International Civil Aviation Organization

Twelfth Meeting of the Air Traffic Management Sub-Group (ATM/SG/12) of APANPIRG

Bangkok, Thailand, 23 – 27 September 2024

Agenda Item 3: Performance Frameworks and Metrics

PROGRESS OF THE ASIA/PACIFIC AIR TRAFFIC MANAGEMENT SUB-GROUP DATA ANALYTICS AD-HOC GROUP MEETING (ATM/SG DAG)

(Presented by Singapore on behalf of Australia, China, Hong Kong China, Indonesia, Papua New Guinea, Philippines, Singapore, Sri Lanka, Thailand and the United States)

SUMMARY

This paper informs of the progress made by the ATM/SG DAG. The ATM/SG DAG was established at the Eleventh Meeting of the Air Traffic Management Sub-Group (ATM/SG/11) of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG). To date, the ATM/SG DAG had convened 3 meetings – 2 online and 1 physical and had agreed on the terms of reference and framework for measuring and reporting of 8 key performance indicators (KPIs) under the Global Air Navigation Plan (GANP). The ATM/SG DAG has since commenced data sharing and analysis for the 8 agreed KPIs.

1. INTRODUCTION

1.1 The Global ATM Operational Concept (Doc 9854) envisaged a performance-based global air navigation system. Based on this, ICAO published the Manual on Air Traffic Management System Requirements (Doc 9882) and the Manual on Global Performance of the Air Navigation System (Doc 9883). To complement the guidance in Doc 9883 on performance-based approach (PBA) to ATM, the Global Air Navigation Plan (GANP, Doc 9750) included a segment on key performance indicators (KPIs). These were developed for consideration by States to facilitate the PBA.

1.2 Using PBA in the prioritisation and implementation of ATM initiatives provides States/Administrations a data-driven and scientific approach to achieve their performance objectives. To advance the adoption of PBA in the Asia/Pacific (APAC) Region, the Regional ATM Performance Measurement Framework Small Working Group (RAPMF/SWG) was established at the third meeting of the ATM Sub-group (ATM/SG/3) in 2015 to develop the APAC Air Traffic Management Performance Measurement Framework (ATM/PMF). In 2019, the 30th Meeting of the Asia Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/30) endorsed the ATM/PMF. The ATM/PMF provides the stages of implementation for KPIs identified under the KPAs in the GANP and prescribes a step-by-step PBA to ensure that the region will develop data and performance management capabilities in a harmonized manner.

1.3 At APANPIRG/33, ICAO proposed that Singapore and other proponent States form an informal collaborative group to develop the proposal for the formation of a Data Analytics Ad-hoc Group (DAG) at ATM/SG. An informal group ("group") consisting of China, Indonesia, Japan, Malaysia, Singapore, Thailand, and the United States was subsequently formed to conduct trial activities on performance management. The group held 6 meetings from January to October 2023.

Through consistent and insightful discussions, the group confirmed that several States in the region are both willing and ready for harmonized and regular performance measurements.

1.4 The ATM/SG DAG was officially formed at ATM/SG/11 to continue building on this foundation to establish a broader reporting capability across the region that each State can contribute to according to their own capabilities. The ATM/SG DAG had since convened 3 meetings – 2 online and 1 physical to agree on key matters to kickstart performance benchmarking and improve ATM performance in the region.

2. FIRST PHYSICAL MEETING ON 20-21 MAY 2024

2.1 The ATM/SG DAG held its first physical meeting on 20-21 May 2024 in Singapore. Participants of this meeting included delegates from Australia, China, Hong Kong China, Indonesia, Papua New Guinea, Philippines, Singapore, Sri Lanka, Thailand, and the United States. Over two days, the ATM/SG DAG discussed and agreed on the following key matters:

a) Terms of reference and task list

b) Framework for measuring and reporting of KPIs

c) Meeting modality

d) Role assignment

Terms of Reference and Task List

2.2 The ATM/SG DAG members agreed with the terms of reference and task list previously developed at the informal working group. The full terms of reference and task list can be found in **Appendix A**.

Framework for Measuring and Reporting of KPIs

2.3 The ATM/SG DAG members agreed to measure and benchmark the 8 KPIs as identified in **Table 1**. These KPIs were consistent with the KPIs previously agreed by the informal working group and were the same KPIs in stage one of the ATM/PMF endorsed by APANPIRG. A data collection guide outlining the definitions and calculation methodologies for each KPI can be found in **Appendix B**.

KPA	KPI	Variant	GANP KPI Code
Capacity	Airport peak capacity	Departure	KPI09-D
		Arrival	KPI09-A
Capacity	Airport peak throughput	Departure	KPI10-1D
		Arrival	KPI10-1A
Efficiency	Additional taxi-out time	Advanced	KPI02-2
Efficiency	Additional taxi-in time	Advanced	KPI13-2
Predictability	Departure punctuality	± 15 mins	KPI01-2A
Predictability	Arrival punctuality	± 15 mins	KPI14-2A

Table 1: KPIs to be Reported by ATM/SG DAG

2.4 To kickstart data analysis and performance management, a data collation exercise had commenced for the 8 KPIs identified. Concerns regarding participating airports, data availability and data governance were raised. While it would be left to the individual members' discretion to decide which airport(s) to report on, member States noted the benefits of including their busier airport(s) especially those which were already facing capacity constraints and airports where operations were integrated into regional flows.

2.5 Member States were guided to submit 3 months of data in order to perform analytics. Noting the challenges that some member States may face in data submission, the meeting agreed that members would send in data on a best effort basis, based on any data they have on hand; a sub-set of data, albeit incomplete, would still be very useful to kickstart the performance benchmarking and analysis process in the region.

2.6 On data governance, member States agreed that data would not be shared beyond the ATM/SG DAG and any ICAO information/ working papers by the ATM/SG DAG referencing this data would be cleared through individual member States. To facilitate data sharing within this group, the ATM/SG DAG agreed that until a secure portal could be established, data sharing would be done via email exchanges.

2.7 The meeting also brought up the idea of using commercial data for ATM/SG DAG. Commercial data would be less sensitive, and it would help circumvent challenges pertaining to data governance and data availability. The meeting agreed that using commercial data was a viable option and would explore this subsequently.

Meeting Modality

2.8 The ATM/SG DAG members agreed to hold 3 official meetings a year – 1 physical and 2 online. The annual physical meeting would be held during April-May to ensure sufficient lead time to prepare the necessary working papers to update the annual ATM/SG meeting, usually held in September/October. Any ad-hoc meeting could be convened when necessary.

Role Assignment

2.9 Ms. Carol Teo from Singapore was nominated to lead the ATM/SG DAG as the rapporteur.

2.10 The various work of the ATM/SG DAG would be led by the following countries:

Data collation: China

Data analysis on Capacity KPIs (KPI09/10): Australia

Data analysis on Efficiency KPIs (KPI02/13): China

Data analysis on Predictability KPIs (KPI01/14): Singapore

Data reporting: United States

All members would support and contribute accordingly.

3. INTERIM DATA ANALYSIS EXERCISE

3.1 Following the first physical meeting, the group proceeded with an interim data analysis exercise to measure performance for a short period of three months from January to March 2024. This interim data analysis exercise lays the foundation to allow members to familiarise with the data collation and analysis process before advancing further for a more in-depth analysis exercise. For countries with many airports, only the major airports by traffic count were included. The airports participating in this exercise can be found in **Figure 1**.

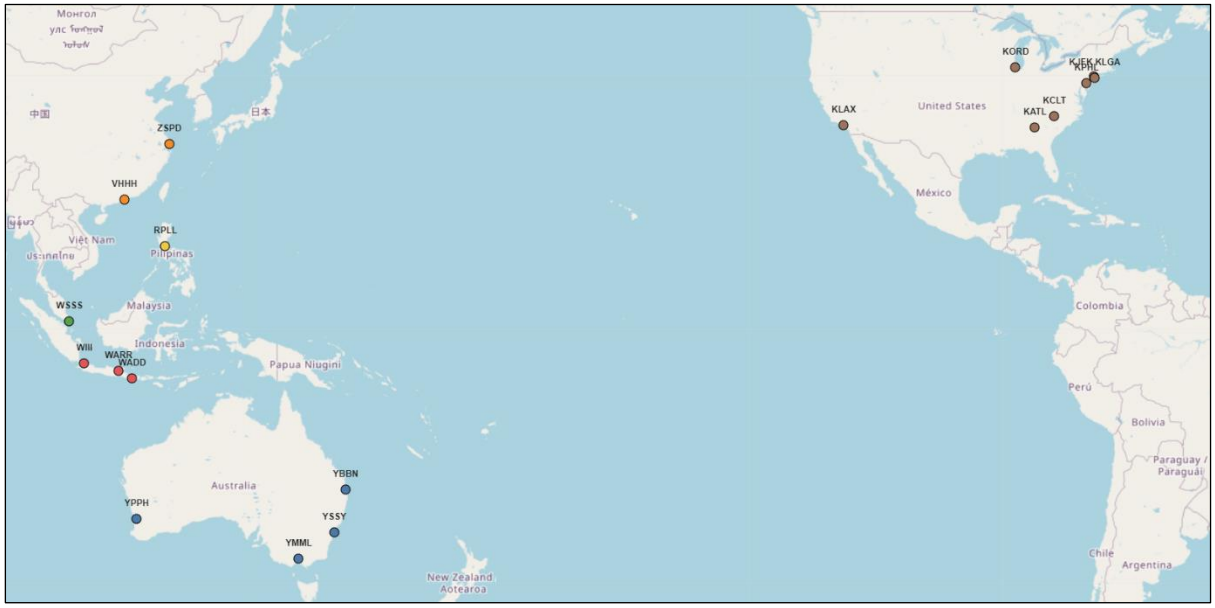

Figure 1: Airports Participating in this Interim Data Analysis Exercise

3.2 Further analysis of the data gathered for the 8 KPIs are elaborated below.

Capacity

3.3 **Figure 2** and **Figure 3** show the airport peak capacity and airport peak throughput for arrival and departure respectively.

3.4 It was observed that while majority of airports were operating below their peak capacities, there were a number of airports operating near to the peak capacity. Such airports are likely candidates for application of ATM measures (e.g. flow measures) to help with smoothing traffic flows and with preventing excessive delays and congestion in their terminal areas or on the surface.

3.5 Arrival capacity is determined based on forecasted meteorological conditions (including winds, visibility, and ceilings which dictate the type of approaches available), runway configuration (primarily driven by current and forecasted winds), and operational constraints (construction, maintenance, etc.). Departure capacity is a function of the runway layout and dependencies, and of the required spacing between arrivals and departures. At some airports with single or intersecting runways, the arrival capacity impacts the departure capacity; at other airports with parallel runways, or even multiple sets of runway groupings, departure capacity can be independent of the number of arrivals. Airport capacity combines arrival and departure capacities; occasionally, arrival or departure capacity can be exceeded by the actual operations, typically during short periods with peak arrival or peak departure demand, respectively. Airports that have three or more runways can use specific runways to facilitate excess arrivals for a period of time, followed by using the same runway(s) for departures, which could lead to peak arrival or peak departure throughput exceeding their corresponding capacities.

3.6 For Australia's airports, arrival capacity is set based on forecast and existing operational conditions, departures are subsequently handled dynamically using the available capacity between arrivals based on the runway mode in use. For the purpose of analysis, the departure peak capacity value is calculated using the 95 percentile of the called capacity.

3.7 In the United States, Section 7 of FAA Order 7210.3DD establishes the standards for determining the airport arrival rate (AAR) used as a proxy for arrival capacity. This AAR is defined as a dynamic parameter specifying the number of aircraft the airport and terminal airspace can accept under varying conditions over a 60-minute period. This order sets the procedure for calculating the optimal AAR per primary runway configuration based on the meteorological conditions such as VMC, Marginal VMC, IMC and Low IMC. The maximum runway arrival capacity is calculated as a function of runway threshold crossing speeds and separation constraints. These optimal AARs by MET condition and runway configuration are similar to the idea of a fixed declared capacity.

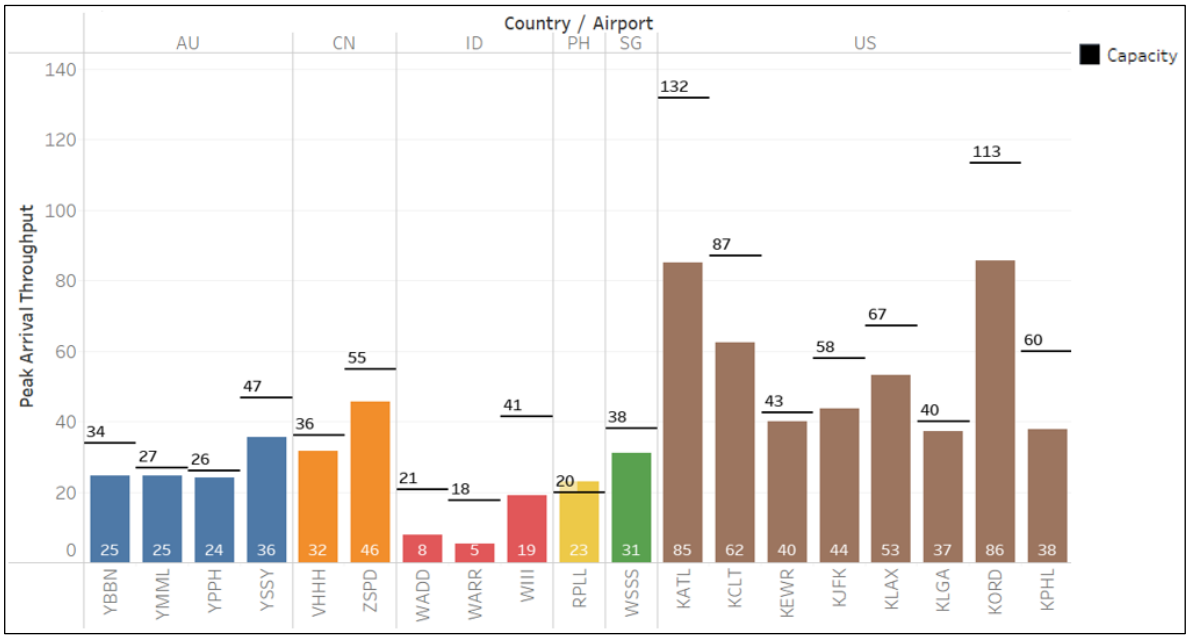

Figure 2: Arrival capacities and peak arrival throughputs (KPI09-A, KPI10-1A)

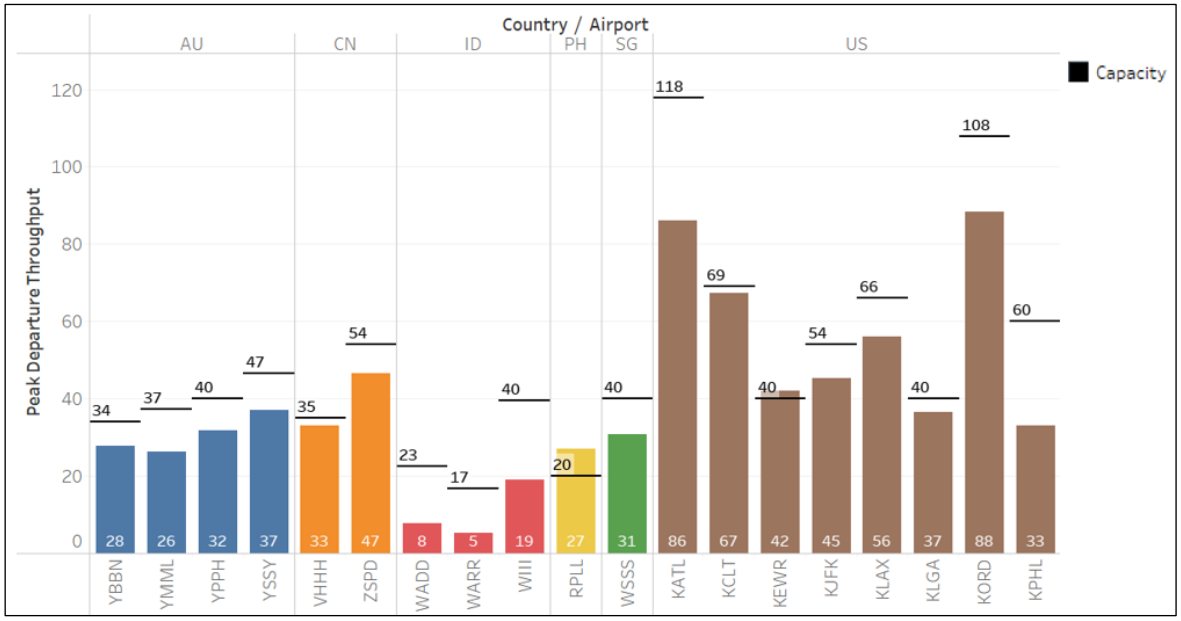

Figure 3: Departure Capacities and Peak Departure Throughputs (KPI09-D, KPI10-1D)

Efficiency

3.8 **Figure 4** and **Figure 5** show the average additional taxi time taken for arrival and departure respectively.

3.9 It was observed that the advanced variant (computed with departure gate and runway data) produced a different additional taxi-in and taxi-out time as compared to the basic variant. Airport layout and location of gates relative to runways impact the difference between the basic and the advanced taxi time variants. Large airports often have more runway/gate clusters with long actual unimpeded times. For such airports, the calculated unimpeded or reference taxi times are generally shorter in the basic variant because the 20th percentile applies to the whole airport and favours the shorter runway/gate combinations; as a result, additional taxi times are generally longer in such cases too. The meeting concurred on a preference to adopt the advanced variant for this KPI, as it would take into account these varying distances and allow for a fairer comparison of additional taxi time taken for flights located at different gates.

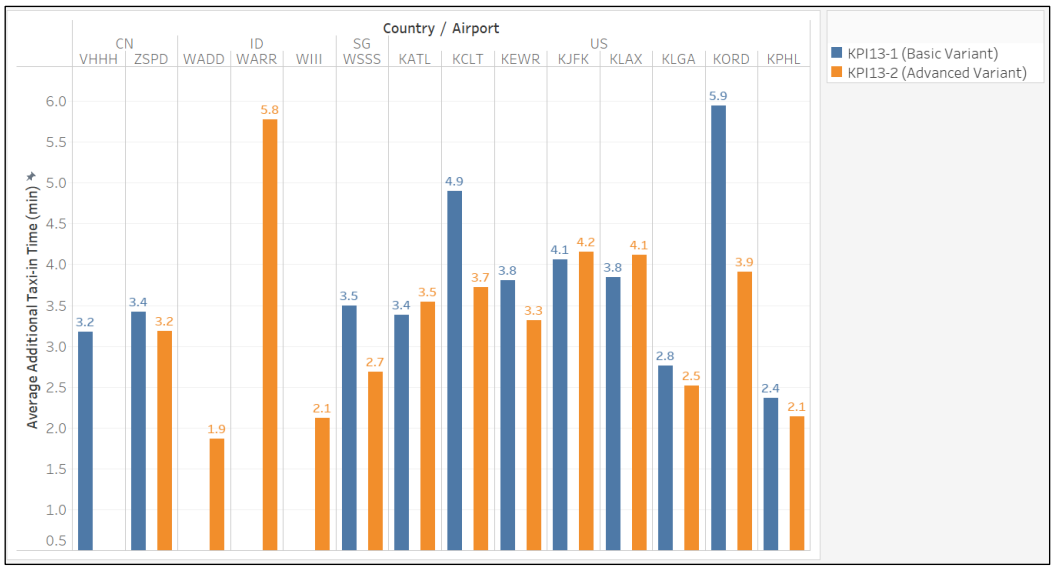

Figure 4: Additional Taxi-In Time for Basic and Advanced Variants (KPI13-1, KPI13-2)

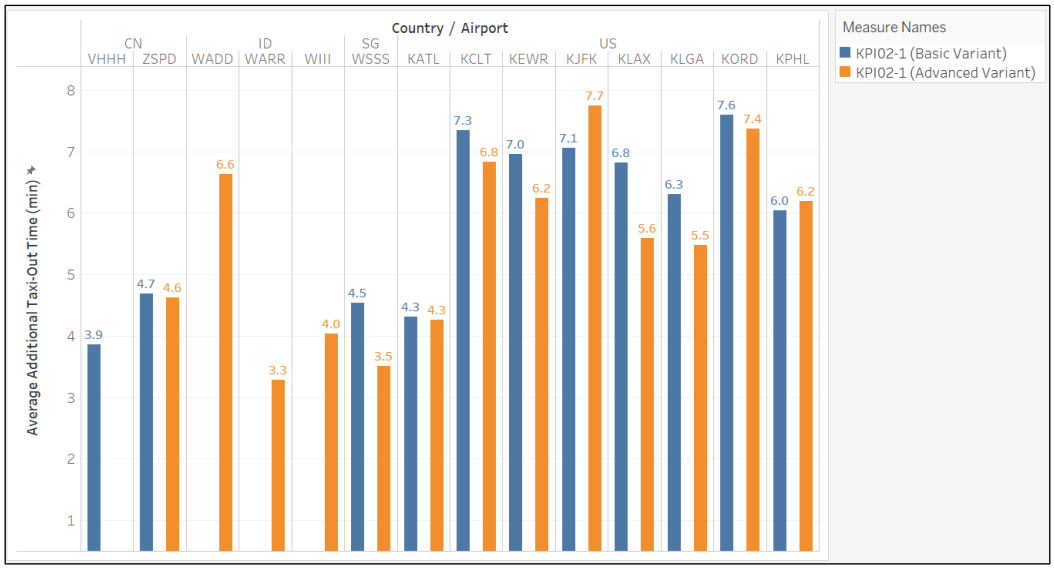

Figure **5:** Additional Taxi-Out Time for Basic and Advanced Variants (KPI02-1, KPI02-2)

Predictability

3.10 **Figure 6** shows the arrival and departure punctuality distribution binned by its deviation from the respective scheduled arrival and departure time.

3.11 Across all airports, we observe that arrival on-time performance is poorer as compared to departures. This is due to observed higher occurrences of both early and late arrivals; departures on the other hand are rarely early. Having more arrivals falling out of the +/- 15 min on-time bin indicates poor adherence to slot schedules which may lead to demand-capacity imbalance. Such observation offers a good starting point to analyse the buffers built into the ATM system to identify areas where greater efficiency can be realized.

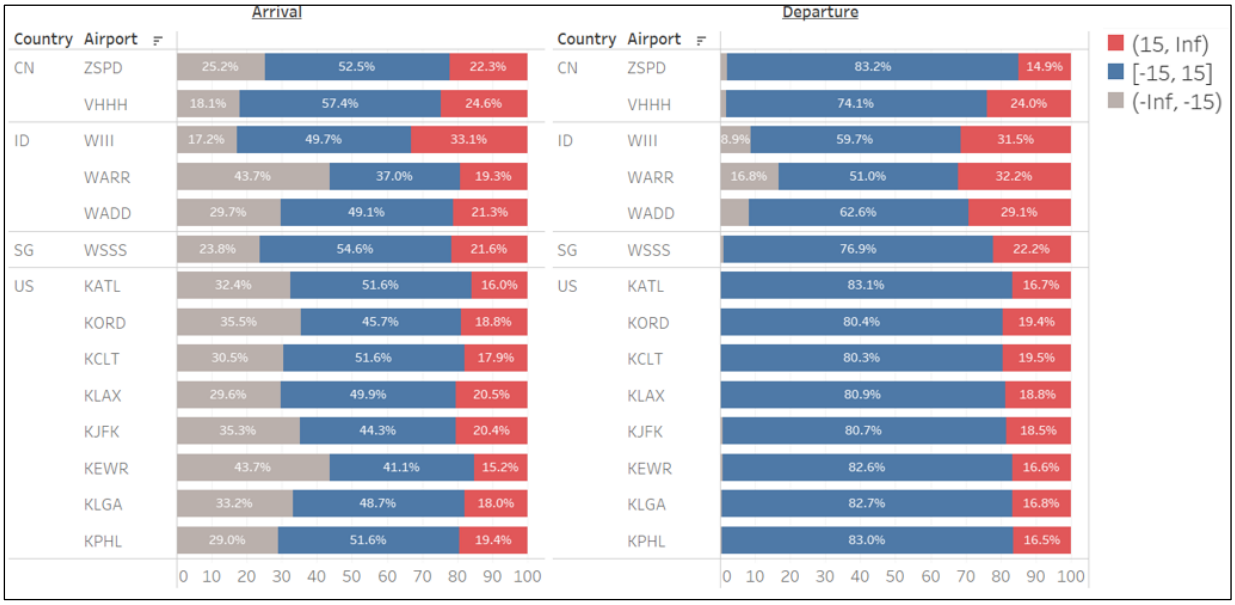

Figure 6: Range of Arrival and Departure Punctuality Across Airports (KPI14, KPI01)

4. ACTION BY THE MEETING

4.1 The meeting is invited to:

a) discuss the information contained in this paper;

b) encourage member States who are not currently members to join the ATM/SG DAG; and

c) seek continued support from existing members to actively participate and share data.

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APPENDIX A – TERMS OF REFERENCE AND TASK LIST FOR ATM/SG DAG

TERMS OF REFERENCE AND TASK LIST FOR ATM/SG DATA ANALYTICS GROUP (DAG)

Background

The Global ATM Operational Concept (Doc 9854) envisaged a performance-based global air navigation system. Based on this, ICAO published the Manual on Air Traffic Management System Requirements (Doc 9882) and the Manual on Global Performance of the Air Navigation System (Doc 9883). To complement the guidance in Doc 9883 on performance-based approach (PBA) to ATM, the Global Air Navigation Plan (GANP, Doc 9750) included a segment on key performance indicators (KPIs). These were developed for consideration by states to facilitate the PBA.

Using PBA in the prioritization and implementation of ATM initiatives provides States/Administrations and organizations a data-driven and scientific method to achieve their performance objectives. To advance the adoption of PBA in the Asia Pacific (APAC) Region, the Regional ATM Performance Measurement Framework Small Working Group (RAPMF/SWG) was established at the third meeting of the ATM Subgroup (ATM/SG/3) to develop the APAC Air Traffic Management Performance Measurement Framework (ATM/PMF). In 2019, the 30th meeting of the Asia Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) endorsed the ATM/PMF. The ATM/PMF provides the stages of implementation for KPIs identified under the KPAs in the GANP and prescribes a step-by-step performance-based approach to ensure that the region will develop data and performance management capabilities in a harmonized manner.

At APANPIRG/30, APAC States/Administrations were urged to consider the ATM/PMF and initiate their own performance measurement practice, including the trial implementation of the eight Stage 1 KPIs listed in the ATM/PMF to support the achievement of the Seamless ATM and regional ATFM goals in the APAC region. At the 41st meeting of the ICAO Assembly, the Technical Commission also urged States/Administrations and PIRGs to establish a performance-based management approach and define performance targets according to their needs. At APANPIRG/33, a small working group was proposed to be established at ATM-SG/11 to identify Key Performance Indicators (KPIs) to be measured and studied, and to develop a proposal to track regional KPIs.

Objective

Establish a framework for evaluation of ATM performance that enables consistent reporting across APAC States/Administrations.

Scope

Through a phased approach and information exchange between the States/Administrations, identify data and analytical capabilities across the APAC region, and KPIs suitable for assessment of ATM performance in the region. Propose a reporting framework consisting of common ATM KPIs, data requirements and evaluation methodologies for their assessment.

Required Expertise

Performance management experts and ATM operations experts from States/Administrations, international organizations, ANSPs, airspace users and airport operators in the APAC region. These members will provide subject matter expertise related to the different KPIs and contextual information, as well as on operations research, data science, statistics, or data / technological matters.

Tasks

Task 1: Identify initial ATM KPIs, data collection requirements and common data analysis and evaluation methodologies for APANPIRG.

Task 2: Validate ATM KPIs, data requirements and common evaluation methodologies through an interim data analysis exercise.

Task 3: Propose framework for reporting of ATM KPIs, including frequency and mechanism.

Task 4: Study insights provided by State / Administration reports and propose additional KPIs and/or modifications to existing KPIs to expand understanding of opportunities to improve ATM performance in APAC region.

APPENDIX B – DATA COLLECTION GUIDE

1. INTRODUCTION

This document contains the definitions and calculation methodologies to be used for the Data Analytics Group's (DAG's) performance management and data collection purposes. The data gathered will be studied and used to provide insights and illustrate the benefits of performance management.

2. PROTECTION AND USE OF DATA

a) All data provided and used shall be protected against public disclosure.
b) Data provided should only be used for the purposes of the DAG's work as guided by the DAG's Terms of Reference and Task List.
c) Written permission from the data provider shall be sought for the use of data for any purpose not provided for in (b).
d) Data quality and validation is the responsibility of the data provider.

3. GENERAL NOTES

The KPIs are based on GANP KPIs and organized by the GANP Performance Objectives (https://www4.icao.int/ganpportal/ASBU/KPI). Deviations from GANP definitions are italicized (if applicable). Only KPI variants considered by the DAG will have their definitions listed here. KPI variants will be identified by suffixing the main KPI identifier. For example, Variant 2A of KPI01 will be referred to as KPI01-2A. Data will be collected at a resolution of once a month. Cut-offs will be determined by Actual Take-off Time (ATOT) and Actual Landing Time (ALDT) in UTC.

For calculation of unimpeded or reference times, a full year of data from 2019 shall be utilized, unless otherwise specified.

4. PREDICTABILITY

For the predictability performance objective, the informal group will be collecting data to calculate variants 2A and 2B of the KPIs, i.e. KPI01-2A, KPI01-2B, KPI14-2A, KPI14-2B.

4.1 DEFINITIONS

KPI Name	Departure Punctuality (KPI01)
Definition	Percentage of flights departing from the gate on-time (compared to schedule).
Measurement	% of scheduled flights
Variants	Variant 2A – % of departures delayed within ± 15 mins of scheduled time of departure Variant 2B – % of departures delayed <= 15 mins versus schedule
Parameters	On-time threshold (maximum positive or negative deviation from scheduled departure time) which defines whether a flight is counted as on-time or not. Recommended values: 5 minutes and 15 minutes.
Data Requirement	For each departing scheduled flight: • Scheduled time of departure (STD) • Actual off-block time (AOBT)
Formula	At the level of individual flights: • Exclude non-scheduled departures • Categorize each scheduled departure as on-time or not At aggregated level: • Compute the KPI: number of on-time departures divided by total number of scheduled departures

Table 1 – Departure punctuality definition

KPI Name	Arrival Punctuality (KPI14)
Definition	Percentage of flights arriving at the gate on-time (compared to schedule).
Measurement	% of scheduled flights
Variants	Variant 2A – % of arrivals delayed within ± 15 mins of scheduled time of arrival Variant 2B – % of arrivals delayed <= 15 mins versus schedule
Parameters	On-time threshold (maximum positive or negative deviation from scheduled arrival time) which defines whether a flight is counted as on-time or not. Recommended values: 5 minutes and 15 minutes.
Data Requirement	For each arriving scheduled flight: • Scheduled time of arrival (STA) • Actual in-block time (AIBT)
Formula	At the level of individual flights: • Exclude non-scheduled arrivals • Categorize each scheduled departure as on-time or not At aggregated level: • Compute the KPI: number of on-time departures divided by total number of scheduled departures

Table 2 – Arrival punctuality definition

4.2 DATA COLLECTION

To calculate the predictability KPIs, we would require the breakdown of flights by Arrival, Departure, and time buckets. There will be three time buckets and x = Actual − Scheduled for the below definitions:

- (-INF, -15) Flights arriving or departing when x < -15 minutes.
- [-15,15] Flights arriving or departing when -15 ≤ x ≤ 15 minutes.
- (15, INF) Flights arriving or departing when x > 15 minutes.

Table 3 shows a sample of the data collection template with dummy data for illustration.

Airport	Date	Phase	No. of Flights	(-INF, -15)	[-15,15]	(15, INF)
ZZZZ	2022-11	DEP	12,345	190	8,386	3,769
ZZZZ	2022-12	DEP	12,346	114	8,064	4,168
ZZZZ	2023-01	DEP	12,347	137	8,886	3,324
ZZZZ	2022-11	ARR	12,348	2,203	6,887	3,258
ZZZZ	2022-12	ARR	12,349	2,038	6,237	4,074
ZZZZ	2023-01	ARR	12,350	2,347	6,619	3,384

Table 3: Data collection template for predictability with dummy data

4.3 CALCULATION METHODOLOGY

For departures,

1. Exclude non-scheduled flights and cancelled flights.
2. Calculate the time difference AOBT − STD.
3. Categorize each flight into the 3 buckets of (-INF, -15), [-15,15], (15, INF).
4. Sum up the number of flights in each bucket for every month.

For arrivals,

1. Exclude non-scheduled flights and cancelled flights.
2. Calculate the time difference AIBT − STA.
3. Categorize each flight into the 3 buckets of (-INF, -15), [-15,15], (15, INF).
4. Sum up the number of flights in each bucket for every month.

5. EFFICIENCY

For the predictability performance objective, the group will be collecting data to calculate both the basic and advanced variants of the KPIs. i.e. KPI02-1, KPI02-2, KPI13-1, KPI13-2.

5.1 DEFINITIONS

KPI Name	Additional taxi-out time (KPI02)
Definition	Actual taxi-out time compared to an unimpeded/reference taxi-out time.
Measurement	Minutes/flight
Variants	Variant 1 – Basic (computed without departure gate and runway data) Variant 2 – Advanced (computed with departure gate and runway data)

KPI Name	Additional taxi-out time (KPI02)
Parameters	Unimpeded/reference taxi-out time: • Recommended approach for the basic variant of the KPI: A single value at airport level, e.g. the 20th percentile of actual taxi times recorded at an airport, sorted from the shortest to the longest. *[For basic variant, reporting can be done at runway level if data is available]* • Recommended approach for the advanced variant of the KPI: A separate value for each runway/gate cluster combination, e.g. the average actual taxi-out time recorded during periods of non-congestion (needs to be periodically reassessed). *[For advanced variant, the reference taxi-out time will be set at 20th percentile of actual taxi times recorded. To prevent issues with low sample sizes, data may be reported at runway and gate cluster level instead of at the individual gate level.]*
Data Requirement	For each departing flight: • Actual off-block time (AOBT) • Actual take-off time (ATOT) In addition, for the advanced variant: • Departure gate ID • Take-off runway ID
Formula	At the level of individual flights: 1. Select departing flights, exclude helicopters 2. Compute actual taxi-out duration: ATOT minus AOBT 3. Compute additional taxi-out time: actual taxi-out duration minus unimpeded taxi-out time At aggregated level: 4. Compute the KPI: sum of additional taxi-out times divided by number of IFR departures

Table 4 – Additional taxi-out time definition

KPI Name	Additional taxi-in time (KPI13)
Definition	Actual taxi-in time compared to an unimpeded/reference taxi-in time.
Measurement	Minutes/flight
Variants	Variant 1 – Basic (computed without landing runway and arrival gate data) Variant 2 – Advanced (computed with landing runway and arrival gate data)
Parameters	Unimpeded/reference taxi-in time: • Recommended approach for the basic variant of the KPI: A single value at airport level, e.g. the 20th percentile of actual taxi times recorded at an airport, sorted from the shortest to the longest. *[For basic variant, reporting can be done at runway level if data is available]* • Recommended approach for the advanced variant of the KPI: A separate value for each runway/gate cluster combination, e.g. the average actual taxi-in time recorded during periods of non-congestion (needs to be periodically reassessed). *[For advanced variant, the reference taxi-in time will be set at 20th percentile of actual taxi times recorded. To prevent issues with low sample sizes, data may be reported at runway and gate cluster level instead of at the individual gate level.]*
Data Requirement	For each arriving flight: • Actual in-block time (AIBT)

KPI Name	Additional taxi-in time (KPI13)
	• Actual landing time (ALDT) In addition, for the advanced variant: • Arrival gate ID • Landing runway ID
Formula	At the level of individual flights: 1. Select arriving flights, exclude helicopters 2. Compute actual taxi-in duration: AIBT minus ALDT 3. Compute additional taxi-in time: actual taxi-in duration minus unimpeded taxi-in time At aggregated level: 4. Compute the KPI: sum of additional taxi-in times divided by number of IFR arrivals

Table 5 – Additional taxi-in time definition

5.2 DATA COLLECTION

The Efficiency KPIs will be collected with the following data collection template.

Airport	Date	KPI02-1	KPI02-2	KPI13-1	KPI13-2
ZZZZ	2022-11	10.03	4.85	2.07	1.75
ZZZZ	2022-12	11.71	5.27	2.34	1.83
ZZZZ	2023-01	11.89	5.32	2.40	1.90

Table 6 – Data collection template for efficiency with dummy data

5.3 CALCULATION METHODOLOGY

Reference Time

1. Only include IFR flights.
2. Calculate actual taxi-out or taxi-in times for each flight: ATOT − AOBT or AIBT − ALDT respectively.
3. Group flights by runway and gate cluster.
4. For each group, obtain the 20th percentile taxi-out or taxi-in time as the runway and gate cluster combination's reference time.

Additional Taxi Time

1. Only include IFR flights.
2. Calculate actual taxi-out or taxi-in times for each flight: ATOT − AOBT or AIBT − ALDT respectively.
3. Group flights by runway and gate cluster.
4. For each group, subtract the reference time from the actual times to obtain the additional taxi-out or taxi-in time, using a different reference time for each runway and gate cluster combination.
5. Obtain the average additional taxi-out or taxi-in times for the month across all flights.

6. CAPACITY

For the capacity performance objective, the informal group will be collecting data to calculate all variants of KPI09, i.e. KPI09-A, KPI09-D, KPI09-AD. For KPI10, variant 1 on IFR operations will be calculated, i.e. KPI10-1A, KPI10-1D, KPI10-1AD

6.1 DEFINITIONS

KPI Name	Airport Peak Capacity (KPI09)
Definition	The highest number of operations an airport can accept in a one-hour time frame (also called declared capacity). Can be computed for arrivals, departures, or arrivals + departures.
Measurement	Number of departures / hour, Number of landings / hour, Number of (departures + landings) / hour
Variants	Variant A – Airport peak arrival capacity Variant D – Airport peak departure capacity Variant AD – Airport peak movement capacity (departures + arrivals)
Parameters	None
Data Requirement	Scheduling parameters for slot controlled airports Airport acceptance rates (AAR) Airport departure rates (ADR)
Formula	At the level of an individual airport: 1. Select highest value from the set of declared capacities 2. Compute the KPI: convert the value to an hourly rate, if the declaration is at smaller time intervals

Table 7 – Airport peak capacity definition

KPI Name	Airport Peak Throughout (KPI10)
Definition	The 95th percentile of the hourly number of operations recorded at an airport, in the "rolling" hours sorted from the least busy to the busiest hour. Can be computed for arrivals, departures, or arrivals + departures.
Measurement	Number of departures / hour, Number of landings / hour, Number of (departures + landings) / hour
Variants	Variant 1 – IFR operations only To be combined with: Variant A – Airport peak arrival capacity Variant D – Airport peak departure capacity Variant AD – Airport peak movement capacity (departures + arrivals)
Parameters	Time interval for "rolling" hours. Recommended value: 15 minutes The percentile chosen to exclude outliers. Recommended value: 95th percentile
Data Requirement	For each flight: Actual landing time (ALDT) Actual take-off time (ATOT)
Formula	At the level of an individual flights: 1. Select flights, exclude helicopters 2. Convert the set of landings to hourly landing / departure rates by "rolling" hour 3. Sort the "rolling" hours from the least busy to the busiest hour 4. Compute the KPI: it equals the landing rate value of the 95th percentile of the "rolling" hours

Table 8 – Airport peak throughput definition

6.2 DATA COLLECTION

Data will be collected for all variants of KPI09. For KPI10, data will be collected for KPI10-1A, KPI10-1D, and KPI10-1AD.

Airport	Date	KPI09-AD	KPI10-1AD	KPI09-A	KPI10-1A	KPI09-D	KPI10-1D
WSSS	2022-11	73	45	38	27	40	24
WSSS	2022-12	73	47	38	28	40	25
WSSS	2023-01	73	47	38	27	40	24

Table 9 – Data collection template for capacity with sample data

6.3 CALCULATION METHODOLOGY

This section will focus on KPI10 only as KPI09 consists of declared capacities.

Rolling Hours

The time interval for rolling hours will be set at 15 minutes. To illustrate rolling hours, consider the below example where we begin from 0900. Hourly peak throughputs will be calculated for the following time periods, where a new hourly period is considered every 15 minutes:

- 0900 – 1000
- 0915 – 1015
- 0930 – 1030

… and so on

Airport Peak Throughput

1. Restrict the hours considered to 0600 – 2259 local time for all airports.
2. For each month, calculate the number of flights per rolling hour for arrivals, departures, and arrivals + departures.
3. Arrange these rolling hours from the least number of flights to the greatest number of flights.
4. The 95th percentile rolling hour will be taken as the peak throughput

— END —