Asia-Pacific Multi-Nodal

CANSO Air Traffic Data Exchange for the Americas (CADENA)

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CANSO – General Organisational Information

Vision

• To be the recognised leader in transforming global air traffic management (ATM) performance

Membership

• 90 Full Members (ANSPs) representing 90% of the world traffic
• 89 Associate Members (Organisations that supply goods and services to the air traffic management industry, as well as academic institutions and aircraft operators)
ATFM Implementation Best Practices

- ATFM Operations Around the World
  - Multi-Nodal
  - CADENA
How Multi-Nodal Came About?

- To start, what do we know about ATFM around the world?

- Most operate as single / centralized entity providing ATFM service within FIR or area of responsibilities

- Most focus on domestic flights or flights within area of responsibilities, which captures >70% of overall traffic

- Most exempt international and long-haul traffic from outside the area

- *WHY DID THIS NOT WORK FOR ASIA-PACIFIC?*
Why does conventional ATFM concept not work for Asia-Pacific?

How Multi-Nodal Came About?

- Hong Kong International & Singapore Changi
  - Domestic: 22.7%
  - International: 77.3%

- Bangkok Suvarnabhumi
  - Domestic: 19.5%
  - International: 80.5%

- Kuala Lumpur International
  - Domestic: 33.3%
  - International: 66.7%

- Jakarta Soekarno-Hatta
  - Domestic: 0%
  - International: 100%
How Multi-Nodal Came About?

Why does conventional ATFM concept not work for Asia-Pacific?

70% domestic participation is NOT met for most airports
How Multi-Nodal Came About?

Why does conventional ATFM concept not work for Asia-Pacific?

...but can be met with regional international traffic
How Multi-Nodal Came About?

So what did Asia-Pacific do?

CANSO Whole of flight CDM Pilot Project between BKK-SIN 2011-2012

Distributed Multi Nodal Regional ATFM Concept 2014 - ....

Research Collaboration on Regional ATFM Concept 2013

CANSO Whole of flight CDM Pilot Project between BKK-SIN 2011-2012

Tripartite CDM Project between BKK-HKG-SIN 2012-2013
What is Multi-Nodal Concept?

Distributed Multi-Nodal ATFM Network: The Concept

Bases:
- Common ATFM principles and guidance with harmonized protocols supported by agreed Common Operating Procedures (COP)
- Effective information sharing and dissemination framework

Concept:
Independent “virtual” ATFM nodes supported by interconnected information sharing framework

Supplemented by: A-CDM Process
ATFM Implementation Best Practices

- ATFM Operations Around the World
  - Multi-Nodal
  - CADENA
CADENA
The Game Changer in Latin America
The Region needed CADENA

- CADENA broke new ground and is changing the way the region delivers air traffic flow management
- CADENA was established in June 2016, has been implemented, and is improving
- More States are joining the effort
- The aviation community is realizing the operational benefits of collaboration
CADENA Implementation Roadmap

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## CADENA Members, Stakeholders and Observers

### Members
- TTCAA (Trinidad & Tobago, Aug 2016)
- IDAC (Dominican Republic, Aug 2016)
- ECNA (Cuba, Aug 2016)
- JCAA (Jamaica, Aug 2016)
- DC-ANSP (Curaçao, Aug 2016)
- SENEAM (Mexico, Aug 2016)
- COCESNA (CENAMER, Aug 2016)
- EANA (Argentina, Aug 2016)
- FAA (USA, Aug 2016)
- CGNA (Brazil, Feb 2017)
- ANSA (Aruba, Feb 2018)
- DGAC (Costa Rica, Feb 2018)
- AEROCIVIL (Colombia, Apr 2018)
- MWCR (Grand Cayman, Sep 2018)

### Stakeholders
- Aerolinas Argentina
- Aeromexico
- Air Canada
- American
- Atlas Air
- Azul
- Caribbean Airlines
- Copa
- Delta
- JetBlue
- Mesa Airlines
- Sky Airlines
- Spirit Airlines
- United
- UPS
- Volaris
- WestJet
- ICAO
- ALTA
- ACI
- IATA
- NBAA

### Observers
- Panama, Venezuela, Peru, Paraguay, Uruguay, Chile
Weekly Regional Planning Web Conference

- Weekly Web Conference on Fridays
- Target duration is 30 minutes or less
- CADENA ANSPs share the responsibility of hosting the Web Conferences
- Regional aviation stakeholders participate
- Information is shared, discussed, and the ATFM plan is established collaboratively

- Simple and EFFECTIVE!
CADENA Tactical Web Conferences

- Hurricane
- Route Issues
- Equipment Issues
- Excessive TMM Issues

Example: Hurricane Planning Web Conferences

**Benefits**
- Common situational awareness
- Rapid and fluid information flow
- Improvement of operational safety

**Frequencies**
- 17 Web Conferences in 2017
- 9 Web Conferences in 2018
Regional Operations Plan

SENEMAP Mexico: 25/Feb/2019 15:12

Anticipated Demand Information: HIGH

TMM Planned: MMMX DOMESTIC GDP MMUN, 29MIT TRAFFIC FROM HOU AREA DEST MMUN. (15 - 23UTC).

Urgent Advisory

Weather: NO SIGNIFICANT WEATHER

Volcanic Ash: NONE

Constraints: NOTAM
   (A0533/19 NOTAMR A0449/19
      A) MMUN
      B) 201901310600
      C) PERM
      E) FLT TO MMUN BY AWY UB-881 NOT AUTH )

Special Events: NONE

Equipment Outages: NONE

Other NOTAM A0790/19, ROUTES TO BE FILLED DEST MMUN. (SEE ADVISORIES SECTION)

JCAA Jamaica: 25/Feb/2019 13:33

Anticipated Demand Information: MEDIUM

TMM Planned: NONE

Urgent Advisory
CADENA Operational Information System

OIS: effective to share information and improve common situational awareness

- ATFM Daily Plan (ADP)
- Regional TMM
- Active Reroutes
- Advisories
- Airport Capacity Info
- Reroute Repository

In English and Spanish

https://www.cadenois.org/
 Supports standardized procedures and practices
 Outlines roles and responsibilities
 Describes ATFM structure and operation
 1st version July 2017. Updated version planned summer 2019
 Based on ICAO Doc 9971 – “Manual on Collaborative Air Traffic Flow Management (ATFM)”
CADENA–Advanced ATFM Operational Simulation Training

- CADENA developed and implemented (at no cost to ANSPs) Advanced ATFM Operational Simulation Training. The training brought together neighboring ANSPs to:

  - Understand capacity, constraints, and predicted demand
  - Develop ATFM solutions with the least operational impact for the ANSP and the region
  - Analyse the results of traffic management measures on the efficient flow of traffic and the balancing of demand to available capacity
  - Collaboratively identify operational issues and work towards a common goal

- Training will continue to include ANSPs throughout the region to foster a common understanding of regional constraints and beneficial and collaborative solutions
CADENA – TFM Data Exchange

- Critical to exchange flight data (e.g., Flight Plan, Position Data) for the accurate demand information
- FAA has Traffic Flow Management System (TFMS) and System Wide Information Management (SWIM)
- Colombia has full ATFM capabilities
- TTCAA started TFM DE in October 2017
- COCESNA ready to test TFM DE (as of Feb 2019)
CADENA – Next Steps

- Continue collaboration with ICAO
- Continue improvement of Procedures and Processes
- Additional ANSPs for traffic data exchange to improve demand information
- Additional aviation stakeholders participation
- Provide additional CADENA Advanced ATFM Operational Training Opportunities
Asia-Pacific Multi-Nodal

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Back-up Slides

• A-CDM
A-CDM – Some History

- **A-CDM** arose from the need to minimize the disruptive effects from bad weather conditions.

- **Back in Year 2000** trials were conducted at several major European airports to study and develop an Airport CDM concept for Europe.

- This led to the creation of the Airport CDM Task Force in Eurocontrol and the result was **Airport CDM Implementation Manual**.

- Munich Airport was the **first A-CDM airport back in 2007**.
A-CDM – Quick Facts

✓ Airport CDM (A-CDM) aims at improving the overall efficiency of airport operations by optimizing the use of resources and improving the predictability of events.

✓ It focuses especially on aircraft turn-round and pre-departure sequencing processes.

- 28 European airports are fully A-CDM compliant and more are to come
- Airports in the APAC, ME and South America are starting to adopt A-CDM

Globally Endorsed
✓ ACI
✓ CANSO
✓ IATA
✓ ICAO
A-CDM in APAC

- **ICAO recommends** states in APAC to implement A-CDM in accordance with the **Seamless ATM Plan**.
- The Plan prioritizes the implementation of the **Global Air Navigation Plan Aviation System Block Upgrades (ASBUs)**
- Recommended ASBU upgrades are:
  - B0-ACDM Airport CDM
  - B1-ACDM Enhanced Airport CDM
- [https://www.icao.int/sustainability/Pages/ASBU-Framework.aspx](https://www.icao.int/sustainability/Pages/ASBU-Framework.aspx)
WHAT TIME IS IT?

✓ Single source of the “TRUTH” – all stakeholders look at the SAME information.
A-CDM – What is it REALLY about?

- Move away from the "FIRST COME FIRST SERVED" to “BEST PLANNED BEST SERVED” = Adherence to TOBT and TSAT
- Integration with ATFM = Information exchange for better demand & capacity balancing
A-CDM – What is it REALLY about?

1. Information Sharing
2. Milestone Approach
3. Variable Taxi Time (VTT)
4. Pre-Departure Sequence
5. CDM in Adverse Conditions
6. Integration with Flow Management

A-CDM creates predictability and common awareness during events such as typhoons, thunderstorms, de-icing operations, etc. CDM in Adverse Conditions.

What is it REALLY about?
A-CDM – What is it REALLY about?

Local Rules & Procedures

Arr. Flight Data
- Exit (Est. Taxi In Time)
- Turn Around Time
- Exot (Est. Taxi Out Time)

Arr & Dep Sch. & Flight Plan
- Stand Planning
- Arr & Dep Sch. & Flight Plan
- AMAN
- Final Approach
- ATCC/FDPS

Gate Data
- Actual Landing
- Actual in Block
- A-SMGCS & Ground Surveillance
- AODB

Dep. Flight Data
- AOBT (Actual Off Block Time)
- ATFM
- CTOT (Calculated Take Off Time)
- A-SMGCS & Ground Surveillance

Ground Movement Data
- A-SMGCS & Ground Surveillance
- AODB

Local Rules & Procedures
- EOBT
- STD
- TOBT
- TSAT
- ELDT
- EIBT
- TTOT
- ARDT (Actual Ready Time)
- ASAT (Actual Start-up Approval Time)
- ARDT (Actual Ready Time)
- ATFM
- Local Rules & Procedures

What is it REALLY about?
To achieve A-CDM success, it will require collaboration between key stakeholders. The collaboration will be based on commonly agreed procedures and information exchange to achieve TOBT, TSAT and ATFM integration.
A-CDM – REAL Benefits!

Local benefits

- Average taxi-out time savings between 0.25 and 3 minutes per departure.
- Average schedule adherence improvements between 0.5 and 2 minutes per flight.
- Reductions in the number of late arrivals and flight cancellations.
- Improved management of and recovery from adverse conditions.
- Reduction in Flight Activation Monitoring suspensions.
- Increased peak departure rates at the runway.
- Improved take-off time predictability by 85% during adverse conditions.

Network benefits

- Reduction in the standard deviation of take-off accuracy from 14 to between 5 and 7 minutes.
- Clear reduction in en route sector over-delivery risk when fed by 60% of flights from a CDM airport.
- Increase by 3.5 - 5.5% of en route capacity when Europe’s 50 busiest airports become integrated.
- 80% of en route capacity benefits realised when the top 30 European airports are integrated.
- Average ATFM delay reduction of three minutes per regulation.
- 40 CDM airports could yield reductions of average ATFM delay of 20-25%.
- Departures from ACDM airports receive less ATFM delays than departures from non-ACDM airports through the same restriction – by an average of one minute per flight.
A-CDM and ATFM – Why?

- VERY WELL defined, tested and implemented in EUROPE!

- Outside of Europe the ATFM Concepts look different → how integration is supposed to work is still to be worked out.
ATFM and A-CDM

✓ ATFM and A-CDM can both exist as “stand-alone” BUT this will not realize the full benefits

→ INTEGRATE

✓ Integration will require harmonization of ConOps, data sharing and quality assurance

→ COLLABORATION
Back-up Slides
Agenda

1. What is ATFM?
2. Implementation Best Practices
3. ATFM Tools
4. Global Application and Next Steps
ATFM Benefits - Societal

- Improved quality of air travel
- Increased economic development through efficient and cost-effective services
- Reduced fuel burn, greenhouse gas emissions, and operating costs
ATFM Benefits - Predictability

- Allows us to build achievable schedules
- Allows us to load the appropriate fuel weight
- Every kilo of extra fuel offsets cargo and passenger capacity
- We may have to offload passengers and cargo to carry extra fuel
- It costs fuel to carry fuel
- Predictable direct sectors are 4-6% more efficient than tactical direct sectors
- Collaborative approach allows us to help the system
Global Application – Airline Benefits

European

• The European system has been designed to manage the capacity constraints, and to allow airports to manage airport activities. Out of necessity, A-CDM was developed in order to allow airports to begin proactively coordinating the arrivals and departures with the CFMU NM

Eurocontrol CFMU

• The CFMU, has developed a number of tools and procedures to manage traffic within the EU area. It has focused on utilizing the tools to manage the data associated with flights, and to coordinate with the airports and airlines. The basic structure develops a network plan in advance of the operational day, and then works with ANSPs to mitigate unexpected disruptions. The CFMU does not have the authority to unilaterally modify the network plan.

Performance?

□ The level of performance, is based on the number of delays and preference approvals.
□ Weather and other issues have reduced the overall performance. In particular, the lack of flexibility in the airspace, staffing and workforce actions, and lack of harmonized equipage, have contributed to delays.

Main Challenges?

□ Airspace needs to be more accessible. The amount of OAT airspace over Europe limits ANSP flexibilities.
□ Airlines may need to adjust flight times in order to take advantage of preferred routes
□ Airports need to improve management of gates and support activities.
United States/FAA

- The FAA has a very robust ATFM system. The CDM structure utilized by the FAA provides a venue for stakeholders to commonly agree on issues related to real-time operations. Via a suite of tools, ATC, airlines and airports are able to reduce delays by optimizing resources and improving predictability of events.

FAA Air Traffic Command Center

- The FAA ATCSCC is active in managing and coordinating aspects related to the flow of all traffic within US delegated airspace and works directly with airport operators to lessen capacity constraints and restrictions, by determining how best to mitigate enroute and airport delays. The FAA’s ATFM module is interconnected with ACCs and adjacent FIRs.

Performance?

- The FAA reports on both airport and FAA ATC performance.
- Delays and other performance measures are tracked.
- Airlines are provided opportunities and encouraged to comment and daily performance.

Main Challenges?

- Weather is a huge factor impacting the US.
- New entrants such as commercial space activities, and RPAS operations will have an impact on specific areas.
- Further development of technologies will assist the FAA in improving their operation, but may make it difficult to harmonize systems with Global partners.
Asia-Pacific

- There is no centralized provider of ATFM services within the region, however, there are a number of States with Domestic ATFM programs. What Asia has realized is that they will not have a centralized Unit for the region, therefore alternative options must be explored to provide Cross Border ATFM, that would link the various domestic ATFM initiatives - hence Multi Nodal and NARAHG (Korea, Japan, Eastern China). In addition, to the above a number of ANSPs and airport operators manage activities utilizing A-CDM principles.

Demonstrations

- The region will undergo a demonstration of SWIM capabilities later in 2019. As the region moves forward, SWIM will be a key enabler in building a multi-modal LR-ATFM system. In this regard, Australia is currently embarking on a LR-ATFM project which will look at planning of their arrival sequence much further out than today and integrate it with their AMAN and GDP.

Performance?

- The region currently experiences a varying degree of delays. Quite often, they are attributable to weather and capacity constraints.
- In addition, the amount of available airspace is limited due to reserved military areas.

Main Challenges?

- Available airspace, Civil & Military sharing, i.e., FUA
- Development of automated interoperable systems
- Established links with adjacent FIRs will enable the sharing information
- Improved use of weather forecasting and opening of alternative routes.
There is no centralized provider of ATFM services in the region. The lack of available airspace, and areas where military operations restrict the use of established route structures, only adds to congestion and reductions in capacity.

ICAO has formed a Task Force to consider the subject.

There are a number of events upcoming that will increase the demand on available airspace.

ANSPs in the region, although largely equipped with new systems, have not implemented interoperable systems that enable automated sharing and collaboration.

ICAO has formed a Task Force to consider the subject.

There are a number of events upcoming that will increase the demand on available airspace.

ANSPs in the region, although largely equipped with new systems, have not implemented interoperable systems that enable automated sharing and collaboration.

Capacity demand has resulted in delays at a number of airports.

Although not a significant factor, weather has the potential to disrupt operations.

AIS and Flight Plan data is provided via AFTN.

The use of AIDC is increasing, but inconsistent.

The lack of interoperability between systems, inhibits advancement.

Implementation of SWIM will improve the ability of systems to communicate, but progress is slow.

Lack of available airspace and routes will continue to restrict capacity.

Political situation results in difficulties for ANSPs...
**Americas**

- Although the region benefits from having a number of advanced ANPS who are implementing advanced systems, there are challenges related to system interoperability with surrounding regions. This disconnect is not sustainable.

**ATFM Development**

- Here to, the America’s region is open to advancing robust methods for managing operations, however they have challenges with airspace restrictions, and weather avoidance.
- There is a need to implement interoperable systems, thus allowing harmonized procedures.

**Performance?**

- Weather accounts for the majority of delays.
- Airport capacity constraints, due to size and configuration are also key factors affecting the performance.

**Main Challenges?**

- Lack of automation improvements.
- SWIM technology would assist the ANSPs in being able to share information.
- Airport infrastructure and management of gates and support activities, could also improve predictability, and increase efficiencies.
- Inter-regional coordination and the use of alternative routings during weather events would improve overall operations.
Global Application – Airline Benefits

Overall Benefits

- Enhanced ATM system safety
- Increased **predictability**
- Increased situational awareness
- Reduced fuel burn and operating costs
- Effective management of irregular operations and unforeseen events

NOTE: An ATM system which has no plans regarding capacity, i.e., no systems in place to manage flows, ultimately may become a hindrance to maintaining a steady flow of traffic and result in increased costs
Next Step - Tools Development

- Long Range ATFM
- Trajectory Based Operations
- Gate-to-Gate System Integration
- Advanced Weather Prediction and Interpretation Tools
- Cloud Based Applications
Wrap-up

1. What is ATFM?
2. Implementation Best Practices
3. ATFM Tools
4. Global Application and Next Steps
CANSO and IATA
ATFM: Collaborating for Air Traffic Flow Efficiency

Moderator: Rafael D. L. Quezada, CANSO Operations

Speakers: Stuart Ratcliffe, Metron Aviation
Fredrik Lindblom, Saab
Daniel Vaca, IATA
Javier Vanegas, CANSO Latin America
Thank you to our speakers.

For more information visit their booths:

Booth 403

Booth 1259

Booth 305

Booth 147
Agenda

1. What is ATFM?
2. Implementation Best Practices
3. ATFM Tools
4. Global Application and Next Steps
What is ATFM and How it Works?

1. ATFM Objectives
2. ATFM Concepts
3. CDM Objectives
4. ATFM Functional Flow
What is ATFM? and How it Works

- Air traffic flow management (ATFM) is used to manage the flow of traffic in a way that minimizes delays and maximizes the use of the entire airspace. ATFM can regulate traffic flows involving departure slots, smooth flows and manage rates of entry into airspace along traffic axes, manage arrival time at waypoints, flight information region or sector boundaries, and reroute traffic to avoid saturated areas. ATFM may also be used to address system disruptions including crisis caused by human or natural phenomena. – ICAO Global Air Navigation Plan

- Air traffic flow management (ATFM) is an enabler of air traffic management (ATM) efficiency and effectiveness. It contributes to the safety, efficiency, cost effectiveness, and environmental sustainability of an ATM system. It is also a major enabler of global interoperability of the air transport industry. – ICAO ATFM/CDM
ATFM Objectives

- The objective of ATFM is to safely increase air traffic management (ATM) efficiency and effectiveness
- To equitably balance air traffic capacity and demand
- To improve predictability and deliver cost efficiencies that enable global interoperability of the air transport industry
- To enhance the environmental sustainability of an ATM system
ATFM Concepts

A service established with the following objectives:

- Contribute to a safe, orderly and expeditious flow of air traffic
- Ensure that Air Traffic Control (ATC) capacity is utilized to the maximum extent possible
- Ensure that the traffic volume is compatible with the capacities declared by the appropriate air navigation service provider (ANSP)
CDM Objectives

- Provide real-time operational information to stakeholders to facilitate a common and accurate view of demand and system constraints
- Enhance decision making and capacity utilization
- Requiring that all system stakeholders function in an equitable manner for the betterment of the system.
- Exchanging decision-making information among the stakeholders to optimize system capacity and thus improve:
  - Operational quality and stability
  - Operational reliability and predictability
  - Demand and capacity balancing
  - Air space organization, which is critical for maximizing capacity and enhancing system safety.
- Improve ATM performance, while balancing the needs of individual ATM community members
ATFM Functional Flow

Integrated ATFM/CDM—Functional Flow

ATFM Stakeholders
- ANSP
- Airports
- Aircraft Operator

Common Situational Awareness

Specify Capacity

Monitor Demand and Capacity

Perform CDM

Evaluate Alternative TMIs

Initiate or Modify TMIs

Predict Demand

Report Metrics and Analyze Performance (Real-Time and Post-Events)
Capacity
Predict Demand

Integrated ATFM/CDM—Functional Flow

- Specifying Capacity
- Monitoring Demand and Capacity
- Predicting Demand
- Performing CDM
- Evaluating Alternative TMIs
- Initiating or Modifying TMIs
- Reporting Metrics and Analyzing Performance (Real-Time and Post-Events)
Evaluate ATFM Solutions
Perform CDM
Initiate ATFM Solutions

Integrated ATFM/CDM—Functional Flow

Common Situational Awareness

Specify Capacity

Perform CDM

Monitor Demand and Capacity

Evaluate Alternative TMLs

Initiate or Modify TMLs

Predict Demand

ATFM Stakeholders:
- ANSP
- Airports
- Aircraft Operator

Report Metrics and Analyze Performance (Real-Time and Post-Events)
How Does an ATFM Service Operate?

- National/Regional/International perspective
- National perspective
- Local perspective
- Airport perspective

Central ATFMU

ACC

TMA

TWR