AEROTHAI Aeronautical Radio of Thailand
บริษัท วิทยุการบินแห่งประเทศไทย จำกัด

SWIM Business Requirements:
How AEROTHAI Developed Our Use Cases

Sugoon Fucharoen (Kin)
SWIM Business Requirements Brainstorming
6 – 7 November 2023

Agenda

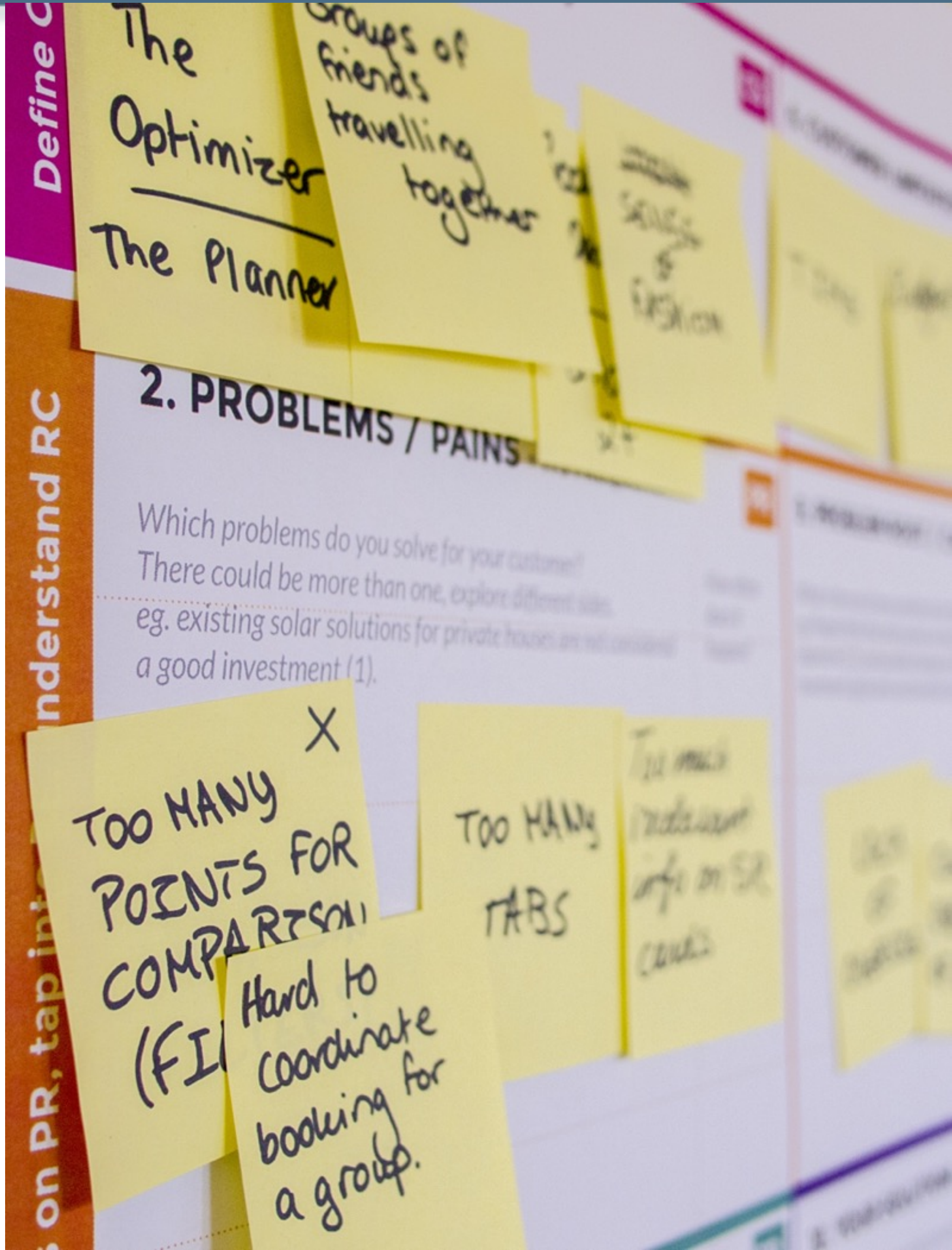
Target Outcome:

An understanding of how to develop business requirements (operational scenarios) for SWIM development

☐ What is the role of operational scenario in SWIM development?

☐ How does a scenario get developed...
☐ ...and how does it get used?

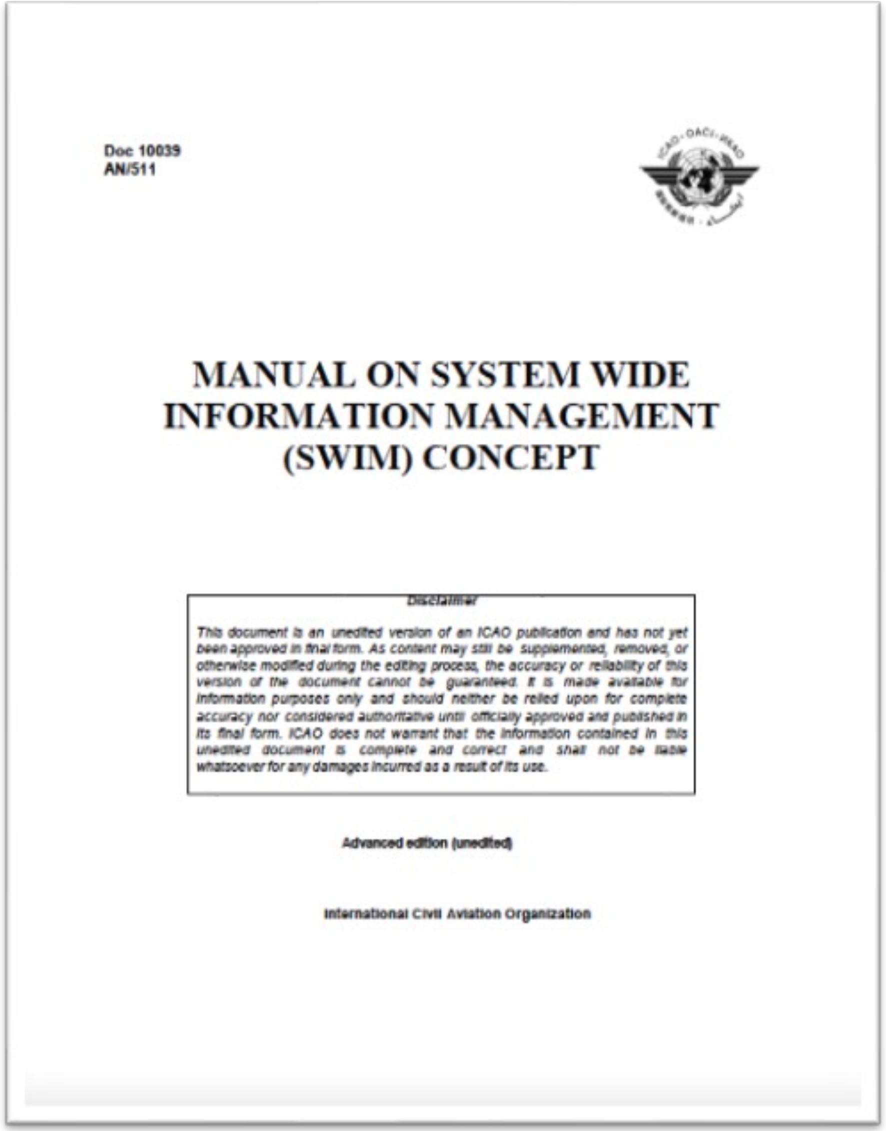
☐ AEROTHAI's Use Cases and Experience


Define
Understand RC
on PR, tap into
The Optimizer
The Planner
Groups of friends travelling together
2. PROBLEMS / PAINS
Which problems do you solve for your customer?
There could be more than one, explore different sides.
eg. existing solar solutions for private houses are not considered a good investment (1).
TOO MANY POINTS FOR COMPARISON
Hard to coordinate booking for a group.
TOO MANY TABS

To start with...

Why Do We Need Operational Scenario?

Why Do We Need Operational Scenario?



Doc 10039
AN/511

MANUAL ON SYSTEM WIDE INFORMATION MANAGEMENT (SWIM) CONCEPT

Disclaimer

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Advanced edition (unedited)

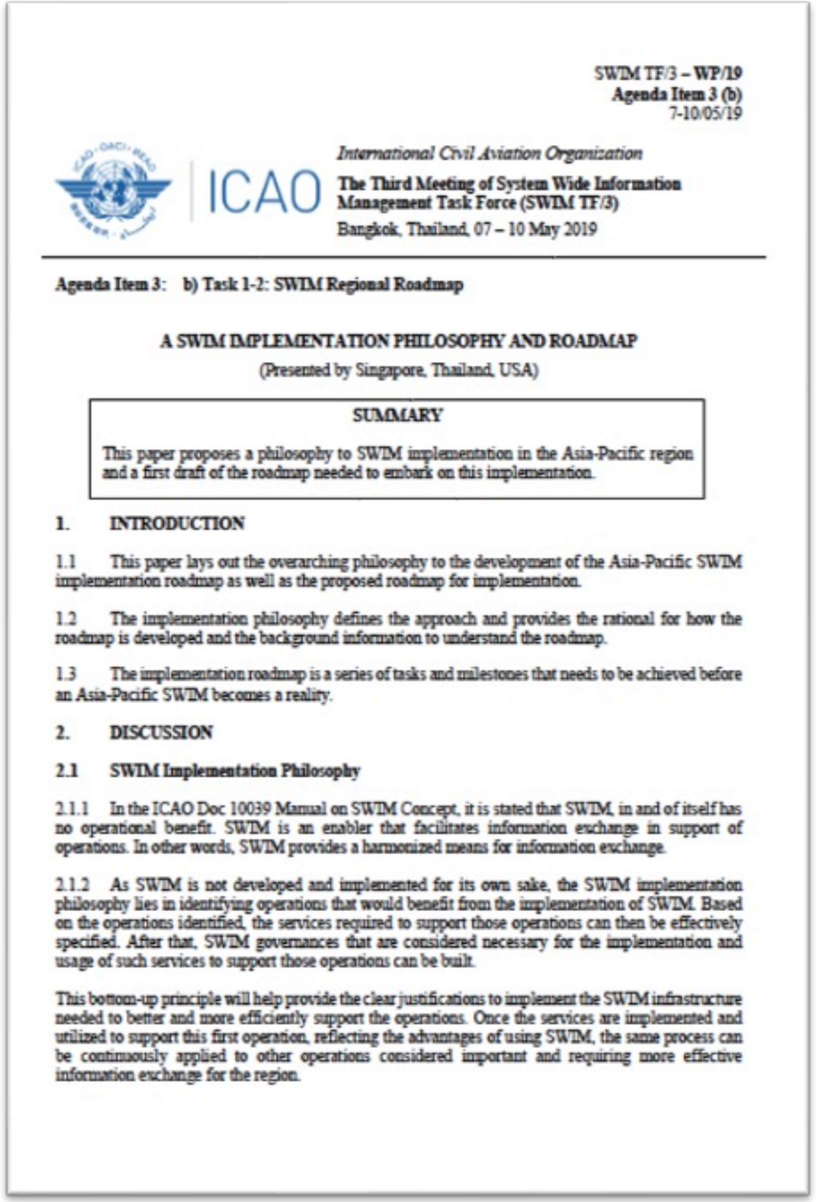
International Civil Aviation Organization

(ICAO Doc 10039, para. 2.3.3)

“**SWIM is not developed for its own sake**; its justification lies in the needs of its client applications […]”.

“**SWIM conveys the requirements of the operational ATM services** through applications that define the scope and quality of the information.”

Why Do We Need Operational Scenario?



SWIM TF/3 – WP/19
Agenda Item 3 (b)
7-10/05/19

International Civil Aviation Organization
The Third Meeting of System Wide Information Management Task Force (SWIM TF/3)
Bangkok, Thailand, 07 – 10 May 2019

Agenda Item 3: b) Task 1-2: SWIM Regional Roadmap

A SWIM IMPLEMENTATION PHILOSOPHY AND ROADMAP

(Presented by Singapore, Thailand, USA)

SUMMARY

This paper proposes a philosophy to SWIM implementation in the Asia-Pacific region and a first draft of the roadmap needed to embark on this implementation.

1. INTRODUCTION

1.1 This paper lays out the overarching philosophy to the development of the Asia-Pacific SWIM implementation roadmap as well as the proposed roadmap for implementation.

1.2 The implementation philosophy defines the approach and provides the rational for how the roadmap is developed and the background information to understand the roadmap.

1.3 The implementation roadmap is a series of tasks and milestones that needs to be achieved before an Asia-Pacific SWIM becomes a reality.

2. DISCUSSION

2.1 SWIM Implementation Philosophy

2.1.1 In the ICAO Doc 10039 Manual on SWIM Concept, it is stated that SWIM, in and of itself has no operational benefit. SWIM is an enabler that facilitates information exchange in support of operations. In other words, SWIM provides a harmonized means for information exchange.

2.1.2 As SWIM is not developed and implemented for its own sake, the SWIM implementation philosophy lies in identifying operations that would benefit from the implementation of SWIM. Based on the operations identified, the services required to support those operations can then be effectively specified. After that, SWIM governances that are considered necessary for the implementation and usage of such services to support those operations can be built.

This bottom-up principle will help provide the clear justifications to implement the SWIM infrastructure needed to better and more efficiently support the operations. Once the services are implemented and utilized to support this first operation, reflecting the advantages of using SWIM, the same process can be continuously applied to other operations considered important and requiring more effective information exchange for the region.

(APAC SWIM Implementation Philosophy)

"[…], the **SWIM implementation philosophy lies in identifying operations that would benefit** […]."

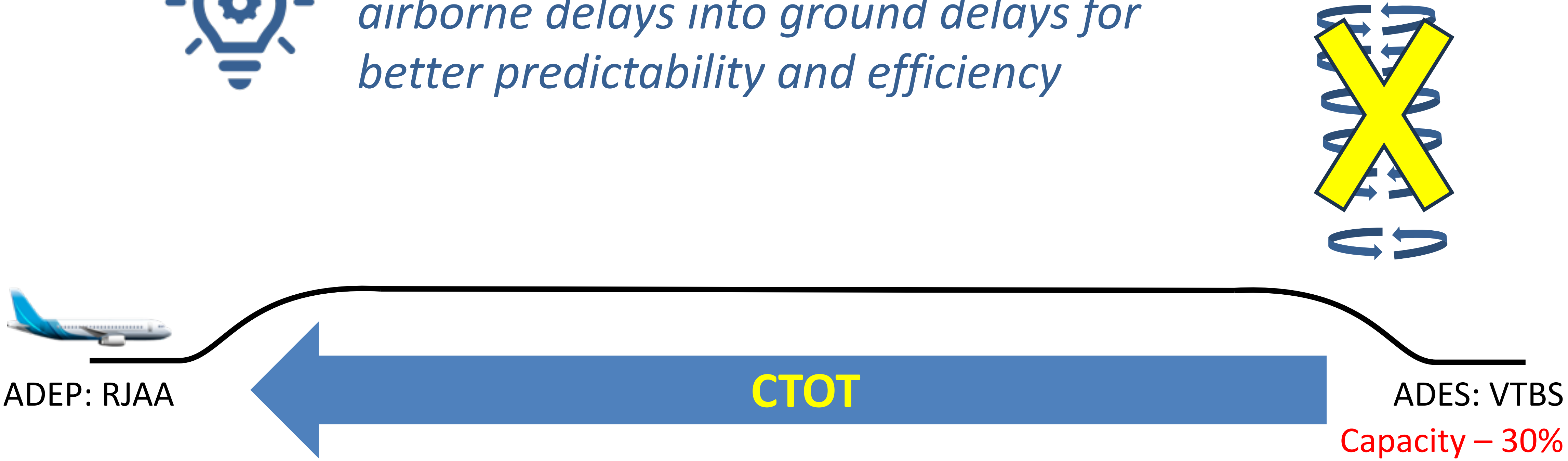
"The bottom-up principle will help provide the clear justifications to **implement the SWIM infrastructure needed to better and more efficiently support the operations**."

(ICAO APAC SWIM TF/3, WP/19)

Developing an Operational Scenario
Case Study: the Ground Delay Program (GDP)

GDP: The Basics

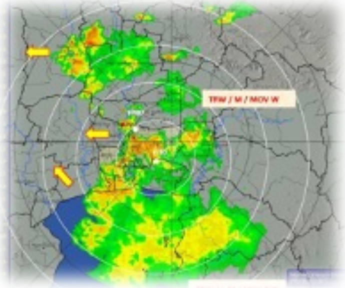
Transforming the foreseen/expected airborne delays into ground delays for better predictability and efficiency



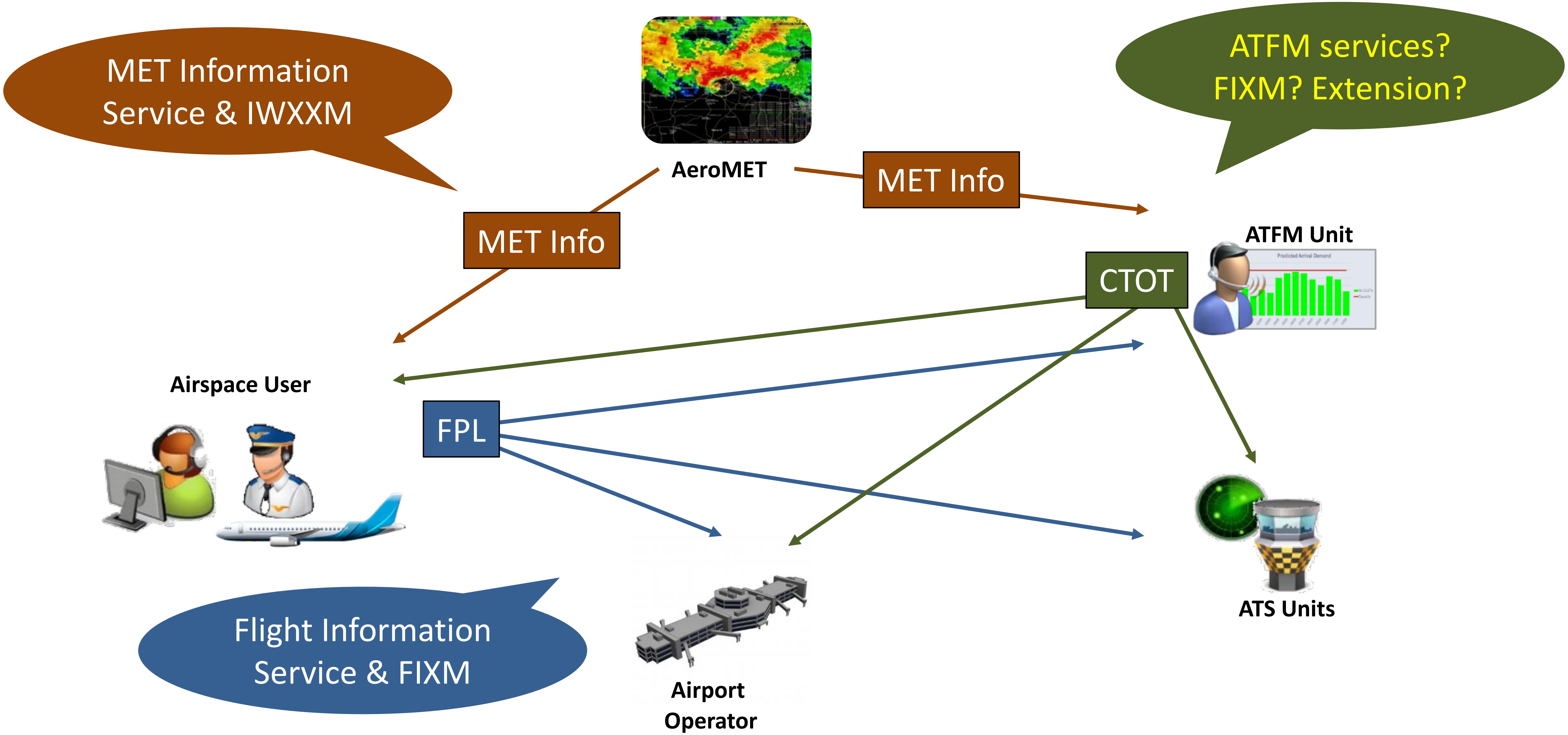
ADEP: RJAA

ADES: VTBS

Capacity – 30%



GDP: The Information Flow



MET Information Service & IWXXM

AeroMET

MET Info

MET Info

ATFM services? FIXM? Extension?

ATFM Unit

CTOT

Airspace User

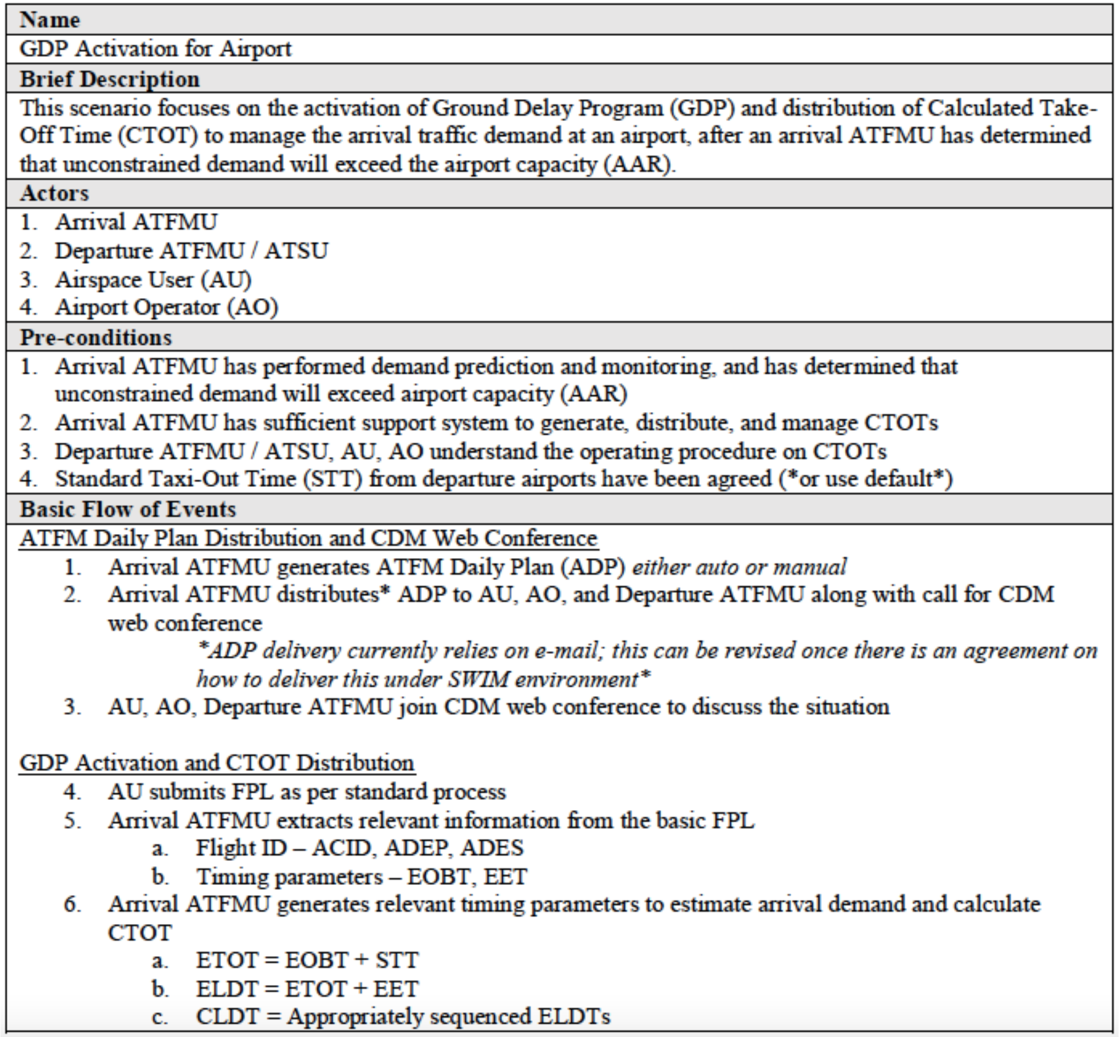
FPL

Flight Information Service & FIXM

Airport Operator

ATS Units

From Information Flow to Ops Requirement



Name

GDP Activation for Airport

Brief Description

This scenario focuses on the activation of Ground Delay Program (GDP) and distribution of Calculated Take-Off Time (CTOT) to manage the arrival traffic demand at an airport, after an arrival ATFMU has determined that unconstrained demand will exceed the airport capacity (AAR).

Actors

1. Arrival ATFMU
2. Departure ATFMU / ATSU
3. Airspace User (AU)
4. Airport Operator (AO)

Pre-conditions

1. Arrival ATFMU has performed demand prediction and monitoring, and has determined that unconstrained demand will exceed airport capacity (AAR)
2. Arrival ATFMU has sufficient support system to generate, distribute, and manage CTOTs
3. Departure ATFMU / ATSU, AU, AO understand the operating procedure on CTOTs
4. Standard Taxi-Out Time (STT) from departure airports have been agreed (*or use default*)

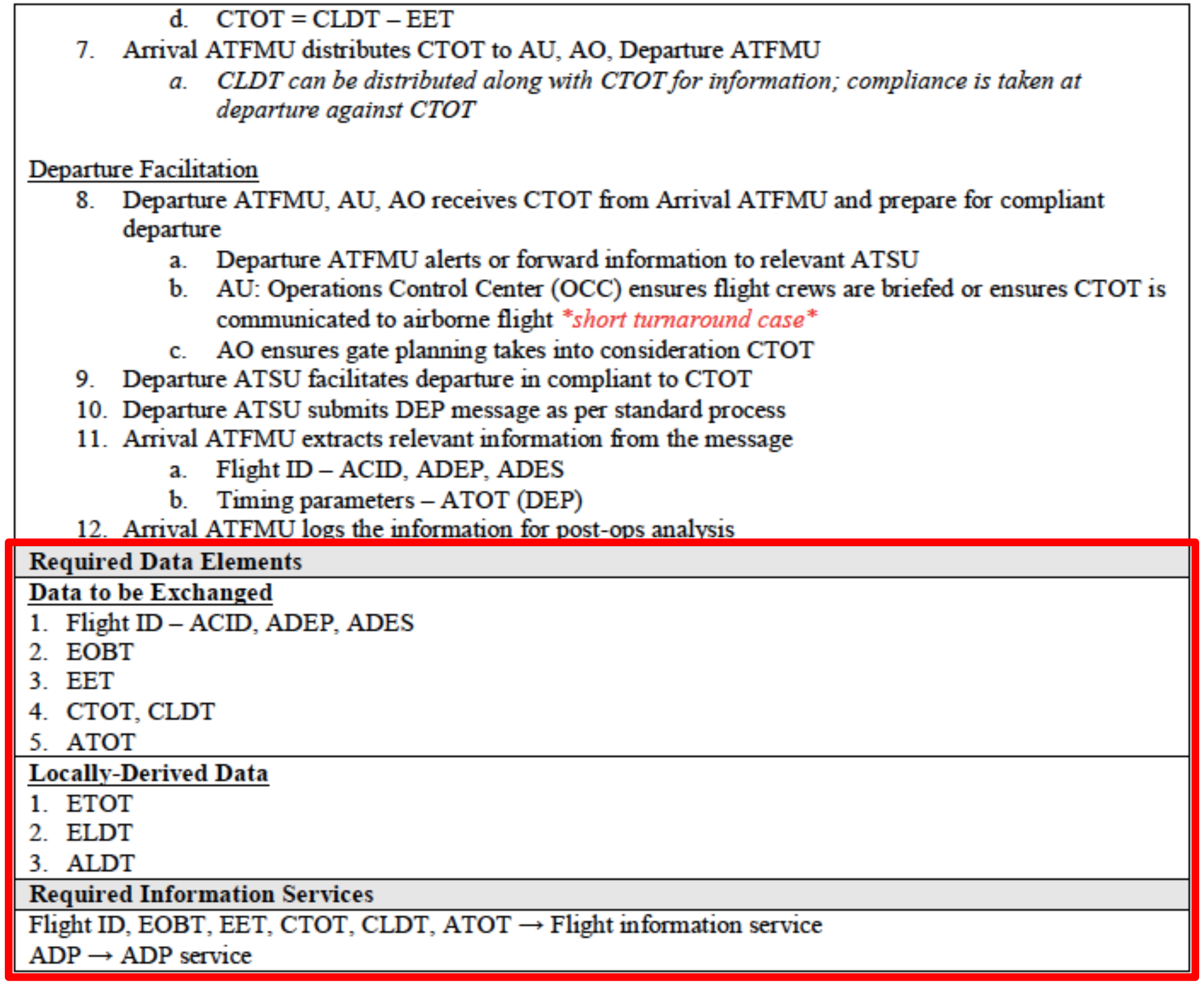
Basic Flow of Events

ATFM Daily Plan Distribution and CDM Web Conference

1. Arrival ATFMU generates ATFM Daily Plan (ADP) *either auto or manual*
2. Arrival ATFMU distributes* ADP to AU, AO, and Departure ATFMU along with call for CDM web conference
    ADP delivery currently relies on e-mail; this can be revised once there is an agreement on how to deliver this under SWIM environment
3. AU, AO, Departure ATFMU join CDM web conference to discuss the situation

GDP Activation and CTOT Distribution

4. AU submits FPL as per standard process
5. Arrival ATFMU extracts relevant information from the basic FPL
    a. Flight ID – ACID, ADEP, ADES
    b. Timing parameters – EOBT, EET
6. Arrival ATFMU generates relevant timing parameters to estimate arrival demand and calculate CTOT
    a. ETOT = EOBT + STT
    b. ELDT = ETOT + EET
    c. CLDT = Appropriately sequenced ELDTs



    d. CTOT = CLDT – EET
7. Arrival ATFMU distributes CTOT to AU, AO, Departure ATFMU
    a. *CLDT can be distributed along with CTOT for information; compliance is taken at departure against CTOT*

Departure Facilitation

8. Departure ATFMU, AU, AO receives CTOT from Arrival ATFMU and prepare for compliant departure
    a. Departure ATFMU alerts or forward information to relevant ATSU
    b. AU: Operations Control Center (OCC) ensures flight crews are briefed or ensures CTOT is communicated to airborne flight **short turnaround case**
    c. AO ensures gate planning takes into consideration CTOT
9. Departure ATSU facilitates departure in compliant to CTOT
10. Departure ATSU submits DEP message as per standard process
11. Arrival ATFMU extracts relevant information from the message
    a. Flight ID – ACID, ADEP, ADES
    b. Timing parameters – ATOT (DEP)
12. Arrival ATFMU logs the information for post-ops analysis

Required Data Elements

Data to be Exchanged

1. Flight ID – ACID, ADEP, ADES
2. EOBT
3. EET
4. CTOT, CLDT
5. ATOT

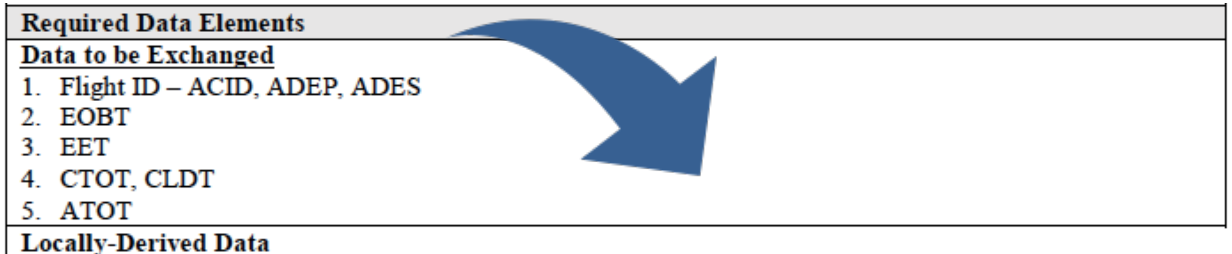
Locally-Derived Data

1. ETOT
2. ELDT
3. ALDT

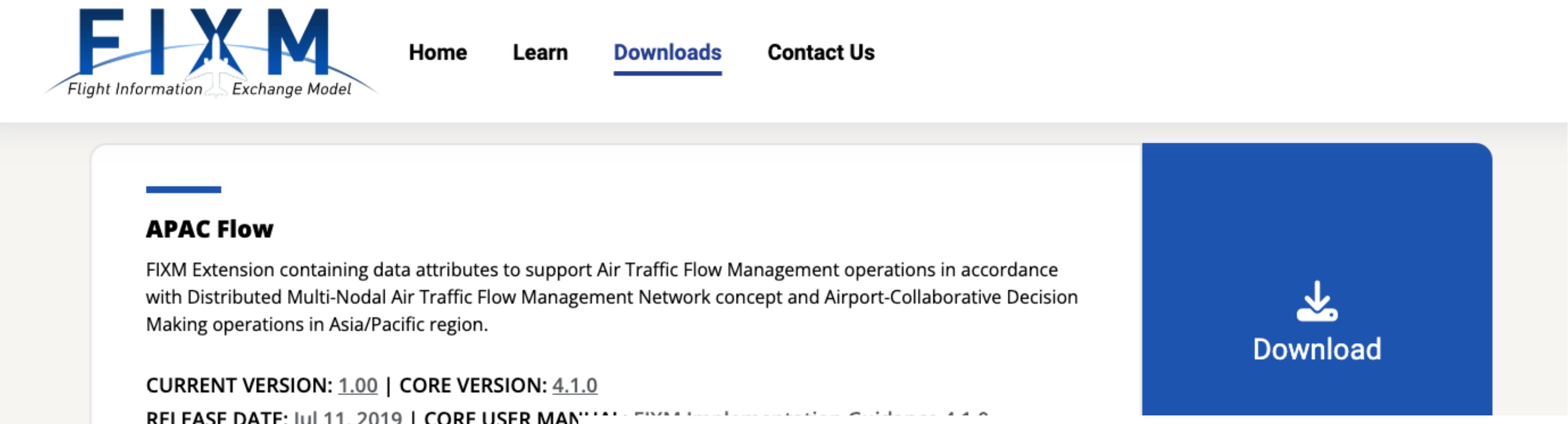
Required Information Services

Flight ID, EOBT, EET, CTOT, CLDT, ATOT → Flight information service
ADP → ADP service

From Ops Requirement to Technical Enablers



Required Data Elements
Data to be Exchanged 1. Flight ID – ACID, ADEP, ADES 2. EOBT 3. EET 4. CTOT, CLDT 5. ATOT
Locally-Derived Data 1. ETOT 2. ELDT 3. ALDT
Required Information Services
Flight ID, EOBT, EET, CTOT, CLDT, ATOT → Flight ADP → ADP service



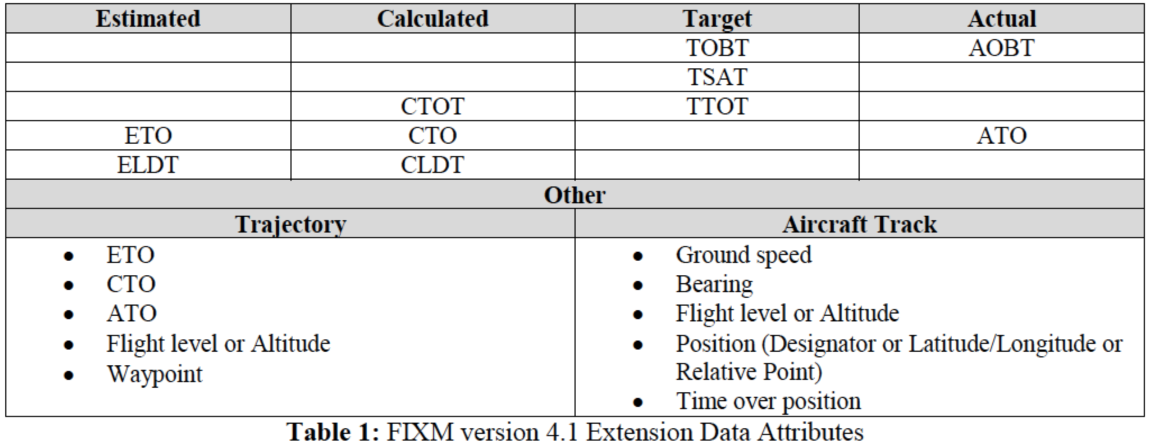
APAC Flow

FIXM Extension containing data attributes to support Air Traffic Flow Management operations in accordance with Distributed Multi-Nodal Air Traffic Flow Management Network concept and Airport-Collaborative Decision Making operations in Asia/Pacific region.

CURRENT VERSION: 1.00 | CORE VERSION: 4.1.0

RELEASE DATE: Jul 11, 2019 | CORE USER MAN

Previous Releases



Estimated	Calculated	Target	Actual
		TOBT	AOBT
		TSAT	
	CTOT	TTOT	
ETO	CTO		ATO
ELDT	CLDT		

Other	
Trajectory	**Aircraft Track**
• ETO • CTO • ATO • Flight level or Altitude • Waypoint	• Ground speed • Bearing • Flight level or Altitude • Position (Designator or Latitude/Longitude or Relative Point) • Time over position

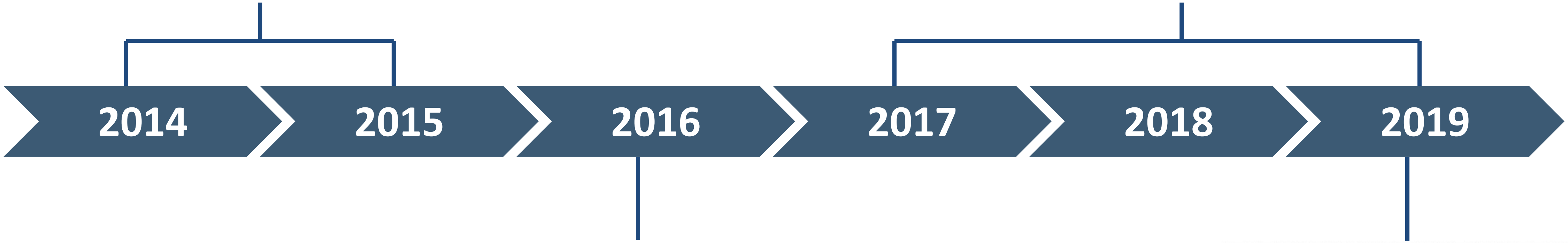
Table 1: FIXM version 4.1 Extension Data Attributes

APAC FIXM 4.1 Extension developed to support distributed multi-nodal ATFM operations & ATFM/A-CDM integration

AEROTHAI Experience

Developing Operational Scenarios for Demonstration Projects

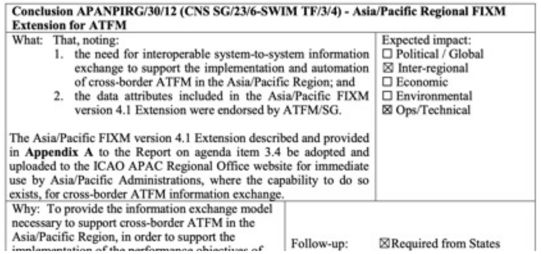
AEROTHAI Journey in SWIM/FF-ICE/TBO



Mini Global Demo I & II

SWIM in ASEAN Demonstration

Establishment of ICAO APAC SWIM TF
championed by
SIN, THA, USA through
APAC CNS SG/20
Current Chair:
Dr. Amornrat J., AEROTHAI



Conclusion APANPIRG/30/12 (CNS SG/23/6-SWIM TF/3/4) - Asia/Pacific Regional FIXM Extension for ATFM	
What: That, noting: 1. the need for interoperable system-to-system information exchange to support the implementation and automation of cross-border ATFM in the Asia/Pacific Region; and 2. the data attributes included in the Asia/Pacific FIXM version 4.1 Extension were endorsed by ATFM/SG. The Asia/Pacific FIXM version 4.1 Extension described and provided in **Appendix A** to the Report on agenda item 3.4 be adopted and uploaded to the ICAO APAC Regional Office website for immediate use by Asia/Pacific Administrations, where the capability to do so exists, for cross-border ATFM information exchange.	Expected impact: ☐ Political / Global ☒ Inter-regional ☐ Economic ☐ Environmental ☒ Ops/Technical
Why: To provide the information exchange model necessary to support cross-border ATFM in the Asia/Pacific Region, in order to support the	Follow-up: ☒Required from States

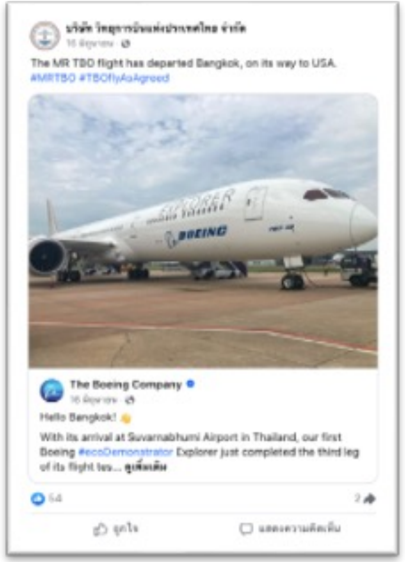
Development of
FIXM v4.1 APAC Extension
reviewed by FIXM CCB and published on global FIXM website

AEROTHAI Journey in SWIM/FF-ICE/TBO

MULTI-REGIONAL TBO

ATFM/A-CDM Integration & FIXM v4.2 APAC Extension Development
(ATFM, A-CDM, TS, FF-ICE, TBO)

Multi-Regional TBO Live-Flight Demonstration



บริษัท วิทยุการบินแห่งประเทศไทย จำกัด

The MR TBO flight has departed Bangkok, on its way to USA.
#MRTBO #TBOflyAsAgreed

The Boeing Company

Hello Bangkok! 👋

With its arrival at Suvarnabhumi Airport in Thailand, our first Boeing #ecoDemonstrator Explorer just completed the third leg of its flight tes... ดูเพิ่มเติม

2020 | 2021 | 2022 | 2023

Prototype Development
- SWIM Technical Infrastructure
- SWIM Information Services
- FF-ICE/R1 Services

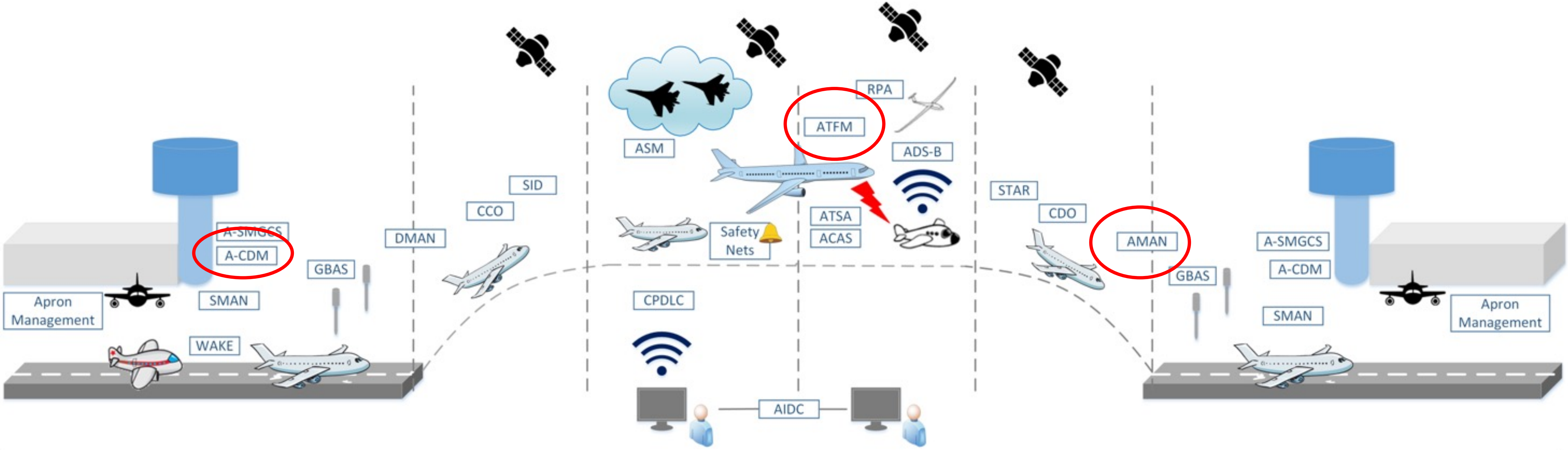
FF-ICE/R1 Tabletop Exercise

ATFM/ASM/A-CDM Integration
FF-ICE/R1 Technical Trial
Lab Demo
- FF-ICE/R2 airborne trajectory negotiation and revision
- ATFM/AMAN integration
- FF-ICE/R1 & A-CDM integration

Choosing the Operational Scenarios

Key Question: What operational enhancements can be improved with SWIM?

For AEROTHAI, we started with these...


RPA
ATFM
ASM
ADS-B
SID
CCO
DMAN
Safety Nets
ATSA
ACAS
STAR
CDO
AMAN
A-SMGCS
A-CDM
GBAS
SMAN
Apron Management
WAKE
CPDLC
AIDC
A-SMGCS
A-CDM
GBAS
SMAN
Apron Management

Scenario Development for
SWIM in ASEAN Demonstration

SWIM in ASEAN Demonstration

USA proposed to assist in putting together a SWIM demonstration involving all AMSs

Planning out activities and milestones for the demonstration among Singapore, Thailand, and USA

ATWG/34

ATTC/14

Inaugural Planning Session

Oct 2016 | Jan 2016 | Mar 2017 | May 2017 | Aug 2017 | Oct 2017

Discussion between Singapore and Thailand started

ICAO APAC SWIM TF/1

Participant Package sent to AMSs and interested States

SWIM IN ASEAN DEMONSTRATION

SWIM in ASEAN Demonstration

11	**12**	13	14	**15**
Dress Rehearsal	**Demonstration Bangkok**	Travel Day	Dress Rehearsal	**Demonstration Singapore**

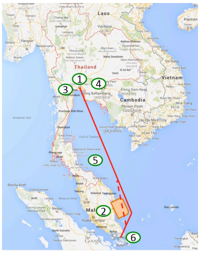
Nov 2019 Demonstration
11-15 Nov 2019

Preparation

2017

2018

2019



Operational scenarios design session between Singapore and Thailand
Nov 2017

Apr 2018
TIM/1

Sep 2018
TIM/2

Apr 2019
TIM/2.5

Aug 2019
TIM/3

SWIM IN ASEAN DEMONSTRATION

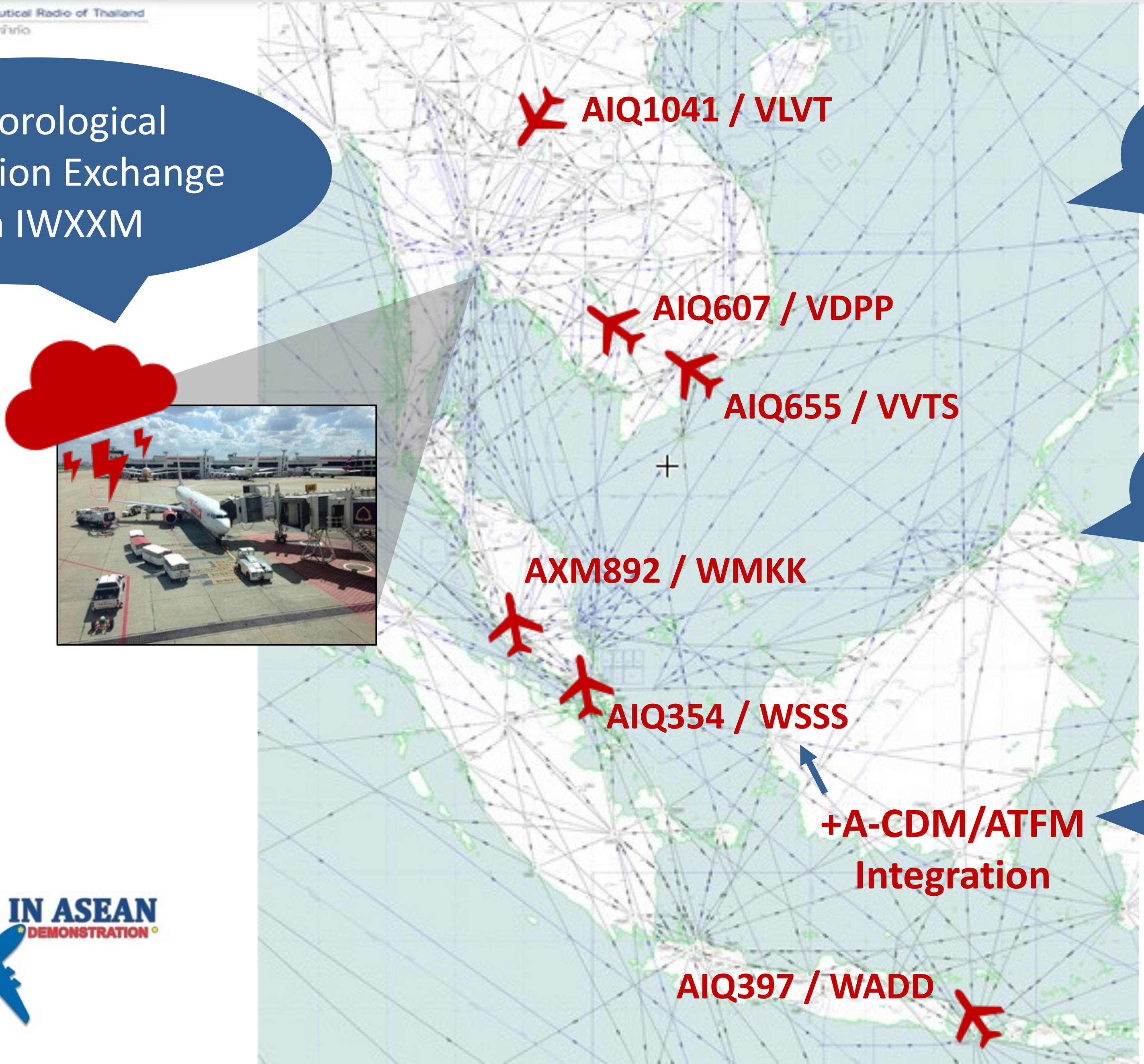
Scenario Example: GDP-over-SWIM

Meteorological Information Exchange with IWXXM

Flight Planning & Flight Object Management with FIXM

ATFM Information Exchange with FIXM Extension

ATFM/A-CDM Integration with FIXM Extension


AIQ1041 / VLVT
AIQ607 / VDPP
AIQ655 / VVTS
AXM892 / WMKK
AIQ354 / WSSS
+A-CDM/ATFM Integration
AIQ397 / WADD

SWIM IN ASEAN DEMONSTRATION

Scenario Development for
Multi-Regional TBO Demonstration

From SWIM to TBO Demonstration

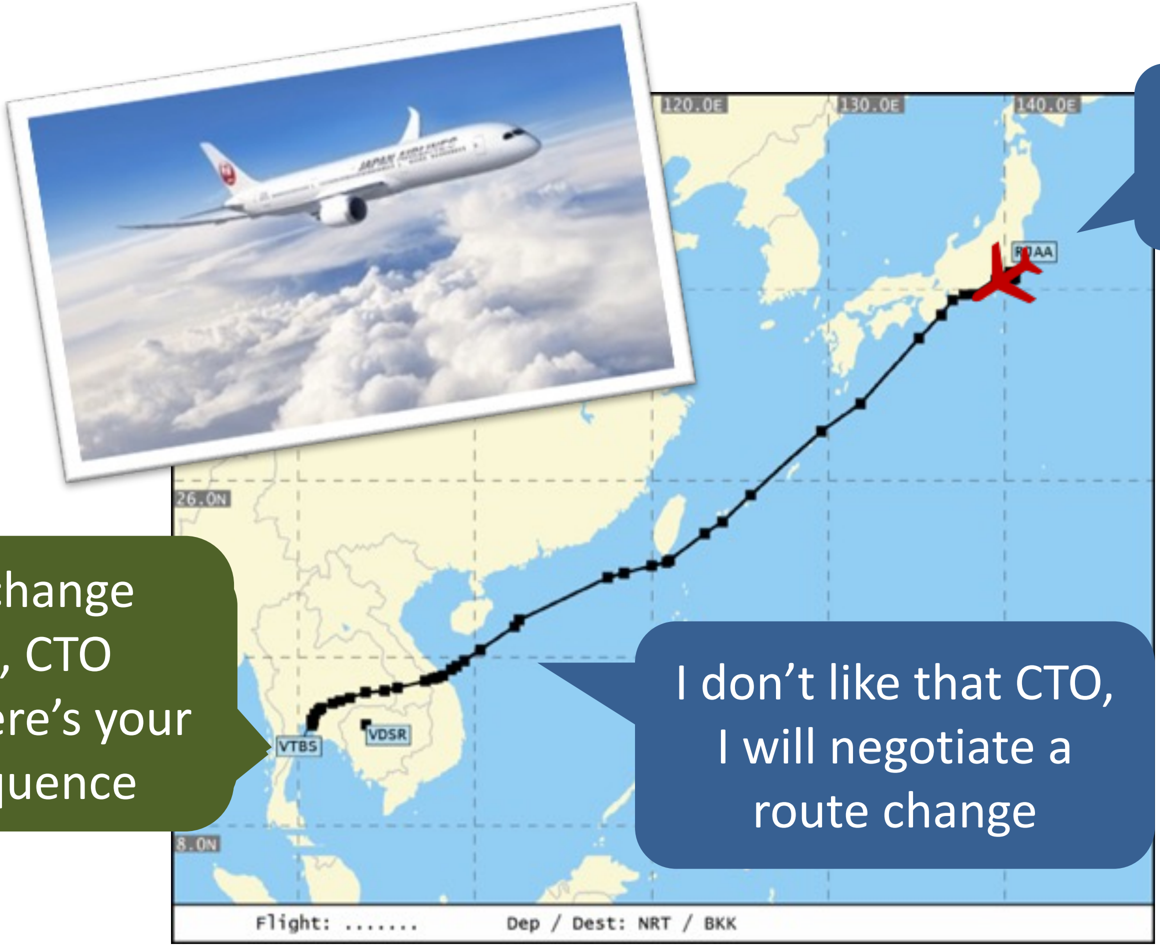
Bringing in Expanded Information Services and Enhanced Capabilities

- SWIM Technical Infrastructure
- Standardized Data Formats
- FF-ICE/R1 Services
- FF-ICE/R2 Services

- Enhanced Situational Awareness and D/C Balancing
- Pre-Departure Trajectory Negotiation
- Trajectory Information Exchange & Conflict Resolution
- Post-Departure Trajectory Negotiation

MULTI-REGIONAL TBO

Scenario Example: Enhanced ATFM-over-SWIM


120.0E
130.0E
140.0E
RJAA
26.0N
VTBS
VDSR
8.0N
Flight: ....
Dep / Dest: NRT / BKK

I’m planning a flight from RJAA to VTBS

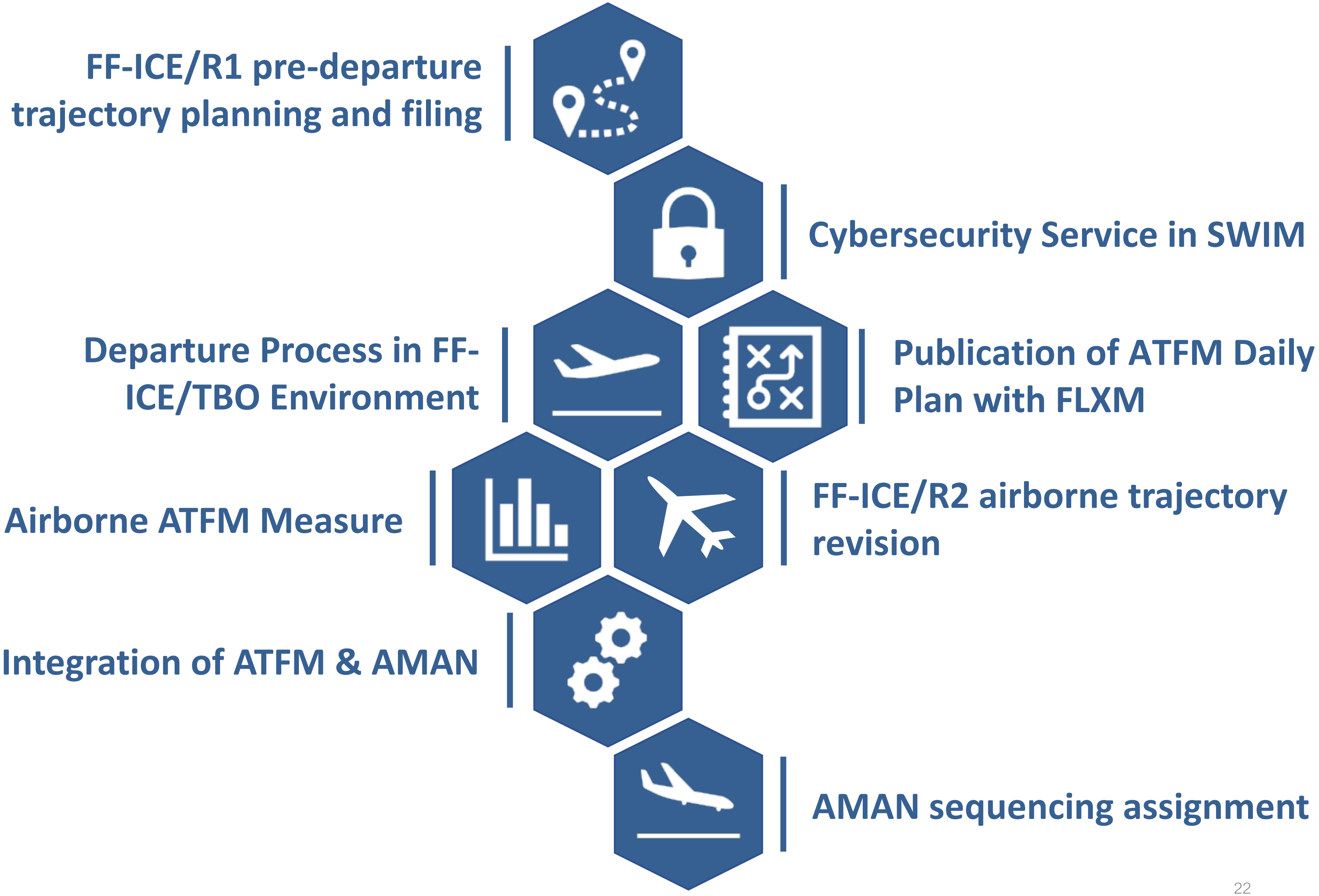
I don’t like that CTO, I will negotiate a route change

Ok route change accepted, CTO cancelled, here’s your AMAN sequence

MULTI-REGIONAL TBO

Scenario Example: Enhanced ATFM-over-SWIM

120.0E
130.0E
140.0E
RJAA
26.0N
17.0N
8.0N
VTBS
VDSR
Flight: ....
Dep / Dest: NRT / BKK



FF-ICE/R1 pre-departure trajectory planning and filing

Cybersecurity Service in SWIM

Departure Process in FF-ICE/TBO Environment

Publication of ATFM Daily Plan with FLXM

Airborne ATFM Measure

FF-ICE/R2 airborne trajectory revision

Integration of ATFM & AMAN

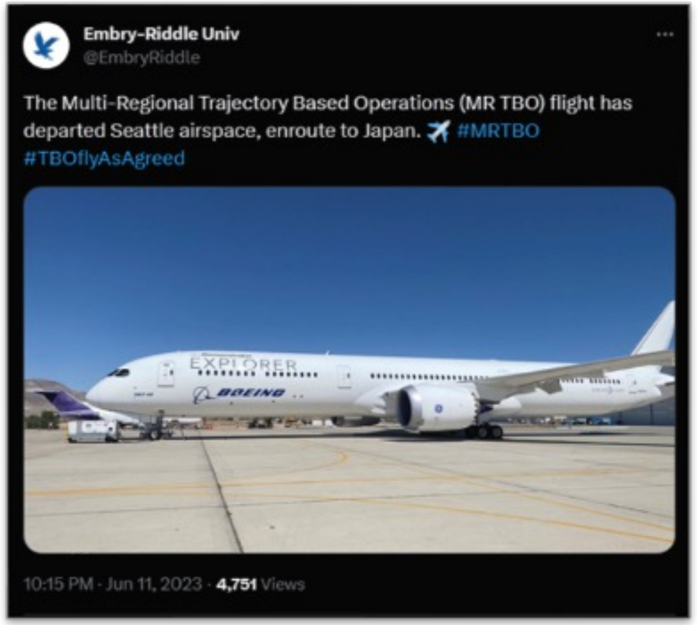
AMAN sequencing assignment

We Took the Demo to the Sky Too...

#MRTBO

#TBOflyAsAgreed

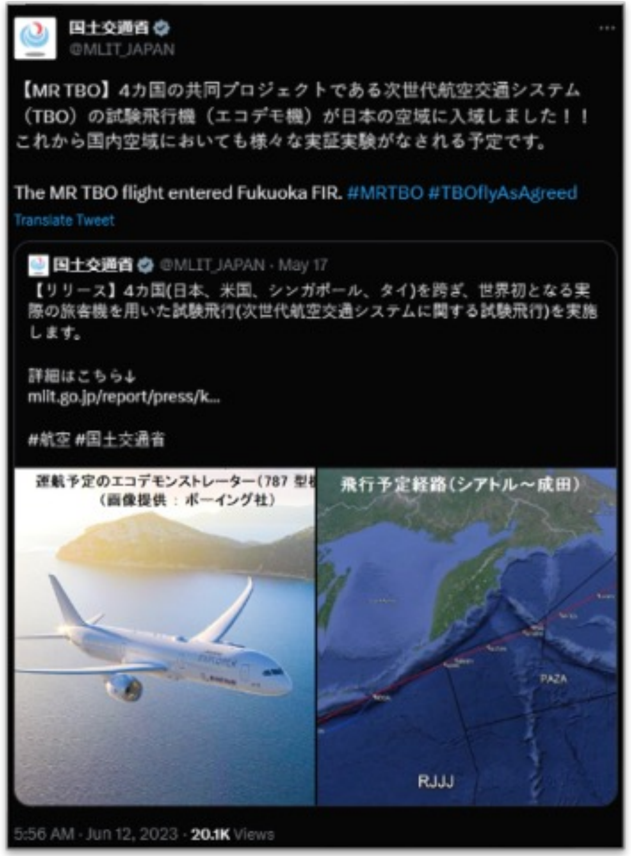
(Sorry I don't have time to cover the scenario in detail)



Embry-Riddle Univ
@EmbryRiddle

The Multi-Regional Trajectory Based Operations (MR TBO) flight has departed Seattle airspace, enroute to Japan. ✈ #MRTBO #TBOflyAsAgreed

10:15 PM · Jun 11, 2023 · 4,751 Views



国土交通省
@MLIT_JAPAN

【MR TBO】4カ国の共同プロジェクトである次世代航空交通システム（TBO）の試験飛行機（エコデモ機）が日本の空域に入域しました！！
これから国内空域においても様々な実証実験がなされる予定です。

The MR TBO flight entered Fukuoka FIR. #MRTBO #TBOflyAsAgreed

Translate Tweet

国土交通省 @MLIT_JAPAN · May 17

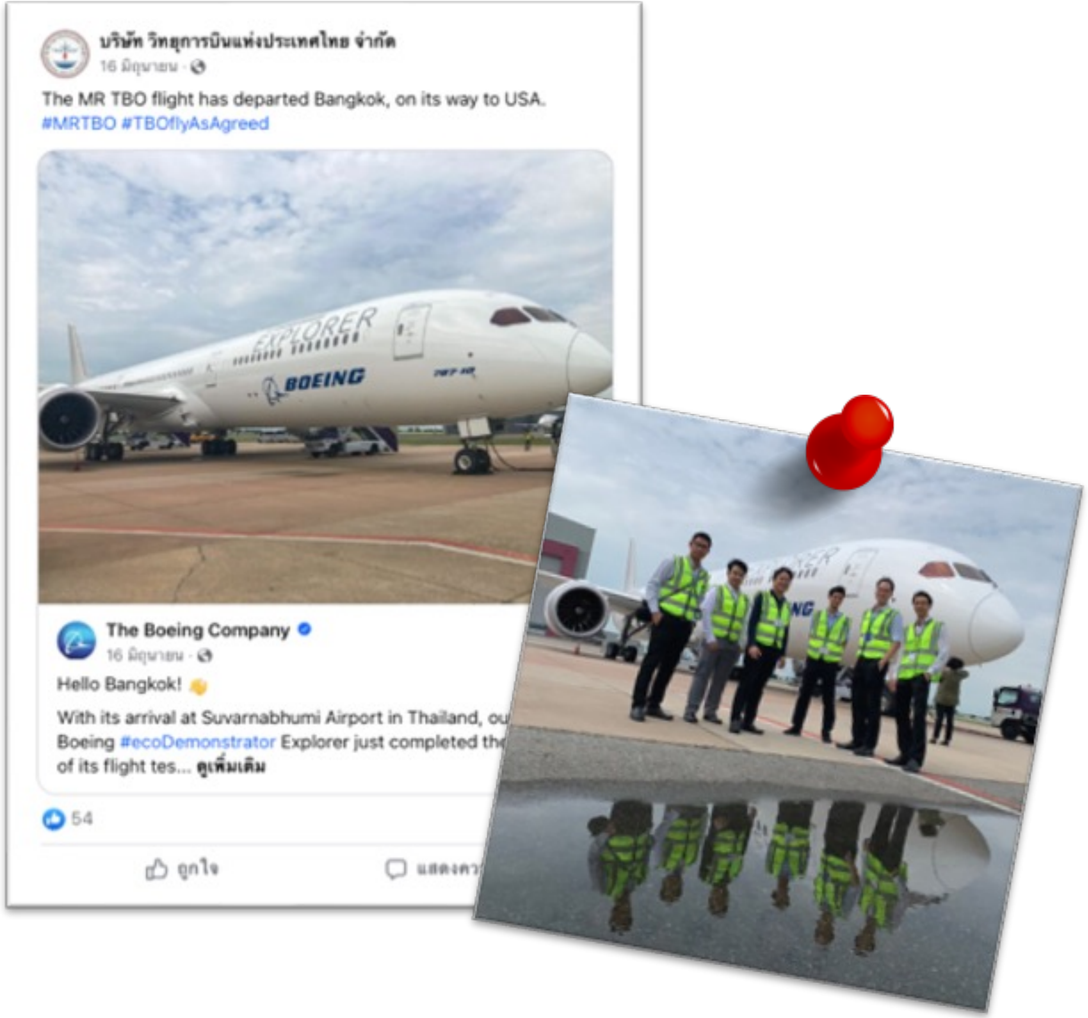
【リリース】4カ国(日本、米国、シンガポール、タイ)を跨ぎ、世界初となる実際の旅客機を用いた試験飛行(次世代航空交通システムに関する試験飛行)を実施します。

詳細はこちら↓
mlit.go.jp/report/press/k...

#航空 #国土交通省

運航予定のエコデモンストレーター（787 型
（画像提供：ボーイング社）
飛行予定経路（シアトル～成田）
PAZA
RJJJ

5:56 AM · Jun 12, 2023 · 20.1K Views



บริษัท วิทยุการบินแห่งประเทศไทย จำกัด
16 มิถุนายน ·

The MR TBO flight has departed Bangkok, on its way to USA.
#MRTBO #TBOflyAsAgreed

The Boeing Company
16 มิถุนายน ·

Hello Bangkok! 👋

With its arrival at Suvarnabhumi Airport in Thailand, ou
Boeing #ecoDemonstrator Explorer just completed th
of its flight tes... **ดูเพิ่มเติม**

MULTI-REGIONAL TBO

Some Final Words

Lessons Learned from Scenario Development

As You Work on the Brainstorming...

- ✓ **Start with the basic**
  - ➢ What are you doing now on the Ops floor that can benefit from SWIM-based communication?
- ✓ **Then make a wish list**
  - ➢ What are some things that you need but cannot do with the current information exchange technologies? What data/information will help?
- ✓ **Break it down clearly**
  - ➢ How does it work step-by-step, and what is the flow of data elements in the process?

THANK YOU!

Contact Me