International Civil Aviation Organization

The Second Meeting of the APANPIRG ATM Sub-Group (ATM /SG/2)

Hong Kong, China, 4-8 August 2014

Agenda Item 4: ATM Systems (Modernisation, Seamless ATM, CNS, ATFM)

NEW DELHI A-CDM IMPLEMENTATION

(Presented by Airports Authority of India)

SUMMARY

This paper presents a brief introduction to the approach applied by India to implement Airport – Collaborative Decision Making (A-CDM) at IGI Airport New Delhi. The benefits in terms of reduced carbon emissions, after the implementation of in-house developed fully functional A-CDM at Delhi Airport, is also discussed. The paper in the end outlines the map ahead for future developments in A-CDM. For IGI Airport New Delhi, AAI has met this ASBU Block '0' requirement.

1. INTRODUCTION

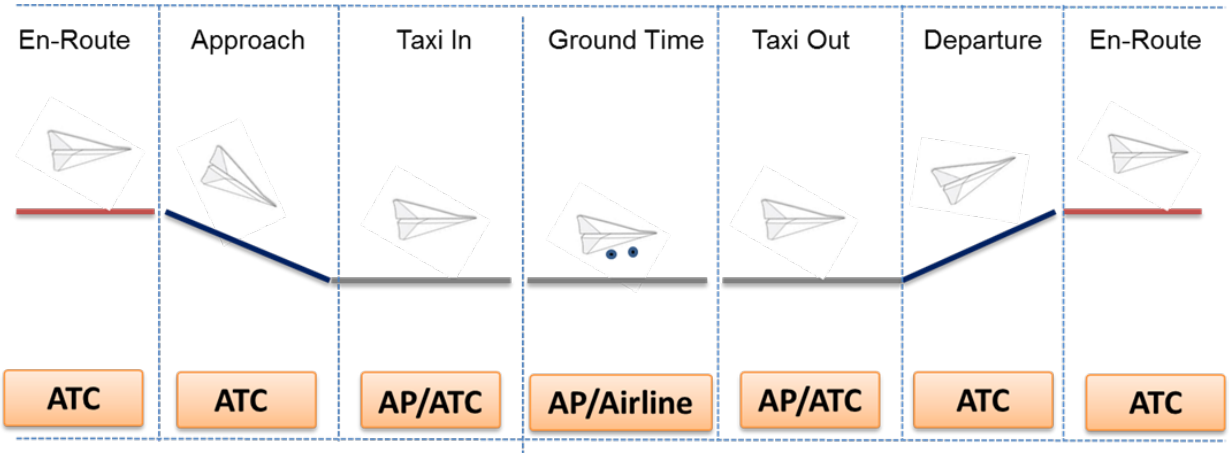
1.1 India's aviation industry has been witnessing a boom. Over the last decade domestic airline passenger traffic in India has grown more than four-fold from 14 million passengers in Financial Year 2003 to 56 million in Financial Year 2013, and the number of international passengers increased from 15 million to 43 million over the same period. The magnitude of growth that is expected will create significant pressures on air traffic management in India to which ad hoc responses will not suffice. Long term solutions will require a new way of thinking with a fresh approach.

1.2 A step forward to meet the challenges posed in this direction is the implementation of Airport - Collaborative Decision Making I (A-CDM) at Indira Gandhi International Airport. (IGI Airport) New Delhi. The Delhi Airport - Collaborative Decision Making (DA-CDM) at IGI Airport is a joint initiative between Airports Authority of India, Delhi International Airport (P) Ltd. (the Airport Operator) and the airlines operating at IGI Airport. IGI Airport is the first airport in India to implement A-CDM.

2. DISCUSSION

DA-CDM implementation

2.1 Airport Collaborative Decision Making (A-CDM) is a concept which aims at improving Air Traffic Flow and Capacity Management at airports by reducing delays, improving the predictability of events and optimizing the utilization of resources. A-CDM encompasses the approach of a flight, the turnaround and the departure.

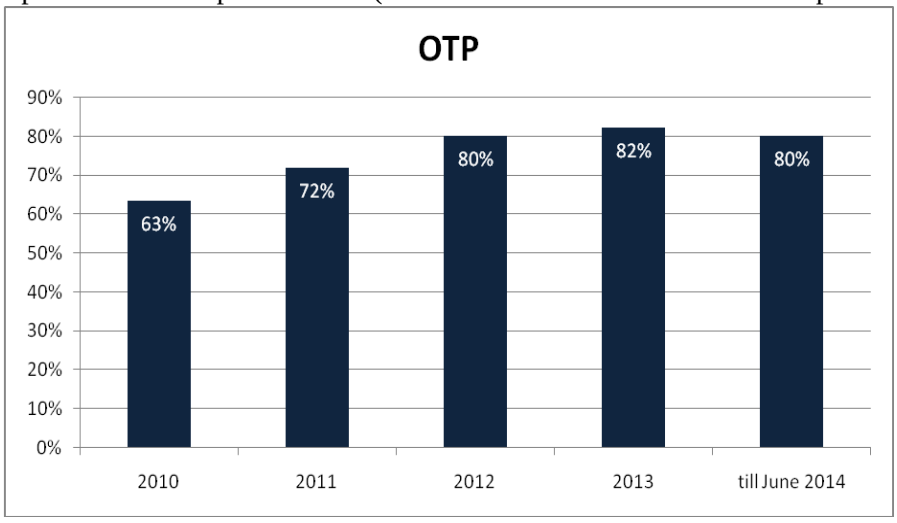


2.2 To implement A-CDM at IGI Airport, the Work Packages were split into various activities. An action plan was developed and maintained with timelines to track progress of each work package.

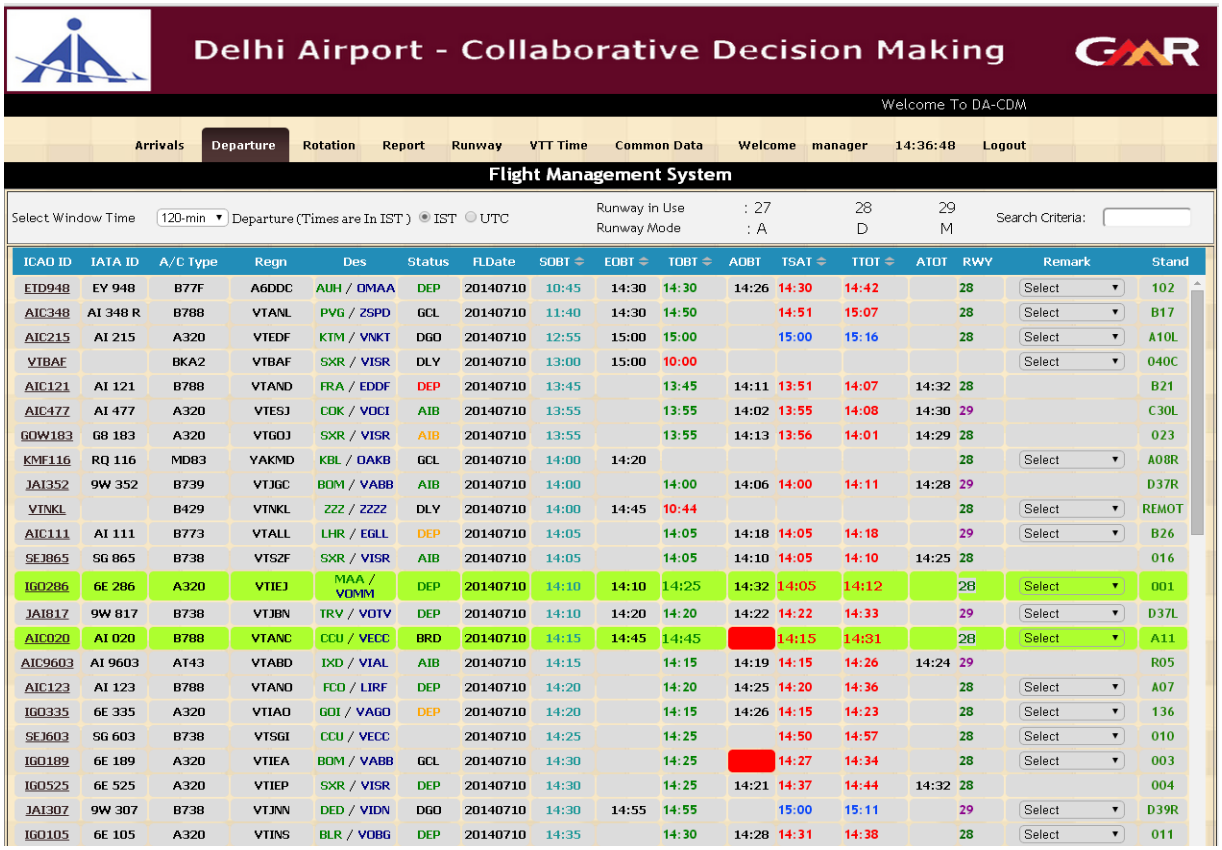
1. Concept of DA-CDM
2. KPI and Milestones
3. DA-CDM Platform
4. Stakeholders
5. Test Phase
6. Training
7. TSAT Manual Entry
8. Live Implementation
9. Pre-departure Sequencing

2.3 Airport CDM Information Sharing requires that shared information is available through a common system, connected via proper interfacing to all partners' systems and database. This common system is the main infrastructure, which is known as the DA-CDM Platform. The DA-CDM portal is a web based application developed in-house after interacting with all the partners. This platform has interface with Airport Operator through Airport Operations Data Base on one hand and with ATC for entering ELDT, TSAT and TTOT and with airlines/ GHAs to facilitate entry of TOBT on other hand through web. Platform can be made available to concerned partners. The results have been as follows:

Departure On-time performance (15 minutes of Scheduled Time of Departure)



2.4 At Indira Gandhi International Airport, Delhi, the implementation of A-CDM significantly contributed to the improvement in on-time performance (OTP) and the increase in the number of aircraft movements.



ICAO ID	IATA ID	A/C Type	Regn	Des	Status	FLDate	SOBT	EOBT	TOBT	AOBT	TSAT	TTOT	ATOT	RWY	Remark	Stand
ETD948	EY 948	B77F	A6DDC	AUH / OMAA	DEP	20140710	10:45	14:30	14:30	14:26	14:30	14:42		28	Select	102
AIC348	AI 348 R	B788	VTANL	PVG / ZSPD	GCL	20140710	11:40	14:30	14:50		14:51	15:07		28	Select	B17
AIC215	AI 215	A320	VTEDF	KTM / VNKT	DGO	20140710	12:55	15:00	15:00		15:00	15:16		28	Select	A10L
VTBAF		BKA2	VTBAF	SXR / VISR	DLY	20140710	13:00	15:00	10:00						Select	040C
AIC121	AI 121	B788	VTAND	FRA / EDDF	DEP	20140710	13:45		13:45	14:11	13:51	14:07	14:32	28		B21
AIC477	AI 477	A320	VTESJ	COK / VOCI	AIB	20140710	13:55		13:55	14:02	13:55	14:08	14:30	29		C30L
GOW183	G8 183	A320	VTGOJ	SXR / VISR	AIB	20140710	13:55		13:55	14:13	13:56	14:01	14:29	28		023
KMF116	RQ 116	MD83	YAKMD	KBL / OAKB	GCL	20140710	14:00	14:20						28	Select	A08R
JAI352	9W 352	B739	VTJGC	BOM / VABB	AIB	20140710	14:00		14:00	14:06	14:00	14:11	14:28	29		D37R
VTNKL		B429	VTNKL	ZZZ / ZZZZ	DLY	20140710	14:00	14:45	10:44					28	Select	REMOT
AIC111	AI 111	B773	VTALL	LHR / EGLL	DEP	20140710	14:05		14:05	14:18	14:05	14:18		29	Select	B26
SEJ865	SG 865	B738	VTSZF	SXR / VISR	AIB	20140710	14:05		14:05	14:10	14:05	14:10	14:25	28		016
IGO286	6E 286	A320	VTIEJ	MAA / VOMM	DEP	20140710	14:10	14:10	14:25	14:32	14:05	14:12		28	Select	001
JAI817	9W 817	B738	VTJBN	TRV / VOTV	DEP	20140710	14:10	14:20	14:20	14:22	14:22	14:33		29	Select	D37L
AIC020	AI 020	B788	VTANC	CCU / VECC	BRD	20140710	14:15	14:45	14:45		14:15	14:31		28	Select	A11
AIC9603	AI 9603	AT43	VTABD	IXD / VIAL	AIB	20140710	14:15		14:15	14:19	14:15	14:26	14:24	29		R05
AIC123	AI 123	B788	VTANO	FCO / LIRF	DEP	20140710	14:20		14:20	14:25	14:20	14:36		28	Select	A07
IGO335	6E 335	A320	VTIAO	GOI / VAGO	DEP	20140710	14:20		14:15	14:26	14:15	14:23		28	Select	136
SEJ603	SG 603	B738	VTSGI	CCU / VECC		20140710	14:25		14:25		14:50	14:57		28	Select	010
IGO189	6E 189	A320	VTIEA	BOM / VABB	GCL	20140710	14:30		14:25		14:27	14:34		28	Select	003
IGO525	6E 525	A320	VTIEP	SXR / VISR	DEP	20140710	14:30		14:25	14:21	14:37	14:44	14:32	28		004
JAI307	9W 307	B738	VTJNN	DED / VIDN	DGO	20140710	14:30	14:55	14:55		15:00	15:11		29	Select	D39R
IGO105	6E 105	A320	VTINS	BLR / VOBG	DEP	20140710	14:35		14:30	14:28	14:31	14:38		28	Select	011

Snapshot of DA-CDM portal

Insight into DA-CDM Development:

2.5 After months of in-house study and extensive analysis of A-CDM of Eurocontrol model, the first draft on DA-CDM procedures was developed and circulated on 09th Aug. 2011 by Delhi ATC to all the prospective partners. This laid the foundation for DA-CDM. The already existing Universal Flight Information System (UFIS) platform of DIAL was thought of as a cost effective IT solution.

2.6 DA-CDM is a joint initiative of Airports Authority of India (AAI) and Delhi International Airport (Pvt) limited (DIAL). A continuous dialogue was initiated and kept open throughout the development/test period. A steering group was formed which included representatives from IT professionals, ATC professionals and airport operator. This steering group held a number of meetings with the airlines to seek their opinion and feedback for development of portal and implementation of CDM.

2.7 Delhi Airport has adopted the milestone approach. For this purpose, the guidance material provided by A-CDM manual of Eurocontrol was referred to, including A-CDM models working at various Airports in Europe.

2.8 The first meeting with domestic airlines was held on 16th March 2012. In the meeting CDM platform was presented and features were explained. It was decided to start the test phase of trials by entering TOBT by airlines and TSAT/TTOT by ATC officials in phased manner starting from 0% to 100% flights.

Objective of Test phase was:

2.9 Airlines: To enter TOBTs and compare with AOBT. It helped airlines to improve the accuracy of the TOBT and getting experience with setting accurate TOBT. Over a period of time, TOBT settings of the flights were gradually increased from 0% to 100% of all flights.

2.10 ATC: For the controllers to increase precision in issuing TSATs taking into account the several dynamic factors and to evolve best practices and establish processes for setting and handling the relevant milestones such as TTOT, TSAT, variable taxi times etc.

Brief History on test trials

2.11 In a meeting on 8th June 2012, it was decided to start Test phase from 15th June 2012 with all the domestic airlines. Extensive training was provided for entering TOBT and clarifying the concept of DA-CDM to airlines officials. Initial trials were done, with effect from 26th June 2012, with Indigo Airlines for entering TOBT. Later on other airlines also participated.

2.12 On 31st August 2012, a meeting was called with all international airlines and ground handlers to initiate the testing of DA-CDM. Extensive training was provided for entering TOBT and clarifying the concept of DA-CDM to international airlines/ ground handlers. During the test period based upon feedback from the airlines/ground handlers improvements were done in the system.

2.13 On 29th January 2013, in consultation with airlines and ground handlers, it was decided that live trials would be carried out as per following details:

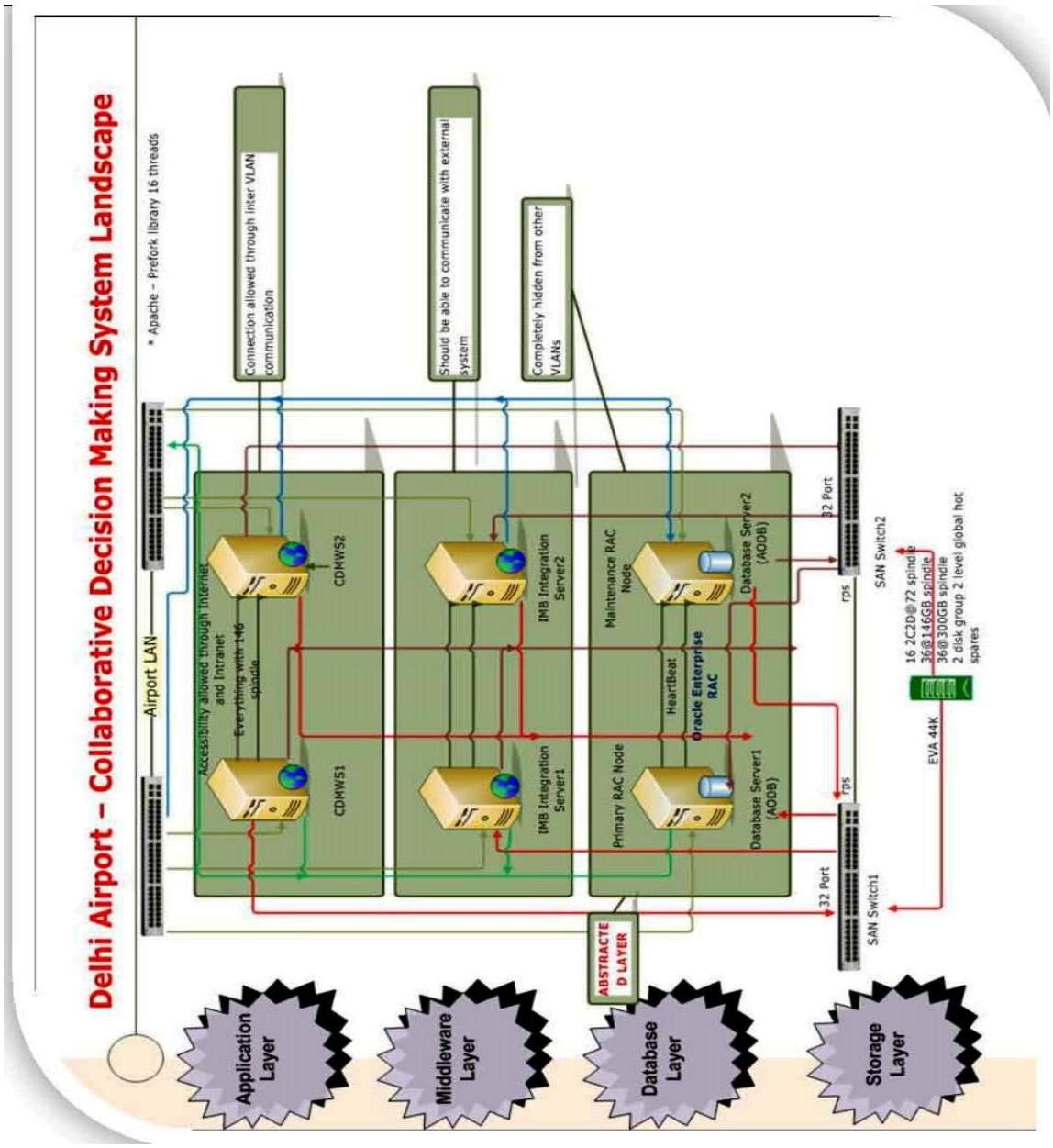
- 18, 20 and 22 Feb. 2013: For 02 hours duration from 1300 to 1500 hrs.
- 25 Feb to 01 Mar 2013: For 02 hours duration from 1030 to 1230 hrs.
- 04 and 05 Mar. 2013: For 04 hours duration from 1200 to 1600 hrs.
- 06 and 07 Mar. 2013: For 06 hours duration from 1100 to 1700 hrs.
- 11 and 12 Mar. 2013: For 02 hours and 30 minutes duration from 0500 to 0730 hrs.

2.14 During the trial periods, no actual slots were cancelled but the instances of breach in timing tolerances were recorded, so that, procedures and overall system intricacies could be fine tuned. All the trials were followed by feedback meetings to discuss the shortcomings and learning for the improvement of the system.

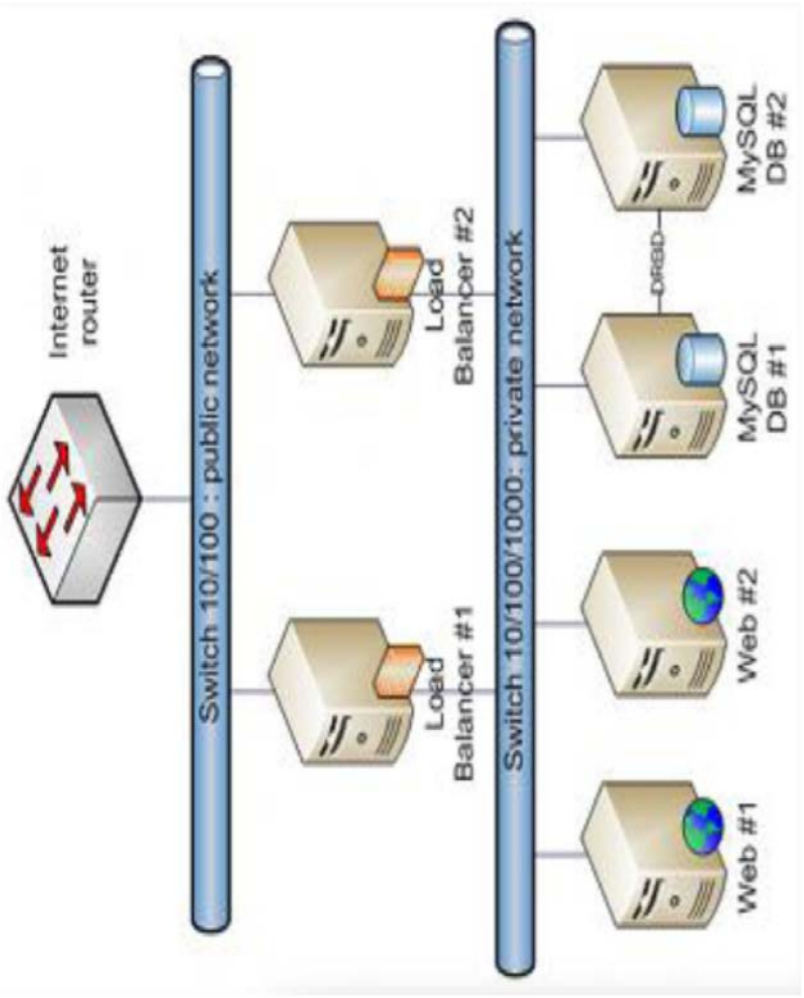
2.15 The second phase of trials was carried out from 20 March to 12 April 2013.

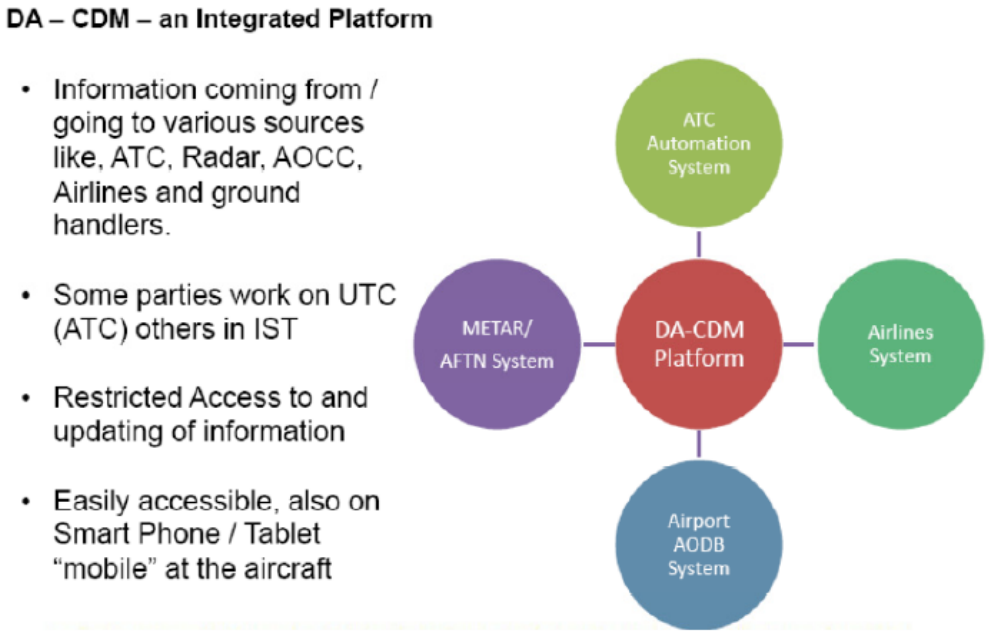
2.16 The third phase of trials was carried out from 26 April to 12 May 2013 from 1100 hrs to 1700 hrs (local) during day and 2330 to 0230 (local) hrs during night time. Apart from this, several meetings were conducted for continuous system improvement and also for educating all the partners on DA-CDM Concepts, practical usage and benefits.

2.17 After feedback was received from all the partners i.e. ATC, Airlines, Ground Handlers, Airport operator, etc. and after making necessary improvements in the system, it was decided to implement DA-CDM with effect from 05th June 2013. Before implementing, necessary approvals from DGCA were taken. AIP supplement 21 of 2013 was issued subsequently enumerating the detailed procedures.



Data Flow in DA-CDM (Block diagram)


Internet router
Switch 10/100 : public network
Load Balancer #2
Load Balancer #1
Switch 10/100/1000: private network
MySQL DB #2
DRBD
MySQL DB #1
Web #2
Web #1



2.18 The benefit of A-CDM at Delhi Airport in terms of reduced carbon emissions with A-CDM implementation is attached as Annexure-A to this Working Paper.

Enhancements in the pipeline for DA-CDM:

2.19 To take DA-CDM to the next level, certain enhanced features are in the pipeline. These are as follows:

i. Enhanced integration of DA-CDM with ATM automation system.
ii. AMAN-DMAN integration.
iii. A-SMGCS integration.
iv. Integration with ATFM.
v. Automation of TSAT.
vi. Automation of TOBT (taking MTTT from GH).
vii. Generation of Alerts.
viii. Updation of dynamic VTTs.
ix. Time stamping of events.
x. Use of electronic flight progress strips in ATC.

2.20 India offers an opportunity to exchange the ideas and experience of developing and implementing A-CDM with other Airports in the Region.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the successful implementation of DA-CDM; and that in future such an A-CDM tool integrated with C-ATFM can be implemented to facilitate the efficient flow of traffic between identified city pairs located in neighbouring States also.

b) discuss the benefits of implementing A-CDM.

Annexure-A

Reduced Carbon Emissions with A-CDM implementation.

Introduction:

1 Air transport supports economic and social development worldwide, yet contributes to the production of greenhouse gases, roughly two per cent of CO_2 emissions from human activity. A common, coordinated and global approach to addressing the impact of air transport operations on noise and local air quality around airport and the much broader challenge of climate change is the need of the hour. Airport Operator, Air Navigation Service provider and Airlines Operators have done their share through streamlined operational procedures, assisted in this effort by modern air navigation aids and procedures.

2 Delhi Airport Collaborative Decision Making has been implemented at IGI Airport on 05th June 2013 i.e. World Environment Day, with a vision to reduce the delays to aircraft operations by sharing the situational awareness among all the airport partners on real time basis , thereby reducing the operational inefficiencies and fuel wastages and hence achieving reduced CO2 emissions in the environment.

3 Prior to A-CDM implementation at IGI Airport, New Delhi, on an average ground holding delays of 5-6 minutes/flight were observed for approximately 80 percent of the departing flights. The implementation of DA-CDM has resulted in containing this delay to an average of one minute for the above mentioned departing flights.

Assumptions:

4 The average aircraft movement (Arrival and Departures) at IGI Airport New Delhi is presently 900 movements per day, of which 50 percent are Departures. Out of these 450 departing flights approx. 100 experienced no delay in taxi and at holding point, prior to A-CDM implementation. With the implementation of A-CDM the taxi and holding point delay have been reduced from approx. 6 minutes to approx. 1 minute for the remaining 350 departing flights.

Tool Used to calculate Fuel savings:

5 International Civil Aviation Organization (ICAO) IFSET (ICAO Fuel Savings Estimation Tool) Version 1.0 © ICAO 2011has been used as an automated means for modeling, estimating and reporting the fuel savings achieved as a result of implementation of operational improvements. The tool estimates the difference in fuel mass consumed by comparing a pre-implementation (i.e. “baseline”) case against a post-implementation case (i.e. “after operational improvements”).

Methodology:

6 All analyses begin with describing the baseline and post-implementation cases. The details pertaining to IGI Airport as given in the following table, have been specified for operations in both scenarios.

7 This is accomplished by selecting the aircraft types from a dropdown list of available types and then entering the number of operations. The list contains basic aircraft categories that can be selected. Those aircraft categories include: single engine piston, multi engine

piston, turboprop, short range single aisle jet, medium range single aisle jet, twin aisle jet (2 engine), and twin aisle jet (3+ engines). The resultant fuel savings have been reported on the same basis.

Report:

8 The following details of the fleet mix operating as departures at IGI Airport have been taken into account for the purpose of estimation.

The estimated figures have been arrived at by considering the data on delays to the departing flights during Taxi and holding point for a period of five months (5th June 2013 to 05th Nov 2013).

The Fuel Savings figure in Kg per Day achieved so has been extrapolated to arrive at an estimate for the yearly fuel Savings.

S. No.	Category of Aircraft	Number of Aircraft	Aircraft Participating In DA-CDM		Aircraft Not Participating In DA-CDM	
			Numbers	Percentage	Numbers	Percentage
1.	Three plus engine Twin Aisle Jet	15	15	100	0	0
2.	Twin Aisle Jet	95	95	100	0	0
3.	Single Aisle Jet	140	140	100	0	0
4.	Regional Jet	70	50	71.43	20	28.57
5.	Turboprop	30	25	83.33	5	16.67
	TOTAL	350	325	92.86	25	7.14

Scenario	**Old Fuel in Kg**	**New Fuel in Kg**	**Fuel Savings in Kg/Day**
DA-CDM Fuel Savings	37100	7100	30000

Savings of Fuel after the implementation of DA-CDM.

I. Per Day Fuel Savings: 30,000 Kg.
II. Per Year Fuel Savings: 30,000 Kg * 365 days = 10.95 Million Kg.
III. Per Day Fuel Savings: 37,500 Litres.

[Assuming 800 g of Fuel = 1 litre of Fuel]

IV. Per Year Fuel Savings: 37.5 Kilo Litres * 365 days = 13.6875 Million Litres.
V. **Per year savings through DA-CDM: USD 14.37 Million.**

[13.6875Million Litres @ USD 1.05/ Litre]

[Average rate of fuel in Delhi: USD 1050 per Kilo Litres]

VI. **Per year CO_2 reduction through DA-CDM: 34.49 Million Kg.**
[10.95 Million Kg. * 3.15 = 34.49 Million Kg]

[1 tonne of burnt jet fuel emits 3.15 tonnes of CO_2 vide http://www.greenaironline.com]

9 Operational improvements are a key strategy that can be applied to deliver tangible reductions in aircraft fuel consumption. The Global Air Navigation Plan (Doc 9750) and the Operational Opportunities to Minimize Fuel Use and Reduce Emissions (Circular 303) are among several documents providing guidance regarding operational improvements being implemented to improve efficiency of the ATM System.

10 DA-CDM is an example of growing cooperation between government and industry on a programme of action to reduce climate impacts from aviation emissions and minimise harmful impacts on our ecosystems. This endeavour aims to be a significant contribution to the overall sustainability of aviation and follows best practices for sustainable air transport industry.

11 Against a background of increasing concern regarding the impact of aircraft engine emissions on the environment, the ability to reduce fuel burn and emissions accrued from operational improvements being put in place by the ANSP (Air Navigation Service Provider) i.e. Airports Authority of India as a pioneering initiative in India is of high importance.
