International Civil Aviation Organization

FLIMSY (Flimsy/03)

ICAO Asia and Pacific (APAC)
Twenty-third Meeting of the Meteorological Information Exchange Working Group (MET/IE WG/23)

Bangkok, Thailand, 25 to 28 March 2025

Agenda Item 6: Meteorological information exchange in IWXXM form

UPDATES TO IWXXM FAQs

(Presented by Hong Kong China and Australia)

SUMMARY

This flimsy presents proposed updates to the Frequently Asked Questions (FAQs) resource to support IWXXM implementation in the APAC Region.

1. INTRODUCTION

1.1 "*IWXXM Implementation in APAC Region – FAQs*" (IWXXM FAQs) is a handy reference document developed to consolidate answers to questions raised during past ICAO APAC IWXXM workshops for assisting States in the IWXXM implementation. At the Twenty-fifth Meeting of the Meteorology Sub-Group (MET SG/25) held in 2021, Conclusion MET SG/25-01 was adopted to approve the IWXXM FAQs document. The First Edition of the document was published on the ICAO APAC Office eDocuments website in October 2021.

1.2 At MET/IE WG/21, updates to the IWXXM FAQs were proposed in WP/07 Updates to IWXXM FAQs - Lesson Learnt and Common Issues. A new section "Section 14: Lesson learnt and common issues" was developed based on lesson learnt and common issues identified during the implementation and monitoring of IWXXM exchange via AMHS.

2. DISCUSSION

2.1 To ensure the content of the IWXXM FAQs remains relevant and up-to-date, this flimsy proposed to review and update the document published in 2023. The proposed amendments to IWXXM FAQs document are provided in the APPENDIX for review.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper; and

b) review the proposed updates to IWXXM FAQs document in the APPENDIX and provide further suggested changes, if any;

c) consider an action for publishing the new edition of IWXXM FAQs document, and;

d) discuss any relevant matter as appropriate.

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IWXXM IMPLEMENTATION IN APAC REGION

Frequently Asked Questions

(FAQs)

Third Edition

March 2025

IWXXM IMPLEMENTATION IN APAC REGION
Frequently Asked Questions (FAQs)
Third Edition – March 2025

Introduction

The majority of the information contained below are answers to questions raised during previous ICAO APAC IWXXM workshops or webinars:

- Hong Kong, China (10 – 12 October 2017)
- Bangkok, Thailand (12 – 14 June 2019)
- Nuku'alofa, Tonga (04 – 06 December 2019)
- Webinar (27 – 29 October 2020)

These FAQs are categorised into the following topics:

1. What is IWXXM?
2. The role of IWXXM in the international air navigation system
3. IWXXM production
4. IWXXM exchange
5. IWXXM exchange test~~ing~~
6. IWXXM compression
7. IWXXM versions
8. IWXXM translation
9. IWXXM validation and quality control
10. IWXXM extensions
11. Guidance, education, capacity building
12. End-user considerations
13. Cyber security
14. Lesson learnt and common issues

For further details, please refer to the aforementioned technical presentations and the following ICAO documentation:

- ICAO Doc 10003 – *Manual on the Digital Exchange of Aeronautical Meteorological Information*
- ICAO IWXXM Guidelines - *Guidelines for the Implementation of OPMET Data Exchange using IWXXM* (Refer https://www.icao.int/APAC/Pages/eDocs.aspx > MET)
- ICAO Doc 9880, Part II – *Ground-Ground Application – Air Traffic Services Message Handling Services (ATSMHS)*

IWXXM IMPLEMENTATION IN APAC REGION
Frequently Asked Questions (FAQs)
Third Edition – March 2025

1. What is IWXXM?

1.1 What does the acronym IWXXM stand for?

- ICAO Meteorological Information Exchange Model (commonly mistakenly pronounced as ICAO Weather Information Exchange Model due to the WX in the acronym).

1.2 What is IWXXM?

- It is a form of ~~human-readable and machine-readable computer code in~~ encoding based on the Extensible Markup Language (XML). It also uses Geography Markup Language (GML), which is a way of writing geographic information in Extensible Markup Language (XML) in order to share, store and display geographic information.

1.3 What will IWXXM be used for?

- Information encoded in IWXXM ~~products are used~~ is intended for operational exchange~~s~~ of meteorological information for ~~use in~~ aviation. It includes XML/GML-based representations ~~for current products standardised~~ of Traditional Alphanumeric Code (TAC) formatted products described in the International Civil Aviation Organization (ICAO) Annex 3 and World Meteorological Organization (WMO) No. 49, Vol II, such as METAR/SPECI, TAF, SIGMET, AIRMET, Tropical Cyclone Advisory, Volcanic Ash Advisory and Space Weather Advisory, ~~but will expand the scope significantly beyond these legacy formats for meteorological data~~ and is being expanded to include new information services accessible via ICAO System Wide Information Management (SWIM) environment.

1.4 Why change to IWXXM?

- IWXXM is not only intended to improve the quality of the information being exchanged through published schemas and validation processes, the included rich metadata also allows less ambiguous machine-to-machine exchange and consumption of meteorological information. ~~Using XML and GML formats allows significantly richer data to be shared more efficiently between modern systems. This will contribute~~ Ultimately this contributes to greater efficiency and safety in air traffic both for Aircraft Operators (AOs) and Air Navigation Service Providers (ANSPs).

1.5 Who will use IWXXM?

- ~~Because IWXXM is for sharing aviation meteorological data, all stakeholders in the aviation value-chain, in particular Air Traffic Management, will gain value from having IWXXM capable systems. This includes~~ All stakeholders in the aviation domain may need to handle IWXXM messages covering preparation, exchanging and consumption of aviation meteorological information including Air Traffic Management, airlines, ANSPs, airports and of course, MET service providers.

2. The role of IWXXM in the international air navigation system

2.1 What's the relationship between the role of IWXXM and GANP?

- We are migrating from product-centric to data-centric provision of aviation meteorological information in accordance with the Global Air Navigation Plan (GANP). For more information on the latest GANP, refer to https://www4.icao.int/ganpportal/.

2.2 ~~We need to transition from the traditional alphanumeric code (TAC) form to IWXXM.~~ What ICAO needs to do to facilitate transition from the provision of aviation meteorological information from TAC to IWXXM?

Specifics to this transition include:

- Introduction of IWXXM.

- Proposal to remove generation of TAC as an Annex 3 standard from ~~2029~~2030.
- States should consider necessary systems changes to migrate to IWXXM data as an alternate information service by ~~2029~~2030.
- These Annex 3 changes do not preclude a State from generating TAC, but there will be no ICAO requirement for international distribution or distribution to other States.

2.3 ~~What's the next plan of ICAO on IWXXM in detail?~~ What would be the subsequent evolution of IWXXM?

- ~~Refer to the presentation on GANP~~
- ~~Following the initial IWXXM implementation, ICAO is planning to migrate IWXXM away from being product oriented (e.g. METAR, TAF) to be more service oriented. As a result, it is expected that new IWXXM reports for aerodrome observations and aerodrome forecasts will likely be introduced~~ Design-wise IWXXM will move from TAC template-based or product oriented (e.g. METAR, TAF) representation to phenomenon-based or object oriented representation. The latter aligns with the provision of aviation meteorological information via information services over SWIM. This new design has been used in IWXXM messages for WAFS Significant Weather Forecast and the upcoming Volcano Observation Notice to Airman (VONA) and Quantitative Volcanic Ash (QVA) Concentration Information.

2.4 How does the ICAO Meteorological Panel (METP) roadmap envisage architecture for the exchange of OPMET data? AMHS or SWIM?

- The architecture will migrate from IWXXM exchange via AMHS to ~~into a~~ SWIM architecture. The exact ~~architecture is~~ details are still being developed, but here is the current draft proposal of timeframe and capabilities:

	~~**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~~
~~**Information Exchange Services**~~	~~RODB TAC request/reply RODB IWXXM request/reply~~	~~RODB TAC request/reply RODB IWXXM request/reply RODB IWXXM notification (optional) WFS, WCS, WMS (optional)~~	~~RODB IWXXM request/reply RODB IWXXM notification (optional) WFS, WCS, WMS~~	~~WFS, WCS, WMS Other web services~~
~~**Data Types**~~	~~Text Gridded Objects~~	~~Text Gridded Objects~~	~~Text Gridded Objects~~	~~Gridded Objects~~
~~**Data Addressing**~~	~~AFS Addressing~~	~~AFS Addressing IP (optional) SWIM Registry (optional)~~	~~AFS Addressing IP SWIM Registry~~	~~IP SWIM Registry~~

	Capabilities Expected During Block 1 (2019-2024)	Capabilities Expected During Block 2 (2025-2030)	Capabilities Expected During Block 3 (2031-2036)	Capabilities Expected During Block 4 (2037+)
Communication Protocols	AMHS FTBP	AMHS FTBP AMQP/HTTP (optional)	AMHS FTBP AMQP/HTTP	AMQP/HTTP
Information Exchange Services	RODB TAC request/reply RODB IWXXM request/reply	RODB TAC request/reply RODB IWXXM request/reply OGC Standardized Services (optional)	RODB IWXXM request/reply OGC Standardized Services	OGC Standardized Services
Data Addressing	AFS Addressing	AFS Addressing IP (optional) SWIM Registry (optional)	AFS Addressing IP SWIM Registry	IP SWIM Registry
Information Exchange Flow	NOC, ROC, RODB, IROG	NOC, ROC, RODB, IROG Dynamic (optional)	NOC, ROC, RODB, IROG Dynamic	Dynamic
Data Aggregator	NOC, ROC, RODB, IROG	NOC, ROC, RODB, IROG SWIM Aggregator (optional)	NOC, ROC, RODB, IROG SWIM Aggregator	SWIM Aggregator

2.5 ~~The timetable of IWXXM development in the future?~~ Is there any hint on new IWXXM messages being developed?

- ~~The timetable is still being developed. Eventually, all text Annex 3 products will be migrated to IWXXM, or they will be decommissioned. Annex 3 products are being implemented in IWXXM form in priority order. The remaining order is currently being reanalysed. The next products to be developed in IWXXM are SIGWX (high/mid & low). Regional Hazardous Weather Advisory products may follow.~~ METP/6 conducted in March 2025 had discussed new information services including Aerodrome Meteorological Observation, Aerodrome Meteorological Forecast and Hazardous Weather Information Services which require the use of new IWXXM packages.

~~2.6 Will future ICAO provisions for METAR/SPECI enable automated data via IWXXM?~~

- ~~Yes~~
- ~~While IWXXM provides opportunities for the exchange of high-fidelity MET observation data, the MET Panel is capturing user requirements that will either result in updates to the existing IWXXM schema or, more likely, the introduction of new IWXXM reports to meet these new needs.~~

2.7 ~~How to transmit MET information (beyond Annex 3 products) in IWXXM (Radar, LLWAS, ATM-tailored Met Info, etc.)~~ Will IWXXM support the provision of other MET information beyond those required in Annex 3 like radar, LLWAS?

- ~~IWXXM is well suited to supporting point, line and polygon-based features. Other formats such as gridded (e.g. GRIB) formats and image (e.g. PNG) are better suited for some products, and these will be implemented through SWIM, which is beyond the scope of IWXXM.~~
- ~~These requirements and services are being developed in ICAO METP and will be discussed further at other ICAO APAC forums such as the System Wide Information management (SWIM) Task Force (SWIM/TF) and other workshops.~~
- Yes and No.
- IWXXM can represent phenomena described in geometric shapes (e.g. points, polylines, polygons and volumes[1]) as well as regular or irregular grids. IWXXM provides the flexibility to subsequently consolidate MET information with information from other domains also represented in XML format, like AIXM and FIXM.
- It would be nice to create IWXXM representations for all MET phenomena to provide a clean and unified representation of information in the aviation MET domain. The reality is, however, that users would prefer using formats that best suit their application (e.g. flexibility Vs efficiency). Therefore, a pragmatic approach which takes into account existing and anticipated use cases in designing new information and information services should be the most effective choice. In case ICAO APAC considered it useful for the region or even the globe to exchange certain information in IWXXM format, one may want to raise such requirements for ICAO METP's consideration.

2.8 What are the global/regional plans for transition to SWIM – roles of MET in SWIM?

- ~~METP/4, Recommendation 5/5, endorsed the MET-SWIM Plan and MET-SWIM Roadmap and invited ICAO to upload the draft MET-SWIM Plan and draft MET-SWIM Roadmap to the ICAO METP website (both public and secure) and to distribute it to the Planning and Implementation Regional Groups (PIRGs).~~
- ~~"Plan for MET in SWIM" is available at: https://www.icao.int/APAC/Pages/eDocs.aspx > MET~~
- ICAO Doc 10039, Manual on System Wide Information Management (SWIM) Concept, defines the key concept and protocols used in SWIM.
- In the meteorological domain, there is the Meteorological SWIM Roadmap available at: https://www.icao.int/APAC/Pages/eDocs.aspx > MET
- The current "Plan for MET in SWIM" is expected to be deprecated and be replaced by the Guidelines for MET-SWIM Implementation.

2.9 Will displaying historical data become an issue for any tool in the future? It will need to be able to handle TAC as well as all IWXXM editions that may have been used.

- Potentially. ~~This is being considered by both ICAO and WMO. This should also be considered by States. Often historical records are not kept in their WMO/ICAO format but instead as records in a database.~~ In terms of decoding since the version of schema used to encode an IWXXM message is required to be included there should be no ambiguity in data retrieval. For TAC it is less obvious.

2.10 What if meteorological fields evolve far faster than the standard IWXXM format wants to handle?

- Yes, this is possible. If users have local requirements, they can extend the IWXXM schema through extensions, as they do with the TAC today through remarks
- If the same extensions capability is required by multiple States, a regional extension or optional global parameter may be implemented
- Extending the schema does, however, come with a range of other requirements and costs for States and users, so careful consideration should occur before a State chooses to extend the schema.

[1] In IWXXM, volume is specified as a horizontal polygon with a vertical extent (or a 2.5D shape)

2.11 Can we use TAC format (current format) before implementing IWXXM?

- TAC for OPMET is an ICAO standard in Annex 3 and will continue to be until 2030~~2029~~ (at least). So, you will need to continue to provide and consume TAC.
- IWXXM became an ICAO Annex 3 standard in November 2020.

2.12 If a State is yet to implement IWXXM, what should it do?

- ~~If the implementation of IWXXM is delayed (due to COVID or any other reason), a State should register a difference against the relevant Annex 3 provisions in the Electronic Filing of Differences (EFOD) system with an estimated date of implementation.~~
- ~~Please use the EFOD to file the differences, including with Am. 79. Please note that, with reference to ICAO State Letter AN 11/55 20/50, ICAO created a COVID-19 Contingency Related Differences (CCRD) sub-system in the existing EFOD system to capture any differences from ICAO Standards on certification and licensing that may arise from mitigation measures due to the COVID-19 pandemic. It is accessible via the USOAP dashboard. The CCRD specifically facilitates recognition or validation of licenses or certificates affected by the special measures.~~
- States need to implement the generation, and international distribution, of IWXXM as soon as possible.
- States can also look to arrange another State to perform TAC to IWXXM translation to ~~support~~ expedite~~d~~ IWXXM implementation.
- If a State's OPMET is not available in IWXXM form, they should register a difference against the relevant Annex 3 provisions in the Electronic Filing of Differences (EFOD) system with an estimated date of implementation.

~~2.13 Is the flexibility in the implementation timelines sufficient to allow for the impact of COVID-19 applicable to both MET providers, COM and all users?~~

- ~~The Annex 3 amendment cycle changed to a 3-year cycle. The next amendments to ICAO Annex 3 are planned for applicability in 2024, 2026 and 2029 etc.~~
- ~~METP, in conjunction with WMO and IATA, are looking at the impacts of COVID-19 - particularly on when Annex 3 provisions become applicable and how we will implement IWXXM and SWIM in a cost-effective manner.~~
- ~~ICAO & IATA are encouraging earlier adopters.~~

2.14 Any insight on what will "likely" be included in future amendments to ICAO Annex 3~~, Amd. 81, 82 and 83~~?

- ~~Amd 81 (2024), IWXXM and TAC are still standards. Procedures for Air Navigation Services – Meteorology (PANS-MET) is likely to be introduced.~~
- Amd 82 (~~2026~~2025), IWXXM and TAC are still standards. The provision of ~~New~~ SWIM-based information services introduced.
- Amd 83 (~~2029~~2027), IWXXM and TAC remain~~s~~ a standard~~, however it is expected that there will no longer be a standard for the global exchange of TAC~~. The set of information services is expanded~~.~~, including Quantitative Ash Concentration Information Service.
- Amd 84 (2030), IWXXM remains a standard, however it is expected that there will no longer be a requirement for the global exchange of TAC. The set of information services is expanded and likely includes Aerodrome Meteorological Observation Information Service (AMOIS), Aerodrome Meteorological Forecast Information Service (AMFIS) and Hazardous Weather Information Service (HWIS).

3. IWXXM production

3.1 Is it mandatory for an IWXXM message to be generated from the source if it has a TAC counterpart?

- No, but the best implementation is IWXXM generated at the source. This will become increasingly important as new information services are introduced, which are expected to contain additional parameters

and higher resolution information.

- There are already new IWXXM messages with no TAC counterparts. It is not possible to generate these IWXXM messages from TAC.
- In case IWXXM cannot be generated at the source, producing an IWXXM message through TAC to IWXXM conversion is better than providing no IWXXM message at all.
- ~~Preference for IWXXM generated at source (best implementation), but IWXXM converted from TAC is better than no IWXXM~~
- ~~In the future, IWXXM will contain information not present in TAC, so it will not be possible to generate this from TAC.~~

3.2 If a parameter is missing in TAC (e.g., WX is missing in METAR), how to generate the report in IWXXM?

- ~~There are all sorts of examples at the IWXXM translation repository in the Github of WMO Information Management for IWXXM: https://github.com/wmo-im/iwxxm-translation~~
- Consult the document TAC-to-XML-Guidance.txt in https://schemas.wmo.int/iwxxm/[IWXXM version]/examples/TAC-to-XML-Guidance.txt for proper representation of such situations.
- For real life example please check the WMO GitHub repository https://github.com/wmo-im/iwxxm-translation

~~3.3 Is it possible to make the IWXXM element "translatedBulletinID" mandatory for easy reference to the TAC bulletin?~~

- ~~While the attribute "translatedBulletinID" is optional, its presence will be checked by the Schematron rule Common.Report-3 in iwxxm.sch. See the one for IWXXM version 2023-1 at the official schema repository of the World Meteorological Organization (WMO): https://schemas.wmo.int/iwxxm/2023-1/rule/iwxxm.sch~~

3.4 Is there any experience or suggestions about how to convert the location of the significant weather in TAC report to latitude and longitude (or polygons) in IWXXM?

- It's always easier to start with a polygon in the TAC SIGMET message. So, where possible, it is preferred that a polygon is used. However, Annex 3 still allows us to write "S OF", W OF", "ENTIRE FIR", etc. In that case, the FIR boundary needs to be used to help make up the polygon.
- The line will intersect with the FIR, and together they will form a closed polygon covering the meteorological phenomenon involved. There are many software libraries out there to help you do the intersection and return the polygon to you.
- There is also a wiki page summarising the way geometric objects are described in different IWXXM reports. You may want to take a look at https://github.com/wmo-im/iwxxm/wiki/Geospatial-objects-in-IWXXM

3.5 When we would like to disseminate IWXXM reports, is it always necessary to aggregate the reports? I wonder whether we must use <collect:...> schema even if we would like to send non-regular reports, such as SIGMET, SPECI and TAF AMD.

- Only METAR and TAF will need to be aggregated.
- All IWXXM ~~messages~~reports currently being exchanged over AFS, no matter aggregated or not, ~~will have~~ are required to be encapsulated with the COLLECT ~~before sending out through AMHS~~ construct before being sent out.

4. IWXXM exchange

4.1 Should TAC over AMHS be distributed independently of IWXXM, or part of IWXXM?

- TAC and IWXXM should be distributed independently, in parallel.

- For every TAC message, there should be a corresponding IWXXM report~~, and visa-versa.~~
- Inclusion of TAC inside (the comments part of) IWXXM is not recommended. WMO have done this in their examples such that users can clearly see the corresponding TAC and IWXXM information.
- Note: When producing IWXXM from TAC, and the translation cannot be reliably performed, the original TAC is included in the message with no further information.

4.2 How to manage the exchange of TAC and IWXXM concurrently within COM networks?

- The TAC and IWXXM messages have different (but correlated) headers, such that they will not be confused, e.g. an Australian TAF TAC bulletin and IWXXM collective would have the WMO headers of FTAU31YBBN and LTAU31YBBN, respectively.

4.3 Will IWXXM be disseminated by Regional OPMET Centres (ROCs) in the same way as TAC as per the ROBEX Handbook?

- IWXXM exchange shall differ from traditional OPMET exchange, whereby:
  - There is no distributing responsibility for originating stations and National OPMET Centres (NOCs) other than to get their products to their Regional OPMET Centre (ROC);
  - Originating ROC distributes every type of IWXXM OPMET to all other ROCs in the APAC region; and
  - ROCs will distribute received IWXXM messages to the NOC and users in their respective areas of responsibility.
- States are also recommended to make IWXXM available via information services.

4.4 How will ROCs identify whether recipients are capable of receiving IWXXM?

- Refer to the Online Register of APAC IWXXM Exchange Status (Link: https://docs.google.com/spreadsheets/d/1WEcGfMRZq2dgHsfdpFhiefJEcA8OeMhfbCJHTqA7NX0/edit#gid=0), which has been included in the ROBEX Handbook. This online register records the implementation status of IWXXM exchange, including their readiness to receive IWXXM, corresponding AMHS addresses, supported AMHS capability and the status in disseminating IWXXM reports to other ROCs or ~~National OPMET centres (~~NOCs~~)~~.

4.5 What is the status and capability of States with respect to AMHS with FTBP in the APAC region?

- Refer to the Online Register of APAC IWXXM Exchange Status
- Refer to papers, presentations, discussions, reference material, networking contacts in the previous IWXXM workshops and MET/IE WG meetings

4.6 What protocol is used between the MET/IWXXM generation system and the State Communication Centre ~~AMHS~~ to exchange IWXXM?

- Entirely the prerogative of the State, but AMHS/FTBP is preferred. A secure method of transfer is recommended. ICAO does not require AMHS/FTBP for exchange within the State.

4.7 What is the bandwidth requirement for the exchange of IWXXM using AMHS Extended services?

- It depends on the amount of IWXXM reports exchanged and what other data is sent on the link, but IWXXM is approximately 10x data volume of TAC and IWXXM will be sent in addition to TAC and other data
- States should ensure there is adequate capacity in their communication links to support the new IWXXM data

4.8 What is the dependency of the exchange of IWXXM within the Region and Globally?

- The exchange of IWXXM within the Region and ~~Globally~~ globally is dependent on the ROCs and RODBs being IWXXM-exchange capable, and therefore ROCs and RODBs need to be the first to implement support for IWXXM and AMHS~~+FTBP+IHE~~ (including FTBP and IHE).

4.9 What is the technical specification for the gateways system that will translate TAC to IWXXM format?

- There is no single technical specification. There is a functional description of the capability with the IWXXM Guidelines, but interface specification may vary between different solutions/vendors and may include web service, AFTN links, or various other interfaces.

4.10 How do we ensure that there is no message lost in the AMHS when handling TAC & IWXXM format during the Transition period (mixed environment)?

- This has been designed into the system architecture for this transition period. Once IWXXM is implemented, there shall be one IWXXM message for every TAC message. If converting from TAC to IWXXM and poorly formed TAC is identified, then a partially translated IWXXM will be generated. Refer to IWXXM Guidelines.

4.11 Do we need to save all of the converted data in IWXXM to our disk storage? Since the size of the converted data in IWXXM is larger than TAC format but the content is same.

- ICAO requires States to archive all aviation products for at least 28-days. Longer is recommended for various reasons, including investigations and verification.

4.12 What is the maximum size permissible for IWXXM attachments in AMHS?

- AMHS network should support the transfer of IWXXM messages with a maximum file size of 4 MB, including FTBP of up to 2 MB [*Guidelines for the implementation of OPMET data exchange using IWXXM*, 3.1.5, refers]

4.13 What if the bandwidth of a comms link is insufficient to satisfy IWXXM requirements in some existing AMHS circuits?

- ~~Yes, b~~Bandwidth is likely to be insufficient in some APAC links
- Upgrades of these links may be required and can be addressed either through capacity changes of the existing links or the use of the ICAO APAC Common Aeronautical Virtual Private Network (CRV).
- Higher than 64 Kbps is recommended, and the required bandwidth is dependent on the use of the link.

4.14 May I know who is actually responsible for the technical implementation of AMHS in a particular member country? Is it the responsibility of MET or COM?

- Annex 3 [2.1.4] requires that each Contracting State shall designate the authority, hereinafter referred to as the meteorological authority (MA), to provide or to arrange for the provision of meteorological service for international air navigation on its behalf. Therefore, the MET Authority has a clear role and responsibility in ensuring the dissemination of MET information in IWXXM form. It follows that the MA has a responsibility in ensuring that the required mechanism/s are in place (e.g., AMHS + FTBP) to enable the State to disseminate the required MET information in IWXXM GML form. It will almost undoubtedly require close liaison between those concerned with the supply (e.g., MET service provider, COM service provider) and those concerned with the use of meteorological information.

4.15 The exchange of IWXXM requires a full path of FTBP-capability communications from originator to destination. It's hard to ensure the whole path is FTBP-ready, especially during an interruption or reply to an RQX.

- Agree. This is the case until all of the AFS network is AMHS FTBP.
- Refer to the Online Register of APAC IWXXM Exchange Status for details of each APAC States capabilities. (Link: https://docs.google.com/spreadsheets/d/1WEcGfMRZq2dgHsfdpFhiefJEcA8OeMhfbCJHTqA7NX0/edit#gid=0)

4.16 Is there any document describing more detail about RQX and RQM, which explain the IWXXM step before passing AMHS?

- Please refer to IWXXM Guidelines:
  - 2.8 International OPMET Databank, Operational principles: - OPMET Databank Requests
  - 4.1.5 International OPMET Databank, Operational principles: - Databank Requests

4.17 Can AFTN links support the relay of IWXXM?

- Due to technical differences between the old and new formats, aeronautical meteorological information in IWXXM form cannot be transmitted in the same way as in the Traditional Alphanumeric Code (TAC) form via the Aeronautical Fixed Telecommunication Network (AFTN). Instead, the 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) feature over the Aeronautical Fixed Service (AFS).
- In addition, due to the much larger file sizes associated with IWXXM, the ICAO guidance indicates that the total size of an AMHS message (including FTBP) should be up to 4 MB.

4.18 When the IWWXM bulletin is needed to be disseminated to many destinations, could all of the addresses be added in one AMHS message (like sending an e-mail)?

- Many addresses can be added to one AMHS message. For your system, it will just be one message being sent out, but it may end up at 20 destinations.

4.19 Are there any ICAO procedures or guidelines that any NOC has to follow if there is a need to request IWXXM translation services from ROC? If so, any template or predefined form that could be used?

- Please refer to IWXXM Guidelines, including sections 5.3.1: Prerequisites for Translation Centres; and 5.3.7: Translation Agreement.

4.20 Our system now sends out two body parts for IWXXM messages, one as ATS headers with no message and the second as FTBP. Are ATS Headers needed for Basic AMHS with FTBP as originators/recipients?

- IHE and FTBP should be used for the IWXXM exchange over AMHS.
- IWXXM messages should be exchanged using extended AMHS FTBP (single body part) with IPM Heading Extension (IHE). You may refer to the ICAO document 'Guidelines for the implementation of OPMET data exchange using IWXXM'.

5. IWXXM exchange test

5.1 TEST message addresses: is anyone considering being a test (AMHS) endpoint for any parties/countries to send their test IWXXM?

- It is recommended that the RODBs plus any additional volunteer States conduct coordinated testing of IWXXM exchange of AMHS+FTBP as early as possible, if not already done so. It would also be beneficial for airlines to undertake tests with ANSP and MET agencies to understand user needs and potential system solutions.

5.2 How to conduct simulations (tests) of sending/exchanging OPMET data thru AMHS in IWXXM format?

- Refer to *Guidelines for the implementation of OPMET data exchange using IWXXM* and *Checklist for IWXXM Implementation* jointly developed by ACSICG and MET/IE WG.

5.3 What are the common issues observed during IWXXM exchange test over AMHS?

- Two body parts are observed, while IWXXM shall contain a single body part which is an FTBP

- Required fields are missing or in incorrect formats, such as Precedence, Precedence-policy-identifier 1.3.27.8.0.0 and Authorization Time (should end with "Z")
- Reference: Appendix A of "Guidelines for the Implementation of OPMET data exchange using IWXXM"

6. IWXXM compression

6.1 Will compression of individual IWXXM message always be required?

- Gzip compression has been adopted for IWXXM compression for exchange over the AFS
- Compression shall always be done unless a specific agreement has been reached with the corresponding NOC or ROC to perform the compression on behalf of the originating State
- Basic AMHS might provide an acceptable alternate solution (To be confirmed) where there are difficulties implementing the FTBP; the link has ample capacity to support the transmission of uncompressed IWXXM data, and an agreement is in place for the aggregator to perform compression/decompression on behalf of the originator
- Compression of individual IWXXM message is unlikely to be necessary when exchanging IWXXM via information services.

6.2 Is there any rough estimate on the file size of IWXXM for METAR or TAF? Wondering if AMHS/ROC/NOC/RODB in APAC be able to support IWXXM messages exchange with a large file size.

- a sample METAR bulletin with six reports in it makes a ~30k IWXXM file - which becomes ~3.7k compressed

7. IWXXM versions

7.1 What version of IWXXM is recommended to be used?

- To avoid the potential impact to operations due to IWXXM version compatibility issues of the systems, States are required to upgrade the systems for generating, exchanging and consuming IWXXM reports to support the IWXXM version which complies with the latest amendment to Annex 3, as stated in the IWXXM compatibility table (Link: https://github.com/wmo-im/iwxxm/wiki/Package-Compatibility).
- The IWXXM compatibility table summarizes the existing and planned IWXXM versions and the version number of the associated packages. If the version number of a package has not changed or only the patched number has changed from one IWXXM version to another, the schemas for the package are fundamentally the same and the package is compatible across IWXXM versions.

8. IWXXM translation

8.1 How are Translation Centres are established?

- Translation Centres will likely be required
- ROCs, RODBs are encouraged to provide translation services
- Each State is responsible for arranging the provision of IWXXM, and, where required, an agreement with another State to provide TAC to IWXXM translation on their behalf
- A formal agreement is required
- More information on translation function, Translation Centre prerequisites and Translation Centre Agreement is in the presentation on translation from TAC to IWXXM in the IWXXM Guidelines.

8.2 After translation (from TAC to IWXXM), can the data be sent directly to the aggregator, or does it need to be returned to the originator to then send it to the aggregator?

- Either scenario is acceptable, depending on the arrangement between the originator and the translator

8.3 Will the conversion apply in both formats at the RODB?

- Translation of TAC to IWXXM is ~~OK, if necessary~~ allowed, where a formal agreement is established, but the translation and distribution of IWXXM to TAC is not permitted when the original TAC from the source is available

8.4 What happens to regional countries that will not be able to generate ~~change to~~ IWXXM?

- ~~•~~ Each State is responsible for providing or arranging the provision of IWXXM.~~translation services as necessary~~
- Some States now offer translation capability to assist States with the implementation of IWXXM~~Translation Centres will likely be required~~
  Caution: National extensions can be implemented (for differences to Annex 3), but this requires additional effort and cost by the State and should only be implemented in the globally agreed standard way
  Caution: Original TAC must be well structured and reliably structured for it to be reliably converted to IWXXM
- ~~Refer to presentations on Translation of TAC to IWXXM in IWXXM workshops for more details~~

8.5 To provide translation for other States, it is understood that agreement is required. Is there any agreement form/example which State can refer to?

- For guidance on what an agreement should contain, please refer to the IWXXM Guidelines, including the following:
  - Section 5.3.7: Translation Agreement - Provides a list of elements that should be contained in the service agreement between the Translation Centre and applicant State
  - Section 4.1.3: Data Translation Centre - A data translator converts TAC data into IWXXM on behalf of their State and/or another State (i.e. when the data producer is unable to do so). A bilateral or regional agreement should be defined for such circumstances.
  - Section 5.3.1: Prerequisites for Translation Centres - Provides a list of items considered a prerequisite for data translation centres.
  - Reference could be made to the translation service request form available on ICAO EUR/NAT region website

8.6 When ~~could~~ should the IWXXM attribute "translationfailedTAC" be used?

- When TAC to IWXXM is not possible (e.g. due to poorly formed TAC)~~If the wrong codes in TAC lead to incomplete (partial) translation~~, it should be considered as translation failure and indicated by "translationfailedTAC".

8.7 Where can we obtain a converted file that includes TAC and XML (TAC to XML)? We need to check (validation) the translator of IWXXM (TAF/TAF AMD, METAR, SPECI, SIGMET, AIRMET).

- Apart from some examples under https://schemas.wmo.int/iwxxm/2023-1/examples/, there are some additional examples at https://github.com/wmo-im/iwxxm-translation which may want to try with your translator.

8.8 Some APAC OPMET bulletins contain METARs and TAFs from multiple States. If some of these States require translation services and others generate their own IWXXM, what are the options for aggregation - or, if not possible due to current ROC capabilities, creating new bulletins?

- It is recommended that the existing bulletin gets split into two separate bulletins, one containing IWXXM generated at the source, the other containing data for sites that are generated in TAC and translated to IWXXM. An aerodrome (METAR or TAF) data should only exist in one bulletin.
- The ICAO APAC Region has an opportunity, through the MET/IE WG, to develop a proposal/s to update or revise the current ROBEX scheme and ROBEX Handbook to guide States towards the most

appropriate solution for ICAO APAC OPMET bulletins.

~~8.9~~ For an incomplete TAC to IWXXM (Partial) translation, should an error be reported to someone? ~~where does the error message send to if the ROBEX generated TAC bulletin is generated from a ROC noting that NOC is the originator of the TAC message?~~

- Yes, an ~~The~~ error message should be sent to the TAC originator ~~if it is confirmed that the~~ when incomplete translation is caused by invalid TAC format.

9. IWXXM validation and quality control

9.1 How will IWXXM extensions pass validation?

- Extensions should be implemented in a consistent way
- States implementing extensions are also required to develop a schema and recommended to develop Schematron. The schema and Schematron need to be web-accessible such that validation of extensions can be performed.
- Validation should be performed on the extended data

9.2 At this stage, do we need some other IWXXM validation apart from schema and Schematron, such as when a bulletin is out of period or correction received but no prior initial message?

- At this moment, the team considers it more important to deal with the integrity of IWXXM messages. There will likely be separate checks of business rules as part of a mature QC process.

9.3 Where can I find a tool to validate IWXXM?

- There are a number of open-source and commercial tools to validate IWXXM messages. One open-source tool you may want to check out is CRUX from NCAR at https://github.com/NCAR/crux

10. IWXXM extensions

10.1 How to deal with differences to Annex 3 / IWXXM extensions

- ICAO does not recommend States extend the IWXXM schema to include additional information
- ~~Caution:~~ National extensions can be implemented (for differences to Annex 3), but this requires additional effort and cost by the State and should only be implemented in the globally agreed standard way

10.2 Can IWXXM Extension be used to transfer information outside State? If so, is there any specific body like FIXM CCB to validate such Extension for the wider user?

- There is no Change Control Board (CCB) for IWXXM. Changes are managed through WMO and ICAO.
- The Meteorology Panel Working Group on Meteorological Information Exchange (WG- MIE) has been looking at the topic of Extensions. There are a number of WMO Task Team on Aviation Data (TT-AvData) experts who are also experts on WG-MIE.
- It is anticipated that a global repository of extensions will be created to assist States and users understand best practice for extensions.

10.3 Is there a mechanism to indicate that an IWXXM Extension must be understood by the consuming system? That is, the Extension cannot be ignored as there are possible safety issues.

- Yes. There is indeed a directive in the extension part of the IWXXM schema requesting validators/parsers to have access to external schemas being used; otherwise, it will return an error.
- This is also why a producer needs to think twice before producing an IWXXM message with extensions

requiring external schemas. Downstream users will get an error when trying to consume the message if they cannot get hold of the schemas of the Extension.

11. Guidance, education, capacity building

11.1 Will the ROBEX handbook be updated to support the exchange of IWXXM at the RODB?

- ~~Yes: MET/IE WG, Activity 9.4: Review and update ROBEX HB and ICD, including aligning with OPMET bulletin contents and changes associated with IWXXM~~
- ~~Note: m~~Much of the IWXXM related technical detail will not be incorporated into the ROBEX Handbook but instead be contained within the *Guidelines for the implementation of OPMET data exchange using IWXXM* is the main source of guidance

11.2 Where can I find the sharing of the lesson learnt from States that have made progress on the IWXXM implementation on challenges faced & recommended solutions for best practice?

- Refer to presentations, discussions, reference material in the past IWXXM workshops or MET/IE WG meetings.

11.3 Are there any guidelines on IWXXM Visualisation & display?

- This matter is being discussed within the ICAO METP. Details may be added to ~~METP working group had this within their scope, and it is likely to be included within~~ the new ICAO *Procedures for Air Navigation Services for Meteorology* (PANS MET)

12. End-user considerations

12.1 As an end-user, how will IWXXM format affect us?

- The international distribution of TAC is expected to cease in 2030.
- Users are strongly encouraged to plan their migration to IWXXM.
- ~~As the TAC will continue at least until 2029, initially, there will be no effect on users. However, users wishing to benefit from utilising IWXXM will be required to either develop new capabilities or upgrade their systems to support the ingestion of IWXXM data.~~
- Some solutions may be as simple as acquiring off-the-shelf software that can process IWXXM and translate TAC, and be usable on a standard computer screen.
- IWXXM is based on XML and will simplify the development of new airline and pilot applications
- Data volumes are substantially larger than TAC, and the use of IWXXM may impact some users and their communication links (e.g. to aircraft)

12.2 Some airlines have flight planning departments. How will IWXXM be integrated into their flight planning systems?

- Users are required to:
  - Arrange access to IWXXM from one or many sources
  - Manage non-translated TAC in IWXXM
- Users are recommended to:
  - Take appropriate malware and anti-virus precautions if ingesting compressed files
  - Validate received IWXXM
  - Manage off-line copies of all required schema's & code tables
- IWXXM is considered to be beneficial to users' flight planning systems, but TAC will remain available until at least ~~2029~~2030

12.3 What is the implication for States & RODB that are unable to comply with the IWXXM implementation timeline?

- In November 2020, it became an ICAO requirement (standard) to implement and exchange IWXXM
- Depends on the State and their required function. RODBs are critical in the ROBEX scheme – so consequences of non-compliance will be significant
- States not providing IWXXM form of OPMET should file differences with Annex 3 in the Electronic Filing of Differences (EFOD)

12.4 On the consumers' aspect, I think consumers (e.g. airlines) will not be able to connect to AMHS; where and how can they get IWXXM information?

- Quite a few airlines are connected to the AFS via their domestic COM Centre; others connect to the AFS via SITA gateways. ~~The a~~Airlines can upgrade their AFTN connections to local COM Centre to AMHS FTBP, but this might be an investment that is hard to commit to at this moment. Some States also provide access to OPMET information via web services or similar.
- ~~An alternative source of~~ IWXXM can also be accessed via ~~data will be through~~ WIFS and SADIS.

13. Cyber security

13.1 What is the recommended/appropriate cyber security strategy for IWXXM?

- Scan attachment at Message Transfer agent and isolate/remove infected file before distributed further (e.g. to end-users)
- Users systems should scan at either user server or terminals depending on implementation architecture and risk appetite
- Testing should be conducted to assess the impact of scanning at various stages in the ROBEX scheme

14. Lesson learnt and common issues

14.1 What is the correct format of "Authorization Time" element in the IPM heading of AMHS message?

- Format error alarm can be triggered at AMHS due to the absence of character "Z" in "Authorization Time" element in the IPM heading of AMHS message received from other communication centres.
- The "Authorization Time" element is part of the AMHS Functional Group IPM Heading Extensions (IHE) as per ICAO Doc 9880, Part II, table 3-2 and para. 3.3.4.2.
- The "Authorization Time" element of IWXXM messages shall either consist of a specification of the calendar date and UTC time followed by a letter "Z" or a specification of the calendar date, the local time and the difference between local time and UTC.

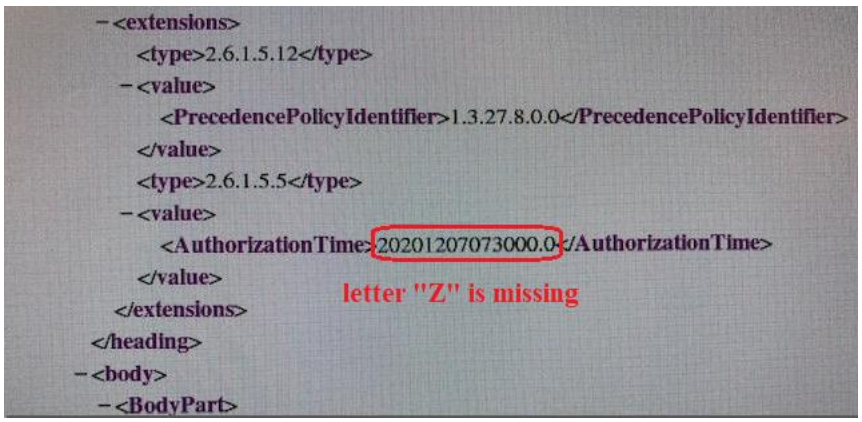

Figure: Examples of correct and incorrect format of "Authorization Time" observed during the reception of AMHS message carrying IWXXM file

14.2 While our AMHS supports File Transfer Body Part (FTBP), could we exchange IWXXM files using an AMHS message with two file body parts?

- Reception of the AMHS messages carrying IWXXM reports may be unsuccessful if the AMHS message contained two file body parts, i.e. one for message body text and the other for attachment file.
- As defined in Section 2.3 in the Appendix A of *Guidelines for the Implementation of OPMET Data Exchange using IWXXM*, the AMHS messages for IWXXM exchange shall contain exactly one body-part which is an FTBP, i.e. IWXXM attachment only without any text body.
- It is recommended that ROCs heading for IWXXM implementation to support the requirement of IPM Heading Extension (IHE) and File Transfer Body Part (FTBP) as the functional groups of AMHS to ensure the AMHS systems and User Agents (UAs) could receive and forward the IWXXM messages properly.

14.3 Could "no clouds of operational significance (NSC)" and "cloud" element be reported together in METAR in IWXXM?

- When NSC is to be given in Aerodrome Routine Meteorological Report (METAR) and cloud and visibility OK (CAVOK) would not be appropriate, format error alarm might be triggered during the IWXXM format validation.
- This is because when NSC would be reported, the "cloud" element would not be required in the IWXXM product.
- Details of context diagram for IWXXM version 2021-2 regarding what elements are mandatory could be found at https://schemas.wmo.int/iwxxm/2023-1/html/.

14.4 In the current TAC OPMET exchange scheme, SIGMET, VAA, TCA and SWXA are distributed by originating centres directly to the destinations without any re-distribution by ROCs. Is there any change to the exchange scheme for IWXXM-formatted SIGMET, VAA, TCA and SWXA?

- IWXXM exchange in APAC Region shall be aligned with *Guidelines for the Implementation of OPMET Data Exchange using IWXXM* ~~*Guidelines for the Implementation of OPMET Data Exchange using IWXXM* (fourth edition, November 2020)~~ and, specifically, ROCs are responsible for the distribution of all types of IWXXM formatted OPMET data to States within the Asia Pacific Region (**Conclusion MET SG/24-11: IWXXM Exchange Approach**).
- Originating ROC distributes every type of IWXXM OPMET (including SIGMET, VAA, TCA, SWXA in addition to METAR/SPECI and TAF) to all other ROCs in the APAC Region.
- A ROC, on receiving an IWXXM report, will forward this to NOCs within their AOR for further distribution to users.
- For example, an originating station only needs to send IWXXM SIGMET to their ROC and does not need to distribute SIGMET to other destinations, which is different from the existing practice for distributing TAC SIGMET to various ROCs/RODBs. Meanwhile, ROC needs to take up the role to distribute the IWXXM SIGMET to other ROCs.

14.5 If the IWXXM report was generated by TAC-to-IWXXM translation within a State, is it necessary to specify the translation centre in the XML?

- It is not necessary to include the "translationCentreDesignator" and "translationCentreName" in the XML if the translation is carried out by IWXXM producers within the own State. If another translation centre performed the translation on behalf of the State, the translation centre needs to be specified in the XML.

14.6 If we complete the system update to support the generation of a new IWXXM version for complying with the requirements of the latest amendment to ICAO Annex 3, is it necessary to confirm the capability of all the recipients in handling reports of the new IWXXM version before disseminating them?

- The States receiving IWXXM reports are requested to ensure that systems developed or procured will work with current and future versions of IWXXM which complies with the requirements of the latest amendment to ICAO Annex 3.
- States should be aware of the possible compatibility issues when exchanging IWXXM OPMET data in different IWXXM versions.

14.7 How to identify the IWXXM version of an aggregated report which consists of IWXXM data in multiple IWXXM versions for different aerodromes?

- When aggregating IWXXM reports in different version, IWXXM namespace should be defined in the form http://icao.int/iwxxm/{version number} for each group of IWXXM reports in the same IWXXM version. The following is a COLLECT example with multiple versions of IWXXM METAR reports.

```
<collect:meteorologicalInformation>
   <iwxxm:METAR xmlns:iwxxm="http://icao.int/iwxxm/3.0">
      ...
   </iwxxm:METAR>
   <iwxxm:METAR xmlns:iwxxm="http://icao.int/iwxxm/2021-2">
      ...
   </iwxxm:METAR>
   ...
</collect:meteorologicalInformation>
```

----- end -----

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