C-ATFM Network
  - C-ATFM Operations
  - Current Status and Activities
  - Challenges in Implementation
  - Future Developments



# AIRCRAFT MOVEMENTS - FORECAST



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YEAR	International	Domestic	Total
	A/c Movements (in '000)	A/c Movements (in '000)	A/c Movements (in '000)
2018-19	455.46	2007.80	2463.27
2019-20	482.79	2208.58	2691.37
2020-21	511.76	2429.44	2941.20
2021-22	542.47	2672.38	3214.85
2022-23	569.59	2832.73	3402.32
CAGR	5.8%	9.2%	8.6%

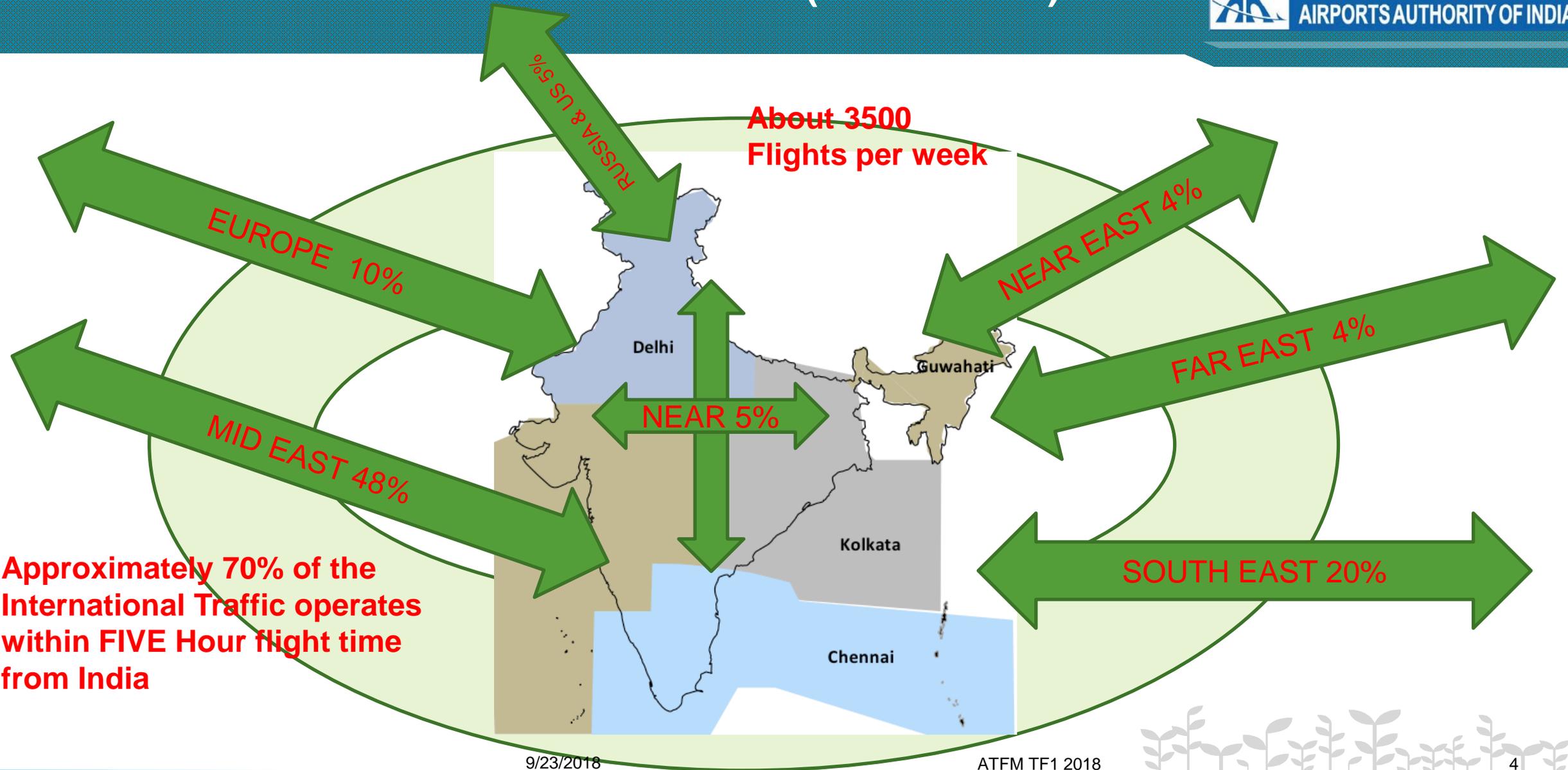
Aircraft  
Movements  
(in '000)



# INTERNATIONAL TRAFFIC FLOW ( PER WEEK)



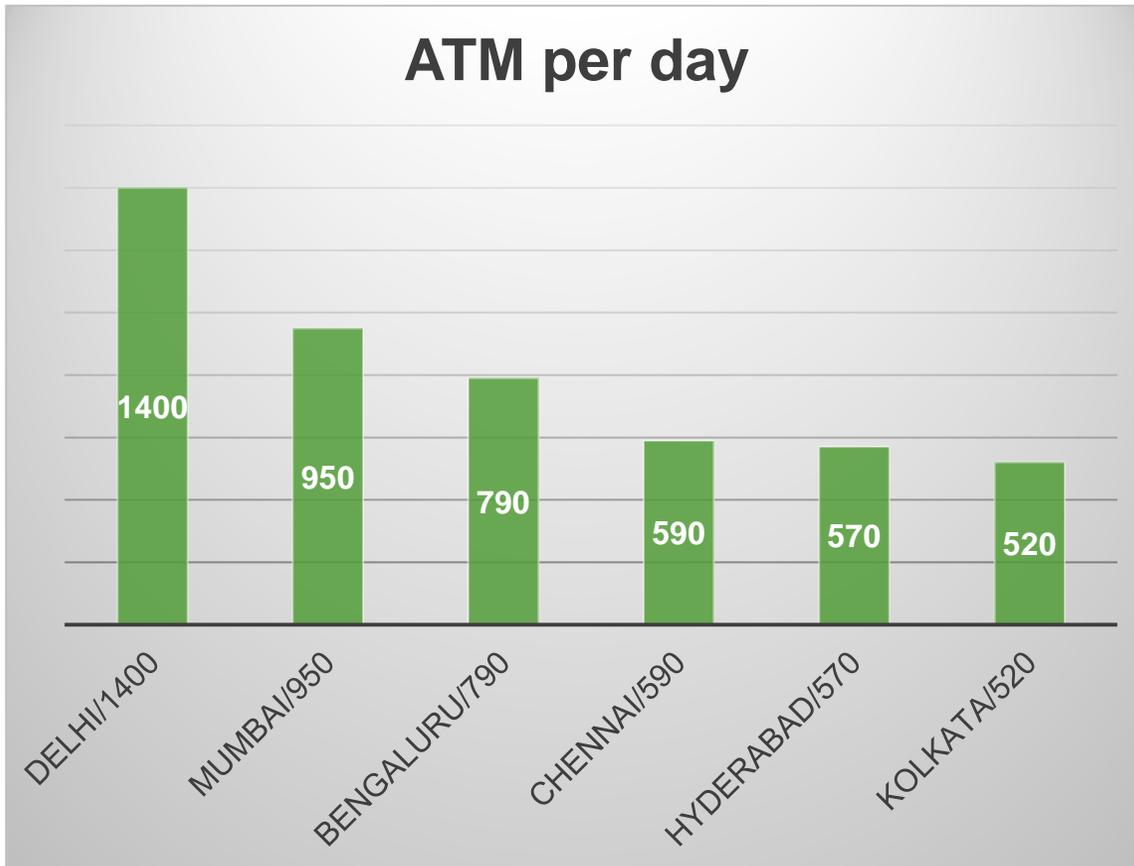
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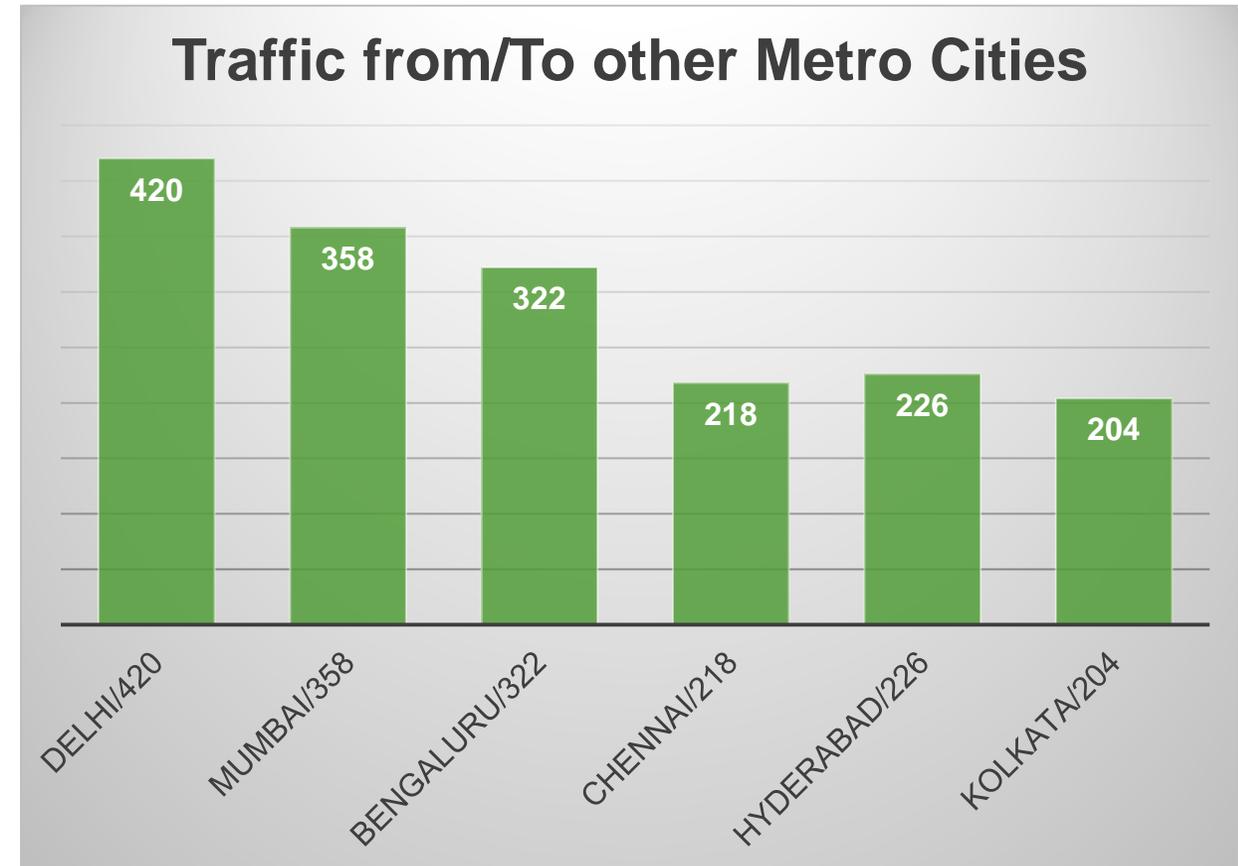
# Domestic Traffic Scenario



### ATM per day



### Traffic from/To other Metro Cities



# Six Metro Air Traffic



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Airport	No of Runways	Total ATM Per Day	Peak Traffic Hours (UTC)
Delhi	3	1400	0200-0900, 1000-1100, 1200-1600
Mumbai	2	950	0200-0300, 0400-0600, 1300-1600
Bengaluru	1	790	0300-0500, 1200-1700
Chennai	2	590	Traffic equally distributed
Hyderabad	1	570	
Kolkata	2	520	

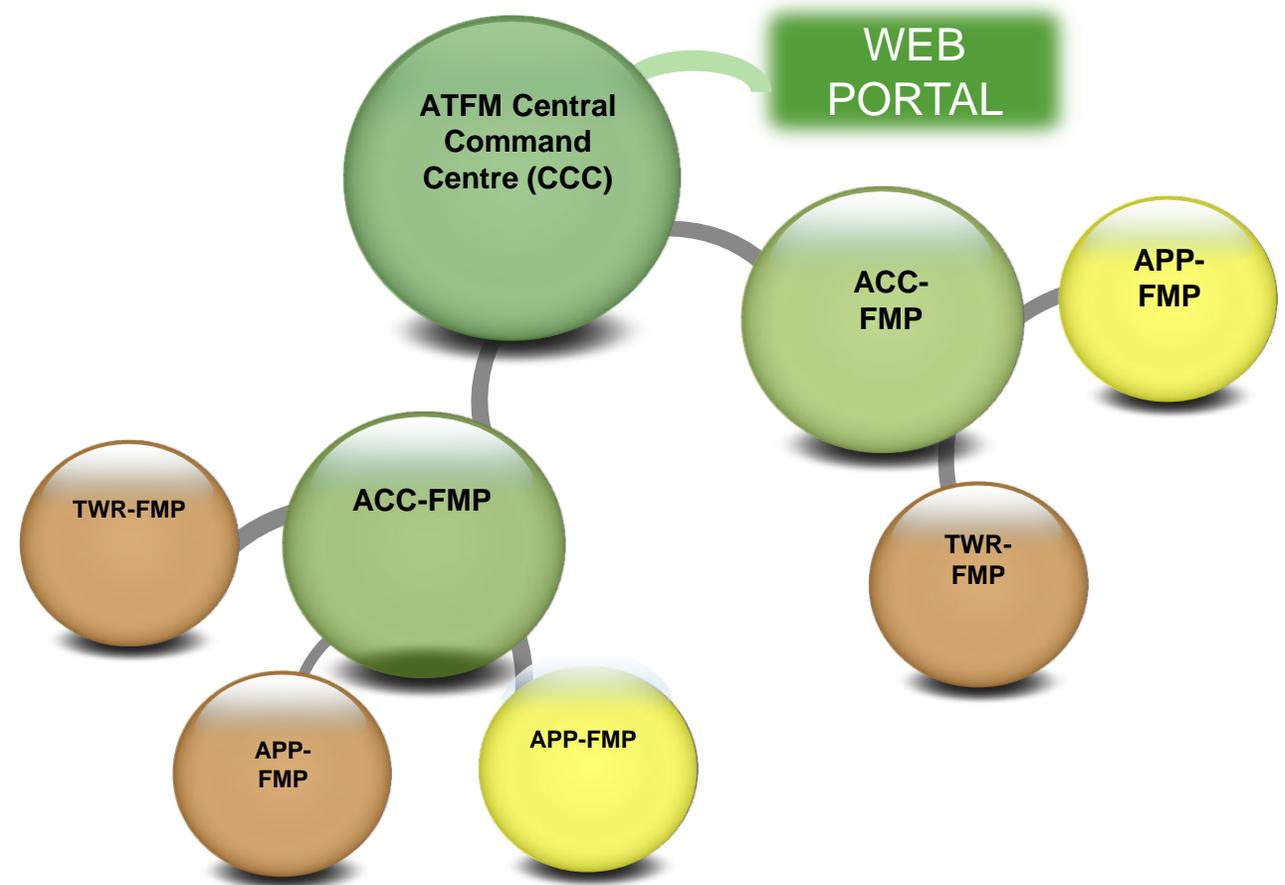




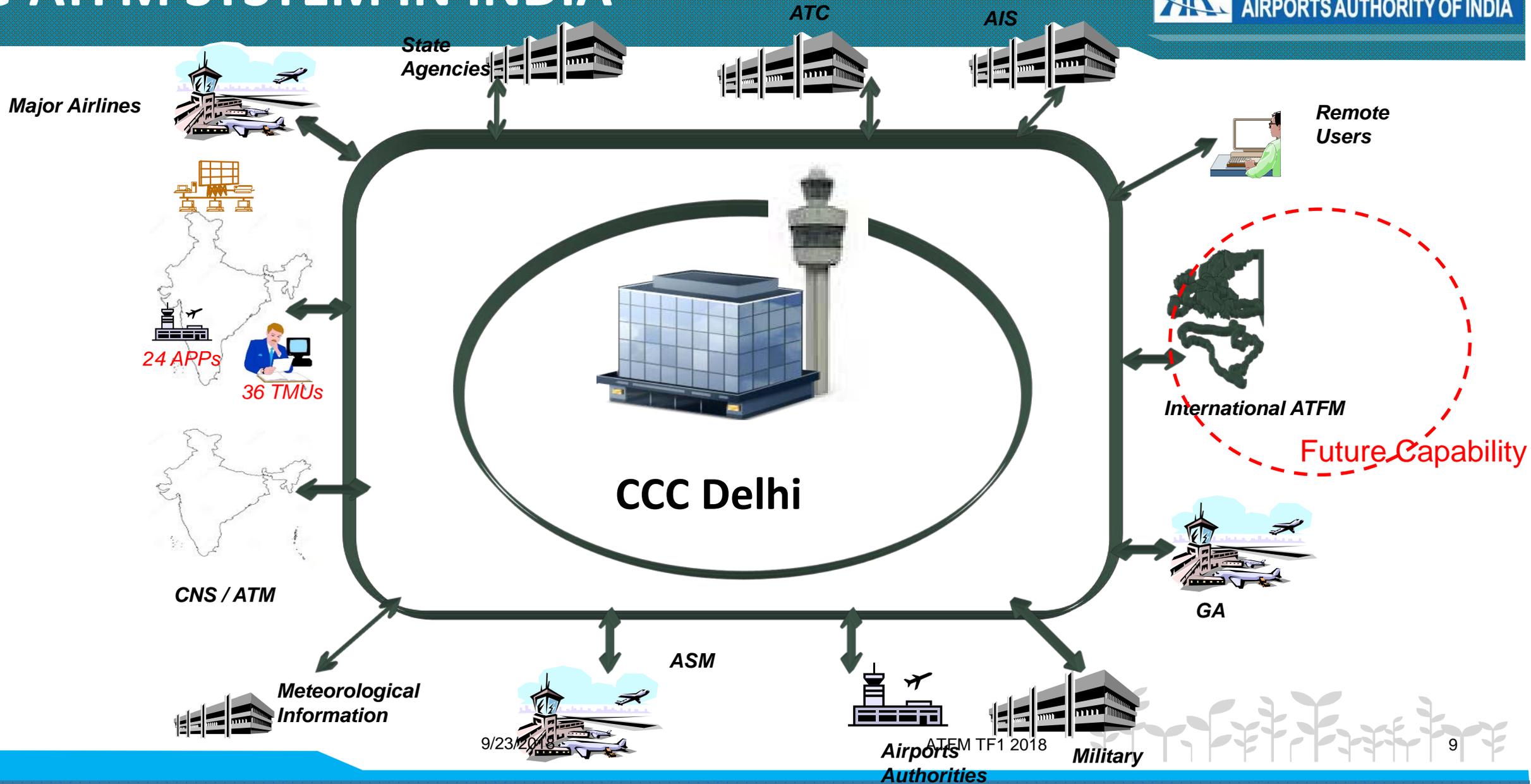
# C-ATFM SYSTEM ARCHITECTURE



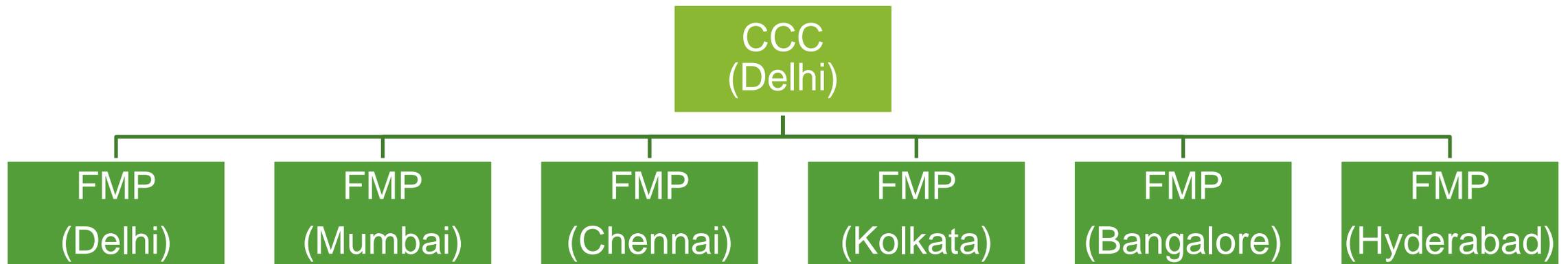
- Objective is to manage and optimize traffic flows by actively collaborating with airlines, airport, defense and other stakeholders on daily basis.
- The Central Command Center ( CCC) will receive strategic and tactical FPL , Weather, Airspace ,Traffic, Airport information for accurate Situational Awareness and decide on needed ATFM measures.
- Flow Management Positions (FMP) will be the unit implementing ATFM program at local ACCs, APP and TWR units.



# C-ATFM SYSTEM IN INDIA



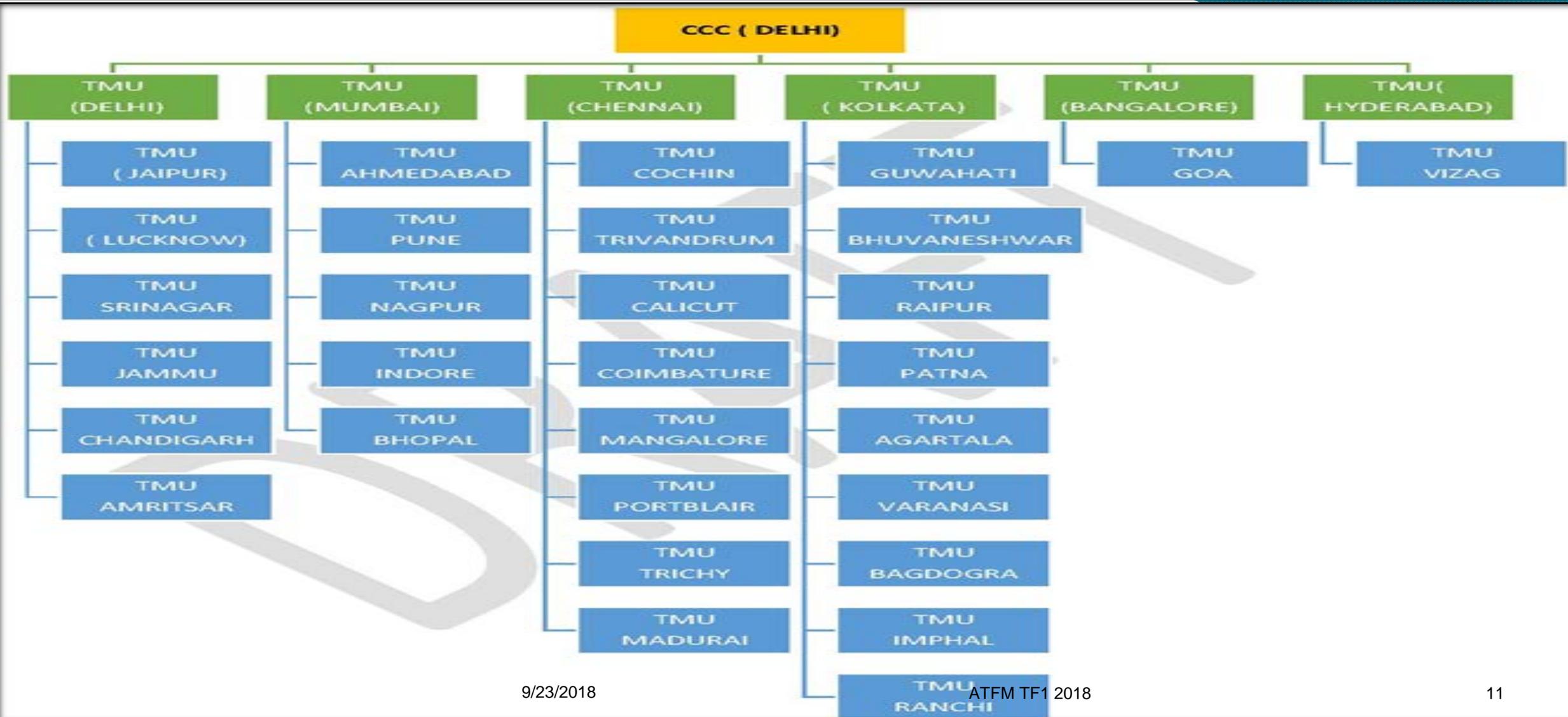
- Phase 1 C-ATFM operations ATFM operation in India started w.e.f. 27/04/2017.
  - a CCC at Delhi and
  - 6 FMPs at the major ACCs of
    - Delhi, Mumbai, Chennai, Kolkata, Bangalore and Hyderabad
    - These cities' airports handle about 60% of Indian traffic



# C-ATFM Organization



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# C-ATFM Operations



- Pre-Flight

- Rerouting
- **Ground Delay Program(GDP)**
- **Airport Stop Program (ASP)**
- Minutes in Trail



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- In-Flight

- Rerouting
- Miles in Trail
- Fix Balancing
- Airborne Holding
- Level capping

ATFM TF1 2018





- ATFM measures should;
  - be kept to the minimum and, whenever possible, be applied selectively only to that part of the system that is constrained
  - be established and coordinated so as to avoid , if at all possible, having cumulative or contradictory effects on the same flights



# Ground Delay Program (GDP)



- The C-ATFM System applies regulations to arrivals to a constrained airport in the form of GDP.
- The departures departing from Indian airports are given a Calculated Take Off Time ( CTOT) .
- The CTOT is the expected time of departure. The airline accordingly adjusts the EOBT.
- The CTOT window is ( -5' to +10' ) .
- CATFM Phase I operations mainly concentrate on GDP program.



# ELEMENTS CONSIDERED FOR FLOW MANAGEMENT



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Visualize Sessions

Current session: Strategicl 15/08/2017 - Tuesday Hour: 00:00 Duration: 24 h

Overview

Demand Alert

Demand Chart

Flight Plans

## Configuration

Interval:  60min  45min  30min  15min  5min

Plan Type (=):  RPL  FPL  Flight Schedule

Update

## Regulated Elements

Aerodromes	Aerodrome Groups	Airway Segments	Airway Segment Groups	Controlled Auxiliary Points	SUAs	FIR Sectors	FIR Sector Groups	Fixed Points	Polygons	SID Segments	SID Segment Groups	STAR Segments	STAR Segment Groups	TMA Sectors	TMA Sector Groups
VABB	VIDP-VABB-VOBL	Q1- BBB DPN 100 480		AAE - VOR	VID109	VOMF.SUML	VIDF GROUP	TIGER	POLY4					BTMB.BTM6	
VIJP	VIDP GROUP	G333- DPN TIGER 220 4			VIR153A	VOMF.SUMM	VIDF FIR		VIRDP					DTMA.DT07	
VABV	AERODROME GROUP1	L750- DPN KKL 280 480				VOMF.SUHS	VIDF WEST		TEST12345					DTMA.DT02	
VAPO	VECF					VABF.BFMB								BTMB.BTM4	
VOGO	VIDP_SOP_GROUP					VECF.SURP								BTMB.BTM5	
VIDP	VOBL_GROUP					VABF.UAHE								BTMB.BCMB	
VECC						VOMF.SUBL								DTMA.DT04	

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- Tactical briefings and conferences:
  - Provide overview of current ATFM situation
  - Discuss any issues
  - Provide outlook on operations for coming period
- Output of these conferences → ATFM Daily Plan (ADP)
- ATFM Daily Plan (ADP) is a set of tactical ATFM measures that will be in force in Indian airspace on the following day.
- .
- The Daily plan will be published/Disseminated by CCC on the basis of following criteria. An ADP includes the following items of information:
  - Aerodrome or Airspace Sector identification;
  - Description of constraints
  - Time frame
  - Proposed ATFM measures; and
  - Remarks/other relevant information.
- ADP will be distributed to stakeholders by either Email or Fax or Web portal of SKYFLOW



# SAMPLE ADP



ATFM DAILY PLAN (ADP) 1711080000 to 1711082359 (UTC)		
CAPACITY AND CONSTRAINTS:		
LOCATION: AD OR SECTOR	APPLICABLE PERIOD	CONSTRAINTS / REMARKS
VIDP	0200 – 0500 UTC 0600 – 0700 UTC 0800 – 0900 UTC 1200 – 1700 UTC	Expect congestion
VABB	0200 – 0500 UTC 0800 – 0900 UTC 1200 – 1400 UTC	Expect congestion
VECC	-----	-----
VOMM	-----	-----
VOBL	1200 – 1300 UTC 1400 – 1500 UTC 1600 – 1700 UTC	Expect congestion
VOHS	-----	-----
ATFM MEASURES:		
LOCATION: AD OR SECTOR	APPLICABLE PERIOD	MEASURES/ REMARKS
VIDP	0300 – 0600 UTC 0600 – 0900 UTC 1200 – 1500 UTC 1500 – 1800 UTC	Expect CTOTs for Arrivals at VIDP <b>(Departures from VIDP to be regulated by DA-CDM)</b>
DEVELOPING ISSUES:		
LOCATION: AD OR SECTOR	APPLICABLE PERIOD	MEASURES/ REMARKS
-----	-----	-----
ANY OTHER ISSUES:		
VIDP RWY 11/29 closure till 0130 UTC 10 <sup>th</sup> November 2017, vide NOTAM No. – A1092/17		

**NOTE: (T): "CDM BEGIN TIME"**

- **"INITIAL CDM SCENARIO FOR PREVIEW"** = CDM BEGIN TIME MINUS 6 HRS OR EARLIER (T-6 HRS)
- **"WINDOW FOR UPDATION"** = CDM BEGIN TIME MINUS 5 HOURS (T- 5 HRS; DURATION: 1 HR)
- **"INITIAL CTOTs"** = CDM BEGIN TIME MINUS 3 HOURS (T-3 HRS)
- **"WINDOW FOR URGENT CHANGE"** = CDM BEGIN TIME MINUS 3 HOURS (T-3 HRS; DURATION: 15 MIN)

S. NO.	SCENARIO NAME	CDM BEGIN TIME (T)	CDM END TIME	FINAL CTOT TIME (T – 02:30 HRS)
1	CDM1_VIDP_081117	0300 UTC	0600 UTC	0030 UTC
2	CDM2_VIDP_081117	0600 UTC	0900 UTC	0330 UTC
3	CDM3_VIDP_081117	1200 UTC	1500 UTC	0930 UTC
2	CDM4_VIDP_081117	1500 UTC	1800 UTC	1230 UTC



# CCC Assessment Process



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- Which airports are congested?
- When and for how long? To what extent?
- Can the situation be managed without restrictions?
- How many aircraft are impacted?
- What time is the expected impacted?
- Do we have the time for stakeholders' collaboration?
- What measures are to be used to balance demand with capacity (i.e., GDP, GS)



# Assessing DCB- Demand Chart



Flow Security Control Flight Plans Meteorology Support Operability Basic Data Air Situation

## > Flow > Situation Analysis

Visualize Sessions Current session: Tactical 09/11/2017 - Thursday Hour: 06:30 Duration: 6 h

Overview Demand Alert Demand Chart Flight Plans

Activation Status Plan Type Airline Flight Type

### Demand Chart VIDP

Interval:  60min  45min  30min  15min  5min

Operation (=):

All

Activation (=)

All

State (=):

Preview/Finished  Canceled  Anulled

Begin Time (>=):

End Time (<=):

Plan Type (=):

RPL  FPL  Flight Schedule  Mix

Airline (=):

Indicative (=):

Level (>=):

Level (<=):

EOBT (=):

EET (=):

ADEP (=):

ADES (=):

Acf. Type (=):

Equip Category:

All

Takeoff (=):

Arrival (=):

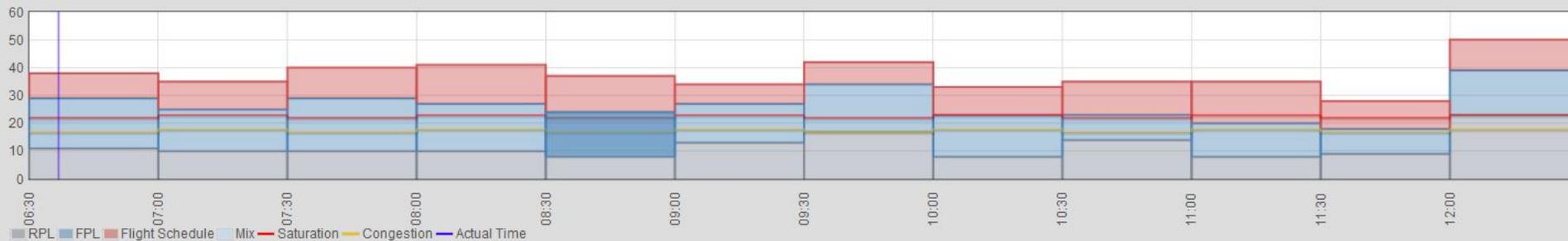
Wake Turb:

All

RVSM Status:

All

Automatic Update



Fields Viewed

Indicative	ADEP	ADES	CHART	EOBT	ETOT	ETA	ATOT	ATA	Delay	Flight Type	Route	Cat.	State	Activation	Activate	Deactivate
IGO509	VIDP	VERC	06:30	06:20	06:30	07:56				FPL	R460 BBN W73E	C	Operational	INA	<input type="button" value="⊞"/>	
JAI331	VABB	VIDP	06:30	04:25	05:05	06:30				Flight Schedule	DOTIP Q1 DOSTO/M078F350...	B	Operational	INA	<input type="button" value="⊞"/>	
GOW213	VIDP	VISR	06:30	06:20	06:30	07:35				RPL	W31W ASARI W31W	C	Operational	INA	<input type="button" value="⊞"/>	
JAI711	VIDP	VEBD	06:30	06:20	06:30	08:13				FPL	LAPOT DCT ALI R460 BBN ...	C	Operational	INA	<input type="button" value="⊞"/>	
VTI976	VAAH	VIDP	06:30	05:00	05:20					Flight Schedule		C	Operational	INA	<input type="button" value="⊞"/>	

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# Applying GDP

> Flow > Collaborative Decision Making

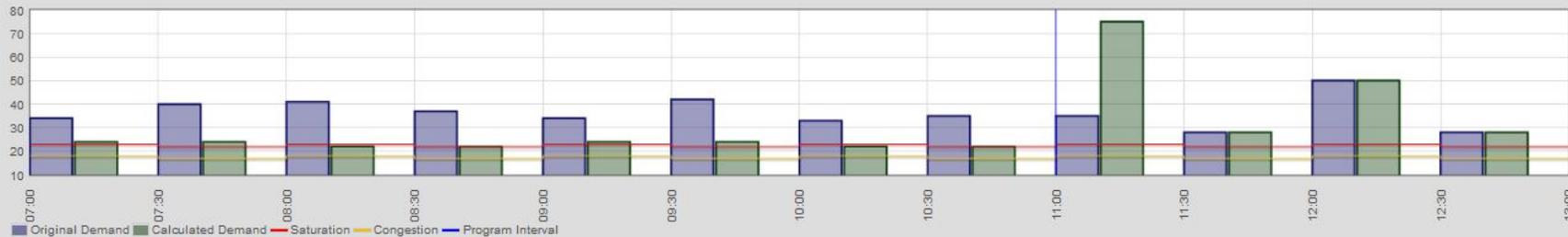
Visualize Sessions SHOWCASE Period: 09/11/2017 - 07:00 to 09/11/2017 - 13:00 Last Update: 09/11/2017 - 06:31 Messages: 7

Overview Demand Alert Demand Chart Flight Plans Programs

Activation Status Plan Type Airline Flight Type Comparative

Demand Chart VIDP

Demand Type:  Interval:  60min  45min  30min  15min  5min  
 Operation (=):  ADEP (=):  ADES (=):  Adt. Type (=):   
 Begin Time (>=):  End Time (<):  Indicative (=):  Equip Category:   
 Plan Type (=):  RPL  FPL  Flight Schedule  Mix RVSM Status:  Wake Turb:



Viewed Fields

Indicative	ADEP	ADES	Graphic	EOBT	ETOT	ETA	COBT	CTOT	CTA	Delay	Plan Type	Route	Cat.	State	Activation	Program	Exempt
IGO554	VISR	VIDP	07:00	05:25	05:53	07:00	05:25	05:53	07:00	00:00	Flight Schedule	W31E	C	Canceled	INA	CNL	
VTI812	VOBL	VIDP	07:00	04:25	04:44	07:00	04:25	04:44	07:00	00:00	Flight Schedule	W57 HIA W20 BPL Q24	C	Canceled	INA	CNL	
KZR908	VIDP	UAAA	07:00	06:50	07:00	10:17	06:53	07:03	10:20	00:03	FPL	OB DAG DCT BUTOP A589...	C	Operational	INA	ADP	
IGO6367	VEPT	VIDP	07:00	05:15	05:42	07:00	05:15	05:42	07:00	00:00	Flight Schedule	W45 LKN R594	C	Canceled	INA	CNL	
IGO398	VIDP	VEBD	07:00	06:50	07:00	08:40	06:51	07:01	08:41	00:01	FPL	DCT DPN R460 LKN Q18...	C	Operational	INA	ADP	
VTI994	VABB	VIDP	07:00	04:55	05:14	07:00	04:55	05:14	07:00	00:00	Flight Schedule	Q24	C	Canceled	INA	CNL	
IGO895	VOMM	VIDP	07:00	04:29	04:39	07:00	04:29	04:39	07:00		FPL	Q24	C	Managed	DEP		
IGO918	VECC	VIDP	07:02	04:56	05:06	07:02	04:56	05:06	07:02		FPL	R460 LKN R594	C	Managed	DEP		
JLL4647	VILK	VIDP	07:03	06:06	06:16	07:03	06:07	06:17	07:04	00:01	RPL	DCT LKN R594	C	Managed	INA	ADP	
JAI340T	VIDP	VABB	07:05	06:55	07:05	08:24	06:55	07:05	08:24		FPL	NIXAK DCT REBON Q2 J...	B	Operational	INA		



- The Flight Plan Operator is able to differentiate priority flights (hospital, military, emergency, authorities) to be excluded or treated in a special way in the application of restrictive flow control.
- The following are excluded from ATFM measures
  - Flights experiencing emergency including unlawful interference
  - Flights on SAR
  - Medical evacuation flights
  - Flights with “head of State “ status
  - Other flights identified by State



# Execution Report



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(A Public Sector Undertaking - Miniratna-Category-1)  
Rajiv Gandhi Bhawan, Safdarjung Airport  
New Delhi - 110003  
FONE: 91-11-24632950  
FAX.: 91-11-24632950

## Scenario situation

Scenario: SHOWCASE  
Motive: trials  
Advisory Validity:

Period: 09/11/2017 - 07:00 to 09/11/2017 - 13:00

Amount plans delayed: 186 Sum plans delay: 78:09 Delay Average: 00:25 Maximum delay min: 82 Total flights in the program: 224  
5 min: 19% 15 min: 30% 30 min: 64% 45 min: 84% 60 min: 99%

Total: 258

Indicative	ADEP	ADES	EOBT	ETOT	ETA	COBT	CTOT	CTA	Delay	Flight Type	Airline	Route	Program
CPA043	VHHH	VIDP	03:10	03:10	08:10	03:11	03:11	08:11	00:01	Flight Schedule	CATHAY	TEBID A201 LKN R594 ...	ADP
VTI882	VOCI	VIDP	04:30	04:33	07:20	04:30	04:33	07:20	00:00	Flight Schedule	VISTARA	W118 CCB W43 BIA Q22...	CNL
VTI812	VOBL	VIDP	04:25	04:44	07:00	04:25	04:44	07:00	00:00	Flight Schedule	VISTARA	W57 HIA W20 BPL Q24	CNL
IGO943	VOBL	VIDP	04:50	05:03	07:20	04:50	05:03	07:20	00:00	Flight Schedule	IFLY	W57 HIA W20 BPL Q24	CNL
VTI994	VABB	VIDP	04:55	05:14	07:00	04:55	05:14	07:00	00:00	Flight Schedule	VISTARA	Q1	CNL
IGO487	VOMM	VIDP	05:10	05:32	07:55	05:10	05:32	07:55	00:00	Flight Schedule	IFLY	Q24	CNL
IGO6367	VEPT	VIDP	05:15	05:42	07:00	05:15	05:42	07:00	00:00	Flight Schedule	IFLY	W45 LKN R594	CNL
AIC486	VOPB	VIDP	05:20	05:50	09:00	05:20	05:50	09:00	00:00	Flight Schedule	AIRINDIA	VATLA P628 ASOPO W66...	CNL
IGO554	VISR	VIDP	05:25	05:53	07:00	05:25	05:53	07:00	00:00	Flight Schedule	IFLY	W31E	CNL
SEJ474	VASU	VIDP	05:53	06:03	07:22	05:53	06:03	07:23	00:01	RPL	SPICEJET	APANO W12N QQZ A347 ...	ADP
LLR614	VIJU	VIDP	06:00	06:08	07:35	06:00	06:08	07:35	00:00	Flight Schedule	ALLIED	W34 PK W31E	CNL
IGO985	VOCB	VIDP	05:50	06:09	08:45	05:50	06:09	08:45	00:00	Flight Schedule	IFLY	W43 BIA W57 HIA DCT ...	CNL
JLL4647	VILK	VIDP	06:06	06:16	07:03	06:07	06:17	07:04	00:01	RPL	LITE JET	DCT LKN R594	ADP
SEJ2844	VIAX	VIDP	06:05	06:17	07:10	06:05	06:17	07:10	00:00	Flight Schedule	SPICEJET	DCT IBANA W36 CHG W3...	CNL



## Sample Request sent To ATFM

```
message>  
-TITLE AOI  
-EVENT DEP/ARR  
-ARCID ETH3739  
-ADEP VIDP  
-ADES HAAB  
-EOBD 141217  
-EOBT 1030  
-AOBD 141217  
-AOBT 1040  
-ATOT 1045  
-RWYDEP 27L  
-PKDEP 37  
-TIMESTAMP 141217104500  
</message>  
</ns2:request>  
</ns2:receiveAoi>
```

## Sample Request sent By ATFM to DIAL

```
message>  
-TITLE DPI  
-ORGNID VIDPACDM  
-ARCID ETH3739  
-ADEP VIDP  
-ADES HAAB  
-EOBD 141217  
-EOBT 1030  
-CTA 1240  
-CTOT 1045  
-TIMESTAMP 141217104100  
</message>  
</ns2:request>  
</ns2:receiveDpi>
```

## • CTOT Messages

```
< 2018-08-27 00:47:21 > -----  
ZCZC TCM0005  
FF VIDPZTZX VIDFZQZX  
VILHZTZX  
270047  
VIDPCTFM  
(DLA-SEJ122-VILH0247-VIDP-  
DOF/180827)
```





- **Role of Flow Management Positions in ACCs**
- The role of the FMP is to provide the direct link between ATC and the AOs in respect to ATFM measures and events
  - Runway landing and departure rates
  - Airport declared taxi times
  - Runway configuration
  - Sector configurations
  - Unusual events that will affect capacity (such as adverse w/x ,blocked runways or military exercises)



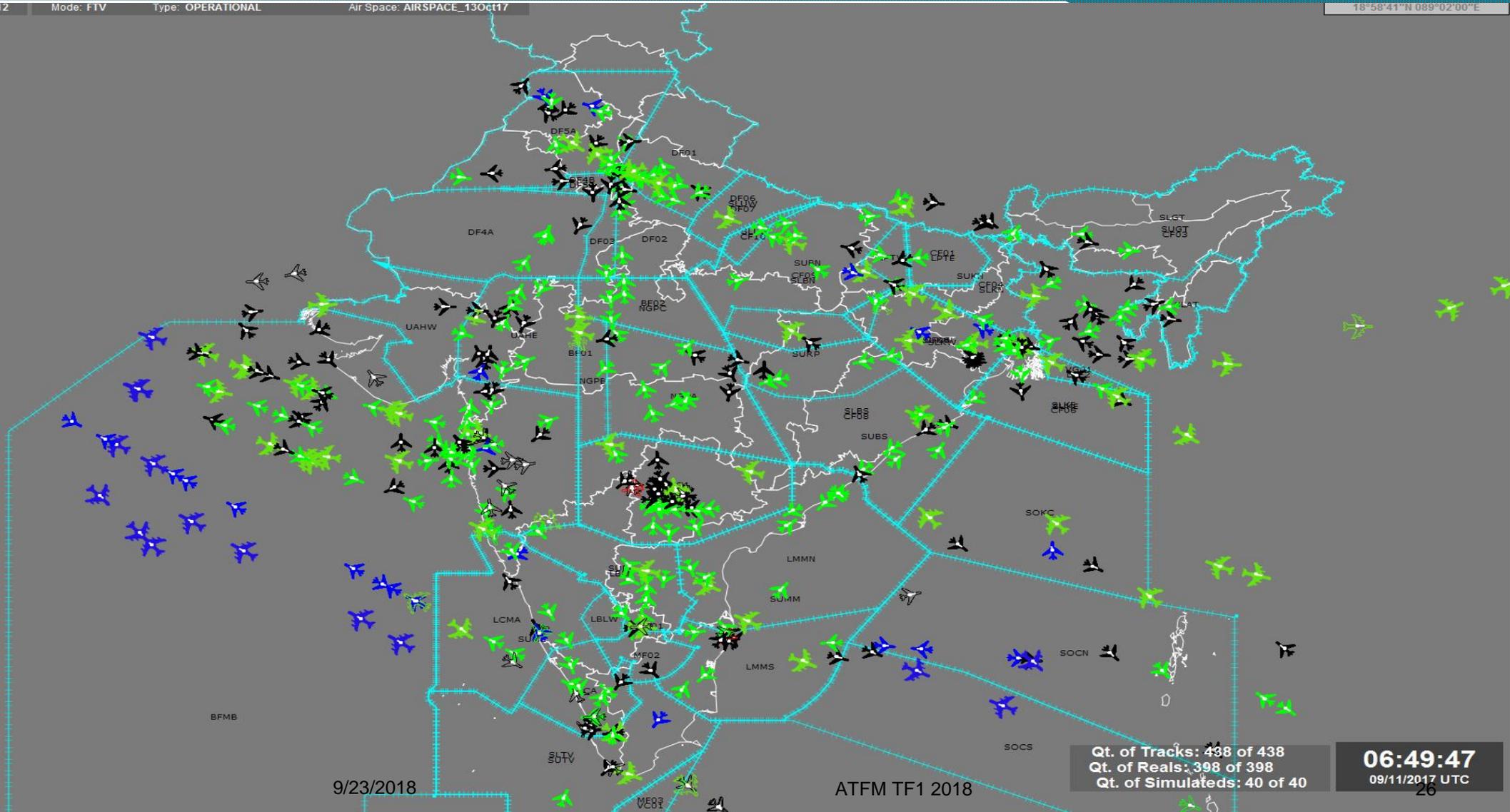
# Air Situation Display



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Version: 4.1.12 Mode: FTV Type: OPERATIONAL Air Space: AIRSPACE\_13Oct17

18°58'41"N 089°02'00"E



9/23/2018

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Qt. of Tracks: 438 of 438  
Qt. of Reals: 398 of 398  
Qt. of Simulated: 40 of 40

06:49:47  
09/11/2017 UTC

# Web Portal (Under Development)



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This website is under construction. Information contained is not updated and considered as prototype. Hence strictly advised not to be used for any Operational Purposes.



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(A Miniratna - Category -1 Public Sector Enterprise)

LOGIN



NEWS

E-HELP DESK

RESOURCES

C-ATFMS

Search



ENGLISH



CENTRAL  
AIR TRAFFIC  
FLOW MANAGEMENT  
PORTAL OF INDIA



24-08-2018

TARGET DATE:

24-08-2018 D 0 (TACTICAL)

24-08-2018

11:28:15 UTC

POST-OPERATIONS

TACTICAL

PRE-TACTICAL

STRATEGIC

## ACTIVE SPECIAL USE AIRSPACE (SUA)

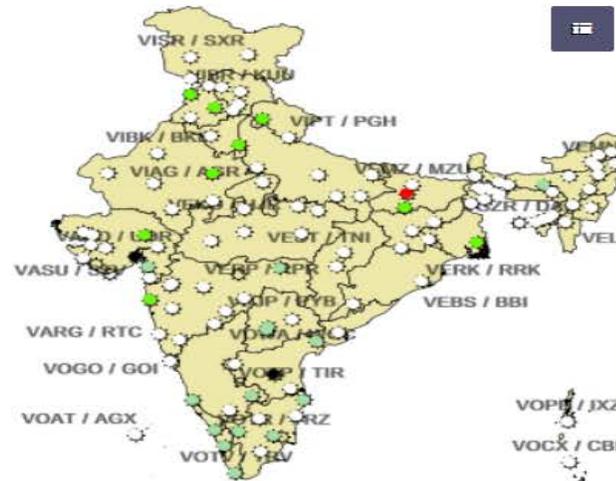
Search by Indicative



INDICATIVE	CONDITION	TIME	
ER202B	⚠	00:00 23:59	+
ER202C	⚠	00:00 23:59	+
ER203A	⚠	00:00 23:59	+
ER203B	⚠	00:00 23:59	+

NEWS

## C-ATFM MAP



SITUATION DELAY SUA ATFMEASURES

LABELS

## AERODROME SITUATION

## FLIGHT INFORMATION

Expected delay information of specific flight

Flight Number



## ATFM MEASURES

Search by Program/Element



PROGRAM ELEMENT PERIOD

No published ATFM measures.

## METAR

Search by METAR/ICAO Code (Aerodrome)



# Process of Implementation



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## Phase I 2015-17

- Airport ( Ground )Delay Program
- Airport Arrival Constraints e.g. weather, runway outage
- Addressing constraints of Six Major Airports

## Phase II 2017-19

- Ground Delay Program and Airspace Flow programs supporting Airspace Congestion & DCB at most airports across Country
- Interconnectivity among ATFM –ACDM systems
- Availability of WEB Services for all stakeholders

## Phase III 2019 onwards

- Ability to exchange information with adjacent ATFM Systems-communication Protocol?
- Participation in Cross Border ATFM - ?





- Decentralized Decision Making
- CDM Partners share the data for “Common Situational Awareness”
- CDM Partners share a consultation process for decision making
- The ATFM Directorate of AAI is responsible for keeping the Common Situational Awareness updated through collecting and assimilation of data.
- The CDM decision is binding on all CDM partners





- CDM Partners have access to C-ATFM system
- Secure login
- Common Situational Awareness
- Request change for own flights to TFM
- TFM approves changes
- Can CANCEL, CHG, SWAP own flights
- AIP India Sup 25/2017 describes the responsibilities and role of stakeholders
- AAI has also coordinated with stakeholders to arrive at “ Common Business Rules “ for efficient CDM process. Now under consideration at highest level.
- Military ( Indian Air Force , Indian Navy ) is an important stakeholder and CDM Partner.
- The CDM Process is evolving with more participation and contribution from all stakeholders.





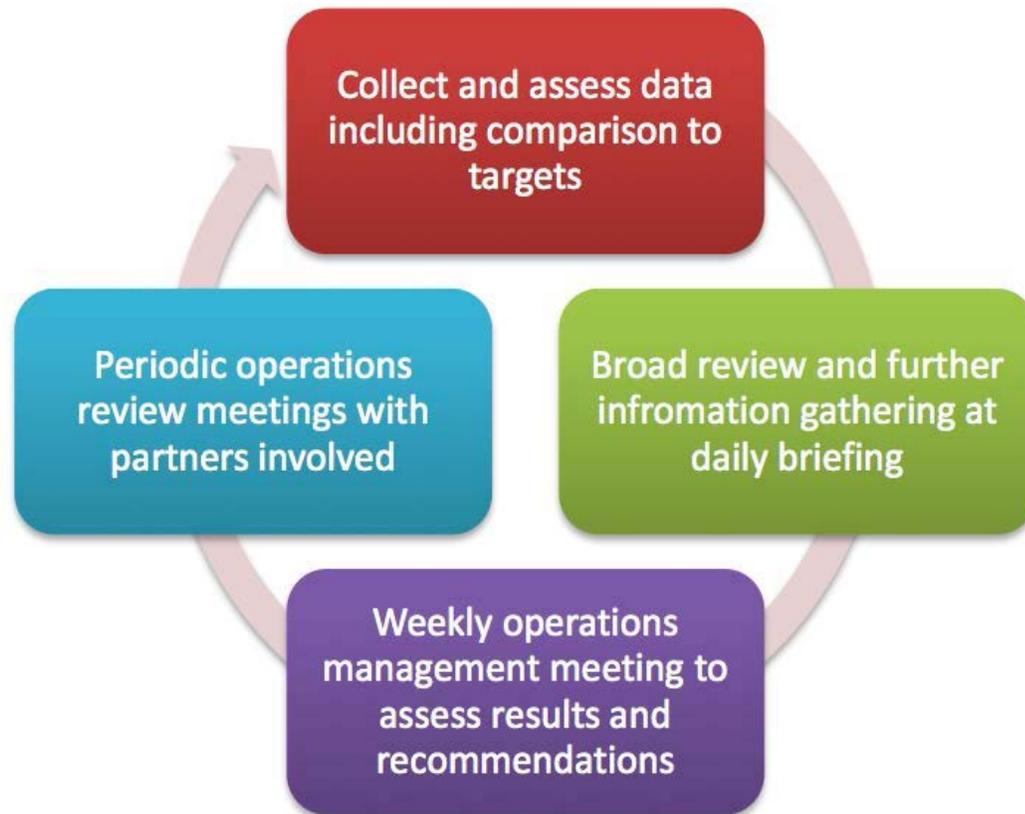
# POST OPS ANALYSIS



# POST OPERATIONS ANALYSIS (1/3)



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# ATFM Parameters being monitored



ATFM Program Impact	ATFM Ground delay statistics (ATFM ground delay defined as CTOT-ETOT)	ATFM Compliance Measurement
ATFM Scenario	ATFM Delay statistics	Overall compliance rate
Affected Flight statistics	ATFM Delay Distribution	ATFM departure slot adherence distribution
	Month wise Average ATFM Delay	Adherence rate of Airline operators
		Adherence rate of Regions
		Adherence rate of Airports within different Regions

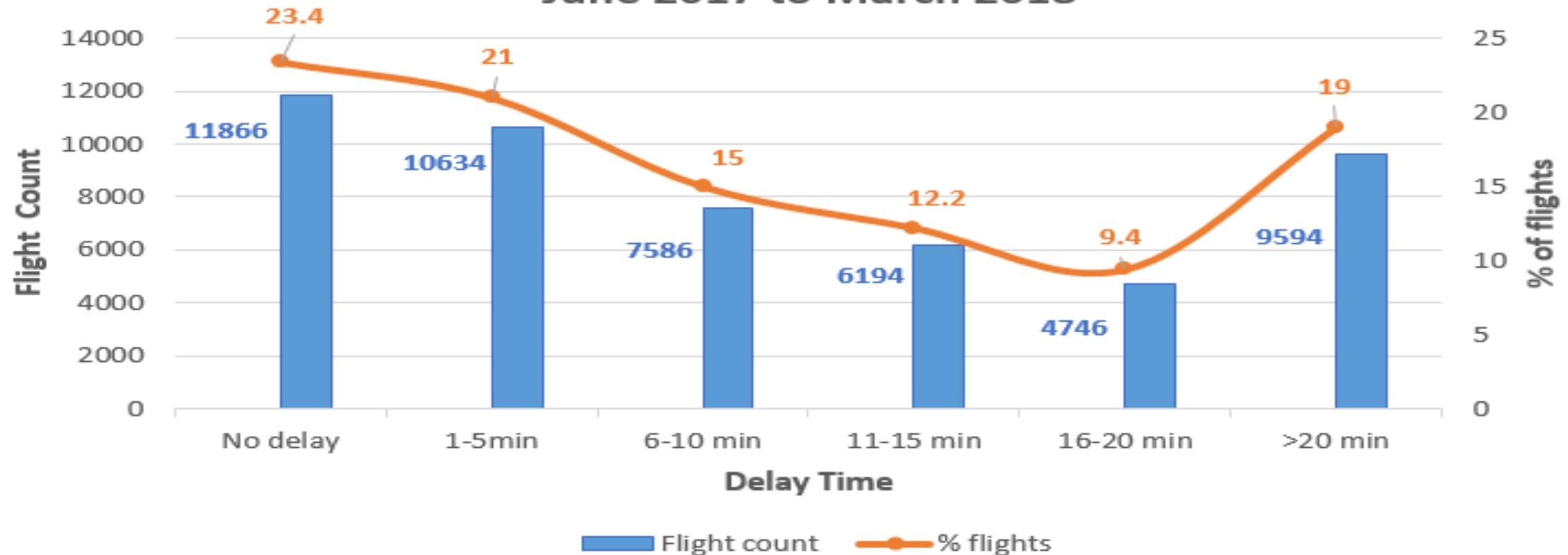


# ATFM Ground Delay



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## ATFM Ground Delay Distribution June 2017 to March 2018

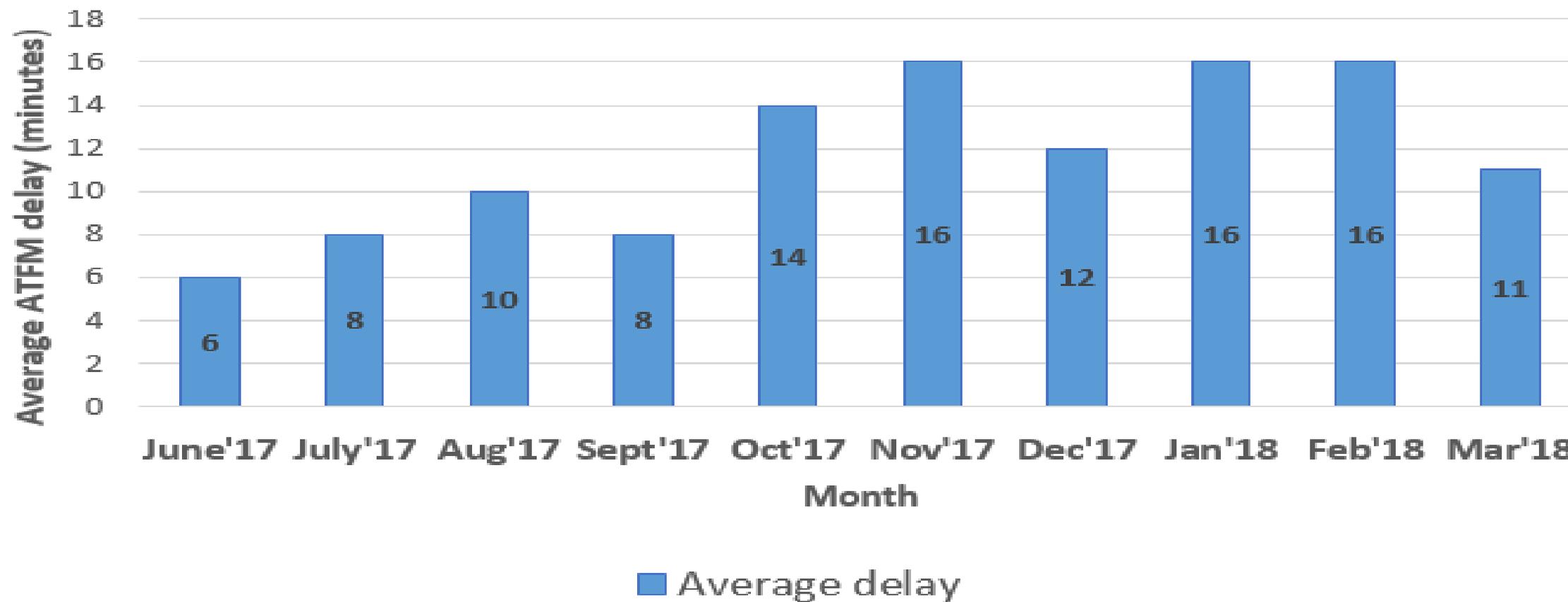


# Month wise Average ATFM Delay



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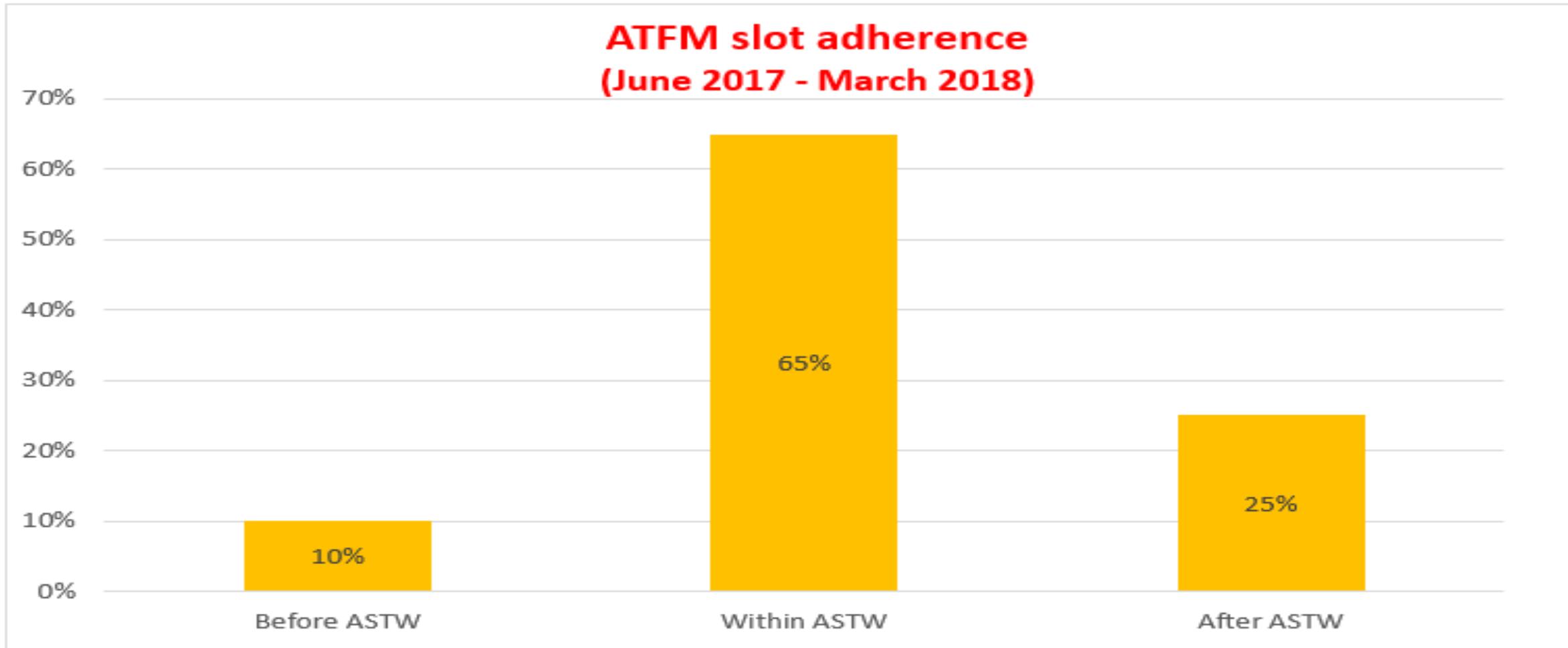
## Monthwise Average ATFM Delay per flight



# ATFM Slot Adherence



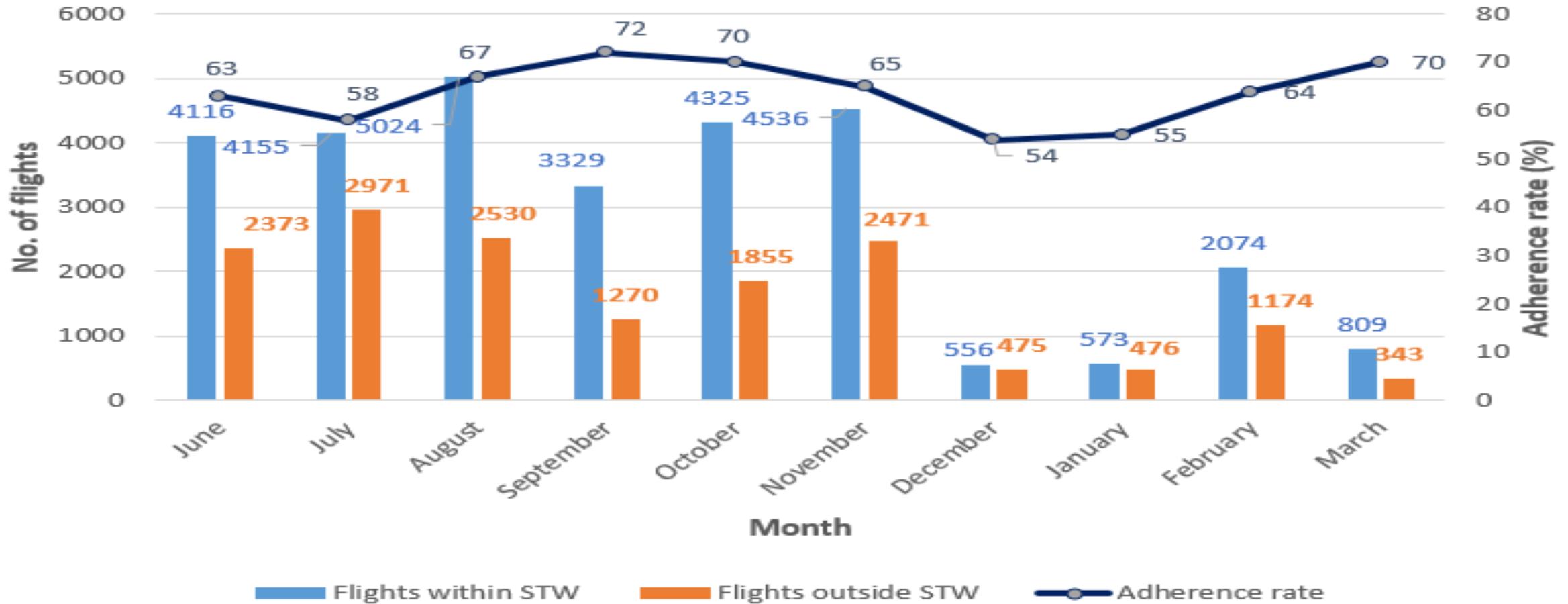
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# ATFM Departure Slot Adherence (Month wise)



## ATFM Departure Slot Adherence - Monthwise (2017-18)





# Concluding .....



# CHALLENGES



- Data availability for network-wide demand projection – Eg., Flight Plan Data, No Ops Data, delay, change .....
- Flexibility to adapt the plan
- Capacity can change, the plan must be able to change with it
- Aircraft operators can modify flight priorities and schedules
- Non adherence to CTOTs and Flight Schedule;
- Active Participation of Stakeholders;
- Reliable Met Forecast ;
- Evolution of C-ATFM System;
- Integration of ACDM with ATFM
- Airspace Reorganization – WIP;
- Coordination with Military – FUA





- Implementation of ATFM measures in Indian Airports –
  - Phase I commenced on 27<sup>th</sup> April 2017 for 6 airports
  - Phase II September 2018–Nation wide application
- Cross Border ATFM – 2019 ?
- Integration with Global ATFM.

# Do you have any questions?



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