Effectiveness from applying the A-CDM model at Tan Son Nhat International Airport

Thai Son Le[1], Van Thuy Ha[2]

[1]Vietnam Aviation Academy (VAA), Vietnam
[2]Saigon Ground Services
Corresponding Author / E-mail: sonlt@vaa.edu.vn

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ABSTRACT

This study aims to evaluate the effectiveness of the pilot application of the ACDM model at Tan Son Nhat International Airport, Vietnam. The A-CDM model has been approved by Vietnam Airlines Corporation for pilot implementation at Tan Son Nhat Airport. Statistical data has been used for evaluation and analysis. The results show that the rate of on-time flights has increased, avoiding congestion and long waiting times for aircraft, optimizing the airport infrastructure, and saving fuel. The study also points out some limitations and suggests future research directions.

KEYWORDS: A-CDM model, Multi-Stakeholder collaboration, Airport, Operations.

1. Introduction

The growth of air traffic worldwide is surpassing the capacity of current airport systems, leading to a crisis in modern commercial aviation. To address this issue and reduce congestion, delays, and environmental impact, airports are increasingly adopting a system called Airport Collaborative Decision Making (A-CDM) (Guimera et al., 2005). A-CDM aims to enhance the efficiency of airports and air traffic networks. Specifically focusing on airports, A-CDM offers solutions that can lead to cost reduction, environmental benefits, capacity optimization, and improved efficiency (EUROCONTROL, 2014). A-CDM involves sharing information among stakeholders in the airport system to create a shared situational awareness and develop joint strategies to tackle operational challenges. This can result in shortened taxi times (up to 7% reduction), decreased fuel consumption (up to 7.7% reduction), and reduced ATFM (Air Traffic Flow Management) delays (up to 10.3% reduction) (Pickup, 2016). In Vietnam, there are 64 foreign airlines and 5 Vietnamese airlines operating in the international market. They operate over 169 international routes connecting 28 countries and territories in North America, Europe, the Middle East, Asia, and Africa to destinations in Vietnam, including Hanoi, Da Nang, Ho Chi Minh City, Cam Ranh, Phu Quoc, Da Lat, and Hue. The 10 largest international markets for transporting passengers to Vietnam are Korea, Thailand, Taiwan, Japan, China, Singapore, Malaysia, Hong Kong, Australia, and India.

Vietnam Airports Corporation (ACV) manages 21 airports, including Tan Son Nhat International Airport (TIA) and Noi Bai International Airport (NIA), which are the busiest and most crowded airports in Vietnam, with over 200,000 take-offs and landings per year. Since 2018, Vietnam has been participating in international workshops to raise awareness about A-CDM, gaining insight into this new and challenging operating model.

ICAO recommends that airports with a yearly flight frequency of over 100,000 should implement the A-CDM model (Eurocontrol, 2014). Furthermore, Circular No. 29/2021/TT-BGTVT of the Ministry of Transport also stipulates regulations for establishing and executing A-CDM. It specifies that airports with a yearly flight frequency of 100,000 flights (specifically Noi Bai and Tan Son Nhat – the two largest international airports in the country, with flight volumes exceeding 100,000 flights/year) are required to develop and implement A-CDM. In 2019, Tan Son Nhat Airport experienced its peak operational load, with over 260,000 take-offs and landings, facilitating more than 41 million passengers. Despite its design capacity being 25 million passengers, the actual numbers highlight the congestion issues faced by Tan Son Nhat Airport, both in the air and on the ground.

The collaborative decision-making model (A-CDM) is a popular trend among major airports worldwide. Currently, 32 airports in Europe have successfully implemented it, while 8 airports including Amsterdam, Barcelona, Berlin, Brussels, Frankfurt, Geneva, London Heathrow, Munich, Naples, and Paris CDG are testing its implementation. In Asia, around 19 airports have successfully implemented A-CDM, such as Changi in Singapore, Incheon in Korea, Shanghai, Beijing, Hong Kong in China, and Suvarnabhumi in Thailand. Kuala Lumpur in Malaysia and the Philippines will soon implement it. In Vietnam, the A-CDM model is being piloted in phase 1 at Tan Son Nhat and Noi Bai International Airports (VietNam Plus, 2024).

This paper aims to report on a case study at Tan Son Nhat airport to provide an in-depth look at an airport's approach to preparing for the full implementation of Airport Collaborative Decision Making (A-CDM).

The rest of this paper is organized as follows. In the next section, relevant literature on airport-collaboration decision making is analyzed. Section 3 points out the case study and results at Tan Son Nhat International Airport. Section 4 points out the results when implementation at phase

1. Finally, our conclusions, the managerial implications and suggestions for further research are presented.

2. Literature Review

2.1 Airport operations need collaboration

In the turnaround process, the service delivered comes from the collaboration of at least four main parties: airport operators, airline operators, air navigation service providers (ANSPs), and ground handling companies. These stakeholders are customers and consumers of each other to achieve mutual efficiency. These tasks need to be coordinated to ensure that as many aircraft as possible are serviced promptly, hence maintaining an effective turnaround procedure, which is essential for freeing gates and enhancing airport capacity. This is what A-CDM aims to achieve.

To implement A-CDM at busy airports, the necessary change capabilities are required to ensure a smooth transition to move the airport to a new level of operation, where A-CDM scenarios assume different levels of collaboration between key stakeholders. These include increased information sharing to ensure that all stakeholders have a clear understanding of the possible picture (the lowest level of collaboration) and decisions on the reallocation of scarce resources to airport users (the highest level of collaboration).

In their study of stakeholder coordination, Salmon et al. (2009) highlighted several key related concerns:

• Insufficient sharing of crucial information between agencies.

• Poor communication of information among stakeholders can lead to inaccuracies or incomplete understanding.

• Ineffective management of information gathering, organization, compilation, and distribution.

• Insufficient and incompatible communication technologies.

• Insufficient availability of a shared operational overview.

• Lack of clarity regarding each agency's roles, responsibilities, contributions, and resources.

• There is a critical absence of clear and effective leadership.

• Cultural differences among stakeholders.

• There is a lack of suitable training scenarios that involve multiple agencies.

• Insufficient frameworks, processes, and systems for multi-agency response.

• Experience in collaboration between stakeholders in the organization.

2.2 Collaborative Decision Making (CDM)

Collaborative decision-making (CDM) is a process that focuses on how a decision on a specific course of action is made among two or more community members. Through this process, community members (Air Traffic Management-ATM) share information relevant to the decision, interact, establish day-to-day options, and apply decision-making approaches and principles. The overall goal of the process is to improve the performance of the ATM system while balancing the needs of each member of the ATM community (ICAO, 2014). It defines the following CDM features (ICAO, 2014): (a) CDM is a supporting process that is always applicable to other activities, such as demand/capacity balancing, and can be used throughout the timeline of strategic planning activities (for example, infrastructure investment) through to real-time activities; (b) CDM is a means to achieve process performance targets, not a goal in itself. These performance objectives should always be agreed through collaboration; (c) While information sharing is essential to CDM, such sharing is not sufficient to fully realize CDM and achieve its goals; (d) To ensure that collaborative decisions are made quickly and fairly, CDM also requires pre-defined and agreed processes and rules(e) CDM ensures that decisions are made transparently by the best available information provided by participants at the right time and in the right way; and (f) The development and operation of a CDM process follows the following typical stages:

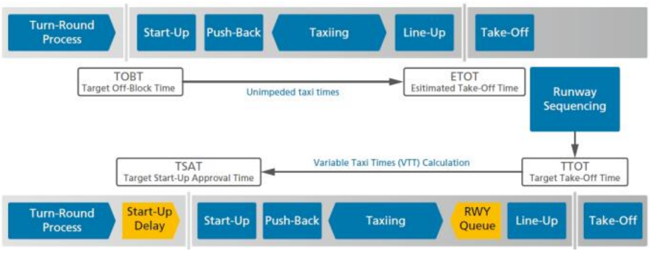
• Identify the need for CDM;
• Analyze CDM;
• Identify and verify CDM;
• Where to implement CDM;
• Implement and validate CDM; and
• Operate, maintain and improve CDM (ongoing).

Therefore, CDM is one of the suitable processes for the studies, decision-making processes, and implementation of the necessary elements for the operation of these new members of the Aviation Industry. "The process is commonly utilized in this industry." Implementing Airport-CDM involves a change in procedures and a cultural change in all stakeholders. They also state that the system is based on two main elements (Steiner et al., 2014): (1) Predictability of events; and (2) On-time execution of operations.

CDM at congested airports has demonstrated that air transport agencies can achieve significant improvements at airports without sacrificing internal goals and the others by which different operators achieve those goals. The goal of A-CDM is to reduce delays and improve system predictability while optimizing resource utilization and reducing environmental impacts. An airport is considered a CDM airport when the conceptual elements of ACDM Information Sharing (ACIS), Turn-Around Process (CTRP), and Variable Taxi Time Calculation (VTTC) are applied at the airport.

2.3 A-CDM Concept

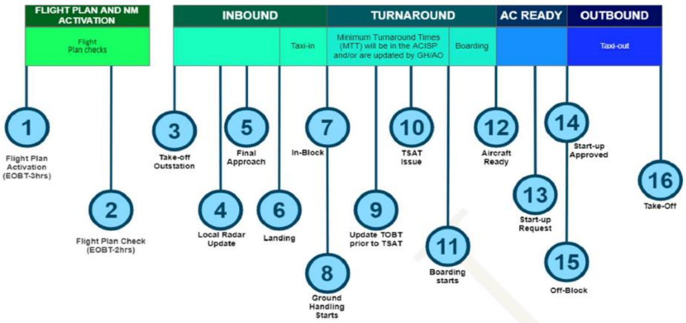
The A-CDM (Airport Collaborative Decision Making) concept includes 16 key milestones along the aircraft's trajectory at the airport, emphasizing an airport-centric perspective. It is essential for the relevant stakeholders to monitor these milestones for each flight to provide a reliable Target Off-Block Time (TOBT), which is the most critical parameter regarding aircraft control. The recommended milestones include: activation of the ATC Flight Plan; the Estimated Off-Block Time (EOBT) set two hours before arrival; takeoff from the outstation; local radar updates; final pproach; landing; in-block time; target startup approval; off-block time; and takeoff.



(Source: Airport Corporation of Viet Nam, 2024)

Figure 1: 16 milestones according to the A-CDM implementation guide

One outstanding issue is the Target Start-Up Approval Time (TSAT) and its relationship with the TOBT, which is provided by the ground handler. Our approach seeks to determine a proxy for the TSAT using an assumed time for when the aircraft is ready. The forecast of milestone events can be dynamically adjusted based on the actual situation. Additionally, there are vital connections between the TOBT, TSAT, and Target Take-Off Time (TTOT), which become crucial when making tactical decisions about air traffic flow and capacity management. (Figure 2).



(Source: Schultz et al, 2019)

Figure 2: Calculation of Target Start-up Approval Time

The implementation of Airport Collaborative Decision Making (A-CDM) requires extensive negotiations among stakeholders and the adoption of new operational procedures by operators, with a strong focus on information exchange. The main objective of sharing information is to establish a common situational awareness and enable accurate data analysis based on reliable and factual information. Estimated arrival times and target departure times will be continuously updated as new information becomes available at each time point. This updating process is designed to ensure adherence to scheduled timeframes by comparing data and notifying relevant units based on flight and operational plan information.

A-CDM data can be accessed through the A-CDM Information Sharing Platform (ACISP), a system that supports current and future integrations. Once the information connection is established, input data is transmitted in real time through the internal systems of the relevant units. ACISP will serve as the central hub for exchanging and integrating data and information among these units, ensuring a comprehensive view of operational situations. ACISP data will be accessible via web browsers and mobile platforms, facilitating remote access for all units involved.

ACDM also encompasses several critical elements, including variable taxi times, pre-departure sequencing, management of adverse conditions, and collaborative flight update management. Rather than relying on predetermined values for aircraft taxiing, the use of variable taxi times (VTT) along with taxi time forecasts can enhance the optimal utilization of apron and taxiway capacity during peak periods. Key inputs for calculating VTT include flight data such as aircraft type, location, runway configuration, traffic demand, and historical data. Once the Target Off-Block Time (TOBT) is provided, VTT facilitates the prediction of actual demand on the taxiway and runway system, allowing for the optimization of start-up approvals.

3. Case study at Tan Son Nhat International Airport

This study gathers data on the A-CDM model testing process from 00:00 on August 1, 2024, to 23:59 on October 31, 2024. It primarily focuses on the ATFM (Air Traffic Flow Management) and CTOT (Calculated Take-Off Time) processes. Data collected from the testing report on KPIs (Key Performance Indicators) at Tan Son Nhat International Airport will be used to compare the results from the period of May 2024 to July 2024 with those from August 2024 to October 2024.

A-CDM processes at TSN airport are mainly performed on the ACM portal platform for data entry, coordination and information sharing.

3.1 Method to use milestone

In A-CDM processes, the term milestone is commonly used. It refers to significant points in each activity, such as the completion of a stage, phase transition, or step. The guidance document for implementing ACDM at Tan Son Nhat International Airport complies with ICAO and is shown in Table 1.

Table 1: Milestones Descriptions

No	Milestones	Descriptions
1	Activate air traffic flight plan	Activate the air traffic flight plan on AFTN/AMHS and ACISP for flights departing from A-CDM airport. The latest activation time is 210 minutes before EOBT for international flights, 150 minutes before EOBT for domestic flights with remote check-in, and 60 minutes before EOBT for flights submitting FPT draft directly to ARO/AIS Tan Son Nhat. Particularly for flights departing from airports applying the Multi-Node Operation Method Level 2/Level 3 to airports and airspace of ATFM level 3 nodes, the submission of flight plans must comply with the current multi-

		node ATFM operation method in Vietnam.
2	Check flight plan	Flight schedules must be reviewed prior to departure from A-CDM airport. Information for flights subject to ATFM regulations must be issued at this time. The latest time to do so is 210 minutes before EOBT for international flights and 150 minutes before domestic flights.
3	Take off from the airport	Record the actual take-off time from the airport to ATOT as soon as possible to have a basis for updating the next flight times.
4	Update monitoring information	The timestamp begins when the aircraft enters the flight information region, determined by its position in the en-route area and progress. Confirm or recalculate subsequent timestamps.
5	Approach	Update ELDT and EIBT times based on the order of arrival of flights. Confirm or recalculate subsequent times.
6	Landed	Record the actual landing time (ALDT) Confirm or recalculate subsequent time points
	In-block	Record Actual In-block Time Confirm or Calculate Subsequent Timelines
8	Ground service starts	Record actual time of ground service start.
9	Update TOBT before TSAT issuance	Confirm / update TOBT time TOBT is updated into the system to serve as a basis for arranging departure order and issuing TSAT.
10	Issue TSAT	Air traffic control units issue TSAT based on TOBT and actual operating conditions.
11	Boarding starts	Update the time when passengers start boarding the plane.
12	Actual aircraft readiness time	Record actual aircraft readiness time when the aircraft is closed and ground handling equipment (GSE) is ready.
3	Permission to start the engine	Record the actual time the crew requests permission to start the engine.
14	Approval to start the engine	Record the actual time ATC approves engine start.
15	Off-block	Real-time recording of aircraft leaving parking position.
16	Take off	Real-time recording of aircraft takeoff times.

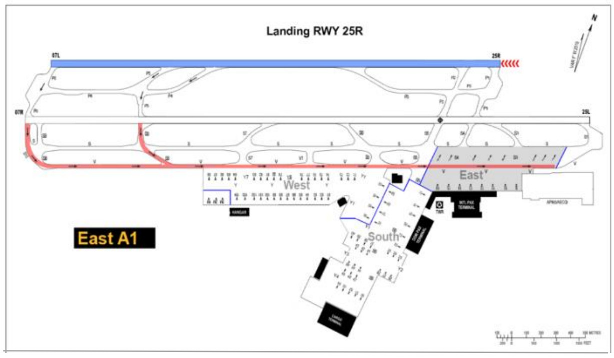
(Source: Airport corporation of Viet Nam, 2024)

At each time point, additional information will be provided to help calculate and update the estimated arrival time and target departure time. The estimated arrival time and target departure time can be updated from the first time point when the flight plan and flight schedule are provided. This update process will be continuously repeated to compare data and check compliance with time frames. After receiving and processing the data, the process is aimed at updating the time points and alerting the relevant units based on the flight information and the operating plan information of each unit.

3.1.1 Variable Taxi Time

Standard Airport Taxi Routes (SATR) are designed to improve the operational capacity of the airport operation area, optimizing aircraft control activities on the ground by using pre-defined standard taxi routes for both departure and arrival aircraft.

Aircraft taxi operations at Tan Son Nhat International Airport are operated by two sub-areas of Tan Son Nhat Ground Control Unit, GCU 1 and GCU 2. The operation area at Tan Son Nhat Airport has a complex configuration, aircraft must move through many taxiways before reaching the runway waiting point for departure or after the aircraft lands to taxi to the parking position.



(Source: Airport corporation of Viet Nam, 2024)

Figure 3: East A1 rolling route map

3.1.2 Departure Sequence

The departure sequence establishes a sequence of departures from the stand to take into account operator preferences and operational constraints. In phase 1, the TSAT framework is established based on the TOBT. ATC will use the TOBT and the TSAT framework available in the A-CDM PORTAL to plan and assign TSAT to each aircraft.

3.1.3 Unavailable conditions

During June and July, takeoff and landing flights are affected by strong gusts of wind and fog when landing. On June 22, the Vietnam Air Traffic Management Corporation reported that at Tan Son Nhat Airport, there was heavy rain with thunderstorms, strong gusts of wind, and horizontal visibility was reduced to 500m. According to the Tan Son Nhat Aviation Meteorological Center, 29 flights were waiting, 7 flights had to divert to the waiting airport, and one flight returned to the departure airport.

By planning for flight management before, during, and after adverse conditions, airport operations will be maintained, and all stakeholders will have a clear understanding their roles to achieve the best performance. A-CDM aims to optimize the resources of the airport and its stakeholders. This is particularly important where airport capacity is constrained. Stakeholders need to monitor and evaluate airport capacity continuously to ensure that performance is at its best when conditions are least flexible.

3.2 A-CDM process at Tan Son Nhat International Airport

3.2.1. SOBT

SOBT is the time when the aircraft starts moving away from the current parking position as planned. The time of departure of the aircraft from the parking position is issued based on the seasonal flight schedule licensed by the Civil Aviation Authority of Vietnam.

3.2.2. EOBT

EOBT is the expected time when the aircraft starts moving away from the parking position.

The airline schedules the next day's flight (including EOBT time) and the Service Unit updates the data into SMIS/VMS to synchronize into the ACDM Portal before 10:00PM every day.

Foreign airlines, private flights, charter flights, and official flights can authorize the Ground Service Unit. The flight schedule will be provided by the Ground Service Unit.

On the day of operation, the EOBT will be updated according to the air traffic flight plan (FPL) or via DLA/CHG message, specifically:

- The airline sends the FPL to the ARO/AIS via AMHS/AFTN or AIS/AIM or email no later than:

  150 minutes before the EOBT for domestic flights.

  210 minutes before the EOBT for international flights.

  60 minutes before the EOBT when using a hard copy FPL for the Tan Son Nhat ARO/AIS.

- The airline sends a DLA/CHG message and notifies the ARO/AIS, and ATFMC includes the new EOBT of the flight (send a DLA message if the flight is delayed by more than 15 minutes but less than 60 minutes).
- If the flight is delayed by more than 60 minutes from the old EOBT, the airline sends a new ATS Flight Plan and notifies the ARO/AIS, ATFMC.

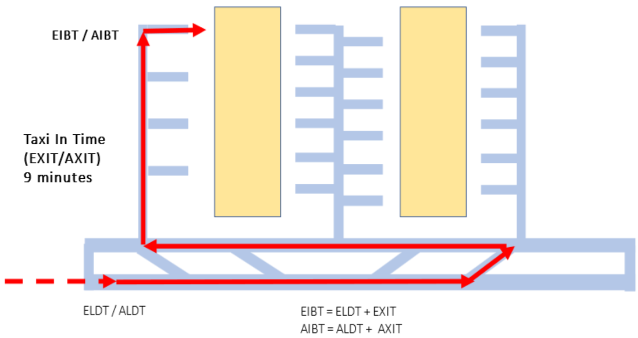
3.2.3 Estimated Landing Time (ELDT)

ELDT is the estimated time the aircraft touches down on the runway. ELDT is provided by ATC to the ACDM Portal

3.2.4 Estimated In-Block Time (EIBT)

EIBT is the estimated time for the aircraft to taxi into the parking position. The A-CDM Portal system automatically calculates the EIBT based on ELDT time data and estimated taxi-in time (EXIT).

The estimated taxi time VTT is an important factor in ensuring the accuracy of the prediction of take-off/in-block time, especially at airports with complex operating conditions. The estimated taxi-out/in time is used to calculate EIBT, TTOT, and TSAT. The estimated EXIT/EXOT taxi time is determined specifically for each runway, parking position, and each type of aircraft in the condition that the runways are degraded due to operating beyond the design frequency, receiving many new generation aircraft with large payloads and tire pressures, such as Airbus A350-900, Boeing B787-9 and B787-10. By determining EIBT, it is possible to calculate most accurately and reduce the waiting time for take-off and landing at Tan Son Nhat airport (Figure 3).



(Source: Airport corporation of Viet Nam, 2024)

Figure 4: The formula for calculating EIBT from ELDT and EIBT from ALDT

3.2.5. Actual Landing Time (ALDT)

ALDT is the actual time the aircraft touches down on the runway. After the aircraft lands, the ARO will send a Landing message to SMIS via AFTN/AMHS. Then ACDM Portal automatically updates from SMIS the EIBT time (ALDT + EXIT (estimated taxi-in time)).

3.2.6 Actual In-Block Time (AIBT)

AIBT is the real-time the airplane taxis to and stops at the parking position, and it is manually updated by the Ground Service Unit via the internal system connected to the A-CDM Portal system or directly to the A-CDM Portal system.

3.2.7 TOBT data source

As soon as the flight schedule is updated to the A-CDM Portal system, the initial TOBT is calculated based on the flight plan information and is set using the SOBT, and the Ground Service Unit is primarily responsible for updating the TOBT. The ground service unit shall update the TOBT for the flight based on available resources, service plan, and airline approval.

The TOBT may be updated based on the EOBT. According to the flight plan from the current TOBT, If the EOBT changes, the ground service unit shall update the new TOBT.

3.2.8 Engine Start Acceptance Time (TSAT)

TSAT is provided by ATC via ACDM Portal based on updated TOBT data (via automatic calculation system or manual update by Ground Service Unit upon request of Airline), and TSAT is calculated by ATC for each flight based on TSAT Windows and actual operating situation.

3.2.9 Engine Start-up Approval Procedure

The engine start-up procedure is based on the TSAT allocation plan. Based on the TOBT received by ATC. Within TSAT +/- 5 minutes, the crew requests and receives engine start-up approval clearance from ATC.

The crew should monitor and update TOBT and TSAT directly on the A-CDM Portal system. In case the crew cannot monitor the TOBT and TSAT updates on the A-CDM Portal system, they must contact the Ground Services Unit directly to receive TOBT and TSAT information.

3.3 ACDM Flight Status

The progress of an A-CDM flight to Tan Son Nhat International Airport is divided into four main stages: Planning, Aircraft Arrival, Ground Handling, and Departure. Each stage has milestones corresponding to the flight status.

* Planning Phase:

The flight is set to SCH status on the system after:

- The airline sets up the flight schedule for the next day and sends it to Tan Son Nhat International Airport (TIA) and the relevant Ground Service unit.
- For airlines that do not have a representative at the airport, the flight schedule will be provided by the ground service unit.
- The service unit updates the flight schedule into SMIS/VMS to synchronize with ACDM Portal
- Tan Son Nhat International Airport arranges parking positions for flights.
- The flight is set to INI status on the system after:
- The airline sends the FPL to ARO/AIS via AMHS/AFTN or AIS/AIM/email or submits a hard copy no later than:
- 150 minutes before EOBT for domestic flights.
- 210 minutes before EOBT for international flights.
- 60 minutes before EOBT when using a Hard Copy Flight Plan for ARO/AIS Tan Son Nhat.

* Arrival Phase:

The system will change the flight status to FIR after:

- The aircraft approaches the Ho Chi Minh Flight Information Region and begins planning the landing sequence for the arriving aircraft.
- ATC provides the ELDT of the arriving aircraft to the ACDM Portal
- The system will change the flight status to FNL after:
- 5 minutes before the ELDT, the ATC APP sets the arriving aircraft to final approach.
- The system will change the flight status to ARR after:
- The aircraft lands.
- The touchdown time becomes the reference time for the ALDT, and the ALDT message is automatically sent from SMIS to the ACDM Portal.

* Ground Service Phase:

The flight is set to IBK status on the system after:

- The aircraft enters the parking position, and the ground service unit records the AIBT value of the flight.
- The flight is set to BRD status on the system after:
- The ground service unit updates the boarding time by entering the ASBT time on the unit's system or directly into the A-CDM Portal based on the time the first boarding card is scanned at the aircraft gate.
- The flight is set to RDY status on the system after:
- The ground service work is completed, and ARDT is entered on SMIS/VMS after consulting the pilot about pushback readiness.

* Departure Phase

The flight is set to OBK status on the system after:

- The aircraft leaves the parking position.
- The ground service unit enters the AOBT time into the system.
- The system will change the flight status to DEP after:
- The aircraft departs from the runway,
- ACDM Portal receives ATOT notification recorded by DEP message from SMIS.

4. Result

The application of ACDM is currently in the testing phase and focuses only on ATFM and CTOT. Statistics for the last 3 months are shown in Table 2 with the application rate still low due to adverse weather conditions.

Table 2: Apply ATFM measures

Month	Apply ATFM	Rate	Apply CTOT	Rate
08/2024	313/479	65,3%	29/57	50,8%
09/2024	341/470	72%	81/156	52%
10/2024	385/540	71,2%	155/235	6,.9%

(Source: TIA, 2024)

Table 3: Test results

KPIs	**Results after 03 months 05-06-07/2024 (I)**	**Results after 03 months 08-09-10/2024 (II)**	**Compare (I) & (II)**	**Reason**
Landing Time Compliance (ALDT-ELDT)	88,7 %	**92,8%**	Slight increase	ADS-B data source updates consistently in accuracy
In-block Time Compliance (AIBT – EIBT)	93 %	75 %	significant reduction	Impact due to thundersto-rms and bad weather conditions

				at the airport
Flight Crew TSAT Compliance (ASRT-TSAT)	92,4%	**93,7%**	Slight increase	Flight crews increase compliance with procedures
ATC TSAT Compliance (ASAT-TSAT)	92,7%	**92,7%**	The same	ATC compliance
Off-block Time Compliance (ARDT – TOBT)	98,1%	**98,2%**	the same	Increase service efficiency of ground service units and airlines
Off-block Time Compliance (AOBT–TOBT)	60,3 %	**62,7%**	Increase	
Flight plan compliance (+/-15p) (AIBT-SIBT)	50,6 %	**52,6%**	Increase	Airline Flight Planning Recommen-dations
OTP flight plan compliance (+/-15p) (AOBT-SOBT)	61,35 %	**65,92%**	Increase	recommend HK Airlines to make better plans. Make better flights.
Accuracy of expected roll-out time (AXOT – EXOT)	68 %	**70,7%**	Slight increase	due to VIP operations to TSN and the impact of weather, change of take-off and landing direction in the test window.
KPI17 – Induced Start-up delay (ASAT – ASRT)	88,4 %	**89,1 %**	Slight increase	

(Source: TIA, 2024)

Table 3 shows that the main indicators monitored in the two periods all showed stable and slightly increased indicators. Only AIBT – EIBT decreased due to storms or bad weather at the airport. Ensuring high on-time performance helps to limit the situation of having to turn around waiting for landing, minimize waste in slot usage and air traffic management, the situation of aircraft stopping for a long time on the runway, and at the same time, the baggage and cargo services of the flight will be better.

5. Conclusions and Implementations

The implementation of the A-CDM model during Phase 1 at Tan Son Nhat International Airport has significantly improved the forecasting and adjustment of flight operations. From August 1, 2024, to October 31, 2024, the application of the A-CDM model remained stable. Key performance indicators (KPIs) showed continued improvement, and the compliance rate increased compared to the previous three months. Additionally, the average taxi time for aircraft decreased by 1.29 minutes per flight, an improvement over the previous three-month period, which saw a reduction of 1.12 minutes per flight. This demonstrates the effectiveness of the A-CDM model in saving fuel for airlines. Through enhanced coordination among airlines, airports, and air traffic control agencies, flights can be planned and adjusted to minimize delays while ensuring the safety of air transport.

However, some A-CDM processes at the airport are still manually, which can lead to errors, delays, or data loss due to human factors, which increases the workload for ground staff, who must closely monitor the accuracy of TOBT to ensure accurate TSAT data in the system. In addition, air traffic controllers must manually update ASRT and ASAT data, adding to the challenges. TSN International Airport has invested heavily in information technology to improve operations management and collect and analyze data from various sources, thus providing accurate and real-time information on the status of flights and airport infrastructure. Integrated information systems help stakeholders better understand the situation and make coordinately and accurately. Therefore, cooperation among stakeholders is crucial for the A-CDM model. Airports, airlines, air traffic control agencies, and others must collaborate to share information and ensure consensus on the operational procedures. This collaboration helps to optimize processes, minimize delays, and improve the efficiency of the aviation system.

The airport will coordinate with IT ACV to proactively deploy technical improvements such as updating TOBT/TSAT times to the VDGS system. It is also advisable to keep investing in the automatic departure sequencing system (PDS). This should include the integration of automatic information sharing between Airport Collaborative Decision Making (A-CDM) and Air Traffic Flow Management (ATFM). Additionally, deploying a solution to automatically integrate data between the Air Traffic Management (ATM) system (QLBMN) and A-CDM will help reduce the workload for air traffic controllers and minimize risks associated with human factors.

This study still has some limitations. First, it is only a phase 1 study, not a complete study ACDM process. Second, with the short time, the research results cannot be applied to the entire process. Therefore, in the future, the research direction should be to test the process for a long time at more airports.

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