International Civil Aviation Organization

Sixteenth Meeting of the Asia/Pacific Air Traffic Flow Management and Airport Collaborative Decision-Making Steering Group (ATFM & A-CDM/SG/16)

Bangkok, Thailand, 06 – 10 April 2026

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

LESSONS LEARNED FROM THAILAND ATFM SYSTEM TRANSITION

(Presented by Thailand)

SUMMARY

This paper presents lessons learned from Thailand's transition of the in-house developed ATFM support system – the *Air Traffic Flow Advisory System (ATFAS)* – from version 1.0 to version 2.0. The system transition was completed on 21 January 2026, and the new system. – ATFAS v2.0 – was entered into the Operational Trial phase from 22 January 2026. It is hoped that the lessons shared in this paper can be useful for other States/Administrations in their ATFM system development and operational implementation effort.

1. INTRODUCTION

1.1 Thailand's ATFM service provision began in 2007 with the commencement of the Bay of Bengal Cooperative ATFM (BOBCAT) service administered by the Bangkok Air Traffic Flow Management Unit (Bangkok ATFMU). Through the BOBCAT operations in the first few years, Thailand gained experience in ATFM operations and recognized the need to implement ATFM to balance traffic demand and ATC capacity within the Bangkok FIR. Given that traffic demand within the Bangkok FIR comprises nearly equal distribution between domestic and international flights, Thailand began participating in regional cross-border ATFM initiatives starting from the *Whole-of-Flight Collaborative Decision Making* project spearheaded by CANSO in 2010 – 2011, before becoming a core member of the *Distributed Multi-Nodal ATFM Operational Trial* and subsequently the *Asia-Pacific Cross-Border Multi-Nodal ATFM Collaboration (AMNAC)* in later years.

1.2 With participation in cross-border ATFM initiatives from 2010 onward, Thailand expanded the scope of Bangkok ATFMU's service to include not just the BOBCAT operations but also the *General ATFM Service* to balance demand and capacity in the Bangkok FIR in the context of regional cross-border ATFM operations. The *General ATFM Service* was fully operationalized in 2015, in conjunction with the initiation of the *Distributed Multi-Nodal ATFM Operational Trial*.

1.3 To support the *General ATFM Service*, the Aeronautical Radio of Thailand Limited (AEROTHAI) – as Thailand's Air Navigation Service Provider responsible for, among other things, national ATFM services – developed and deployed the first version of the ATFM support system, the *Air Traffic Flow Advisory System (ATFAS)*, in 2015. The Bangkok ATFMU has since utilized ATFAS v1.0 to support its operations, primarily for conducting Ground Delay Programs (GDPs), from 2015 to 2025.

1.4 During the ten-year operational period of ATFAS v1.0, areas for improvement were identified through operational experience. Based on these findings, AEROTHAI began developing enhancements to ATFAS v1.0 in 2020, culminating in *ATFAS v2.0* in 2023, and commenced final testing and transition activities from 2024 onward. The transition was completed at the end of 2025, and *ATFAS v2.0* entered Operational Trial on 22 January 2026.

1.5 This paper presents the key new features introduced in ATFAS v2.0 and the lessons learned through the system development and transition process.

2. DISCUSSION

Key Features of the Air Traffic Flow Advisory System (ATFAS) Version 1.0

2.1 The *Air Traffic Flow Advisory System (ATFAS)* was developed by the Air Traffic Services Engineering Research and Development department of AEROTHAI to support Thailand's *General ATFM Service* provision, with a focus on traffic demand prediction, monitoring, and the activation and management of Ground Delay Programs (GDPs). This focus on GDPs was aligned with the Asia/Pacific Regional ATFM concept of operations, the Asia/Pacific Regional Framework for Collaborative ATFM, and the Common Operating Procedures of the AMNAC project.

2.2 Key features of *ATFAS v1.0* included:

(1) **Strategic Airport & Airspace Traffic Demand Prediction**, which was a feature to generate charts showing *strategic* traffic demand based on airlines' flight schedules obtained from a third-party data aggregator, strategic airport slots obtained from the national slot coordination committee for major aerodromes, and special flight permissions obtained from the national civil aviation regulator.

(2) **Pre-Tactical Airport & Airspace Traffic Demand Monitoring**, which was a feature to generate charts showing *pre-tactical* traffic demand based on flight plans and ATS movement messages.

(3) **Tactical Airport Traffic Monitoring**, which was a feature to generate charts showing *tactical* traffic demand at an aerodrome, based on the *pre-tactical* demand data supplemented by surveillance-derived estimates.

(4) **Ground Delay Program Support**, a set of features to activate a GDP, calculate and distribute Calculated Take-Off Times (CTOTs), and manage distributed CTOTs, including adding new flights and revising or cancelling CTOTs already issued. The GDP support function distributes CTOTs and their revisions through a public webpage, e-mails, and AFTN-based messages in accordance with the agreed regional procedure[1].

(5) **CTOT Forwarding Support**, a feature to process CTOT information received through AFTN-based ATFM messages and forward those messages to local stakeholders, including airspace users, aerodrome operators, and ATC units.

2.3 CTOT information distributed from the features described in 2.2(4) and 2.2(5), particularly through AFTN-based ATFM messages, was also distributed to relevant automation systems, including the ATM automation system (ATC support system) and the in-house Pre-Departure Sequencer

[1] Reference is made to the *Asia/Pacific AFTN/AMHS-Based Interface Control Document, v2.0.*

supporting the A-CDM process at aerodromes where implemented (e.g. VTBD and VTBS). This ensured effective information linkage in support of CTOT-compliant departure facilitation.

2.4 The features described in paragraph 2.2 supported Bangkok ATFMU's provision of the *General ATFM Service* throughout the ten-year period from 2015 to 2025. During that period, areas for improvement were identified, prompting AEROTHAI to develop an upgraded version of the system between 2020 – 2023 in anticipation of a growing and increasingly complex traffic demand environment.

Identified Areas for Improvements for ATFAS v1.0

2.5 Identified areas for improvements for ATFAS v1.0 included:

(1) **Segregated traffic demand pictures** – strategic, pre-tactical, and tactical traffic demand information had to be viewed separately.

(2) **Limited airspace volume options** – ATFM measures could only be implemented for published airspace sectors.

(3) **Batch CTOT delivery** – CTOTs for all flights in a GDP were distributed simultaneously, limiting the system's flexibility to re-optimize demand and re-allocate ATFM slots for later flights as the situation evolved.

(4) **Inability to support multiple concurrent constraints** – when multiple concurrent aerodrome and airspace constraints existed within the Bangkok FIR, the Bangkok ATFMU was required to initiate multiple GDPs, which could result in flights being assigned conflicting CTOTs.

(5) **Manual CTOT revision process** – airspace users were required to contact the Bangkok ATFMU by phone to request CTOT revisions, with staff then manually identifying available ATFM slots, adding to workload during peak hours.

(6) **Separate and manual ADP generation and distribution process** – Bangkok ATFMU staff were required to manually complete a Microsoft Word file and distribute ADPs via e-mail.

Key New Features in ATFAS v2.0

2.6 Based on the identified areas for improvement, AEROTHAI developed an upgraded version of the system – *ATFAS version 2.0* – between 2020 and 2023. Key features of ATFAS v2.0 include:

(1) **Integrated ADP generation** – Bangkok ATFMU staff can create and distribute an ADP directly from within the system.

(2) **Automated external ADP processing** – ADPs distributed by other ATFM units in the region in accordance with the established procedure[1] are automatically received, processed, and displayed on the system's landing page.

[1] Reference is made to the *Asia/Pacific ADP Exchange Procedure* and the relevant section in the *AMNAC Common Operating Procedure*.

(3) **Integrated traffic demand view** – traffic demand information is consolidated in a single view, enabling Bangkok ATFMU staff to assess demand based on the best available information.

(4) **User-defined airspace monitoring and management** – the Bangkok ATFMU can define a custom airspace volume for traffic demand monitoring and, where necessary, GDP management. This is particularly useful during special airspace activities such as large-scale joint military exercises.

(5) **Multi-constraint ATFM measure support** – multiple aerodrome and airspace constraints can be managed concurrently, with CTOTs calculated using a network optimization algorithm, preventing conflicting CTOTs from being issued to the same flight.

(6) **One-by-one CTOT distribution** – CTOTs are distributed individually to each flight at 90 minutes before its Estimated Off-Block Time (EOBT), allowing the system to continuously re-optimize ATFM slot allocations as the situation evolves.

(7) **Self-managed CTOT revision** – airspace users can request and receive CTOT revisions directly through the system. This automation has significantly reduced the coordination workload, resulting in an average decrease of 2,000 coordination calls per month for the Bangkok ATFMU.

2.7 These new features represented a significant change to the system, requiring AEROTHAI to undertake an extensive transition process between 2024 and 2025.

System Transition Activities

2.8 In the two-year period leading up to the transition, AEROTHAI conducted final system tests while engaging with relevant stakeholders – both internal (e.g. ATC units) and external (e.g. airspace users and the national civil aviation regulator) – through meetings, workshops, training sessions, and distribution of user manuals and documentation.

2.9 Following successful preparation, the transition from ATFAS v1.0 to ATFAS v2.0 was completed at 2300 UTC on 21 January 2026, with **the new system becoming operational from 0000 UTC on 22 January 2026**.

Lessons Learned in the System Design and Transition Efforts

2.10 The development and transition process yielded several important lessons. The most significant ones are summarized below:

(1) **Importance of appropriate airspace sector definition** – accurate traffic demand counting depends on a well-defined airspace sector. The definition should account not only for sector boundary coordinates, but also for how ATC handles traffic within that sector – for instance, a flight may briefly enter the sector yet be managed entirely by an upstream or downstream ATCO. Close engagement with ATC units is therefore essential when establishing these definitions.

(2) **Accuracy of FPL2012-derived trajectory** – FPL2012, which remains the basis for traffic demand prediction in ATFAS v2.0, has information gaps to be filled when modeling a flight's trajectory. The accuracy of the trajectory model directly affects traffic demand accuracy and, by extension, the effectiveness of ATFM measures.

(3) **Preparation and maintenance of the aeronautical information database** – a well-maintained, up-to-date aeronautical information database is essential for accurate flight plan processing. Where the database relies on legacy non-digital sources, manual processing will be required, and staffing should be planned accordingly.

(4) **Value of consistent stakeholder engagement** – consistent engagement throughout the development and transition process – through meetings, workshops, training sessions, and social media platforms (e.g. LINE application) – was crucial in keeping stakeholders informed and enabling them to raise issues promptly.

(5) **Planning for the unexpected** – despite extensive pre-transition testing, several unforeseen issues arose on the transition day, including incomplete CTOT displays on the CTOT Distributor webpage, the inability of the in-house Pre Departure Sequencing system to pull CTOTs for further processing, and temporary server instability caused by a higher-than-anticipated processing load. These issues required immediate troubleshooting. Operational staff coordinated with external stakeholders (airspace users and international ATFM units) to request support, including exemptions for Thailand departures from CTOTs, while technical staff investigated and resolved the software issues. This "all hands on deck" approach ensured that personnel were available to address issues as they arose.

2.11 Thailand hopes that these lessons will be useful to other States/Administrations in their ATFM system development and operational implementation efforts.

Next Steps for ATFAS System Development

2.12 *ATFAS v2.0* is now in service as an *operational trial*, with issues and feedback from stakeholders – including the Bangkok ATFMU, ATC units, and airspace users – being logged for resolution and further improvement. Bug fixes and minor adjustments are expected in the coming months, and AEROTHAI will continue to engage with and inform stakeholders of any changes that may be necessary.

2.13 Thailand also actively leads or participates in regional forums driving future improvements, including – *inter alia* – the Asia/Pacific ATFM Concept Design Ad-Hoc Group, the Asia/Pacific FF-ICE Ad-Hoc Group, and the Asia-Pacific TBO Pathfinder initiative. These forums will shape how ATFM operations in the region evolve in the context of new enablers such as SWIM, FF-ICE (Release 1 and Release 2), and TBO. This evolution will in turn inform the capabilities to be developed for future versions of Thailand's ATFM support system.

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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