OPMET data dissemination according to the ICAO Meteorological Information Exchange Model (IWXXM)

Tulum, Mexico, September 8 -12, 2025

Topics

1. Introduction to the International Civil Aviation Organization (ICAO) Meteorological Information Exchange Model (IWXXM)

2. IWXXM versions

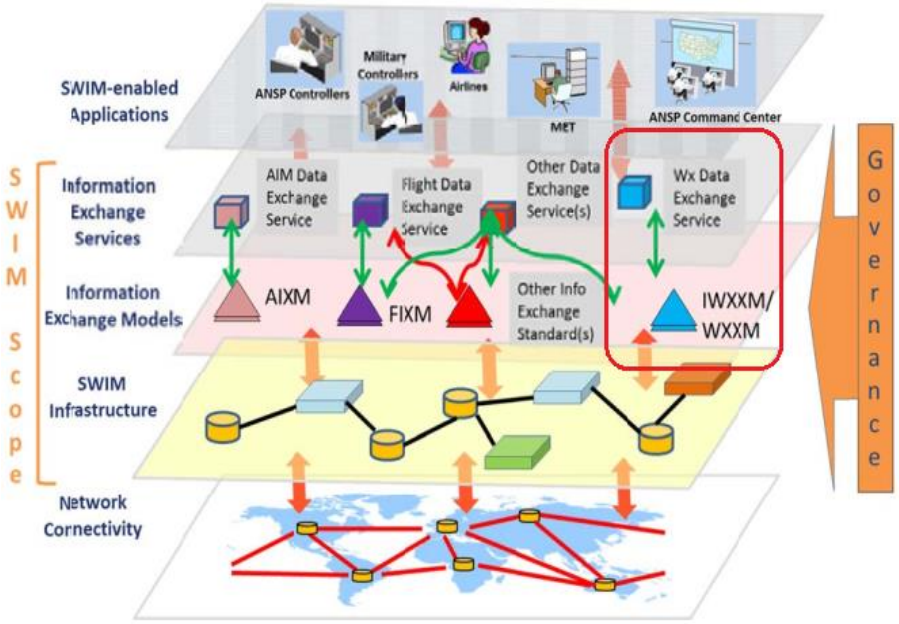
3. Implementation of operational meteorological (OPMET) data exchange using IWXXM

4. OPMET Data Dissemination Transition from Aeronautical Fixed Telecommunications Network (AFTN)/Aeronautical Message Handling System (AMHS) to System-Wide Information Management (SWIM)

5. Regional advances in the implementation of OPMET IWXXM data dissemination

Introduction

- The availability of aeronautical meteorological information in a ***globally interoperable digital format*** is seen as a key enabler for future global air traffic management within a system-wide information management (SWIM) environment [1].



- The introduction of IWXXM as an ***international standard format*** for the exchange of meteorological information represented ***the start of a significant change*** from the provision and exchange of textual operational meteorological (OPMET) data ***towards a digital environment***, in support of the ICAO Global Air Navigation Plan (GANP) and a transition towards a SWIM environment.

Introduction

- IWXXM is an ***information model*** designed for the operational exchange of meteorological information for aviation.

- Expressed in Unified Modelling Language (UML), the logical model of IWXXM utilizes the Geography Markup Language (GML) to express ***geographical features*** of meteorological phenomena.

- XML/GML Schema serialized from the UML model, together with a set of Schematron Rules, define IWXXM.


```
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    </iwxxm:surfaceWind>
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      <iwxxm:AerodromeHorizontalVisibility>
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```

Introduction

- ***IWXXM imports AIXM*** for describing aeronautical features as required by the individual type of report. This includes descriptions of an aerodrome or a flight information region (FIR).

- A challenge remains in obtaining the correct aeronautical information, especially for centres that perform translation from Traditional Alphanumeric Code (TAC) to IWXXM on behalf of another State.

Introduction

- Unlike the TAC forms of the ICAO Annex 3 to the Convention on International Civil Aviation, Meteorological Service for International Air Navigation, ***IWXXM is not intended to be directly used by consumers*** like pilots. IWXXM is designed to be consumed by software acting on behalf of the consumers, such as display software.

IWXXM versions

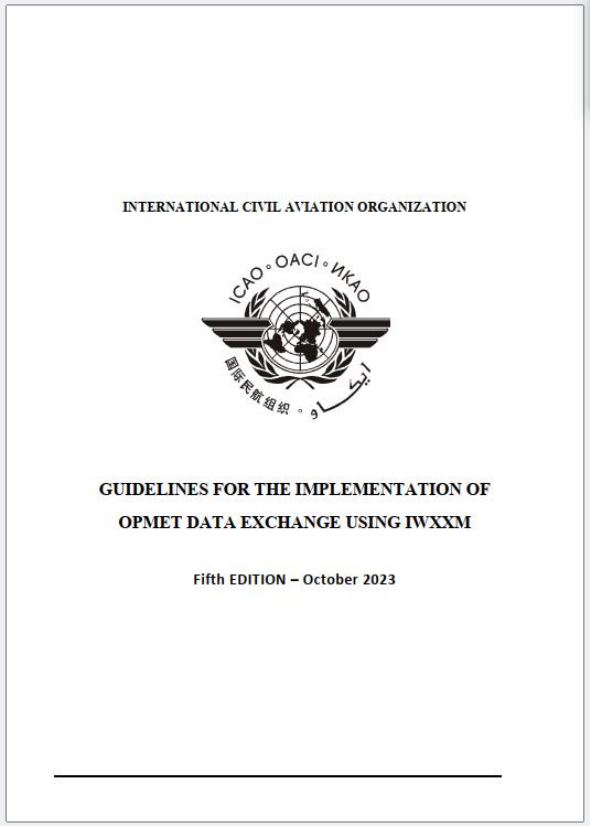
After IWXXM 3.0, a new version scheme [2][3] has been adopted in which individual package will maintain its own version number instead of inheriting the version number from IWXXM. This eliminates the need to advance the version number of a package with no apparent change with its schema.

IWXXM Version Publication date	ICAO Annex 3 Applicable date	METAR/ SPECI	TAF	SIGMET	AIRMET	Tropical Cyclone Advisory	Volcanic Ash Advisory	Space Weather Advisory	WAFS SIGWX Forecast
WXXM 1.1 Jun 2015	Amendment 76 14 Nov 2013	1.1	1.1	1.1	N/A	N/A	N/A	N/A	N/A
IWXXM 2.1 Nov 2017	Amendment 77 10 Nov 2016	2.1	2.1	2.1	2.1	2.1	2.1	N/A	N/A
IWXXM 3.0 Nov 2019	Amendment 78 8 Nov 2018	3.0	3.0	3.0	3.0	3.0	3.0	3.0	N/A
IWXXM 2021-2 Nov 2021	Amendment 79/80 5 Nov 2020 (*)	3.1	3.1	3.1	3.1	3.1	3.1	3.0	1.0
IWXXM 2023-1 Jul 2023	Amendment 81	3.1	3.1	3.2	3.2	3.2	3.2	3.0	1.0
IWXXM 2026-1	Amendment 82	3.1	3.1	3.3	3.2	3.2	3.2	3.0	1.0
IWXXM 2029-2	Amendment 83	3.1	3.1	4.0	4.0	4.0	4.0	3.0	1.0
IWXXM 2032-2	Amendment 84	3.1	3.1	4.1	4.1	4.0	4.0	3.0	1.0

(*) States were required to implement IWXXM format for the international exchange of MET information.

Implementation of OPMET Data Exchange using IWXXM

- The main intention of this document is **to *assist with the implementation of IWXXM for OPMET data and its intra- and inter-regional exchange*** over the Aeronautical Fixed Service (AFS) as defined in Annex 3.


INTERNATIONAL CIVIL AVIATION ORGANIZATION

ICAO • OACI • ИКАО

GUIDELINES FOR THE IMPLEMENTATION OF OPMET DATA EXCHANGE USING IWXXM

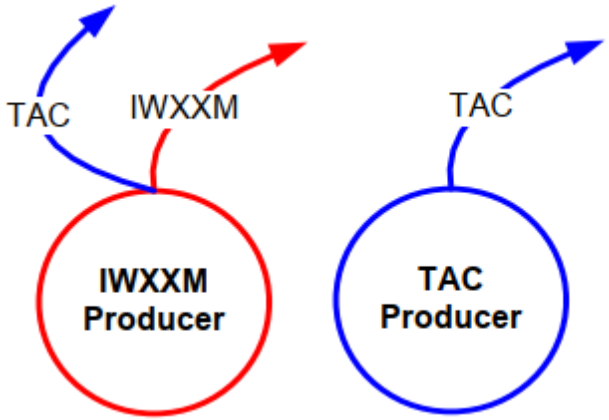
Fifth EDITION – October 2023

Implementation of OPMET Data Exchange using IWXXM

- The framework for the exchange of IWXXM data is organized into a basic set of functions/type of operations. [3]

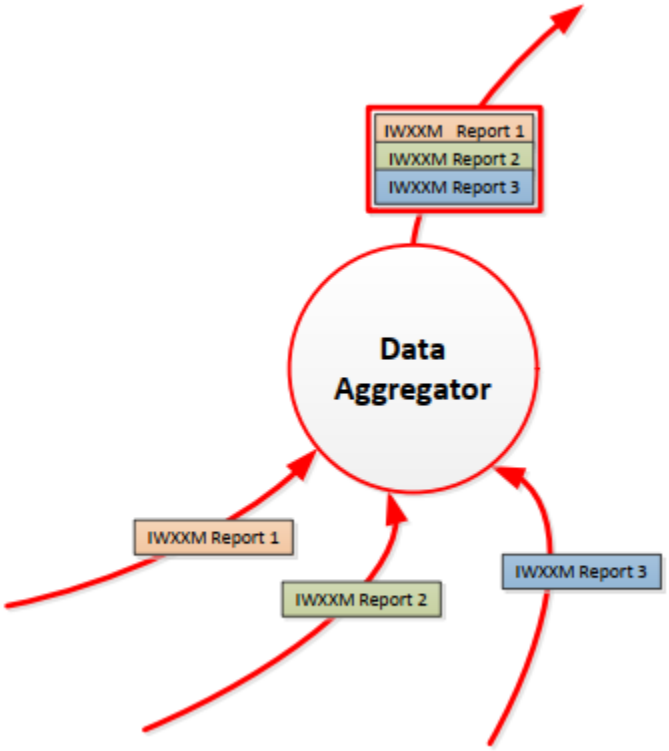
- The ***IWXXM Producer*** produces meteorological information in ***both TAC and IWXXM*** format, as close to source as possible. ***Ideally, both are made at source***.

- The Data Producer function may be ***performed by an aeronautical meteorological station*** (e.g. producing a METAR), a ***Meteorological Watch Office*** (MWO) producing AIRMET or SIGMETs or ***by an Aerodrome Meteorological Office*** (AMO) providing TAFs.



Implementation of OPMET Data Exchange using IWXXM

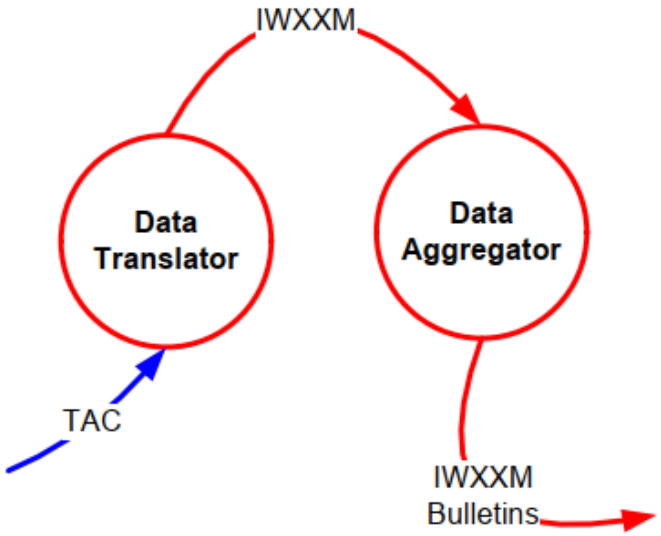
- A ***data aggregator*** takes individual IWXXM reports, decompresses them if already compressed, aggregates them. The aggregation shall consist of ***one or more reports of the same type*** (e.g. METAR,TAF).



Implementation of OPMET Data Exchange using IWXXM

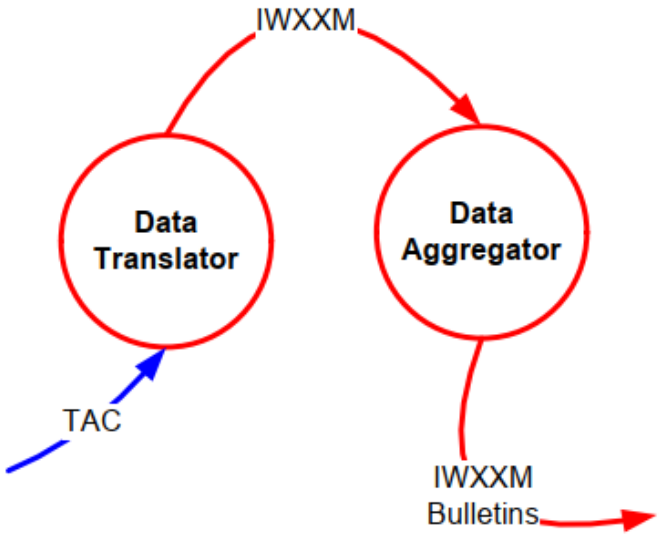
- A ***data translator*** converts TAC data into IWXXM on behalf of their State and/or another State, when the data producer is unable to do so. To do so, it shall be able to parse incoming TACs and apply the data to IWXXM schema.

- It is expected translation will be carried out on a bulletin basis so that the translator will always be associated with a Data Aggregator function



Implementation of OPMET Data Exchange using IWXXM

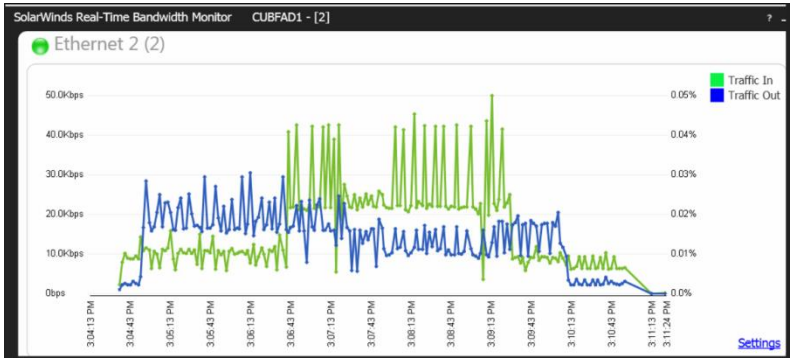
- A Translation Centre will typically ***be placed after the National OPMET Centre (NOC), Regional OPMET Centre (ROC) or Regional OPMET Databank (RODB) and its correction facilities***, if any. Message correction is typically a function of the data originator, NOC or ROC, not the Translation Centre.



Implementation of OPMET Data Exchange using IWXXM

- ICAO guidance identifies the ***Air Traffic Services Message Handling System*** (AMHS) as a ***mechanism for the exchange of IWXXM information*** using the ***extended AMHS File Transfer Body Part (FTBP)*** over the Aeronautical Fixed Service (AFS).

- The ***operational implementation*** of OPMET data dissemination according to the IWXXM model over AMHS ***must be preceded by tests*** that allow for the verification of the systems and networks involved in such dissemination.



OPMET Data Dissemination Transition from AFTN/AMHS to SWIM

- The OPMET IWXXM data exchange ***started outside*** a SWIM environment, but as ***SWIM implementation proceeds***, these exchanges ***will be transitioned to a SWIM environment***. [4]

- MET-SWIM implementation and transition will proceed based upon the Aviation System Block Upgrade (ASBU) schedule outlined in ICAO Doc 9750, Global Air Navigation Plan (GANP)

ASBU Element	ASBU Element Title	ASBU Element Description	Timeline
AMET-B1/4	Dissemination of MET Information	Represents the dissemination of meteorological products using a variety of formats	2019 – 2024
AMET-B2/4	MET Information Service in SWIM	Establishes standards for global exchange of the MET information within the SWIM environment	2025 – 2030
AMET-B3/4			2031 – 2036
AMET-B4/4			2037 – 2042
SWIM-B2/1	Information Service Provision	Defines the requirements for an information service provider to make aviation-related information available as an information service	2025 – 2030
SWIM-B2/2	Information Service Consumption	Defines the requirements for an information service consumer to discover and access aviation- related information provided via information services	2025 – 2030
SWIM-B2/3	SWIM Registry	Implements a SWIM registry as a means for the information service producer to publicize and for an information service consumer to discover information services within a SWIM environment	2025 – 2030
SWIM-B2/4	Air/Ground SWIM for Non-Safety Critical Information	Enables airspace users, specifically flight crew, to make information available to the air navigation service provider (ANSP), including reroute preferences and air reports/ airspace conditions	2025 – 2030
SWIM-B2/5	Global SWIM Processes	Establishes global access to aviation-related information by connecting information service providers and consumers within a global interoperability framework	2025 – 2030
SWIM-B3/1	Air/Ground SWIM for Safety Critical Information	Extends Air/Ground SWIM to enable the exchange of safety critical information	2031 – 2036

MET-SWIM-related ASBU elements and their respective timelines

OPMET Data Dissemination Transition from AFTN/AMHS to SWIM

- Transition to ***MET in a SWIM environment*** can be summarized as including the following components: [5]

  - Provision of ***meteorological information in IWXXM format***;

  - Provision of meteorological information ***via MET-SWIM information services over HTTP***;

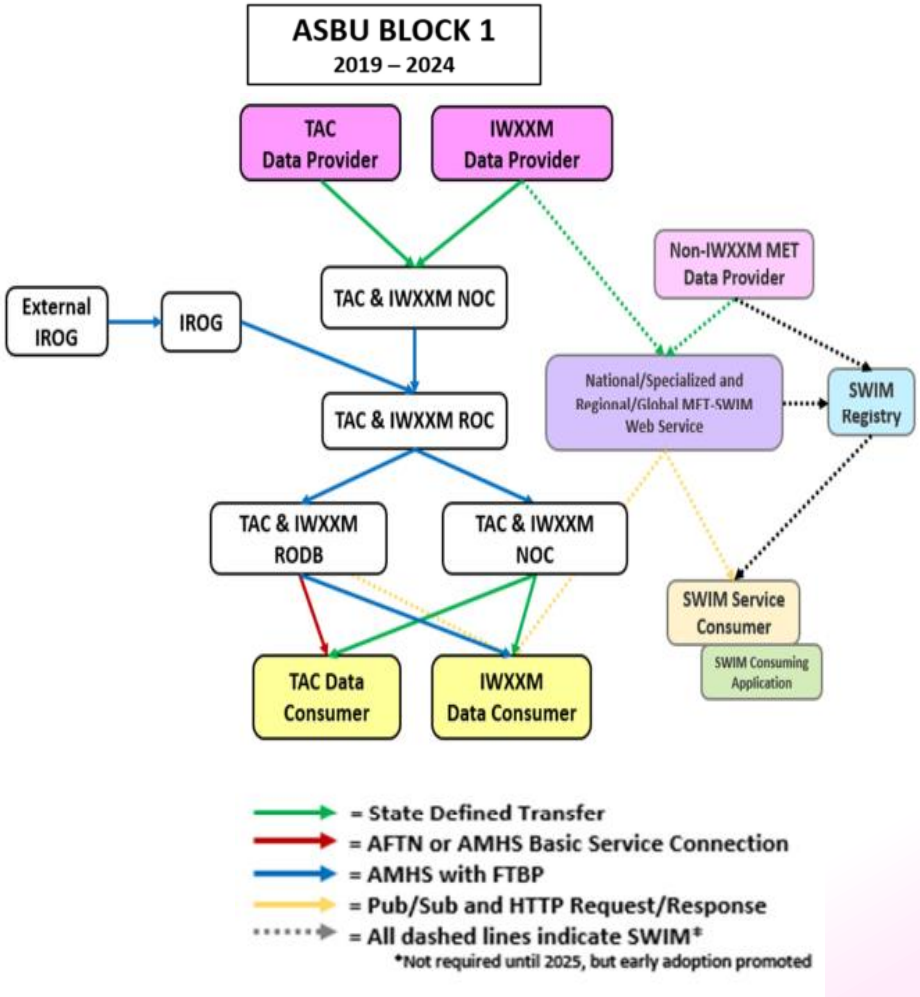
  - ***Additional data types*** beyond IWXXM, ***including gridded data***, like satellite data, radar data and output from numerical weather prediction (NWP) models, ***and objects,*** those that comprise geometries rather than a grid ; and,

  - ***Replacement of AFTN/AMHS*** “message push” communications *with* ***Advanced Message Queuing Protocol*** (AMQP).

OPMET Data Dissemination Transition from AFTN/AMHS to SWIM

- In the architecture for MET-SWIM in Block 1, both ***TAC and IWXXM data is provided to NOCs, ROCs and RODBs via AMHS with FTBP or AMQP / HTTP***, intended for the SWIM environment. [5]

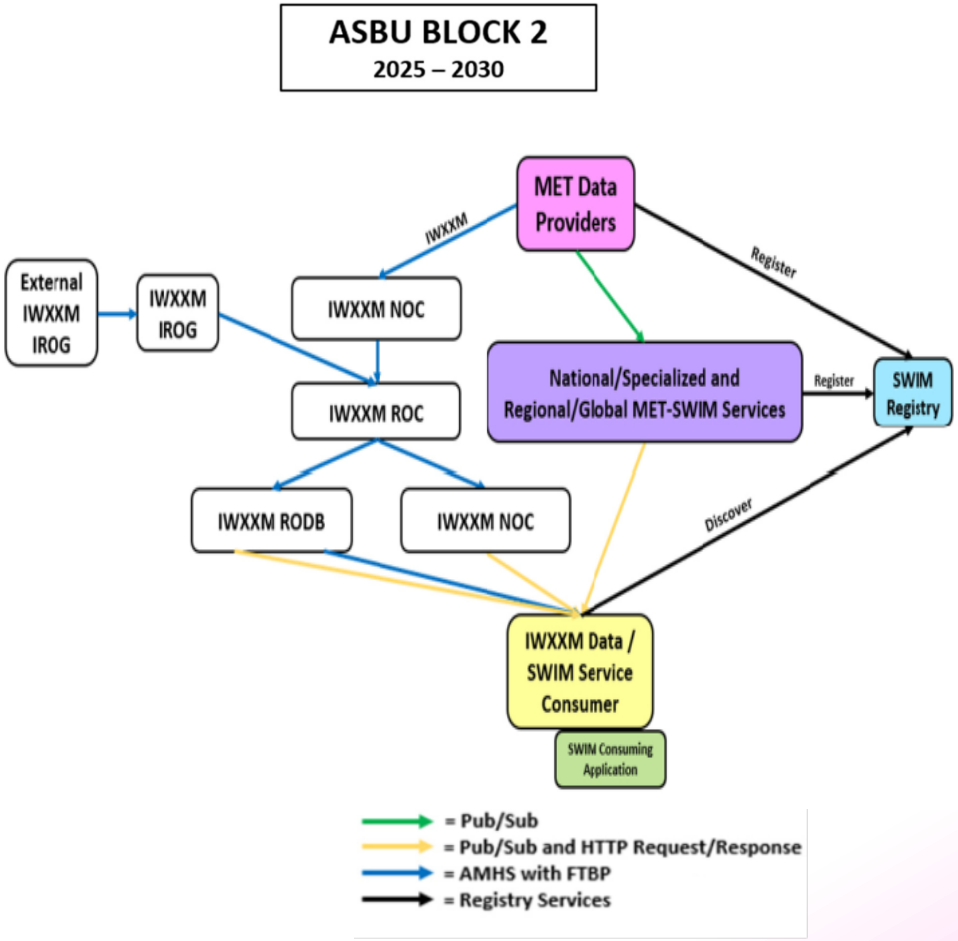
- TAC data consumers will continue to obtain TAC information in the same manner as Block 0. ***IWXXM data consumers will obtain information in IWXXM format from the NOCs and RODBs*** through state defined transfers.



OPMET Data Dissemination Transition from AFTN/AMHS to SWIM

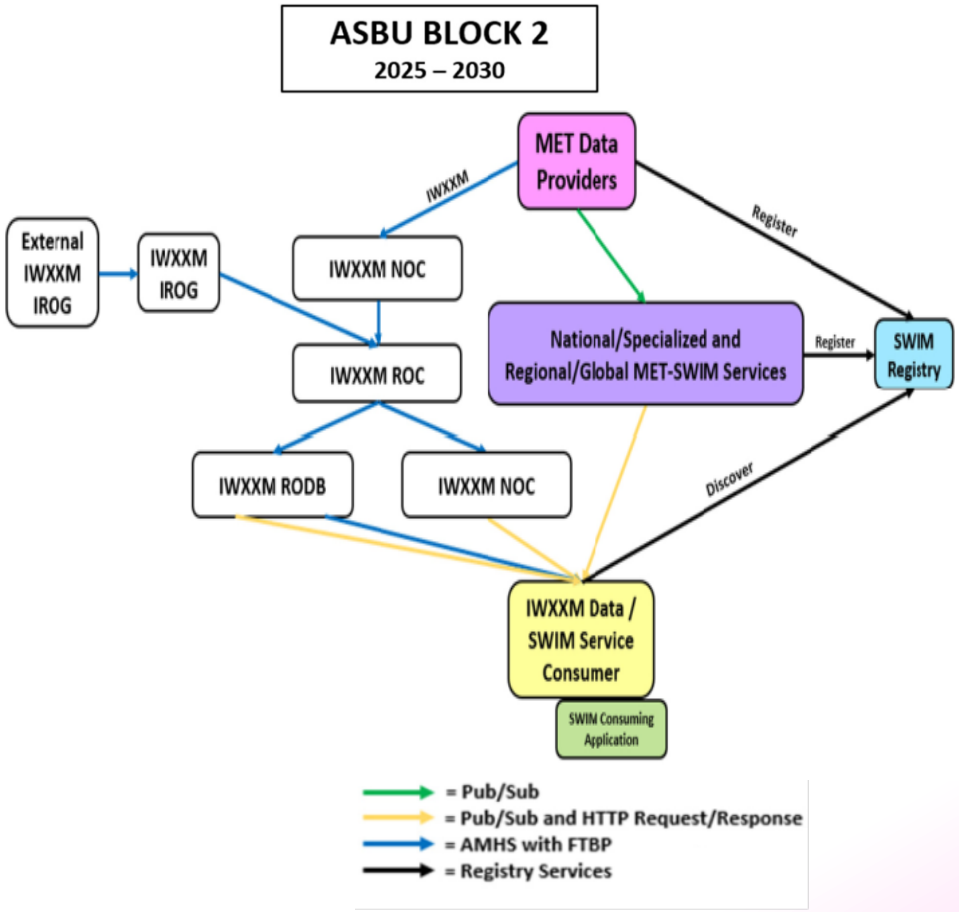
- ***MET data providers are producing meteorological information in IWXXM format*** and continuing dissemination through NOCs, ROCs and RODBs as in Block 1.

- ***MET data providers are also using publish/subscribe connections*** to exchange MET information with National / Specialized and Regional / Global MET SWIM services.



OPMET Data Dissemination Transition from AFTN/AMHS to SWIM

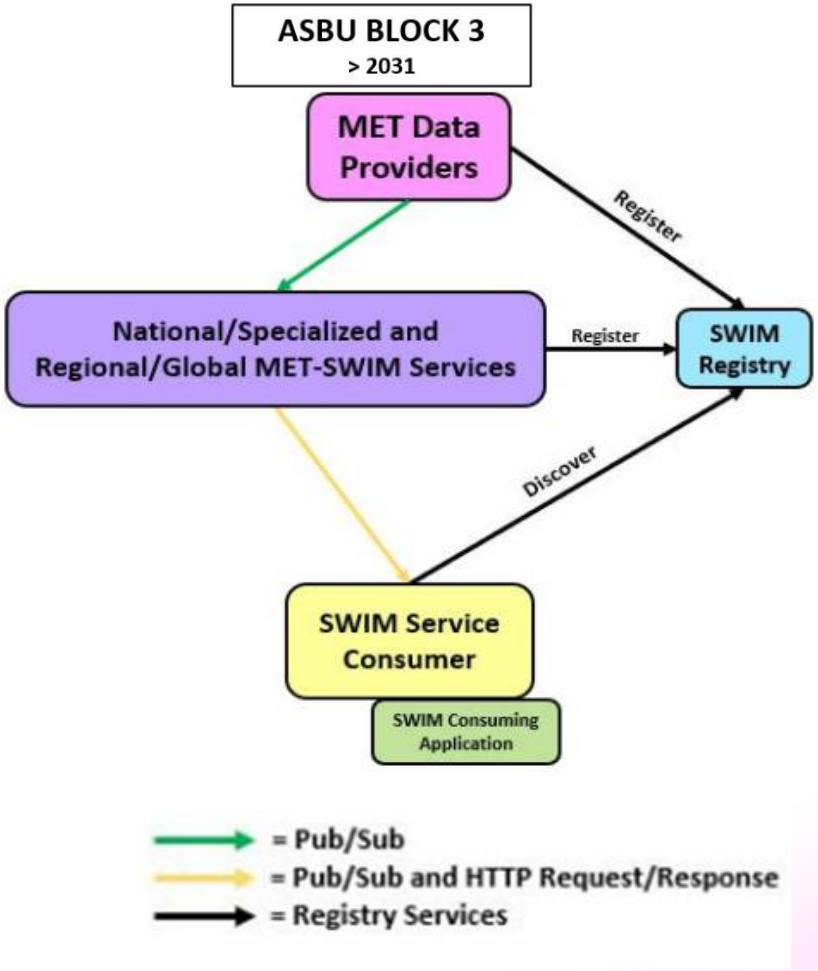
- Both ***the data providers and MET-SWIM services register with the SWIM registry***, from which SWIM consuming applications retrieve information for service consumers to use.



OPMET Data Dissemination Transition from AFTN/AMHS to SWIM

- ***MET data providers use publish/subscribe connections*** to share meteorological information with National / Specialized and Regional / Global MET-SWIM services.

- MET data providers also ***register services in the SWIM registry***, as do National /Specialized and Regional / Global MET-SWIM services.



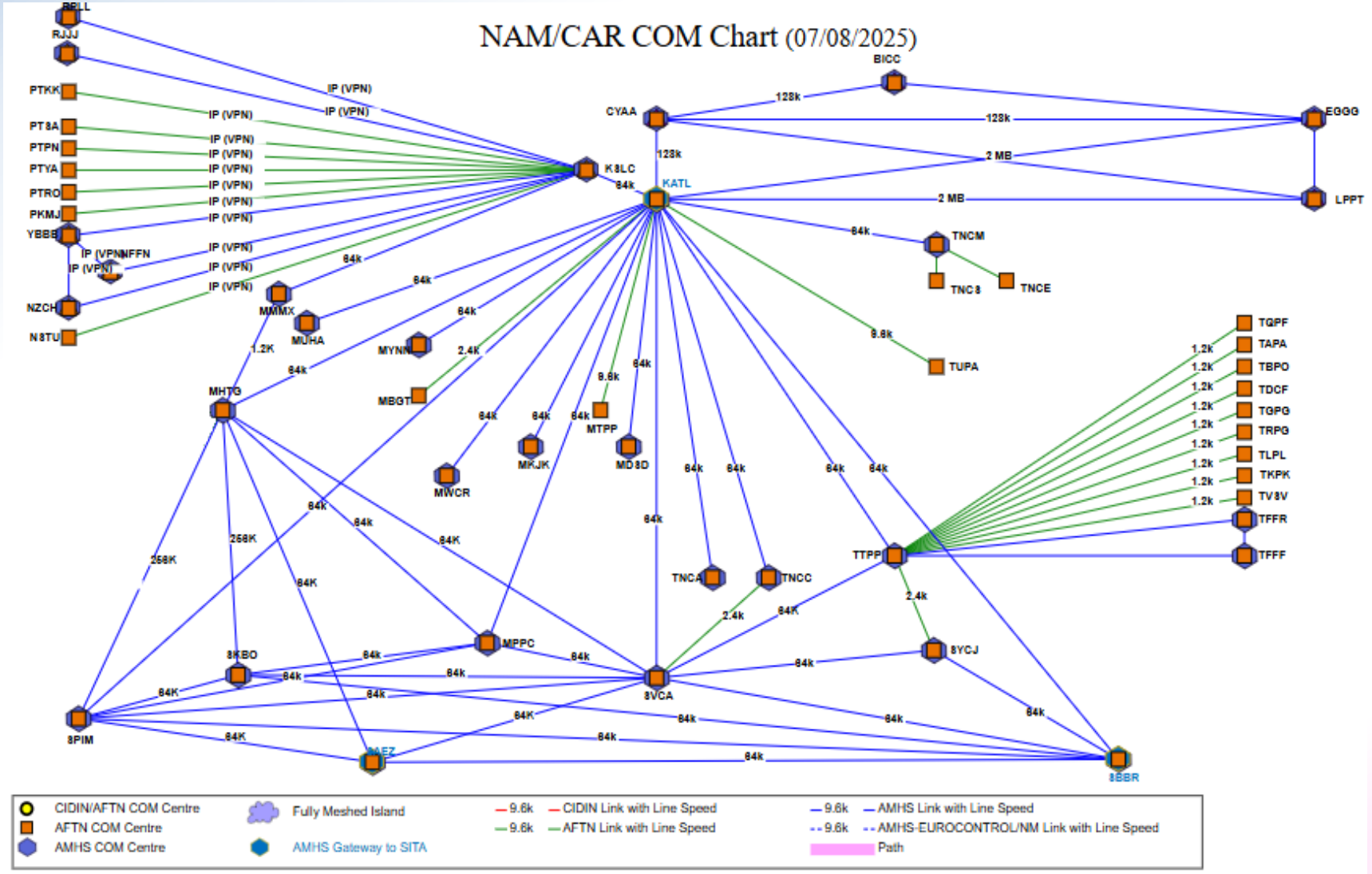
OPMET Data Dissemination Transition from AFTN/AMHS to SWIM

- ***Currently, AMHS FTBP has been adopted*** to exchange MET information in IWXXM format. However, ***in a full SWIM environment***, ***States are expected to implement AMQP/HTTP*** to exchange MET information through information services.

- Where mutually agreed, ***States may bypass the implementation of AMHS*** and ***instead implement AMQP/HTTP*** for SWIM-enabled exchange.[5]

	Block 0 2013-2018	Block 1 2019-2024	Block 2 2025-2030	Block 3 and Beyond >2031
Communication Protocols	AFTN AMHS Basic	AFTN AMHS Basic AMHS FTBP AMQP/HTTP (optional)	AMHS FTBP AMQP/HTTP	AMQP/HTTP

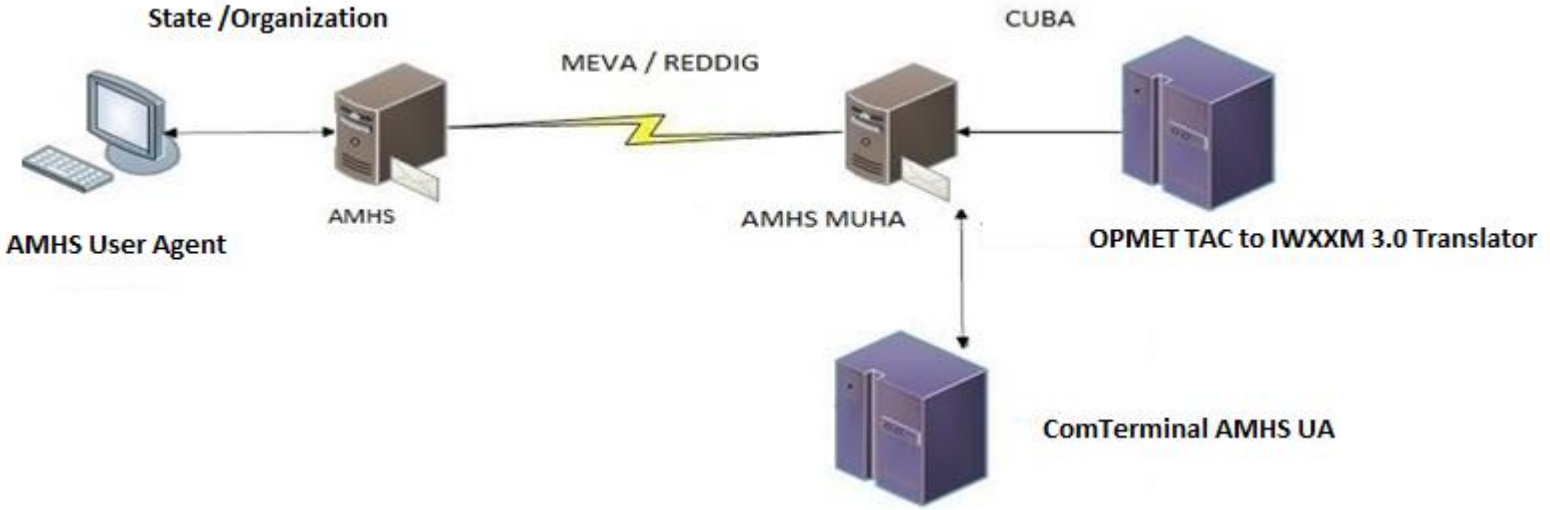
Regional advances in the implementation of OPMET IWXXM data dissemination



Regional advances in the implementation of OPMET IWXXM data dissemination

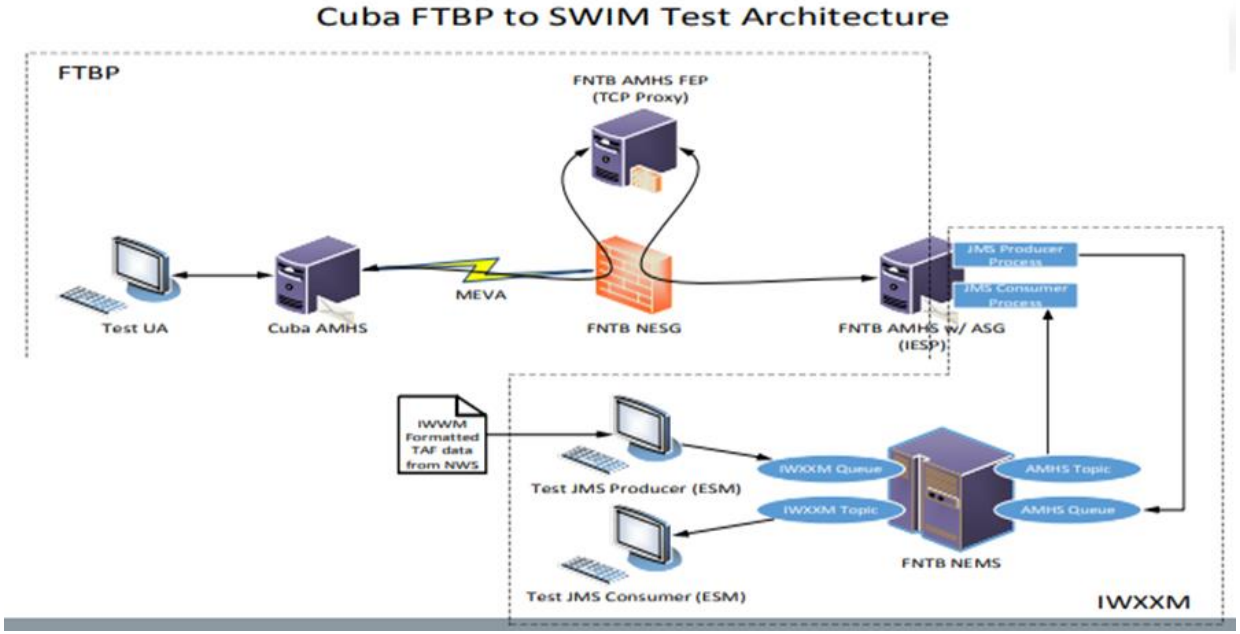
- Various states/organizations have conducted tests [7] that include:

  ✓ Interoperability tests for the exchange of OPMET data IWXXM over AMHS: Cuba - COCESNA, Cuba - FAA, Cuba - RODB Brasilia.



Regional advances in the implementation of OPMET IWXXM data dissemination

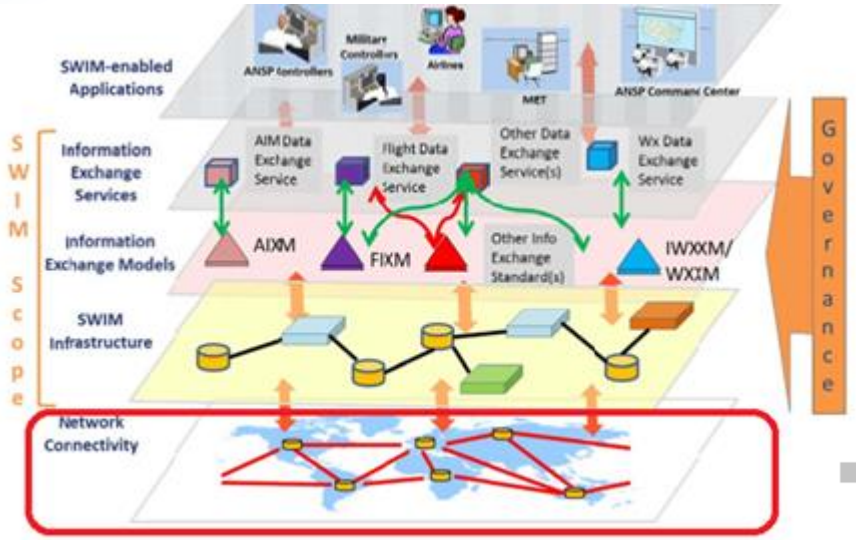
- ✓ Tests for data dissemination from the SWIM environment to AMHS, and vice versa, reaching the FAA AMHS-SWIM Gateway (ASG): Cuba-FAA.



FAA National Test Bed (FNTB) National Airspace System (NAS) Enterprise Security Gateway (NESG)
National Airspace System (NAS) Enterprise Messaging Service (NEMS)
Integrated Enterprise Services Platform (IESP)

Regional advances in the implementation of OPMET IWXXM data dissemination

- Caribbean Air Navigation Services Network (CANSNET), the CAR Region Transmission Control Protocol (TCP)/IP network, ***representing the network connectivity layer in the SWIM infrastructure,*** **is close to start being implemented.**



Conclusions

- To date, progress toward availability of IWXXM and associated exchange has been slow***. Actions need to be taken in the CAR region in order to speed up the IWXXM data dissemination*** in preparation for the plan to remove TAC as a Standard.

- Taking into account the AMHS implementation level in the CAR region is possible ***to widely disseminate IWXXM OPMET data over AFS towards SWIM environments***, upon meeting some technical conditions in the NOCs:

  - ✓ AMHS COM centre able to manage X400 messages with a FTBP
  - ✓ IWXXM OPMET data production
  - ✓ Successful interoperability test for the OPMET IWXXM data exchange

References

- [1] ICAO 10003 Meteorological Information Exchange Model), January 2019
- [2] World Meteorological Organization. Community Platform https://community.wmo.int/en/activity-areas/wis/iwxxm
- [3] Guidelines for the Implementation of OPMET Data Exchange using IWXXM. Fifth Edition – October 2023. [Online]. Available: GUIDELINES FOR THE IMPLEMENTATION OF OPMET DATA EXCHANGE USING IWXXM
- [4] Plan for Aeronautical Meteorological (MET) Information in System-Wide Information Management (SWIM), Version 2.3, April 2021. [Online]. Available: www2023.icao.int/airnavigation/METP/METP Reference Documents/MET-SWIM Plan v2.3.pdf
- [5] Roadmap for Aeronautical Meteorological (MET) Information in System-Wide Information Management (SWIM), April 2021, V 2.3. [Online]. Available: https://www2023.icao.int/airnavigation/METP/METP%20Reference%20Documents/MET-SWIM%20Roadmap%20v2.3.pdf

References

- [6] ICAO 10039 Manual on System Wide Information Management (SWIM) Concept

- [7] Interoperability tests for the exchange of OPMET data IWXXM over AMHS. [Online]. Available: https://www2023.icao.int/NACC/Documents/Meetings/2023/WGRAP02/NACCWGRAP02-WP17.pdf

THANK YOU

Questions