

[EN-I-009] Collaboration to Implement Air Traffic Flow Management (ATFM) Capabilities in the Region with Multiple Air Navigation Service Providers (ANSPs)

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Abstract: The objective of this paper is to provide information on the regional Air Traffic Flow Management (ATFM) implementation project called the Civil Air Navigation Services Organisation (CANSO) ATFM Data Exchange Network for Americas, or CADENA. CADENA demonstrates ATFM capabilities and regional harmonization by various sized states and flight information regions (FIRs) that are managed by multiple air navigation service providers (ANSPs) operating in a loosely affiliated manner. This paper gives an overview of the characteristics of the region, U.S. interests in the region, and the ATFM needs in the region which ultimately led to the creation of CADENA. Following the successful launch of two CADENA initiatives, this paper will further discuss specific approaches for midterm and long-term improvements that aim to improve demand prediction through traffic data exchange via the Federal Aviation Administration's (FAA) System Wide Information Management (SWIM) and Traffic Flow Management System (TFMS). Finally, this paper will outline lessons learned and outcomes from the work done through CADENA.

In terms of a more global ATFM environment, there are regional similarities between the Caribbean and Central America region and the Southeast Asia region. The paper compares and discusses these two regions in the hopes that through the experience with CADENA, the Southeast Asia region may consider this as a case study as they address regional ATFM needs of their own.

Keywords: Air Traffic Flow Management, System Wide Information Management, Traffic Data Exchange, Flight Data Exchange

1. INTRODUCTION

The Federal Aviation Administration (FAA) Air Traffic Organization (ATO) Caribbean Proposal Team prepared the "Regional Air Traffic Flow Management (ATFM) Proposal for the Caribbean" and presented an implementation proposal for the regional ATFM concept to its management in January 2016 [1]. The proposal addressed one of the FAA Administrator's top four Global Leadership Key Initiatives. In March 2016, the FAA and Civil Air Navigation Services Organisation (CANSO) Latin America and Caribbean (LAC) CEO Committee (LAC3) agreed that LAC3 would lead the implementation of this proposal.

The CANSO ATFM Data Exchange for the Americas (CADENA) Regional Implementation Group (RIG) was established in June 2016 to implement regional ATFM, based on the principles of the Collaborative Decision Making (CDM) philosophy [2]. CADENA members signed a Letter of Agreement (LOA) on December 6, 2016, to promote communication, collaboration, and

coordination among themselves regarding ATFM and CDM processes [3].

CADENA members include states throughout the Western Hemisphere because states in South America recognized the benefits of CADENA. However, the original focus of this network was the Caribbean and Central America region and the explanation and reasoning of this paper reflects that intention.

1.1 Characteristics of the Caribbean Region

The Caribbean and Central America region is characterized by multiple air navigation service providers (ANSPs) operating in a loosely affiliated, non-integrated network. There are multiple flight information regions (FIRs) in the compact and complex region of the Caribbean and Central America (refer to Figure 1.1). Sizes and shapes of FIRs vary and they are often managed by different ANSPs with variable ATFM capabilities. Most ANSPs do not generate sufficient internal traffic to effectively manage their traffic flow [4]. Some ANSPs have ATFM units as part of their existing air navigation service structures, some are in the process of doing so. It

is difficult for some ANSPs to have ATFM units for a variety of distinct reasons to their state.



Figure 1.1: Caribbean and Central America Region FIRs

The air traffic demand is expected to grow on an average annual rate of 5% [5]. Highly variable tropical weather patterns and the complexity of numerous airports contribute to schedule uncertainty and delays within the region.

ATFM, based on the principals of CDM, has long been a goal for the region as observed by the Port-of-Spain Declaration [6] where ATFM is one of five regional air navigation targets. However, the perceived need for a central command authority – combined with the cost and political ramifications of establishing such an authority – has impeded progress on ATFM/CDM in the Caribbean and Central America region.

Air transport supports 5.2 million jobs and \$167 billion USD in GDP in Latin America and the Caribbean region [7]. Providing efficient air transport service is a significant matter for the region. The combination of the complexity of the airspace, traffic demand and weather issues make the implementation of ATFM/CDM in the Caribbean region a very important initiative.

1.2 U.S. View of Caribbean Region

The airspace extending from the Florida Panhandle to South America and bordered by the Atlantic Ocean and the Gulf of Mexico, is of economic and strategic significance to the U.S. and the airline industry.

Destinations in the Western Hemisphere accounted for 60% of U.S. outbound international travel in 2014. Passenger travel to Caribbean destinations was in excess of 9 million in 2013 and represented 23% of all international flights in the Western Hemisphere. Additionally, flights to Central and South America frequently fly over Caribbean airspace, adding traffic volume and complexity for flights to and from the dozens of regional airports [1].

In 2014, there were more than 7 million passengers who began their trips in the U.S. and flew to the Caribbean. There are more than 900,000 flights a year crisscrossing the seven adjacent FIRs in the Caribbean and Central

America region [8]. The FAA has been both a strong advocate for global implementation of CDM within an integrated ATFM system and a willing partner to improve safety and enhance efficiency of aviation in the Caribbean and Central America region.

2. IMPLEMENTATION AND APPROACHES

Stakeholders throughout the Caribbean and Central America region recognize that a CDM process is a key enabler of ATFM and that it allows all stakeholders to actively participate in operational decisions which affect them. The CDM process applies to a wide variety of decisions made during strategic, pre-tactical and tactical operations.

The CADENA ATFM implementation approaches [9] are based on the transparent, inclusive, and collaborative philosophy of CDM. CADENA RIG established the governance structure, terms of references, and selected ATFM improvement capabilities by consensus. ATFM implementation capabilities are roughly grouped into three categories: near-term (0-2 years into the future), midterm (2-7 years into the future), and long-term (7+ years into the future) for improvements expected to be deployed.

2.1 Setting the Stage

An appropriate governance structure and management disciplines were defined. The CADENA RIG members were confirmed, and the chair, co-chair, and secretariat were selected. These positions were further defined with written roles and responsibilities agreed upon by CADENA members through a collaborative process. Meeting and communications methods were also defined.

It is important to note that support from each ANSP's upper management was essential for CADENA RIG members to fulfill their responsibilities and implement regional ATFM/CDM.

2.2 Near-Term: Operational Improvements

Operational improvements focus on immediate operational benefits. Initially they should not require a large investment or sophisticated tools. Operational improvements focus on sharing fundamental information which is necessary to establish common situational awareness needed to conduct ATFM. The CADENA RIG members identified both traffic demand and capacity information that existed locally or could already be generated using their existing expertise. Sharing only currently available information is not sufficient to conduct sophisticated ATFM operation, however such information sharing is the most basic and critical step towards regional ATFM and it delivers immediate benefits quickly. Early and explicit successes gave the CADENA RIG members confidence and enthusiasm to continue their efforts for future improvements.

2.2.1 Regional Weekly Operational Web Conference

For decades, the FAA has been conducting operational planning teleconferences 8 times a day, from 7:15AM to 9:15PM every 2 hours, to ensure that the FAA and its stakeholders have a common understanding of the ATFM situation throughout the day. CADENA RIG agreed to conduct similar operational conferences calls weekly on Fridays to prepare for the weekend traffic in the region. This regional weekly web conference became operational on December 16, 2016 improving inter-ANSP communication and regional aviation system predictability, reducing fuel burn and operating costs, reducing pilot and air traffic control (ATC) workload, and enhancing operational safety.

The leadership of this regional web conference is unique. CADENA RIG members rotate the role of web conference host. This rotating host practice gives each ANSP ownership and experience in facilitating the web conference [10].

The outcome of the web conference is an operational plan (OP) establishing ATFM pre-tactical plans and responsibilities for managing air traffic operations in the region for a defined period of time (e.g., the initial period of time for the OP is a 72-hour period commencing at 15:00 Coordinated Universal Time (UTC) each Friday).

The Regional Weekly Operational Web Conference is inclusive and transparent to all aviation stakeholders. It includes participation from regional ANSPs and states, airlines, and international aviation organizations. The table below lists ANSPs who take leadership on the Regional Weekly Operational Web Conference, as of September, 2017:

ANSPs
Argentina
Brazil* (*CADENA member, but do not lead the web conference.)
Central America (Belize, Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua)
Cuba
Curacao
Dominican Republic
Jamaica
Mexico
Trinidad and Tobago

Table 2.2.1: Web Conference Leading ANSPs

2.2.2 Regional Operational Information System

The FAA has had its domestic OIS deployed for a couple of decades, providing stakeholders with the current status of the National Airspace System (NAS). The FAA took the opportunity to share this success story with CADENA, and CADENA RIG members agreed to develop their own OIS for the Caribbean and Central America region. On August 28, 2017, the CADENA OIS was successfully launched (Figure 2.2.2). This initial version consists of

mostly manually entered daily operational information from nine ANSPs (Table 2.2.1) and three FAA Air Route Traffic Control Centers (ARTCC in Miami, Houston, and San Juan). Information shared via the CADENA OIS is taken from the ATFM daily plans (ADPs) which are populated each morning, and allows ANSPs and ARTCCs to update these plans throughout the day as needed. ADPs include information such as local Traffic Management Measures (TMMs) impacting neighboring ANSPs, static demand if available, airport and airspace conditions, weather, and other capacity constraint information.

An enhancement plan for future improvements to the CADENA OIS may include automation of some data collection (i.e., demand data, weather, etc.), improved display of the automatically and manually collected information, and analysis and modeling created from the information provided.

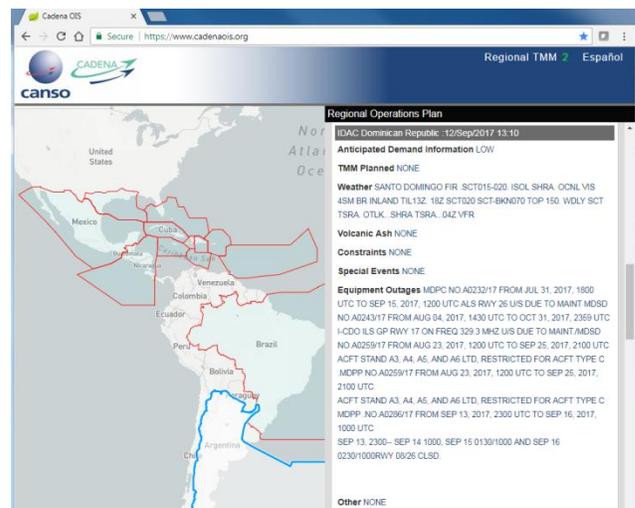


Figure 2.2.2: CADENA OIS Home Page

2.2.3 Airport and Airspace Acceptance Rate Information Sharing

Balancing capacity and demand is a core function of ATFM. While obtaining demand information will be more involved (to be further discussed in the section 2.3 of this paper) the gathering and sharing of capacity information could be accomplished in the near-term. Each CADENA RIG member agreed to provide their major airport and sector capacity information. These acceptance rate numbers were available locally, or created based on local knowledge, and follow the guidance provided by the ICAO document 9971 [11], submitted, archived, and made available for review by their neighboring ANSPs via the CADENA OIS.

2.3 Mid-Term: Traffic Flow Management Data Exchange

The major mid-term improvement for the Caribbean and Central America regional ATFM/CDM will be TFM Data Exchange capability implementation. Having accurate and timely flight traffic demand data is essential to conduct effective ATFM. No consistent flight data exchange methods currently exist in the Caribbean and Central America region, aggravating the lack of common situational awareness.

The FAA has offered ANSPs in the Caribbean and Central America region an opportunity to take advantage of the FAA’s existing TFM Data Exchange capability; specifically, the FAA’s System Wide Information Management (SWIM) and the Traffic Flow Management System (TFMS) Release 13 International Data Providers (IDP) data (i.e., ANSP could be the IDP). The FAA has been providing detailed technical information to the region. The functional structures of FAA’s SWIM and TFMS are shown in Figure 2.3.a and Figure 2.3.b below:

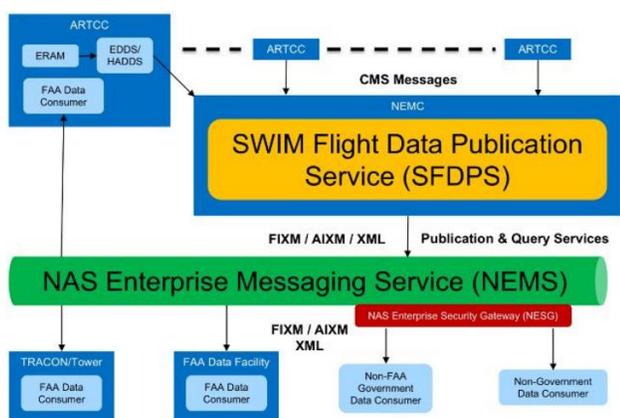


Figure 2.3.a: FAA’s SWIM Functional Diagram

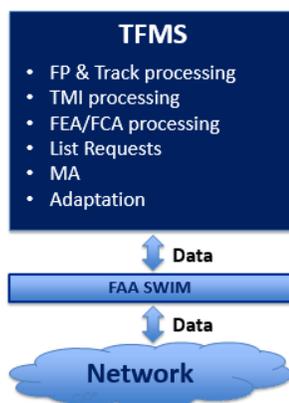


Figure 2.3.b: FAA’s TFMS Functional Diagram

2.3.1 System Wide Information Management Role

The System Wide Information Management (SWIM) facilitates greater sharing of Air Traffic Management (ATM) data. The SWIM helps to reduce infrastructure costs by decreasing the number of unique interfaces between systems and by deploying standard data exchange models such as Aeronautical Information Exchange Models (AXIM), Flight Information Exchange Model (FIXM), and Weather Information Exchange Model (WXIM). The FAA has been sharing ATM data via NAS Enterprise Messaging Service (NEMS) since 2014. Approximately 140 consumers are currently registered to access data via SWIM as of September 2017.

The FAA’s SWIM Program office established the process to support new users to on-ramp to the SWIM. There are two processes, on-ramping to SWIM as a consumer or as a producer. Both processes are broken into seven steps: (1) external consumer contacts SWIM team; (2) select data services and sign access agreements; (3) consumer processing and formalizing requirements; (4) development and testing of consumer interface in the R&D domain; (5) interoperability testing in the FTI national test bed (FNTB); (6) prepare to connect to operations; and (7) start consuming or producing data. The FAA would support CADENA RIG members at every step.

2.3.2 Traffic Flow Management System Role

The FAA’s Traffic Flow Management System (TFMS) replaced its predecessor Enhanced Traffic Management System (ETMS) in 2008 and has been operational ever since. TFMS is a suite of automation tools that serve as the FAA’s primary system for ATFM. TFMS is designed to provide strategic flow management information, however TFMS could support tactical flow management when applied locally. The backbone of the TFMS function is to gather various flight data from various systems, fuse such data, and distribute the data to traffic managers via the FAA Telecommunications Infrastructure (FTI) and to aviation stakeholders via SWIM. Many decision support tools are part of TFMS.

TFMS Release 13 became operational in April 2016. This release provides a mechanism for IDPs to send their flight data via SWIM using a FIXM-based schema to FAA’s TFMS. Each IDP (e.g., ANSP) requires an agreement with the FAA for IDP data exchange. The capability to fuse flight data from various data sources including IDPs is a complex rule-based function. Given that currently the majority of flights are U.S.-generated or -associated, and that such flight data is already managed by the TFMS, CADENA RIG member IDPs are encouraged to take advantage of TFMS’s data fusion capability to share their flight data.

2.4 Long Term: Traffic Management Measures Assisted by Decision Support Tools

CADENA RIG envisions managing traffic flow by expanding the Traffic Management Measures (TMM)

techniques beyond current Miles-in-Trail (MIT), Minutes-in-Trail (MINIT), and re-routes in the future. TFMS decision support tools (DTS) offers TMM techniques such as Ground Stop (GS), Ground Delay Program (GDP), Airspace Flow Program (AFP), and Collaborative Trajectory Options Program (CTOP) which are all good future capabilities for CADENA RIG to consider. However, implementation of these capabilities will require development of policy, business rules, governance structure, networking, and tools, in addition to TFM Data Exchange with a majority of the concerned ANSPs. The establishment of a foundation which would enable sophisticated TMM capabilities, assisted by DST in the regions with multiple states that are in the wide-range of ATFM maturity level, would be challenging in terms of cost, time, and needed policy agreements.

3. LESSONS LEARNED

CADENA RIG has implemented fundamental regional ATFM capabilities in a quick and cost effective manner. Implemented capabilities are the Regional Weekly Operational Web Conferences and the Regional Operational Information System (OIS). The TFM Data Exchange with Trinidad and Tobago is well under way with a TFM Data Exchange bilateral agreement expected to be signed and certified at the end of September 2017. Several other ANSPs are preparing to follow suit. There have been lessons learned during this experience of regional ATFM capability implementation.

3.1 Inclusiveness

The process to establish regional ATFM capabilities must be inclusive regardless of participants' ATFM maturity and involvement levels. However, we learned that the initial group should be limited to key players (i.e. ANSPs only) before any other aviation stakeholders are invited to collaborate in information sharing. If the initial group is too big with variety of agendas of their own, it would be difficult to implement initiatives quickly and effectively. It is highly important that the initial group always keep inclusiveness in mind as their future goal, however new stakeholders and participants are brought in gradually.

3.2 Collaboration

Collaboration is the most important ingredient to the success of regional ATFM. Each member must participate and work under the spirit of collaboration. Even framework building initiatives such as defining organization structure, roles and responsibilities, issues to be discussed, and forums for discussion all require full collaboration. As new members and participants are brought into the group, it is necessary to adjust the process. If the group can bring issues to the table to discuss frankly and seek a satisfactory solution for all in a collaborative manner, success is nearly guaranteed.

3.3 Basic Solutions

The Caribbean and Central America region consists of many ANSPs and states with wide ranging financial and sociopolitical situations. Resources for ATFM implementation are scarce for some ANSPs and states. It is important to remember that solutions do not have to be at the sophisticated level of North America, Europe, and Japan. An initial solution could be simple, inexpensive, and well-known such as web-teleconferences organized with structure and purpose. It is recommended to implement multiple basic solutions while improving those which have already been implemented, keeping in mind that inclusiveness and collaboration are key to success.

4. CARIBBEAN AND CENTRAL AMERICA REGION COMPARED TO SOUTHEAST ASIA REGION

ATFM in the Caribbean and Central America region has changed dramatically since the establishment of CADENA RIG in June 2016. The Southeast Asia region also has been working to implement regional ATFM for the past few years [12] [13]. Lessons learned from CADENA RIG might be applicable to the Southeast Asia region.

4.1 Similarities and Differences

Understanding the similarities and differences between the two regions may help in recommendations moving forward should the Southeast Asia region ANSPs decide to create a similar network.

Similarities are:

- Both regions consist of multiple ANSPs and states that are autonomously operating
- Both regions consist of multiple ANSPs and states whose situation in terms of financial, sociopolitical, and technology levels are wide ranging
- Both regions experience tropical weather patterns each year (refer to Figure 4.1)
- Both regions are experiencing significant traffic growth
- Both regions recognize that aviation industries play key roles in the welfare of region and each state belonging to that region
- Both regions are eager to have effective regional ATFM capabilities

Differences are complex due to geographical locations, composition of member states and neighboring states, historical backgrounds, cultural and language differences, sociopolitical situations, traffic demands and patterns, air traffic procedures, and airspace configurations, to name a few. Each region and each state have their own challenges and opportunities.

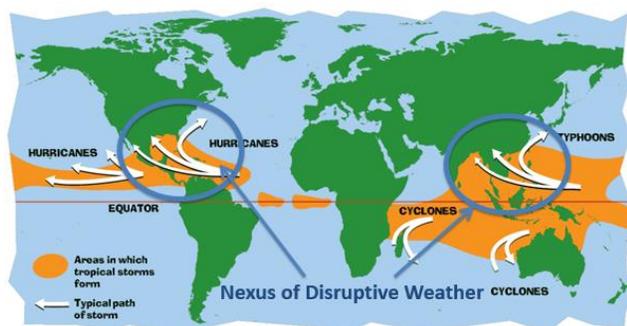


Figure 4.1: Tropical Weather Patterns

4.2 Considerations

Section 3 presented the lessons learned from the successful ATFM implementation in the Caribbean and Central America region. The three components of success were primarily, but not limited to, understanding of inclusiveness, collaboration, and focusing on basic solutions. The author invites regions and states to consider if these successful components are applicable to the regions similar to the Caribbean and Central America region.

5. ACKNOWLEDGMENTS

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