International Civil Aviation Organization
CAR/SAM Regional Planning and Implementation Group (GREPECAS)

WORKING PAPER

PPRC/5 — WP/28
16/07/19

Fifth Meeting of the Programmes and Projects Review Committee (PPRC/5)
Mexico City, Mexico, 16 to 18 July 2019

Agenda Item 5: Review of GREPECAS Programmes and Projects and Subsidiary Groups

5.7 Projects under the Aeronautical Meteorology Programme (B0-AMET)

PROJECTS UNDER THE AERONAUTICAL METEOROLOGY PROGRAMME (B0-AMET) FOR THE CAR REGION

(Presented by the Secretariat)

EXECUTIVE SUMMARY

This working paper presents the follow-up to the Programme H - Aeronautical Meteorology projects in the CAR Region, a summary of the Meteorology Panel activities and its work on the amendments of the Annex 3 to the Chicago Convention Standards and Recommended Practices (SARPs); and introduces the transition of the Meteorological Service from a product-centric environment to an information-centric environment, as expected from the Global Air Navigation Plan (GANP) update.

Action:	The indicated in item 5.1
Strategic Objectives:	• Air Navigation Capacity and Efficiency • Safety • Environment Protection
References:	• Annex 3 - Meteorological Services for international air navigation • Report of the Eighteenth Meeting of CAR/SAM Planning and Implementation Regional Group (GREPECAS/18) • Report of the Second Meteorology (MP/2) Project Meeting of GREPECAS (MP/2) • Report of the Fourth Meeting of the ICAO MET Panel (METP/4)

1. Introduction

1.1 The Second MET Project Meeting in 2017 had reviewed the GREPECAS MET Projects considering the requirements introduced by Amendment 78 to ICAO Annex 3 and had issued Conclusion CAR/SAM/MP1/2 “MET Projects Update”, subsequently included in the CAR Region projects. The GRFEPECAS/18 Meeting had analysed the activities of Project H (MET) and noted the Conclusions and challenges related to the execution of the MET Projects.

1.2 The METP established by the Air Navigation Commission (ANC) in September 2014, is working to draft Standards and Recommended Practices (SARPs) and any additional necessary documentation including concept of operations documents, roadmaps, functional and performance requirements, and service provider selection criteria (in the case of entirely new meteorological services). Each effort is expected to culminate in formal amendments of ICAO Annex 3. The METP/4 Report, reviewed by the ANC, includes recommendations for the consideration of the Planning and Implementation Regional Groups (PIRG).

1.3 The Global Air Navigation Plan (GANP, Doc 9750) is the highest level document for the air navigation strategy and, in its different revisions, it reformulates the B0-AMET module and its evolutions in the Aviation System Block Upgrade (ASBU) blocks.

2. MET Projects

2.1 MET Projects H2, H3, H4 began in March 2018 and will finalize in September 2020; the status of implementation is presented below, based on proposed tasks, activities implemented as scheduled, started with some delay, and those activities requiring mitigation measures.

H2-implementation of meteorological watch for the monitoring of en-route severe phenomena, volcanic ash, tropical cyclones and the release of radioactive material

2.2 The project has had limited development and the targets have been partially achieved, despite efforts to coordinate the activities. From 9 proposed activities, 4 have been implemented as scheduled, 3 have been started with delay, and 2 require mitigation measures. The project is presented as **Appendix A.**

2.3 Through the monitoring conducted from the NACC Regional Office and as reported by international organizations, it was determined that some Meteorological Watch Offices (MWO) in the CAR Region need to improve the issuance and dissemination procedures for Significant meteorological information concerning en-route weather phenomena (SIGMET) messages.

2.4 To provide a solution to the above, a 5-day regional Workshop has been requested, in order to promote the procedures and templates standardization and harmonization for the issuance and dissemination of SIGMET messages, increasing their availability and quality; the Workshop is scheduled for March 2020 and the participation of experts from the following entities is requested: Tropical Cyclone Advisory Centres (TCACs), the Volcanic Ash Advisory Centre (VAAC), the World Area Forecast Centre (WAFC).

2.5 The Workshop will be aimed to the aeronautical meteorological personnel providing the meteorological service for international air navigation at the MWOs in the CAR/SAM Regions, in accordance to the CAR/SAM electronic Air Navigation Plan (e-ANP) Volume II MET-II-1 MWO.

H3-implementation of the quality management system for the provision of the meteorological service for international air navigation (QMS/MET)

2.6 The project has been very active but the targets have been partially achieved despite the coordination efforts. From 9 proposed activities, 2 have been implemented as scheduled, 4 have started with delay, and 3 require mitigation measures. The project is presented as **Appendix B.**

2.7 The main challenge is for States to maintain involved and to participate in the proposed activities, by supporting the execution of the activities.

H4-Optimization of OPMET exchange, including SIGMETs (WS, WV, WC, AND WR), warnings and meteorological alerts

2.8 The project has partially achieved the targets. From 6 proposed activities, 2 have been implemented as scheduled and 4 require mitigation measures. The project is presented as **Appendix C**.

2.9 It is needed to improve access to the Operational Meteorological information (OPMET) exchange reports performed by the Brasilia International OPMET Data Bank (IODB). The report for the third quarter 2018 showed inconsistencies with the OPMET exchange control tables with respect to the AOP I-1, MET II-1 and MET II-2 of the electronic Air Navigation Plan (e-ANP); the update to correct the issue is in progress by the Data Bank.

2.10 The Meeting should note the ICAO Weather Information Exchange Model (IWXXM) OPMET exchange format will become a standard since November 5, 2.020; States are urged to increase its capabilities to transmit and receive OPMET messages in IWXXM – GML.

3. Annex 3 amendment status

3.1 The METP has held four meetings at ICAO Headquarters: in April 2015, October 2016, April 2018 and September 2018; meetings reports are available at the METP website (see website here) for consultation and monitoring by States.

3.2 During the previous four years, Annex 3 to the Chicago Convention has been updated through amendments 77A, 77B and 78, consolidated in the nineteenth and twentieth editions. In general view, the main topics introduced by the amendment process to Annex 3 have been:

a) Digital format for volcanic ash and tropical cyclone advisories and Information concerning en-route weather phenomena which may affect the safety of low-level aircraft operations (AIRMET);

b) the provision of Meteorological/special aerodrome report (METAR/SPECI), Aerodrome Forecast (TAF) and SIGMET information in digital format as a recommended practice;

c) introduction of World Area Forecast System (WAFS) forecast information on cumulonimbus clouds, icing and turbulence and additional flight levels for WAFS gridded forecast information;

d) removal of legacy satellite distribution systems in lieu of Internet-based services;

e) modification of Area forecast for low-level flights (GAMET) forecast requirements;

f) clarification of runway visual range assessment requirements;

g) use of a global reporting format for assessing and reporting runway surface conditions;

h) introduction of space weather advisory information services;

i) improvement of the provision of SIGMET information by MWOs; information on the release of radioactive material into the atmosphere; SIGMET and AIRMET information;

j) modifications of information representations in IWXXM format;

k) aeronautical meteorological personnel qualification and competency, education and training; and consequential amendment concerning change of references related to the provision of aeronautical information service.

3.3 In addition a new proposal for amendment of Annex 3 has been circulated for State comments by 9 July 2019; the proposal contains at least 13 relevant matters, such as the re-suspended volcanic ash, the QMS/MET System, the harmonization of SIGMET information, among others.

3.4 Regarding the MET Panel Recommendations, reviewed by the ANC, for consideration of PIRGS, the Meeting should note:

- METP/4 Recommendation 5/10: Guidelines for the Implementation of OPMET Data Exchange Using IWXXM

- METP/4 Recommendation 5/5: Plan and Roadmap for Meteorology in System Wide Information Management (SWIM)

- METP/4 Recommendation 6/2: Regional SIGMET guide (Updates)

The three aforementioned documents are included, respectively, as **Appendix D, E** and **F** to this working paper.

3.5 Statistics recorded by the Online Framework (OLF) of the Universal Safety Oversight Audit Programme (USOAP) for the Compliance Checklist (CC) in the Electronic Filling of Differences (EFOD), with respect to Annex 3 for the States of the NAM/CAR Regions, only reached 64.36% as of June 2019, indicating that some States do not successfully complete the SARPs amendment process and possible deficiencies of the meteorological service provision in the CAR Region.

4. GANP New edition

4.1 In 2016, the Council and the Assembly of ICAO adopted and endorsed a new fifth edition (2016) of the Global Air Navigation Plan (GANP) (ICAO Doc 9750). The 2016-2030 GANP has retained the ASBU, first introduced as part of the fourth edition of the GANP in 2013, although the blocks themselves have been organized into non-overlapping six-year time increments. Four performance improvements areas (PIA) of the ABSU have also been remained unchanged.

4.2 The next edition of the GANP (sixth edition, 2019) is expected to undergo a more comprehensive update aligned with the six-year block periods. The content of the GANP will be organized into a multilayer structure with each layer tailored to different audiences. This will allow a better communication with both high-level and technical managers, with the objective that no State or stakeholder is left behind. The four-layer structure is made up of global (strategic and technical), regional and national levels, and provides a framework for alignment of regional, sub-regional and national plans.

4.3 In addition, as a result of the METP experts analysis, a possible restructure of the Advanced Meteorological Information Thread AMET blocks 0 and 1 will be implemented, including a different organization and distribution of elements to highlight the foreseen transition from a product-centric environment to an information-centric environment, as well as the migration to include MET in the future system-wide information management (SWIM).

4.4 Upgrades in the GANP will request a detailed revision of the CAR/ e-ANP Volumes I and II, as well as the start of the development of Volume III. In addition, a verification of the effective implementation of the essential MET national and regional services is needed.

5. Suggested Actions

5.1 The Meeting is invited to:

a) review the H Program projects in the corresponding appendices;

b) provide comments to improve the completion of the H Program projects;

c) consider the MET Panel Recommendations included in the appendices and indicate the necessary actions.

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PROJECT H2 IMPLEMENTATION OF METEOROLOGICAL WATCH FOR THE MONITORING OF EN-ROUTE SEVERE PHENOMENA, VOLCANIC ASH, TROPICAL CYCLONES AND THE RELEASE OF RADIOACTIVE MATERIAL

CAR Region	PROJECT DESCRIPTION (PD)	PD N° H2	
Programme	**Project Name**	**Start**	**Finish**
Aeronautical Meteorology *Programme Coordinator:* *Luis Raúl Sánchez Vargas*	IMPLEMENTATION OF METEOROLOGICAL WATCH FOR THE MONITORING OF EN-ROUTE SEVERE PHENOMENA, VOLCANIC ASH, TROPICAL CYCLONES AND THE RELEASE OF RADIOACTIVE MATERIAL Project Coordinator: Ivan González (Cuba) Experts contributing to the project: Enrique Camarillo (Mexico) Humberto Hernandez Peralta (Mexico) Marco Antonio Coria Rodriguez (Mexico) Glendell De Souza (Trinidad y Tobago)	March 2018	September 2020
Objective	Ensure that States implement the IAVW, Annex 3 Standards and Recommended Practices (SARPs) and CAR/SAM eANP (replacing basic Doc 8733), concerning the issuance and distribution of SIGMET information that could affect safety of aircraft operations.		
Scope	The Project comprises Meteorology Watch Offices (MWO) of the CAR Region included in the CAR/SAM e-ANP in coordination with ACC/FIC/NOF, and the Buenos Aires and Washington Volcanic Ash Advisory Centres (VAAC). The procedures for issuing of advisories and messages, the coordination between affected air spaces, as well as the transfer of responsibilities between MWOs will be reviewed and verified. Procedures for the transfer of responsibilities and assistance between the RSMC and the MWO will be defined.		
Metrics	SIGMET Tests continuous improvement. Amount of States with operational procedures implemented		
Strategy	The Project Deliverables will be executed by experts nominated by the CAR Region States, under the direction of the Project coordinator and MET Programme Coordinator oversight through GoToMeeting. Once deliverables are completed, the results will be submitted to the MET Programme Coordinator as a final document to be presented and if the case, for GREPECAS CRPP approval through the GREPECAS fast-track Procedure.		
Goals	100% SIGMET Tests acceptance, in terms of transmission and reception; 100% Of the States with operational procedures.		
Rationale	Severity, persistence, and increased frequency of volcanic activity, tropical cyclones, other severe weather phenomena and the release of radioactive materials into the atmosphere, impacting the Air Navigation Services provision, lead to the need to review, verify and implement operational procedures to increase safety of aircraft operations.		
Related Projects	➢ Air Space in-route structure optimization ➢ ATFM Implementation		

Deliverables of the Project	Relationship with RPBANIP	Responsible	Implementation Status	Date of Delivery	Comments
SIGMET Guide reviewed, updated and aligned to the ICAO template.	RPO 8	Luis Sánchez Ivan Gonzalez Enrique Camarillo Glendell De Souza		June 2018	Guidelines for the Standardization and harmonization of procedures and formats related to the preparation and issuance of Aeronautical Meteorology Information related to en-route severe weather and other phenomena in the atmosphere. Responsibility transition between MWO´s procedures.
Learning Material to train MWOs technical staff	RPO 8	Ivan Gonzalez Enrique Camarillo Glendell De Souza		July 2018	Syllabus including: Necessary Trainer profile. Course General Information. Course Objectives. Course rules and policies. Grading and evaluation method. Learning Resources. Course Calendar
United States NWS Chat Implementation as a redundant mechanism for the interregional coordination.	RPO 8	Luis Sánchez Ivan Gonzalez Marco Antonio Coria		August 2018	
ICAO Doc 9766 Part V update	RPO 8	Iván Gonzalez Enrique Camarillo Glendell De Souza		May 2018	
Guide to perform Regional SIGMET exercises	RPO 8	Iván Gonzalez States		December 2018, 2019	Guidance on the purpose, scope and procedures to perform Regional SIGMET practices.
Information Paper on AMDAR implementation in Mexico and it´s usage in SIGMET preparation	RPO 8	Luis Sánchez Humberto Hernandez Peralta		June 2018	
Protocols for radioactive material released or radioactive clouds cases in the FIR	RPO 8	Luis Sánchez Ivan Gonzalez Marco Antonio Coria		August 2018	Protocol Model including procedures for radioactive material released. Include contingency protocols in coordination with National ATS authority. Teleconference to introduce the Protocol.
SIGMET and Radioactive Material Regional Seminar/Workshop Proposal	RPO 8	Luis Sánchez		December 2018	Workshop for States technical capabilities development to enable proper response to radioactive material released in the FIR To be managed in coordination with WMO, ICCAE/COCESNA.
Agreement Models involving Meteorological authorities, State volcano observatories, aeronautical information service authorities and ATS authorities.	RPO 8	Ivan Gonzalez Marco Antonio Coria		January 2019	
Project Final Report	RPO 8	Luis Sánchez Ivan Gonzalez		September 2020	
Necessary Resources	Funds to conduct meetings, translation of relevant documentation and publication in the NACC Regional Office Web Site. Availability for GoToMeeting.				

Grey *Task not started yet*
Green *Activity being implemented as scheduled*
Yellow *Activity started with some delay, but will be implemented on time*
Red *Activity not implemented on time; mitigation measures are required*

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PROJECT FOR THE IMPLEMENTATION OF THE QUALITY MANAGEMENT SYSTEM FOR THE PROVISION OF THE METEOROLOGICAL SERVICE FOR INTERNATIONAL AIR NAVIGATION (QMS/MET)

CAR Region	PROJECT DESCRIPTION (DP)	PD N° H3	
Programme	**Title of the Project**	**Start**	**End**
Aeronautical Meteorology ***Programme Coordinator**:* *Luis Raúl Sánchez Vargas*	IMPLEMENTATION OF THE QUALITY MANAGEMENT SYSTEM FOR THE PROVISION OF THE METEOROLOGICAL SERVICE FOR INTERNATIONAL AIR NAVIGATION (QMS/MET) **Project coordinator:** Haley Anderson (Trinidad and Tobago) **Experts contributing to the project:** Carlos Fornés Valdés (Cuba) Alejandro Bartolomé (Dominican Republic) Marco Antonio Coria Rodriguez (Mexico) Humberto Hernandez Peralta (Mexico)	*March 2018*	*September 2020*
Objective	Assist States in the implementation of the QMS/MET and certification, where applicable, establish guidelines for the transition to the standard ISO 9001:2015 and projected to the interoperability of meteorological information in compliance with the provisions of Annex 3.		
Scope	Establishment and application of a Quality Management System at the Meteorological Offices in compliance with the standards and recommended practices of Annex 3 and the CAR/SAM e-ANP, Vol. I and Vol. II.		
Metrics	Number of States certified under ISO 9001:2015		
Goals	50% of CAR States apply and certify QMS/MET in accordance with standard ISO 9001:2015 on 31 December 2019; and 100% of CAR States have QMS/MET certified by an organization in accordance with standard ISO 9001:2015 by December 2020.		
Strategy	The Project Deliverables will be executed by experts nominated by the CAR Region States, under the direction of the Project coordinator and MET Programme Coordinator oversight through GoToMeeting. Once deliverables are completed, the results will be submitted to the MET Programme Coordinator as a final document to be presented and if the case, for GREPECAS CRPP approval through the GREPECAS fast-track Procedure.		
Rationale	Ensure the establishment and implementation of a properly organized quality system will contribute towards the safety, regularity and efficiency of international air navigation, improving ATM, optimizing the use of available aerodrome capacity and minimizing the environmental impact of air traffic. Performance management will be an important part of the quality assurance.		
Related projects	Air Space in-route structure optimization ATFM Implementation		

Project deliverables	Relationship with RPBANIP	Responsible	Status of Implementation[i]	Delivery Date	Comments
Corroborate the objectives of the QMS with the Manual on the quality management system for the provision of meteorological service for international air navigation Doc. 9873 ICAO / WMO	RPO 8	- Luis Sánchez - Haley Anderson - Alejandro Bartolomé		April 2018	
ICAO / WMO Regional level coordination to determine the CAR region QMS/MET implementation status ensuring reliable and verifiable information.	RPO 8	- Luis Sánchez - Haley Anderson - Alejandro Bartolomé		June 2018	Tool: Gap Analysis
Integration of CAR States into the WMO quality management forum.	RPO 8	- Luis Sánchez - Haley Anderson		June 2018	Tool: Email of instructions for joining WMO QMF
Dissemination of the guide for the implementation of Quality Management Systems for national meteorological and hydrological services and other relevant service providers - WMO-No 1100 Edition 2017	RPO 8	- Luis Sánchez - Haley Anderson		June 2018	Tool: Correspondence from NACC Office with instructions for accessing the Guide
Analysis of HRM processes to incorporate competency and qualification requirements of Aeronautical Meteorology Personnel, retraining and policies for continuous professional development.	RPO 8	- Haley Anderson - Humberto Hernandez		July 2018	
Plan for the evaluation of competences and qualification of aeronautical meteorological personnel.	RPO 8	- Haley Anderson - Humberto Hernandez		August 2018	

Project deliverables	Relationship with RPBANIP	Responsible	Status of Implementation[i]	Delivery Date	Comments
Virtual workshop for the interpretation of the ISO 9001: 2015 Standard and an implementation strategy.	RPO 8	- Luis Sánchez - Haley Anderson		September 2018	
Assessment of ISO 9001:2015 QMS implementation status, identification of areas for improvement, and the recommendation of corrective actions to be taken.	RPO 8	- Luis Sánchez - Haley Anderson		August 2019 August 2020	Tool: Gap Analysis New project deliverables may be developed based on findings
Installation and on-site training of SAETAF for the CAR / SAM States that require it.	RPO 8	- Carlos Fornés Valdés (Cuba)		September 2020	Cuba in coordination with WMO and ICAO will provide on-site installation and training to the CAR States at no cost. The states must guarantee passage and per diem of the experts according to the norm for the UN agencies.
Final Project Report	RPO 8	- Luis Sánchez - Haley Anderson		September 2020	
Necessary resources	Availability for GoTo Meeting teleconferences is required				

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[i] *Grey* *Task not started yet*
Green *Activity being implemented as scheduled*
Yellow *Activity started with some delay, but will be implemented on time*
Red *Activity not implemented on time; mitigation measures are required*

PROJECT FOR THE OPTIMIZATION OF OPMET EXCHANGE, INCLUDING SIGMETs (WS, WV, WC), WARNINGS AND METEOROLOGICAL ALERTS

CAR Region	PROJECT DESCRIPTION (DP)	DP N° H4	
Programme	**Project Name**	**Start**	**End**
Aeronautical Meteorology ***Programme Coordinator:*** *Luis Raúl Sánchez Vargas*	OPTIMISATION OF OPMET EXCHANGE, INCLUDING SIGMETs (WS, WV, WC, AND WR), WARNINGS AND METEOROLOGICAL ALERTS **Project Coordinator:** Enrique Camarillo (México) **Project Expert contributors:** Uvaldo René Milián Díaz (Cuba) Marshandy Luciano (Curaçao) Alejandro Bartolome Reynoso (Dominican Republic) Raul Adalberto Murillo Silva (El Salvador) Marco Antonio Coria Rodriguez (Mexico) Haley Anderson (Trinidad and Tobago)	*March 2018*	*September 2020*
Objective	Assist in the preparation and dissemination of METAR / SPECI reports and TAF aerodrome forecasts, timely and of high quality in the main airports of 100% of the States and Territories of the CAR Region; Assist the Meteorological Watch Offices (MWO) of the CAR Region, in the preparation and dissemination of timely and quality SIGMET messages for 100% of the Flight Information Regions (FIR) of the CAR Region.		
Scope	Correct preparation and timely dissemination of operational meteorological information involves the units that provide Meteorological Service for International Air Navigation and the international OPMET databanks.		
Metrics	The reception percentage measurement of OPMET information according to Annex 3, Appendix 10. The correct preparation (quality) of the OPMET information according to technical specifications of Annex 3, Appendices 3, 4, 5 and 6.		
Goals	Achieve at least 85% efficiency in the reception of high quality OPMET information for December 31, 2019, during the operating hours of the CAR Region aerodromes included in the FASID MET II-2 Table of the e-ANP , certified by ICAO.		
Strategy	The Project Deliverables will be executed by experts nominated by the CAR Region States, under the direction of the Project coordinator and MET Programme Coordinator oversight through GoToMeeting. Once deliverables are completed, the results will be submitted to the MET Programme Coordinator as a final document to be presented and if the case, for GREPECAS CRPP approval through the GREPECAS fast-track Procedure		
Justification	More timely meteorological information will optimize flight path planning and prediction, thus improving ATM system safety and efficiency. Meteorological information will also minimize the environmental impact of air traffic.		
Related Projects	En-route air space structure optimization ATFM Implementation		

Project Deliverables	Relation with the RPBANIP	Responsible	Implementation Satatus[1i]	Delivery Dates	Comments
FASID MET Charts electronic Air Navigation Plan verification	RPO 8	- Trinidad and Tobago for the Eastern Caribbean - Marshandy Luciano for Netherlands territories. - Raul Murillo for Central America - Uvaldo René and Alejandro Reynoso for Major Antilles and Central Caribbean - Marco Antonio Coria for Mexico		April 2018	
OPMET Information efficiency and quality controls available in the Brasilia and Washington OPMET International Data Bank; equally through USA NWS Kansas City Aviation Weather Center, and airlines operational Centres as coordinated with IATA.	RPO 8	- Enrique Camarillo		April 2018	
Update the e-ANP FASID MET tables.	RPO 8	- Luis Sánchez - Enrique Camarillo - States		July 2018	
Working Paper to propose the elaboration of METAR reports every 30 minutes in the most critical airports and schedules (IATA concept)/define a metric to allow the proposal implementation.	RPO 8	- Luis Sánchez - Enrique Camarillo		August 2018	Background for the implementation of METAR Reports every 30 minutes in EUR/NAT region will be requested to the Regional Officer.
Exchange OPMET tests in XML/GML Format.	RPO 8	- Enrique Camarillo		To be determined	The feasibility of executing this activity will be reviewed
IWXXM Implementation Regional Workshop.	RPO 8	- Luis Sánchez - Enrique Camarillo		2018	It is planned to develop a workshop including Space Meteorology
Project Final Report.	RPO 8	- Luis Sánchez - Enrique Camarillo		September 2020	
Necessary Resources	Funds for meetings with the project members to assess results and propose correcting actions. Availability for GoToMeetings.				

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APPENDIX D
Guidelines for the Implementation of OPMET Data Exchange Using IWXXM

INTERNATIONAL CIVIL AVIATION ORGANIZATION

GUIDELINES FOR THE IMPLEMENTATION OF OPMET DATA EXCHANGE USING IWXXM

DRAFT THIRD EDITION – MAY 2019

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1 Introduction

1.1 Purpose

The main intention of this document is to describe the activities relating to the transition of intra- and interregional operational meteorological (OPMET) data exchange until 2020 and operational exchange beyond. During this period, the amendments to ICAO Annex 3, *Meteorological Service for International Air Navigation*, requiring this transition towards digital data exchange will become applicable for the international exchange of OPMET data.

1.2 Background

The bilateral exchange of IWXXM (ICAO Meteorological Information Exchange Model) based information was introduced in November 2013 through Amendment 76 to ICAO Annex 3, enabling States to exchange their OPMET data not only in TAC (Traditional Alphanumeric Code form) but also in extensible mark-up language (XML) and more precisely geography mark-up language (GML).

This represented the start of a significant change from the provision and exchange of textual OPMET data towards a digital environment supporting the ICAO Global Air Navigation Plan (GANP) and transition towards a SWIM (System Wide Information Management) environment.

Since their inception, OPMET data has been promulgated systems with the data products initially designed to be human readable. Due to bandwidth limitations, these products are highly compact to facilitate a regular and efficient flow of data.

The exchange of IWXXM information became a recommendation through Amendment 77 to ICAO Annex 3 from November 2016, with some States exchanging digital products (IWXXM) from early 2017. The exchange of IWXXM will be a standard from November 2020, as indicated in Amendment 78 to ICAO Annex 3.

The use of OPMET in a TAC format presents an obstacle to the digital use of the data as it often contains typographical errors, is poorly structured and lacks validation. This makes the handling of global data difficult to use correctly and expensive to maintain. These significant difficulties have been highlighted during past code changes. The coding practices in text form also presents an obstacle to efficient automation as State coding exceptions are commonly used.

IWXXM represents the first step to move to an environment where the systems handling this data can make more use of standard applications and techniques. The development of new systems which provide and support digital OPMET requires initial investment but the use of enabling data exchange standards for other domains such as AIXM (Aeronautical Information Exchange Model) and FIXM (Flight Information eXchange Model) along with IWXXM will lead to a cost reduction due to the implementation of widely used data modelling techniques including OGC (Open Geospatial Consortium) segments. Consequently, users are presented with opportunities to create new products at a lower cost by fusing this data.

It is essential that the transition towards the use of IWXXM is adequately planned and equipped to make reliable data sets available to users for exploitation as soon as possible at both a Regional and a Global scale. This guidance document provides elements and steps for consideration in achieving that aim by defining common definitions and concepts, as well as structured phases to be implemented in relation to the International exchange of OPMET data.

1.3 Intended Audience

This document is intended to be used by Centres considering being involved in the exchange of IWXXM data, both within a region and inter-regionally.

2 Current Operations and Capabilities

2.1 Current Capabilities

The current capabilities are dedicated to Traditional Alphanumeric Code (TAC) data exchange, via the Aeronautical Fixed Service (AFS), primarily the aeronautical fixed telecommunications network through AFTN and AMHS protocols, SADIS and WIFS.

AMHS provides a mechanism for the exchange of IWXXM information as attachments by utilising the AMHS File Transfer Body Part (FTBP) feature over the AFS.

2.2 Data Producer/Originating Unit

The TAC Data Producer provides TAC data only.

2.3 Data Aggregator

The function of the Data Aggregator is to take individual TAC reports, perform limited data validation and aggregate them into bulletins. Bulletins shall consist of one or more reports of the same type (e.g. METAR).

2.4 Data Switch

A Data Switch will route the data according to the WMO abbreviated header structure, TTAAiiCCCC, of the bulletin. The bulletin header fulfils the regulations described in WMO doc No 386, *Manual on the Global Telecommunication System*.

2.5 National OPMET Centre (NOC)

The role of the NOC is to gather and validate all - international required OPMET messages – required AOP and agreed exchanged non-AOP - (refer to the Regional (electronic) Air Navigation Plans for AOP) generated by all originating units within a State, to compile national data into bulletins and to distribute them internationally according to the regional distribution schema.

A NOC should perform the following functions:

- Data Aggregator;
- Data Validator; and
- Data Switch.

2.6 Regional OPMET Centre (ROC)

A ROC is responsible for the collection from NOCs and validation of all required AOP and agreed exchanged non-AOP OPMET data in its area of responsibility (AoR) according to the regional distribution schema.

Each ROC is responsible for the collection of all required OPMET data and agreed exchanged non-AOP OPMET data from the other ROCs in the region and the dissemination to the other ROCs of these data from its AoR.

A ROC should perform the following functions:

- Data Aggregator; and
- Data Switch.

2.7 Interregional OPMET Gateway (IROG)

An IROG is responsible for the collection of all required OPMET data and agreed exchanged non-AOP OPMET data from its interregional area(s) of responsibility (IAoR) and its dissemination to the ROCs in its region.

Furthermore, the IROGs are responsible for collection and dissemination of their region's required AOP and agreed non-AOP exchanged OPMET data to their partner IROGs.

The IROG is responsible for the validation of the bulletins sent to the IROGs of its IAoR and received from their IAoR.

For TAC data exchange, an IROG should perform the following functions:

- Data Aggregator; and
- Data Switch.

2.8 International OPMET Databank

An International OPMET Databank provides the capability for users to interrogate TAC data through the AFTN or AMHS. In some regions the databank is known as a Regional OPMET Databank (RODB).

Operational principles:

- OPMET Databank Requests
    - Requests for TAC data can be sent via the AFS using AFTN or AMHS. These requests work as described in current Regional OPMET Data Bank (RODB) Interface Control Documents (ICD).
    - The above example describes the syntax of TAC requests:
        - "RQM/" is used as the start of the query
        - only the new T_1T_2 message types defined by the World Meteorological Organization (WMO) are allowed

          For example: RQM/SALOWW/WSEBBR/WSLFFF=
        - the request is sent to the AFTN address of the International Databank

- OPMET Databank Replies
    - Replies to TAC requests are described in the current RODB Interface Control Documents.
    - Reply reports of a request will be aggregated into one or more messages, according to the same rules used by the Data Aggregators, e.g. no mixing of message types in one file.
    - The RODB Interface Control Documents should specify a set of standardized information & error replies, specifically when the required data are not defined (example: request for a SIGMET with a wrong location indicator)

3 Inclusion of IWXXM within ICAO Annex 3

ICAO Annex 3 defines what IWXXM capability is required at different time frames. These capabilities can also be considered in context of the ICAO SWIM-concept (Doc 10039, *Manual on System Wide Information Management (SWIM) Concept*).

The Amendment 78 to Annex 3 introduced the requirement for the international exchange of the METAR/SPECI, TAF, AIRMET, SIGMET, VAA and TCA XML-formatted messages as a standard with effect from November 2020. In addition, Space Weather Advisories in XML format are a recommended practice and a standard from 2019 and 2020, respectively.

Note: The intention of this Guidelines document is not to define Net Centric services but to provide guidance as a stepping stone for a swift transition to IWXXM implementation as a first step towards SWIM.

4 Proposed service concept

4.1 Operating principles

This section outlines the general principles for transitioning the international exchange of OPMET data. These principles are still based on continued use of the WMO abbreviated header structure and all participating States using the ICAO Extended AMHS. The intention is to support the different identified phases that will lead to a managed IWXXM-based international exchange of METAR/SPECI, TAF, TCA, VAA, AIRMET and SIGMET, Space Weather data by the Amendment 78 to Annex 3 applicability date.

4.1.1 Managing the transition

A group responsible for managing the transition should be identified in each region, for the necessary intraregional and interregional coordination and should be guided by METP WG-MIE with the support of WMO.

It is assumed that different regions will progress at different rates. It is necessary to create a plan that facilitates this different implementation pace.

The Meteorological Panel (METP) Working Group on Meteorological Information Exchange (WG-MIE) has developed this Guidelines document to assist all ICAO regions with the transition to IWXXM exchange. Each ICAO region may also establish a regional version of the document to provide regional information and references but it is important that this should maintain alignment to the global guidelines to ensure the inter-regional exchange is not affected. To simplify management of both the global and regional documentation, regions are encouraged to only modify or add appendices.

One example of regional information would be tests for National OPMET Centres for exchanging IWXXM via the Aeronautical Fixed Service using AMHS with FTBP and AMHS profile for IWXXM data, as indicated as guidance in the Appendix A and Appendix B of this document.

It would be recommended that this regional information be contained in an appendix to the main document, whereby it could be reviewed and agreed, in particular in those regions who have not yet established such regional information.

Note: Groups such as Data Management Group for EUR, the Bulletin Management Group for MID and the Meteorological Information Exchange working group (MET/IE) for APAC could be the right groups to manage this transition (or equivalent groups in other regions). Where AMHS is being used, close cooperation with the State COM Centre is advised to assure an efficient management of AMHS links and interconnections between adjacent regions.

4.1.2 Variances to the IWXXM Model

National extensions (such as remark sections) could only be supported when accompanied by necessary XML tags and in a globally agreed standard way. The international exchange of these extensions will only be supported for data fully compliant to the IWXXM model and abuse of extensions must be prevented.

Note: The term *"IWXXM model*" should be understood as the XML schema including all necessary GML components (including metadata) necessary for the exchange of IWXXM data. The use of extensions within the IWXXM is discouraged and should only be utilised where absolutely necessary.

4.1.3 Translation

A State will be required to produce IWXXM data **in addition** to TAC data for international exchange from November 2020. Generating both formats will help minimize, as much as possible, the translation between formats. It will also avoid operational translation/conversion from IWXXM to TAC and onward forwarding, as the bi-directional conversion will not necessarily result in the same TAC.

Where a translation from TAC to IWXXM is necessary and conducted, the translation centre and date/time of when the translation occurred will be identified within the XML message (refer to section 6.3).

4.1.4 Data collection

When creating a feature collection of the same type of IWXXM data (e.g. METAR), further named as "bulletin", the aggregating centre identifier and date/time group of when the collection was created will be indicated within the XML message. The aggregating centre metadata will be defined as part of a globally accepted GML/XML model.

Only regular reports (e.g. METAR and TAF) will be aggregated. Non-regular reports (e.g. SIGMET, SPECI, AIRMET and VAA) will NOT be aggregated.

A single bulletin will only contain TAC or XML, never both.

A single file will contain only one bulletin.

4.1.5 Transmission & Routing

Given the size and character set of IWXXM messages, it will not be possible for these messages to be transmitted via AFTN. The file containing the bulletin will be compressed and FTBP (**File Transfer Body Part**) under Extended AMHS (**ATS Message Handling System)** will be used to exchange IWXXM data internationally through the AFS.

The principles of exchanging IWXXM data on AMHS are further described in section 5.1.4 but, in general, rules close to the ones governing the TAC transmission are applied.

The WMO abbreviated header structure (TTAAiiCCCC) is part of the filename of the FTBP and used as data identifier. The routing of IWXXM messages should associate this data identifier with AMHS address(es) that the message should be sent to.

As a file name extension, the gzip (.gz) suffix will be used to identify a compressed file containing meteorological data.

Note: The number of FTBPs and the maximum message size are subject to the AMHS specifications and recipients User Capabilities. It would be highly desirable to have a common agreed maximum limit size for AMHS messages between all ICAO regions. A total size of AMHS message (including FTBP) up to 4MB should be considered, as already defined in some regions. The available network path between the Originator and Recipient must be completely AMHS with FTBP support for successful message delivery. It does not necessarily require each COM Centre in the path to operate AMHS in Extended Services to relay an AMHS message with FTBP. To ensure that delivery is within the capabilities of the recipient, it is advised that the User Capabilities are coordinated before the establishment of regular communications. In some regions, this information may be available through Directory Services (X.500/EDS). The available bandwidth for each 'hop' in the network should be considered by COM Centres when switching to AMHS FTBP operations.

4.1.6 Compliance Testing

IWXXM compliance testing platforms or software will be made available in order to allow States to test the compliance of their XML data to the IWXXM model before operational international exchange. This is to assure that the future internationally disseminated data are operationally usable.

4.1.7 International OPMET Databank

In order to allow IWXXM data retrieval from International OPMET Databanks, a standard set of queries for IWXXM data will also need to be developed, agreed and documented. An Interface Control Document will be provided to describe the query structure, structure of the answer(s) and bulletin header(s) to be used by the International Databank, as well as all other information necessary for the automatic use of the query answers. The initial interface for ad hoc requests for IWXXM data will follow similar rules as the TAC-requests (refer to section 5.1.5). It is expected that the range of queries and the method of access will become more extensive as we migrate into a SWIM environment.

4.1.8 Aeronautical Information Metadata

The aeronautical information metadata are part of the XML model and should be transported by the IWXXM data by means of an external reference to AIXM.

The metadata is additional information relevant to the type of the aeronautical information object i.e. an airport, a flight information region (FIR). A challenge resides in getting the correct state of this aeronautical information, especially for centres that will perform translation from TAC to XML that will require this. Therefore, obtaining this from an authorized source (details to be determined) is implied, in order to provide the right piece of information that characterizes the data.

The access to aeronautical metadata should be provided by a link to the AIXM model, therefore avoiding possible inconsistencies between the transported metadata inside the IWXXM data and the current status of this aeronautical information as part of the AIXM model.

5 Functional requirements - Framework

This section is intended to describe the generalized elements which can be used to establish a framework for the exchange of IWXXM data, both intraregional and inter-regionally. One key aspect is that the framework needs to be flexible to permit development of an intra-regional structure suitable to the requirements, but at the same time allowing establishment of controlled and coordinated exchange between Regions.

The framework is organized into a basic set of functions/type of operations as described in section 5.1. A list of requirements that should be met to carry out each respective function as well as illustrations on how these functions may be performed/combined are provided in the same section.

In section 5.2, more complex regional entities which comprise some of the above functions are described.

5.1 Functional definitions

5.1.1 Data Producer/Originating Unit

TAC Producer
This producer provides TAC data only.

IWXXM Producer

This producer provides IWXXM. The IWXXM Producer may provide information in both TAC (until no longer required in Annex 3) and IWXXM forms.

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

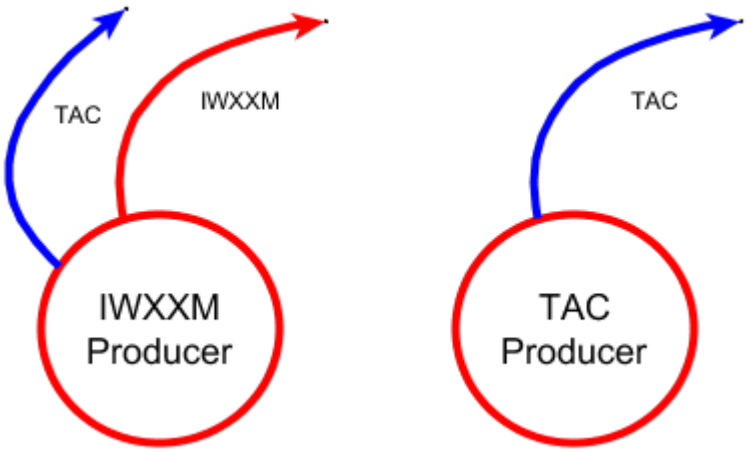

Figure 1: Comparison of IWXXM and TAC Producers

For an IWXXM Producer, the following functions could be the subject to compliance testing:

- The Producer output will conform to the IWXXM Schema;
- The Producer output will pass IWXXM Schematron/business rules; and
- The Producer will apply appropriate (defined) metadata following agreed ICAO rules and regulations.

5.1.2 Data Aggregator

This function takes individual IWXXM reports - decompresses them if already compressed – aggregates them (when multiple METAR or TAF reports), applies the Feature Collection Model and then compresses the file containing the resulting information. The aggregation shall consist of one or more reports of the same type (e.g. METAR, SIGMET).

The 'Feature Collection Model' (COLLECT) is currently used to represent a collection of one or more GML feature instances of the same type of meteorological information. The intent is to allow XML encoded meteorological information to be packaged in a way that emulates the existing data distribution practices used within Aeronautical Fixed System (AFS).

Note: The collection of meteorological information is often referred to as a bulletin.

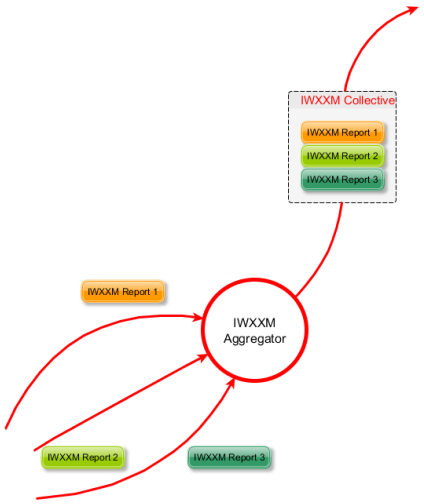

Figure 2: Data aggregation

For an IWXXM Aggregator, the following functions could be the subject of compliance testing.

- The Aggregator output will conform to the IWXXM Schema;
- The Aggregator output will pass IWXXM Schematron/business rules;
- The Aggregator will apply a correct filename to its output;
- The Aggregator correctly compresses data applying an appropriate suffix; and
- The Aggregator will apply appropriate (defined) metadata following agreed ICAO rules e.g. for monitoring and validation issues.

5.1.3 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 bi-lateral or regional agreement should be defined for such circumstances. To do so, it shall be able to parse incoming TACs and apply the data to IWXXM schema. It is expected that this will be carried out on a bulletin basis so that the translator will always be associated with a Data Aggregator function.

It is highly likely that not all incoming TACs will be translatable due to of non-conformance with TAC standards. There will be a need to have procedures in place to deal with any non-compliant data, which may involve further translation where predefined arrangements have been made. Refer to section 6.3 for more details.

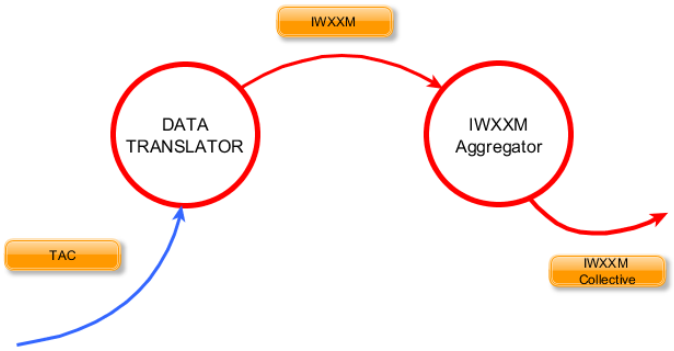

Figure 3: Data Translator generating IWXXM from TAC

Note: A Translation centre should also perform Data Aggregator functions. Whilst the IWXXM Schema may be extended for national translation purposes, an emphasis on maintaining the purity of the schema should be maintained. Where extensions to the schema are proposed to be disseminated internationally, these should follow the WMO extension mechanism for extending the schema and the extensions should be standardised where possible with other States, so that the benefits of the extensions use can be realised by all ICAO members.

5.1.4 Data Switch

A Data Switch will route IWXXM data according to the TTAAiiCCCC part of the filename of the File Transfer Body Part. The filename including the current WMO bulletin header will be structured as follows (WMO naming convention A):

A_TTAAiiCCCCYYGGgg*BBB*_**C**_CCCC_YYYYMMddhhmmss**.xml.gz**

Where the elements in black and bold are fixed elements and:

TTAAiiCCCCYYGGgg is the current WMO header with the date time group

BBB is ***optional*** (as usual),

CCCC is the repeated CCCC part from TTAAiiCCCC,

YYYYMMddhhmmss is the date/time group

Note: gzip is used in the MET domain. The ideal situation is to define the same compression technique for all types of ICAO data. If different compression techniques were to be required, this will need to be coordinated and agreed globally.

The routing table will associate this TTAAiiCCCC data identifier with the AMHS addresses where the data should be sent to. The compressed file will be named with the suffix appropriate to the compression and sent onto AMHS.

FTBP name examples with METAR from LFPW:

A_LAFR31LFPW171500_C_LFPW_20151117150010.xml.gz

1st retarded bulletin: A_LAFR31LFPW171500RRA_C_LFPW_20151117150105.xml.gz

1st corrected bulletin: A_LAFR31LFPW171500CCA_C_LFPW_20151117150425.xml.gz

WMO defined T_1T_2 (from TTAAii) for the following IWXXM data types:

- Aviation Routine Report (*METAR*) *LA*
- Aerodrome Forecast (*"short" TAF*) (VT < 12 hours) *LC*
- Tropical Cyclone Advisory *LK*
- Special Aviation Weather Reports (*SPECI*) *LP*
- Aviation General Warning (*SIGMET*) *LS*
- Aerodrome Forecast (*"long" TAF*) (VT >= 12 hours) *LT*
- Volcanic Ash Advisory *LU*
- Aviation Volcanic Ash Warning (*VA SIGMET*) *LV*
- AIRMET *LW*
- Aviation Tropical Cyclone Warning (*TC SIGMET*) *LY*
- *Space Weather Advisory (SWXA)* *LN*

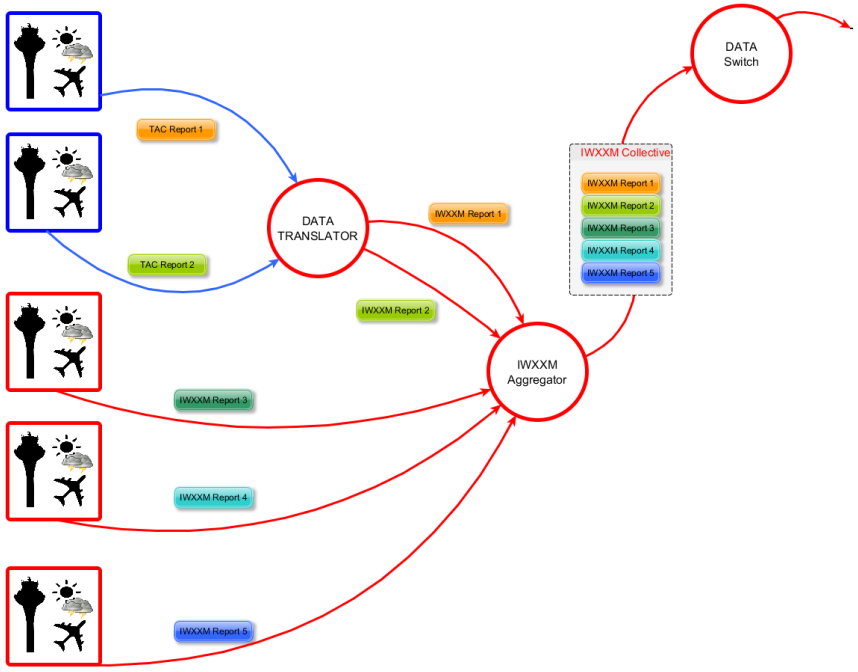

Figure 4: Aggregation of TAC and IWXXM data

5.1.5 International OPMET Databank

An International OPMET Databank (called Regional OPMET databank (RODB) in some regional documentation) will provide the capability for users to interrogate IWXXM data through the AFS in much the same way as the RODBs currently provide global TAC data.

There will be no TAC to IWXXM translation taking place by the Databank in case the requested OPMET is only available in TAC, as this translation should be done upstream by a Translation Centre, unless the databank has formal arrangements to convert TAC to IWXXM on behalf of a State.

Although the implementation of Net Centric Services is beyond the scope of this document, the Databank element could provide Net Centric services in addition to the AFS based IWXXM interrogation capabilities. As

soon as agreed descriptions of the interface to request data via web-services are available, this additional feature may be added for the databank.

For an IWXXM OPMET Databank, the following functions could be the subject of compliance testing.

- The Databank output shall conform to the IWXXM Schema;
- The Databank output shall pass IWXXM Schematron/business rules;
- The Databank has an AMHS interface supporting FTBP;
- Databank shall only send the response back to the originator;
- The Databank shall aggregate the reply reports according to the same rules used by the Data Aggregators;
- The Databank shall apply a correct filename to its output;
- The Databank base correctly compresses data applying an appropriate suffix; and
- The Databank shall respond correctly to the standard interrogations.

The picture below illustrates a possible implementation of an OPMET Databank with combined TAC and IWXXM functionalities.

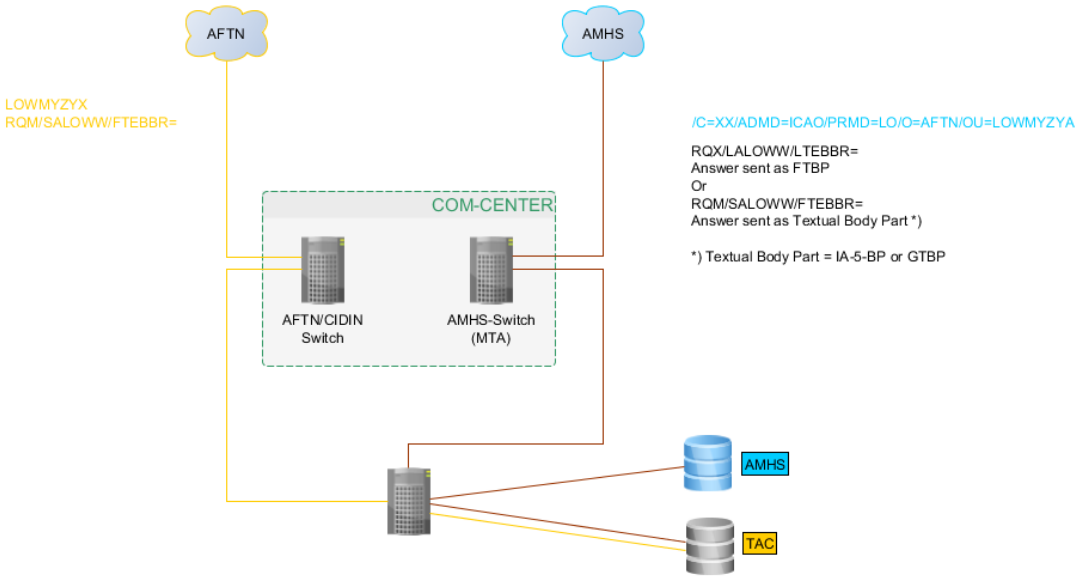

Figure 5: The implementation of a combined TAC & IWXXM Databank

Technical principles:

- Interfaces:
  - the Databank has an AMHS P3 connection to the AMHS Message Transfer Agent (MTA) of a COM centre; and
  - in case the COM Centre still serves AFTN users, the Databank may have a separate AFTN connection to the COM Centres AFTN switch or alternatively, the COM Centre will take care of the AFTN-AMHS conversion.

- Databank tables: data in IWXXM and data in TAC are stored in separate sets of tables.

Operational principles:

- DB Requests

  - Requests for TAC data can be sent via AFTN or via AMHS as international reference alphabet number 5 (IA5) text). These requests will continue to work as described in the current RODB Interface Control Documents;

  - Requests for IWXXM data shall be sent via AMHS as Textual Body Part;

  - Requesting data in IWXXM will work in a similar way as requesting TAC data. The above example uses a syntax similar to the TAC requests, but:

    - "RQX/" is used as the start of the query

    - only the IWXXM T_1T_2 message types defined by WMO (see 5.1.4) are allowed

    For example: RQX/LALOWW/LTEBBR/LSLFFF=

  - Requests for TAC data and requests for IWXXM data shall not be mixed

  - Any violation of the above principles (e.g. the request "RQX/LSLOWW=" received via AFTN), will result in an automatic reply sent by the databank, informing the user that this is not allowed.

- DB Replies

  - Replies to TAC requests will continue to work as described in the current RODB Interface Control Documents.

  - Reply reports of an IWXXM request will be aggregated into one or more files, according to the same rules used by the Data Aggregators, e.g. no mixing of message types in one file.

  - These files will be compressed and a correct file name with appropriate suffix supplied.

  - These files will be sent as FTBP through AMHS and directory services should be used to ensure the recipient is capable to receive this

  - The RODB Interface Control Documents will specify an extended set of standardized information & error replies.

5.2 Regional Centres Definitions

5.2.1 National OPMET Centre (NOC)

The role of the NOC is to gather and validate all required AOP and agreed exchanged non AOP OPMET messages generated by all originating units within a State, to compile national data into bulletins and to distribute them internationally according to the regional distribution schema.

Note: It is assumed that the data provided by NOCs is in accordance with the similar specifications as applicable for an International Data Aggregator

5.2.2 Regional OPMET Centre (ROC)

In its Area of Responsibility (AoR) according to the regional distribution schema, a ROC is responsible for the collection from NOCs of all required AOP and agreed exchanged non AOP OPMET data and for the validation of these OPMET data.

Each ROC is responsible for the collection of these OPMET data from the other ROCs in the region and the dissemination to the other ROCs of these OPMET data from its AoR.

For IWXXM exchange, a ROC should perform the following functions:

- Data Aggregator;
- Data Translation centre; and

- Data Switch.

5.2.3 Interregional OPMET Gateway (IROG)

An IROG is responsible for the collection of all required AOP and agreed exchanged non AOP OPMET data from its Interregional Area(s) of Responsibility (IAoR) and its dissemination to the ROCs in its region. Furthermore, the IROGs are responsible for collection and dissemination of their Region's required OPMET data to their partner IROGs.

The IROG is responsible for the validation of the bulletins sent to the IROGs of its IAoR and received from their IAoR.

For IWXXM exchange, an IROG should perform the following functions:

- Data Aggregator
- Data Translation Centre
- Data Switch

5.2.4 International OPMET Databank

The International OPMET Databank(s) (called Regional OPMET databank (RODB) in some regional documentation and further labelled RODB in this document) are supplied with required OPMET data by the ROCs. These databases can be queried via the AFS by using a specified query language. Details on the query language as well as the supported data types can be found in Regional Interface Control Documents for OPMET Database Access Procedures. Those documents should be updated to integrate the new functions.

A RODB shall be able to fulfil the requirements to handle IWXXM-code as described in paragraph 5.1.5.

6 Generation and use of IWXXM

The IWXXM format is not intended to be read in its raw form by humans. It is intended as a structured, 'machine to machine' message that is then subsequently processed for human interpretation/interaction.

6.1 Operational Status Indicator (PermissableUsage)

Under certain circumstances it has been and will continue to be necessary to distribute meteorological information for test and exercise purposes. To support this need, the IWXXM schema may incorporate non-operational flags.

6.1.1 Definition of Operational and Non-Operational messages

An operational message is one that is intended to be used as the basis for operational decision making. As such, the content of the message may result in decisions that may affect any or all phases of flight by any authorised and competent stakeholder (i.e. air navigation service providers, airport authorities, pilots, flight dispatchers etc). Recipients of such messages (either automatic or human) would therefore expect that the information is sourced from a competent entity and that originating equipment (sensors etc) are serviceable and that any human involvement is carried out by qualified, competent personnel.

A non-operational message is one that is not intended to be used for operational decision making, even though it may contain realistic data (particularly during an exercise). Recipients of such messages shall ignore the content of the message with regard to decision making. Non-operational messages may be further classified as either being related to TEST or EXERCISE.

Definition of Test and Exercise.

There is no known official definition of TEST or EXERCISE within the ICAO lexicon. In some instances, the two words are used interchangeably. Since the use of TEST or EXERCISE would only be used in messages identified as NON-OPERATIONAL, there are circumstances where one may be more appropriate than the other.

TEST messages may be issued for the following reasons:

- As an ad-hoc message to test distribution of a particular message, such as SIGMET when, for example, a new system is installed at an originating centre.
- As part of a more organised test of message routing for non-scheduled messages such as SIGMET.
- As part of the process to introduce IWXXM messages by a particular entity. In this instance, IWXXM messages may be issued on a regular basis over a period of weeks or months in advance of OPERATIONAL status.

In the above cases the messages may contain either realistic data or no data.

EXERCISE messages may be issued for the following reasons:

- As a national or regional (or more rarely 'global') organised event intended to permit stakeholders to become familiar with the data content of messages. An example would be for Regional Volcanic Ash Exercises where stakeholders wish to provide training and 'desk top' scenarios for rare events.
- Under exercise scenarios, the messages will contain realistic data (though not necessarily valid data). For instance, volcanic ash exercises sometimes use volcanic ash data based on historical wind patterns to ensure that the requisite training is provided (i.e. to ensure the volcanic ash data impacts particular FIRs).

6.1.2 Technical Detail on the Operational Status Indicator

Operational Messages:

- Every IWXXM message that is issued for operational purposes shall set the IWXXM element name 'permissibleUsage' to OPERATIONAL.
- Under such circumstances no other information relating to OPERATIONAL status shall be included.

Non-Operational Messages:

- Every IWXXM message that is issued for non-operational purposes shall set the IWXXM element name 'permissibleUsage' to NON-OPERATIONAL.
- Under such circumstances, it will be necessary to provide additional information relating to the reason for the non-operational status.
- The 'permissibleUsageReason' field shall be set to either TEST or EXERCISE.
- The 'permissibleUsageReason' field should contain a short description to provide further information. This is a free text field and is intended to contain the reason for the TEST or EXERCISE. For example;
    - A Volcanic Ash Exercise message may include the name of the exercise in this field 'EUR VOLCEX16'.
    - An organised regional SIGMET test may likewise include 'APAC SIGMET TEST 02 Nov 2016'.
    - For an entity initially issuing IWXXM data as it enters the final phase of transition to IWXXM, production may include 'TEST IWXXM DATA PRE-OPERATIONAL' or similar.
    - Whilst the 'permissibleUsageReason' field may be left empty, this is not considered to be good practice. Where possible, the field should contain some description of the reason for the TEST or EXERCISE.

The examples below are provided for reference:

Example 1: Operational IWXXM data

```
<IWXXM:CLASSNAME ... permissibleUsage ="OPERATIONAL">...</IWXXM:CLASSNAME>
```

Example 2: 'Test' IWXXM data

```
<IWXXM:CLASSNAME ... permissibleUsage ="NON-OPERATIONAL" permissibleUsageReason
="TEST" permissibleUsageSupplementary ="EUR SIGMET TEST 17/09/2018">...</IWXXM:CLASSNAME>
```

Example 3: 'Exercise' IWXXM data

```
<IWXXM:CLASSNAME ... permissibleUsage ="NON-OPERATIONAL" permissibleUsageReason
="EXERCISE" permissibleUsageSupplementary ="EUR VOLCEX 12/03/2018">...</IWXXM:CLASSNAME>
```

Notwithstanding the explicit inclusion of TEST and EXERCISE indicators in all IWXXM messages, it is considered to be best practice to always forewarn stakeholders of TEST events, and in particular EXERCISE events, whenever possible. The message originator, and/or the EXERCISE coordinator where applicable, should consider the most appropriate method to notify stakeholders. A non-exhaustive list of methods would include, State Letter, Exercise Directives, administrative messages, and emails.

It should be noted that, independently of the status of the data, the distribution of data should remain the same (whether the permissibleUsage is OPERATIONAL or NON-OPERATIONAL).

6.2 Unique GML.ID

The gml.id attribute is required to be unique within a XML/GML document. it is not difficult for an IWXXM message creator to make all gml:id unique with the use of, say, natural keys, however when similar types of IWXXM messages like METAR/SPECI or TAF are aggregated (with the use of the COLLECT schema for example), there may be cases of overlap if natural keys are used.

Therefore it is recommended Version 4 of Universal Unique Identifier (UUID - a 128-bit number) is used for gml:id to uniquely identify the object or entity. A fragment of IWXXM METAR message aggregated with COLLECT schema showing the use of UUIDv4 in gml:ids is as follow:

<collect:MeteorologicalBulletin … gml:id= "uuid.6f353602-12a1-40a7-b6b5-3edb14c6241e">

<collect:meteorologicalInformation>

<iwxxm:METAR … gml:id="uuid.15ff064a-6dc4-41e0-bafa-8ee78ed4dc25">

…

A schematron rule should be added from IWXXM v3 to mandate the use of UUIDs in gml:id for IWXXM messages.

6.3 Translating TAC to IWXXM

A Translation Centre will typically be placed after the National OPMET Centre (NOC) or Regional OPMET Centre (ROC) or Regional OPMET Data Bank (RODB) and its correction facilities, if any. Correction will not typically be applied by the Translation Centre but the ROC, NOC or RODB.

When generating the IWXXM, the translator shall include IWXXM fields which define where and when the translation has been carried out in order to provide traceability. This shall be achieved by introducing agreed metadata elements (centre identifier and time stamp) that is part of IWXXM.

Amendment 78 to ICAO Annex 3 includes TEST and EXERCISE fields in the TAC templates for SIGMET, AIRMET, VAA and TCA (with applicability of November 2019) since these non-scheduled messages are from time to time issued during tests and exercises. Until the changes in Annex 3 are implemented following its templates, it will be difficult for the translator to identify test messages. When uncertain, such as when translation fails, the IWXXM should always be presumed to be operational (refer to section 6.1) so that the original TAC message is available for reviewing by a human.

6.3.1 Pre-requisites for Translation Centres

The following items are considered pre-requisite for data translation centres:

- Operate on a permanent 24/7 basis with 24-hour support;
- Robust network between MET node and national AFS node (example, redundant or dual connectivity for the telecommunication links);
- Access to the incoming TAC data and outgoing IWXXM (an AMHS enabled AFS Centre supporting FTBP that is able to send IWXXM data to the AFS;
- Provide IWXXM bulletin compilation (collection) capability; and
- Archive of at least the last 28 days data and logs of at least on the last 2 months translation details (at minimum, full WMO header received, time of reception, rejection or not).

6.3.2 Data Validation

The data validation should be based upon the following:

- Annex 3 provisions / WMO regulations should be used as the basis of validating received TAC information.
- The most recent official version of the IWXXM schema/Schematron should be applied, unless an explicit agreement between the requiring centre and the Translation Centre is agreed.
- The format should be based upon WMO – No. 306, Manual on Codes, Volume I.1, Part A – Alphanumeric Codes FM where applicable; and the WMO FM201 (collect) and FM 205 (Met Information Exchange Model) should be followed.
- The aeronautical metadata descriptions follow AIXM schema. The process for updating metadata should be documented.

6.3.3 Incomplete (Partial) Translation

When TAC to IWXXM translation is necessary but fails, an IWXXM message of the corresponding type (METAR, TAF, …) without any translated MET parameters but containing the original TAC message should be disseminated to users for their manual interpretation. It is also recommended that, if possible and where agreed, an error message be sent to the TAC originator encouraging the TAC originator to re-issue a valid TAC message for subsequent translation and distribution. Another possible policy would consist in having regular monitoring for a past period and communicate back pertinent elements on errors in coding policy to data originators, regional data exchange working groups and/or some users, where agreed.

Transmitting an IWXXM message with minimum data will allow users to monitor only a single meteorological data stream, reducing the dependency on the TAC stream.

The following minimum set of data should be considered:

METAR:

METAR (COR) CCCC YYGGggZ

TAF :

TAF (COR/AMD) CCCC YYGGggZ

SIGMET/AIRMET:

CCCC SIGMET | AIRMET ... VALID YYGGgg/YYGGgg

VAA :

DTG, VAAC

TCA:

DTG, TCAC

SWXA :

DTG, SWXC

where " | " indicates a logical "OR", "(group)" indicates an optional group

6.3.4 Monitoring Functions

The Translation Centre should monitor incoming TAC messages and keep statistics on the data received and IWXXM generated. The statistics collected should be based upon the detail of IWXXM Validation Statistics to be Gathered by ROCs an RODBs (section 8.1).

6.3.5 Validation of the Translator

A TAC to IWXXM Translator could be the subject of compliance testing of the following:

- The Translator output will conform to the agreed IWXXM Schema;
- The Translator output will pass IWXXM Schematron/business rules;
- The Translator will successfully translate a standard set of TAC test data;
- The Translator provides metadata related to when and where data have been translated (see section 4.1.3) - such metadata conforms to the agreed metadata structure; and
- The Translator will apply appropriate (defined) metadata following agreed ICAO rules e.g. for monitoring and validation issues.

The test cases and operated tests to demonstrate the capability of the translator should be made available on request.

The expected data quality on incoming TAC data should be clearly stated and the limitation on the translator (what will be done/what will not or cannot be done) should be stated.

6.3.6 Commencement of Translation Services

It is recommended that initially the Translator should generate data and set the Operational Status Indicator field as “non-operational” and disseminate the IWXXM to a reduced number of recipients wishing to receive the IWWXM to ensure that all the relevant procedures and operations are in place and are clearly understood.

If felt necessary, a learning strategy could be applied such as the reception for an agreed defined period, prior to the operational emission of the IWXXM data. During that period, there could also be another defined contact point on the TAC-producer side to be reached during business hours. In case of an incorrect/rejected TAC message, a procedure should be in place to contact the appropriate State and to request corrections to the incoming TAC.

The date to start the exchange of data operationally should be agreed.

6.3.7 Translation Agreement

The following elements should be contained in the service agreement between the Translation Centre and applicant State:

- Hours of Translation Centre operations (24 hours, 365 days a year);
- Business contact details (e.g. name, phone, email) for both the Translation Centre and the applicant State;
- Operational (24Hr) contact details for both the Translation Centre and the applicant State;
- Details of which data is to be translated (e.g. WMO Header(s) of TAC data, locations indicators, frequency);
- Details of whether and when the originator should be notified when translation of individual messages fails;
- IWXXM distribution details (AMHS addresses);
- Details of which metadata should be used to derive the limits of airspace (boundaries, base, top).
- The aeronautical metadata descriptions follow AIXM schema. The process for updating metadata should be documented.
- Archiving requirements; and
- Procedure on what will be done in case of a failure of all or part of the Translation Centre functionality.

7 Requirements to Transition

The first necessary step is to define the prerequisites in order to be able to exchange IWXXM OPMET data. This will impact not only the network itself, but also the Message Switching Systems and most of the end-user systems.

7.1 Phase 1: Pre–Requisites to Transition

Phase 1 was enabled by Amendment 76 to Annex 3 in November 2013.

To achieve an efficient transition towards IWXXM, Phase 1 activities focused in the following areas and the particular elements identified per area.

7.1.1 Managing the Transition

Regional group(s) should be designated to deal with the transition in order to further define and monitor:

- Intra-regional plan on AMHS infrastructure/links planning and IWXXM data exchange between the ROCs, and between the ROCs and RODBs.
- Intra-regional implementation plan on IWXXM data exchange planning by the States to their ROC.
- Agreement to define how the testing platform and software should be made available and accessible to each State.

It is desirable that responsible group(s) for managing the transition in each ICAO regions be identified and established, that could be responsible for defining the Regions structure and capabilities in the context of the framework.

Furthermore, a full liaison should be established and maintained between the ICAO groups in charge of meteorology & data exchange and groups in charge of the AFS network.

For data translation purposes, if there is a systematic need for the translation of data on behalf of a State, this may be performed by the dedicated ROC for the part of the region under its Area of Responsibility and the IROGs for the interregional distribution.

7.1.2 Documentation

The region should define and have a plan in place to provide IWXXM data. This plan shall be published and maintained by the designated responsible groups (FAQ's etc. should be available).

ICAO and WMO documentation and provisions should be published/available describing the IWXXM code itself as well as documentation referencing the appropriate schemas and rules made available in order to handle this new format.

Cyber Security

Appropriate AFS security elements should be defined by the ICAO groups in charge of information management / networks in order to introduce the operational exchange of IWXXM data via extended AMHS.

It is recommended that appropriate malware and anti-virus precautions are exercised as a bare minimum when dealing with FTBP messages.

7.1.3 Processes

An agreed process should be defined to ensure that data generated by Data Producers are compliant. In order to promote the use of IWXXM, the process should be widely known and shared and some tools to check the compliance state of the data easily accessible and usable.

An identical process should be agreed to initiate and enable the IWXXM exchange between regions.

An AMHS network will be available to support exchange IWXXM data by the use of FTBP between those States wishing to do so. Corresponding AMHS connections should be made available between those Regions exchanging IWXXM data.

Source of Metadata

Updated processes, or notification on modifications about Aeronautical information metadata by the States, should be in place at the end of the period, or metadata sources should be defined and agreed.

Action Plan to Reduce Formatting Errors

Actions plans based on monitoring results about OPMET data not following the agreed coding rules should be undertaken in order to assist States in detecting and correcting incorrect coding policies.

A task should be started to define a procedure that the ROC may use on how to deal with errors in IWXXM-messages, in particular taking into account errors detected in converting TAC-reports. This procedure would ideally provide a clear description on how to report errors to a State that provides these data and clearly define the service and its limitation.

Interregional Cooperation/Coordination

The following tasks should be started:

- The updated processes and notification on modifications on IWXXM bulletins headers between adjacent regions.
- Identification of the interregional exchanges solely based on required AOP and agreed exchanged non-AOP data: actions plans to define clearly the interregional data/bulletins to be exchanged.
- Interregional plan to follow the AMHS infrastructure/links planning between AFS nodes supporting interregional data exchange of neighbouring IROGs.
- Implementation plan for interregional exchange between IROGs.
- An update process to introduce IWXXM in the contingency plans for the IROGs.

7.2 Phase 2: From Nov 2016 until IWXXM Exchange is a Standard

The following elements should be ready prior to the exchange of OPMET data in IWXXM format becoming an ICAO Annex 3 standard, which is defined in Amendment 78, with effect in November 2020.

7.2.1 Operations

- The ROCs & IROGs should have the capability to aggregate and switch IWXXM data.
- The ROCs & IROGs may have the capability to act as translation centres.
- Each NOC should to be ready to exchange IWXXM data at the end of the period.
- The RODBs should have all the capabilities to deal with IWXXM data as well as TAC data.
- Update process or notification on modifications about metadata should be in place not later than the end of the period.
- The standard set of queries for IWXXM data for a RODB should be implemented and documented.
- Updated processes and notification on modifications on IWXXM bulletins headers between adjacent Regions should be in place and tested.

7.2.2 Processes

Institutional and Technical Issues

- A communication plan should be established and enacted to inform States and users - both from ICAO and WMO - about the IWXXM code, the metadata use, and the new procedures to access the RODBs.
- The IWXXM model should integrate the metadata related to Data Aggregator and Data Translator functions.
- A procedure used by the ROC should be in place on how to deal with errors in IWXXM-messages, in particular taking into account errors detected when converting TAC-reports. This procedure includes items on how to report errors to a State that provides these data.

Action Plan about data validation

- 'Validation' (validation against the XML schema) is the specific monitoring and gathering of statistics on schema conformance rather than meteorological data quality.
- Action plans based on monitoring results about TAC data not following the agreed coding rules should be in place in order to assist States in detecting and correcting incorrect coding policies.
- A procedure that the ROC can use on how to deal with errors in IWXXM-messages, in particular taking into account errors detected in converting TAC-reports, should be agreed on and made available. This procedure would ideally provide information on how to report errors to a State that provides these data and clearly define this service and its limitation.
- Messages that do not pass validation against the XML schema will continue to be passed and not rejected by ROCs/RODBs.
- States shall arrange the validation of their IWXXM messages against the corresponding XML schema, and make corrections to the process of generating their IWXXM messages as necessary, as per quality management processes.
- The ROC/RODB should conduct validation of IWXXM messages within their region/area of responsibility, excluding validation of 'State extensions'.
- ROC/RODBs should gather statistics on long-term validation results, broken down by State and Region, and provide this information to the relevant ICAO Regional Office and the METP (in particular WG-MIE and WG-MOG) to identify common or troublesome data quality issues.
- Users should be encouraged to continue to validate messages and they will remain responsible for making sure that the received IWXXM messages are suitable for their purposes.
- Users should review the IWXXM PermissableUsage field to determine whether the message is suitable for operational, test or exercise purposes.

Regional Coordination/Planning

The regional group(s) designated to deal with the transition should define and monitor:

- Intra-regional plans regarding AMHS infrastructure/links and IWXXM data exchange between the ROCs, and between the ROCs and RODBs.
- Intra-regional plans regarding the IWXXM data exchange by the States to their ROC.
- The Contingency plans for the ROCs should integrate the IWXXM data and be ready before the end of the period.
- Testing platform and software are made available and accessible for every State.

Interregional Cooperation/Coordination

- The interregional mechanism to follow the AMHS infrastructure/links planning between AFS nodes supporting interregional data exchange between IROGs should be in place, as should the interregional procedure to notify the changes and new IWXXM bulletins introduction.
- The Contingency plans for the IROGs should include the IWXXM data exchange and be ready at the end of the period.
- It is proposed that bilateral agreements between neighbouring IROGs are set up for the translation of TAC data. This agreement should include notification processes on IWXXM data newly produced by the specific Region.

Figure 6 below provides an example of the ICAO Region 1 interfacing with two other ICAO Regions. In this example, it is assumed that:

- There is no operational exchange of IWXXM data between Region 1 and Region 3.
- There is operational exchange of IWXXM data between Region 2 and Region 1.

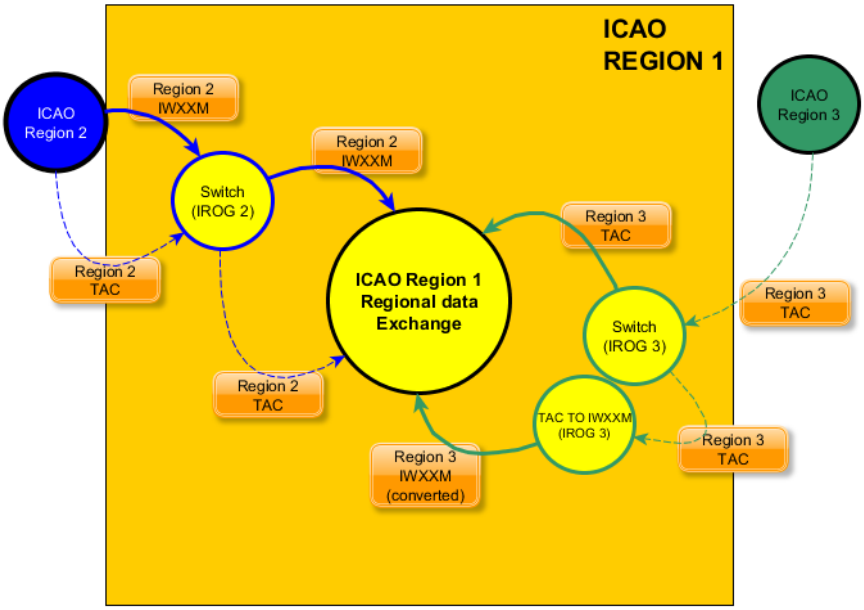

Figure 6: Phase 2, interregional exchange of OPMET with Region 2 (IWXXM & TAC capable) and Region 3 (TAC capable)

7.3 Phase 3: After IWXXM Exchange becomes a Standard

This section is reserved for capability that should be ready from ICAO Annex 3 Amendment 79 applicability date and is yet to be populated.

8 Data Validation and Statistics

8.1 IWXXM Validation Statistics to be Gathered by ROCs an RODBs

Regions should invite their ROCs, IROGs, and/or RODBs to provide statistics about IWXXM data reception, state of compliance of the received data, IWXXM version used, data volume etc. as a measure of the state of IWXXM implementation.

This section defines the general rules about gathering statistics with the aim of providing and proposing a globally consistent way of defining such statistics, assisting the inter-regional comparison and providing a solid bases for the regions to use those statistics as a way to measure IWXXM implementation progression.

8.1.1 Data and Type of Data

Regular Data

The location indicators for regular data should be ICAO compliant indicators (as available on integrated Safety Trend Analysis and Reporting System (iSTARS)) and in conformance with the MET tables defined in the eANPs. For METAR and TAF, it should be noted that the eANP is only required to reference the AOP aerodromes and therefore the minimum set of statistics should be the regular data (i.e. METAR, TAF) related to AOP aerodromes. In addition, if desired, statistics on the agreed exchanged non-AOP aerodromes data can be provided. A clear distinction should appear while presenting statistics to easily discriminate data related to AOP aerodromes from non-AOP aerodromes, where those last ones are presented.

The statistics for IWXXM data should be identical to those provided for TAC data, so as to provide a clear comparison between TAC and IWXXM data produced for the same location and to provide the number of received messages per day (not NIL, not corrected or amended).

Whilst the validation of all messages is encouraged, NIL data, TAF amendments and corrections should not be taken into consideration while producing statistics. The type of TAF (short or long) is defined in eANP Volume II and may be considered to measure the ad-equation to the requirements, if some indices are used in addition to basic statistics.

Non-regular data

The location indicators for non-regular data should also be ICAO compliant indicators (as available on iSTARS) and in conformance with the MET tables defined in the eANPs. For SIGMET, and where applicable AIRMET, they refer to FIR, FIR/UIR, CTA.

The statistics should also be available for VAA and TCA, and for space weather when implemented.

8.1.2 Proposed Statistics

Availability

Availability statistics for IWXXM data should be identical to those provided for TAC data, so as to provide a clear comparison between TAC and IWXXM data produced for the same location and provide the number of received messages per day, not NIL, not corrected, not amended (including not cancelled for TAF). For AIRMET and SIGMET, the cancelled data should not be considered. For VAA and TCA, the number of VAA and TCA per VAAC and TCAC respectively should be provided.

The statistics for VAA/TCA is by nature more complex as the VAA/TCA may refer to VA/TC in other regions, cover multiple FIRs and does not directly refer to location indicators. The distinction between a VAA/TCA that concerns specific region can only be derived by analysing the MET content. Therefore, basic statistics about VAA/TCA reception by the ROC/RODB from the VAAC/TCAC may be considered as a starting point, without any consideration of the content.

Timeliness

Timeliness statistics for IWXXM data should be identical to those provided for TAC data, as to provide a clear comparison between TAC and IWXXM data produced for the same location. The statistics should take into consideration the same source of information as for availability.

Specific statistics about IWXXM model or version

IWXXM validation

The validation against schema/Schematron (i.e. success rate) should be provided. Statistics about the validation should be provided per IWXXM version and will provide a good indication on what data are produced for which IWXXM version.

Acceptance of different versions of IWXXM model

It should be determined whether IWXXM data which is in conformance with a previous version of IWXXM could be considered as “valid” or only the last published official version of IWXXM by the World Meteorological Organization (WMO). A clear policy is yet to be developed by ICAO.

It should be understood that, for statistical purposes, the production of statistics for all received versions is the only correct way to have a good measure of the disseminated products. Therefore, a statistic per station and per version (with the limits previously explained) should be provided, even if it should be unlikely to have different versions of IWXXM schema disseminated for the same location and same type of data. The statistics should provide which version is used for the dissemination of which data per location indicator (and VAAC/TCAC for VAA/TCA).

Operational/non-operational data

The statistics of non-operational versus the total number of data (i.e. percentage of non-operational reports delivered).

Incomplete/Partial Translations

The statistics of incomplete/partially translated versus the total number of reports.

Data volume

Statistics of total data volume for the same location indicator (VAAC/TCAC for VAA/TCA) and daily average/daily total volume.

Additional groups (extensions)

Some statistics could be presented about the number of data with extensions versus the total number of data (with and without extension) per location indicator (VAAC/TCAC for VAA/TCA).

Another statistic about the daily average/ daily total volume of extensions compared to the total volume of data per location indicator (VAAC/TCAC for VAA/TCA) could also be provided.

Optional statistics

ROCs/RODBs could also choose to provide additional statistics about validation failure, to identify deviations from the models, which could be used to derive systematic errors such as the inclusion of additional data elements via methods other than the global agreed way, non-conformance on cardinality or NIL reason for missing mandatory Annex 3 elements.

8.1.3 Statistics Presentation

Statistics should be made available and presented per ICAO region, then per State, then per location indicator (CCCC) with each time an aggregation of the provided statistics from the sub-levels to the upper level (CCCC → State → Region). For VAA/TCA, it should be presented per Region and then per VAAC/TCAC.

The statistics should be gathered on a daily basis, then by monthly basis. The statistics could be provided offline, the day after or some days after.

8.2 IWXXM Validation Statistics to be Gathered by SADIS & WIFS

The SADIS and WIFS Provider States are investigating the value and effort to produce global sets of statistics based upon the data received at their gateway. The details are likely to be the same or similar to those produced by ROCs or RODBs but this is yet to be confirmed.

9 Acronyms and Terminology

AFS	Aeronautical Fixed Service
AFTN	Aeronautical Fixed Telecommunication Network
AIXM	Aeronautical Information Exchange Model
AMHS	ATS Message Handling System
AMO	Aerodrome Meteorological Office
AoR	Area of Responsibility
APAC	ICAO Asia/Pacific Region
AvXML	Aviation XML
COM	Communication
DB	Databank
EUR	ICAO European Region
FAQ	Frequently Asked Questions
FASID	Facilities and Services Implementation Document
FIR	Flight information Region
FIXM	Flight Information Exchange Model
FTBP	File Transfer Body Part
GML	Geography Markup Language
IAoR	Interregional Area of Responsibility
ICAO	International Civil Aviation Organization
ICD	Interface Control Document
IHE	IPM Heading Extension(s)
IPM	Interpersonal Messaging (AMHS)
IROG	Interregional OPMET Gateway
IUT	Implementation Under Test
IWXXM	ICAO Meteorological Information Exchange Model
METAR	Meteorological Aerodrome Report
METP	ICAO Meteorology Panel
MTA	Message Transfer Agent
MWO	Meteorological Watch Office
NDR	Non-Delivery Report
NOC	National OPMET Centre
OGC	Open Geospatial Consortium
OID	Object Identifier
OPMET	Operational Meteorological information

P3	Message Submission and Delivery Protocol
ROC	Regional OPMET Centre
RODB	Regional OPMET Databank (International OPMET Databank)
RQM	Meteorological Databank Request in TAC-format
RQX	Meteorological Databank Request in IWXXM-format
SIGMET	Significant Meteorological Information
SPECI	Special Meteorological Report
SWIM	System Wide Information Management
TAC	Traditional Alphanumeric Code Form
TAF	Aerodrome Forecast
TCA	Tropical Cyclone Advisory
UA	User Agent
VAA	Volcanic Ash Advisory
WMO	World Meteorological Organization
XML	Extensible Markup Language

Appendix A: AMHS Profile Information to Support IWXXM Exchange

1. Introduction

A number of standards have been established by ISO for Message Handling Systems.

In order to describe which standards or group of standards, together with options and parameters, are needed to accomplish a function, it is necessary to specify a profile. Such profiles have been standardized by ISO and are known as International Standardized Profiles (ISPs). Profiles standardize the use of options and other variations in the base standards and deal primarily with the use of implemented capabilities in order to meet requirements for interoperability and efficient interworking.

ICAO Doc 9880, Part II contains the detailed technical specifications for ATSMHS based on a number of international standards and ISPs, complemented by additional requirements. The basic and the extended ATSMHS services meet the basic requirements of the respective ISPs but additional features and supplementary functions are incorporated as necessary in ICAO Doc 9880, Part II. In order to express conformance requirements, i.e. static capability, ICAO Doc 9880, Part II uses the classification defined in the ISPs to include different levels of support (mandatory, optional, etc.). These requirements, applying to the related parameters or elements are specified in the form of Profile requirement lists (PRLs). In a limited number of cases, the PRLs may also include dynamic behaviour requirements, using another classification also defined in the ISPs.

It is noted that the classification of a feature as mandatory in the ISPs corresponds to a requirement regarding static capability, i.e. the ability to generate and/or receive, encode and/or decode a specific parameter, but not to use this parameter in every message sent or received. The same logic is applicable to ICAO Doc 9880, Part II and, as an example, the EUR AMHS Manual.

Furthermore, it is recalled that in ICAO Doc 9880, Part II, for the Basic ATS Message Handling Service, the interface between the ATS Message User Agent and the ATS Message Server has been left open, since this is often an implementation matter local to each AMHS Management Domain. Conversely, for the Extended ATS Message Handling Service, implementation of a P2/P3 or P2/P7 profile compliant with the relevant MHS ISP (among ISP AMH23 to AMH26) is mandated.

The question of compliance with a P2/P3 or P2/P7 ISP for AMHS conformance should be addressed in the context of an implementation making use of some functionalities part of the Extended Service, but not of the whole of it. In particular, it is not specified whether a partial Extended Service implementation which does not include AMHS Security requires conformance with one of the AMH23 to AMH26 profiles or not.

User agents may be implemented exclusively for the support of a specific application/service. Such dedicated user agents may not need to implement all the features defined by ICAO Doc 9880, Part II, and parts of regional AMHS Manuals, where defined. For example, dedicated user agents implemented for the exchange of OPMET data formatted based on the IWXXM model are not supposed to generate messages with SS priority. Similarly, these user agents are not expected to receive messages with SS priority, although this could happen at the reception direction, at least by mistake.

Mandating implementation of features which are not required by the application/service served by certain user agents may generate additional complexity and impose implementation delay, effort and cost, without any operational benefit. In order to eliminate such impediments and facilitate the adoption of the ATS Message Handling Service by end users, the need of defining application/service oriented AMHS profiles, which clarify requirements and may relax some of them by mandating less features than the current AMHS specification, should be recognized. The definition of an IWXXM profile which is applicable to explicit, limited environments, i.e. submission of OPMET data, taking into consideration which features are useless for the specific application/service. The relaxed requirements concern message submission only.

Implementations complying with an application/service oriented AMHS profile are accepted for connection to the AMHS, although possibly not fully compliant from a formal standpoint, provided that conformance to the AMHS IWXXM profile is verified.

2. AMHS Profile for OPMET IWXXM data exchange

AMHS is the intended communication means for MET IWXXM data exchanges using FTBP.

AMHS UAs complying with ICAO Doc 9880, Part II, Second Edition and where applicable, with the additional provisions of regional AMHS Manual, are capable to originate and receive AMHS messages containing such data. The support by UAs of IPM Heading Extensions (IHE), defined in ICAO Doc 9880, Part II as part of the Extended ATS Message Handling Service, is additionally required but represents a minor upgrade already available in several UA implementations.

However, to ensure unambiguous interpretation of messages upon reception, and to facilitate their origination, it is necessary to establish a detailed specification of X.400 and AMHS parameters to be adopted for conveyance of such messages, including those associated with the AMHS file-transfer-body-parts (FTBP).

2.1. Scope of the profile

This profile specification is established for application by AMHS UAs submitting and/or receiving OPMET data in IWXXM format through a P2/P3 or a P2/P7 interface, implemented as part of the following centres or systems:

- National OPMET Centre (NOC)
- Regional OPMET Centre (ROC)
- Interregional OPMET Gateway (IROG)
- Regional OPMET Databank (RODB)
- Any terminal or system receiving or requesting OPMET data in IWXXM format from one of the above centres/systems

This specification is based on the following assumptions, which identify topics out of scope of the AMHS profile, which are addressed in the MET domain:

- The MET domain may add further data types to the IWXXM without affecting the AMHS profile. It is assumed that irrespective of the data format (bulletin or report), the MET domain will always pass an unstructured binary file with a defined filename to the AMHS.
- Data compression will always be performed in the MET domain. The AMHS will not perform compression.
- The MET Domain will define procedures for the submission of RQX messages to RODBs.

2.2. Definition of the profile

A profile based on the exclusive use of the Extended Service shall be used. As a result the IPM-Heading-extensions (IHE) need to be used to carry the ATS priority, Filing time and Optional Heading Information. However, only some of the functional groups which are part of the Extended Service are needed for the profile, namely FTBP and IHE. More specifically, the profile does not require support of AMHS security.

2.2.1. Number of body parts

The IPM body shall contain exactly one body-part which is an FTBP.

The body part selection shall be as represented using the following tabular description.

Table 1: Body part selection for the IWXXM profile

(derived from ICAO Doc 9880 Part II Tables 3-1 and 3-2)

Ref	*Element*	*Doc 9880 static support (Extended Service) Orig/Rec*	*Doc 9880 reference*	*Dynamic action upon generation of IWXXM message*	*Value and/or comments*
Part 2: AMH21/A.1.3 IPM body					
1	ia5-text	O/M		X	
1.2	data	M/M	3.3.3	X	
10	bilaterally-defined	O/M	3.3.5	X	
Part 3: AMH21/A.1.3.1 Extended body part support					
1	ia5-text-body-part	O/M		X	
9	bilaterally-defined-body-part	O/M	3.3.5.1	X	
11	general-text-body-part	M/M	3.3.3 and Part 4, Table 3-1	X	
12	file-transfer-body-part	M/M	3.3.5.1 and 3.3.5.2	G	AMH21/ A.1.3.3
M = mandatory support (static support) O = optional support (static support) or optionally generated (dynamic behaviour) G = generated X = not used					

2.2.2. Selection of IPM heading parameters and parameter values

2.2.2.1. The IPM Heading parameter selection and values are listed in Table 2 below

Table 2: IPM Heading parameters for the IWXXM profile

(derived from ICAO Doc 9880 Part II Table 3-2)

Ref	*Element*	*Doc 9880 static support (Extended Service) Orig/Rec*	*Doc 9880 reference*	*Dynamic action upon generation of IWXXM message*	*Value and/or comments*
Part 1: AMH21/A.1.2 IPM heading fields					
1	this-IPM	M/M	3.1.2.2.1, 3.1.4.2.1 (AMH21 support)	G	
2	originator	M/M		G	Address of the originating OPMET system (MET switch)
3	authorizing-users	O/M		X	
4	primary-recipients	M/M		G	Recipient addresses are populated by the MET switch based on its routing table (EUR Doc 033 section 5 .1.4)
5	copy-recipients	M/M		X	
6	blind-copy-recipients	O/M		X	
7	replied-to-IPM	M/M		X	
8	obsoleted-IPMs	O/M		X	
9	related-IPMs	O/M		X	
10	subject	M/M		G	This field shall carry the TTAAiiCCCCYYGGggBBB part of the filename of FTBP. It is assumed that the subject field is easier to access for human operators in case of retrieval or analysis of transferred messages
11	expiry-time	O/M		X	
12	reply-time	O/M		X	
13	reply-recipients	O/M		X	
14	importance	O/M		X	The receiving UA shall assume that this field takes its default value (“normal”)
15	sensitivity	O/M		X	
16	auto-forwarded	O/M		X	
17	extensions	M/M	3.3.4.1	G	

Ref	*Element*	*Doc 9880 static support (Extended Service) Orig/Rec*	*Doc 9880 reference*	*Dynamic action upon generation of IWXXM message*	*Value and/or comments*
17.6	authorization-time	M/M	3.3.4.2	G	Equivalent to filing time
17.12	originators-reference	M/M	3.3.4.3	X	To avoid confusion with the use of this field in the IHE context (where it is carrying data converted to/from AFTN OHI)
17.13	precedence-policy-identifier	M/M	3.3.4.5, 3.3.4.6 and 3.3.4.7	G	OID value {iso (1) identified-organisation (3) icao (27) atn-amhs (8) parameters (0) amhs-precedence-policy (0)} (see Doc 9880, 3.3.4.7)
Part 4: AMH21/A.1.5 common data types					
1	RecipientSpecifier				
1.2	notification-requests	M/M	3.3.6	X	
1.2.1	rn	M/M	3.3.6	X	IWXXM never use priority SS
1.2.2	nrn	M/M		X	Doc 9880 does not foresee the presence of nrn-request
1.4	recipient-extensions	M/M	3.3.4.1	G	
1.4.3	precedence	M/M	3.3.4.8	G	Equivalent to priority GG: precedence value = 28 (TAF, METAR/SPECI, and also in case of AMD, COR or RTD reports/bulletins) Equivalent to priority FF: precedence value = 57 (AIRMET, SIGMET, VAA, TCA)
2	ORDescriptor				
2.1	formal-name	M1/M1		G	used for originator-address and recipient-addresses

M = mandatory support (static support)

M1 = mandatory O/R name minimal support (static support)

O = optional support (static support) or optionally generated (dynamic behaviour)

G = generated

X = not used

2.2.2.2. Content of body parts

The parameters composing the FTBP shall be in line with the details provided in Table 3 below.

Note: The references to EUR DOC 020 have been indicated to provide more details, if needed.

Table 2: File Transfer parameters for the IWXXM profile

Ref	*Element*	*ATS Messaging Service Profile - static support Orig/Rec*	*European ATS Messaging Service Profile - Reference*	*Dynamic action upon generation of IWXXM message*	*Value and/or comments*
1	related-stored-file	-			
2	contents-type				
2.1	document-type				
2.1.1	document-type-name	M/M	A.2.4.2.1	G	default OID value: 1.0.8571.5.3 {iso(1) standard(0) 8571(8571) document-type(5) unstructured-binary(3)}
3	environment				
3.1	application-reference				
3.1.1	registered-identifier	O/M	A.2.4.2.2 and A.2.4.2.6	G	OID value: 1.3.27.8.1.2 {iso (1) identified-organisation (3) icao (27) atn-amhs (8) application (1) digital-met (2)}
3.4	user-visible-string	O/M	A.2.4.2.6	G	“Digital MET”
4	compression	-			See para below
5	file-attributes				
5.1	pathname				
5.1.1	incomplete-pathname	O/M	A.2.4.2.3	G	bulletin file name as specified in section 5.1.4
5.5	date-and-time-of-last-modification	O/M	A.2.4.2.4	O	

Ref	*Element*	*ATS Messaging Service Profile - static support Orig/Rec*	*European ATS Messaging Service Profile - Reference*	*Dynamic action upon generation of IWXXM message*	*Value and/or comments*
5.13	object-size				
5.13.2	actual-values	O/M	A.2.4.2.5	O	
6	extensions	-			

M = mandatory support (static support)

O = optional support (static support) or optionally generated (dynamic behaviour)

G = generated

X = not used

Compression of the data to be transferred, if needed, shall be performed in the MET domain before creating the FTBP. This avoids using the “compression” field of FTBP, reduces the UA complexity and limits the FTBP functionality to message exchange mechanisms.

The IWXXM data itself shall be included in the FileTransferData element of the file-transfer-body-part. It should be noted that ISO/IEC 10021-7 / ITU-T X.420 (section 7.4.12) specifies the ASN.1 encoding to be used, and that ISO/IEC ISP 12062-2 (section A.1.3.1) expresses additional recommendations regarding this encoding, which should be “octet-aligned EXTERNAL”. Only one EXTERNAL component should be used.

2.2.2.3. Selection of used P3/P1 envelope parameter values

The mapping of P2 parameters onto P3 envelope parameters shall be as specified in ICAO Doc 9880 and X.420.

IPMs with a precedence value of 28 shall use the priority abstract-value “non-urgent”. IPMs with a precedence value of 57 shall use the priority abstract-value “normal”.

The encoded-information-types in the P3 submission-envelope shall be limited to the OID value specified for FTBP (see ITU-T X.420:1999 7.4.12.8, 20.4.c and Annex C), i.e. OID {joint-iso-itu-t(2) mhs(6) ipms(1) eit(12) file-transfer(0)}.

2.2.2.4. Relaxed requirements from complete AMHS specification

Implementers must be aware that due to the “relaxed” status of the requirements above, any of these requirements may be reverted back to a “mandatory” status in a future profile version, as soon as the need for the corresponding missing feature(s) appears operationally. Conformance with the profile implies a commitment to support such evolutions in the profile, which may be considered as “return-to-normal” in terms of AMHS conformance.

Appendix B: Sample Tests for NOCs to Conduct when Introducing IWXXM

Proposed Conformance Tests

1. General description

This section proposes a list of functional tests that allows verification of conformance of User Agent (UA) implementations dedicated for OPMET IWXXM data exchange.

The proposed conformance tests are divided to three categories:

- profile specific submission tests;
- profile specific delivery tests; and
- submission and delivery tests.

1.1 The scope of the profile specific submission and delivery tests is to ensure conformance of UA implementations specifically deployed for the conveyance of OPMET IWXXM data to the respective profile. A test identification scheme of the form WXMxnn has been used, where x=1 is used for submission tests and x=2 for delivery tests. Wherever applicable and to provide more details, reference to the respective EUR AMHS Manual Appendix D-UA test is made.

1.2 Specific UA conformance testing is to ensure that UA implementations dedicated for OPMET IWXXM data exchange will not malfunction upon reception of a field or element not defined by the specific profile, but classified as mandatory in the ISPs and thus also mandatory in AMHS.

2. tests

2.1. Profile specific submission tests

WXM101	**Submission of an IPM including a bulletin consisting of METAR**
Test criteria	The test is successful if the UA submits an IPM including a bulletin consisting of METAR according to the profile defined in Appendix A of this document
Scenario description	Submit from the UA under test an IPM including a bulletin consisting of METAR. Check that: - the P3 submission-envelope includes the following parameters with the correct values: o *originator-name*: OR-name of the originator o *recipient-name*: OR-name of each recipient of the message o *content-type*: 22 o *encoded-information-types*: OID 2.6.1.12.0 o *priority*: non urgent - the following IPM heading fields are present with the correct values: o *originator*: address of the originating OPMET system (MET switch) o *primary-recipients*: recipient addresses as populated by the MET switch

	○ *subject*: TTAAiiCCCCYYGGggBBB part of the filename of FTBP ○ *importance*: normal, if present ○ *authorization-time* of the IPM heading extensions field: equivalent to filing time ○ *precedence-policy-identifier* of the IPM heading extensions field: OID 1.3.27.8.0.0 ○ *originators-reference* of the IPM heading extensions field: absent - the following elements in the common data types are present with the corresponding values: ○ *precedence*: 28 ○ *formal-name*: originator address and recipient addresses - the elements *rn* and *nrn* in the common data types are absent - the message has exactly one file-transfer-body-part - the parameters composing FTBP are according to ISO/IEC ISP 12062-2 (see section A.2.4.2 of the EUR AMHS Manual Appendix B) and the following elements are present with the correct values: ○ *document-type-name*: OID 1.0.8571.5.3 ○ *registered-identifier*: OID 1.3.27.8.1.2 ○ *user-visible-string*: 'Digital MET' ○ *incomplete-pathname*: bulletin file name as specified in section 5.1.4 for example: A_LAFR31LFPW171500_C_LFPW_20151117150010.xml.[compression_suffix] ○ If generated, check the element *date-and-time-of-last-modification* ○ If generated, check the element *actual-values*, the value of which represents the size of the Attachment data in bytes - the elements *related-stored-file*, *compression* and *extensions* of the FTBP parameters are absent - The IWXXM data itself are included in the FileTransferData element of the file-transfer-body-part; the octet-aligned encoding should be used.
EUR AMHS Manual, Appendix D-UA ref:	CTUA1501, FTBP Capability

WXM102	**Submission of IPMs including bulletins of different file size consisting of METAR**
Test criteria	The test is successful if the UA submits several IPMs including bulletins of different file size consisting of METAR according to the profile defined in Appendix A of this document.
Scenario description	Submit from the UA under test a sequence of several IPMs including each time a bulletin of different file size consisting of METAR. The size of the message should not exceed the limit defined in r the regional AMHS Manual. Check all parameters listed in test case WXM101, with the corresponding values. If the element *actual-values* is generated check each time the respective value, which represents the size of the Attachment data in bytes.
EUR AMHS Manual Appendix D-UA ref:	CTUA1501, FTBP Capability with different body-part size

WXM103	Submission of an IPM including a bulletin consisting of SPECI or TAF
Test criteria	The test is successful if the UA submits an IPM including a bulletin consisting of SPECI or TAF according to the profile defined in Appendix A of this document
Scenario description	Submit from the UA under test an IPM including a bulletin consisting of SPECI. Check that all parameters and their respective values are in accordance to test case WXM101, except that the value of the element *incomplete-pathname* is according to the bulletin file name as specified in section 5.1.4 . The test is repeated with the submission of an IPM including bulletin consisting of TAF.
EUR AMHS Manual Appendix D-UA ref:	CTUA1501, FTBP Capability

WXM104	Submission of an IPM including a bulletin consisting of AIRMET
Test criteria	The test is successful if the UA submits an IPM including a bulletin consisting of AIRMET according to the profile defined in Appendix A of this document.
Scenario description	Submit from the UA under test an IPM including a bulletin consisting of AIRMET. Check that all parameters and their respective values are in accordance to test case WXM101, except that: - the *priority* abstract value of the P3 submission-envelope is normal - the value of the element *precedence* is 57 - the value of the element *incomplete-pathname* is according to the bulletin file name as specified in section 5.1.4.
EUR AMHS Manual Appendix D-UA ref:	CTUA1501, FTBP Capability

WXM105	Submission of an IPM including a bulletin consisting of SIGMET or VAA or TCA
Test criteria	The test is successful if the UA submits an IPM including bulletin consisting of SIGMET or VAA or TCA according to the profile defined in Appendix A of this document.
Scenario description	Submit from the UA under test an IPM including a bulletin consisting of SIGMET. Check that all parameters and their respective values are in accordance to test case WXM101, except that: - the *priority* abstract value of the P3 submission-envelope is normal - the value of the element *precedence* is 57 - the value of the element *incomplete-pathname* is according to the bulletin file name as specified in section 5.1.4. The test is repeated with the submission of an IPM including bulletin consisting of VAA. The test is repeated with the submission of an IPM including bulletin consisting of TCA.
EUR AMHS Manual Appendix D-UA ref:	CTUA1501, FTBP Capability

3.2.4.3 Profile specific delivery tests

WXM201	**Delivery of an IPM including a bulletin consisting of METAR**
Test criteria	The test is successful if an IPM, including a collection consisting of METAR, sent by an MTA is received by the UA under test and the parameters specified by the profile defined in Appendix A of this document are properly received.

Scenario description	The MTA sends an IPM including a bulletin consisting of METAR.
	
	Check that the UA under test receives the IPM with the following parameters:
	
	- the message delivery envelope includes the following parameters with the correct values:
	  o *originator-name*: OR-name of the originator
	  o *this-recipient-name*: OR-name of the recipient to whom the message is delivered
	  o *content-type*: 22
	  o *encoded-information-types*: OID 2.6.1.12.0
	  o *priority*: non urgent
	  o *message-delivery-identifier*: it shall have the same value as the message-submission-identifier supplied to the originator of the message when the message was submitted (X.411, section 8.3.1.1.1.1)
	  o *message-delivery-time*: it contains the time at which delivery occurs and at which the MTS is relinquishing responsibility for the message (X.411, section 8.3.1.1.1.2)
	- the following IPM heading fields are present with the correct values:
	  o *originator*
	  o *primary-recipients*
	  o *subject*: TTAAiiCCCCYYGGggBBB part of the filename of FTBP
	  o *importance*: normal, if present
	  o *authorization-time* of the IPM heading extensions field: equivalent to filing time
	  o *precedence-policy-identifier* of the IPM heading extensions field: OID 1.3.27.8.0.0
	  o *originators-reference* of the IPM heading extensions field: absent
	- the following parameters in the common data types are present with the corresponding values:
	  o *precedence*: 28
	- the elements *rn* and *nrn* in the common data types are absent
	- the message has exactly one file-transfer-body-part
	- the parameters composing the FTBP are according to section A.2.4.2 of the EUR AMHS Manual Appendix B and the following elements are present with the correct values:
	  o *document-type-name*: OID 1.0.8571.5.3
	  o *registered-identifier*: OID 1.3.27.8.1.2
	  o *user-visible-string*: ‘Digital MET’
	  o *incomplete-pathname*: bulletin file name as specified in section 5.1.4 IWXXM CONOPS, for example: A_LAFR31LFPW171500_C_LFPW_ 20151117150010.xml.[compression_suffix]
	  o If generated, check the element *date-and-time-of-last-modification*
	  o If generated, check the element *actual-values*, the value of which represents the size of the Attachment data in bytes

	- the elements *related-stored-file*, *compression* and *extensions* of the FTBP parameters are absent - The IWXXM data itself are included in the FileTransferData element of the file-transfer-body-part; the octet-aligned encoding should be used.
EUR AMHS Manual Appendix D-UA ref:	CTUA1601, FTBP Capability

WXM202	**Delivery of IPMs including bulletins of different file size consisting of METAR**
Test criteria	The test is successful if several IPMs, including bulletins of different file size consisting of METAR, sent by an MTA are received by the UA under test and the parameters specified by the profile defined in Appendix A of this document are properly received.
Scenario description	The MTA sends a sequence of several IPMs including each time a bulletin of different file size consisting of METAR. Check that the UA under test receives all IPMs and that the parameters described in test case WXM201 are received with the corresponding values. If the element *actual-values* is present check each time the respective value, which represents the size of the Attachment data in bytes.
EUR AMHS Manual Appendix D-UA ref:	CTUA1601, FTBP Capability with different body-part size

WXM203	**Delivery of an IPM including a bulletin consisting of SPECI or TAF**
Test criteria	The test is successful if an IPM, including a bulletin consisting of SPECI or TAF, sent by an MTA is received by the UA under test and the parameters specified by the profile defined in Appendix A of this document are properly received.
Scenario description	The MTA sends an IPM including a bulletin consisting of SPECI. Check that the UA under test receives the IPM and the parameters described in test case WXM201 are received with the corresponding values, except the element *incomplete-pathname* which value is according to the bulletin file name as specified in section 5.1.4. The test is repeated with the delivery of an IPM including a bulletin consisting of TAF.
EUR AMHS Manual Appendix D-UA ref:	CTUA1601, FTBP Capability

WXM204	**Delivery of an IPM including a bulletin consisting of AIRMET**
Test criteria	The test is successful if an IPM, including a bulletin consisting of AIRMET, sent by an MTA is received by the UA under test and the parameters specified by the profile defined in Appendix A of this document are properly received.
Scenario description	The MTA sends an IPM including a bulletin consisting of AIRMET. Check that the UA under test receives the IPM and the parameters described in test case WXM201 are received with the corresponding values, except that: - the *priority* abstract value of the P3 submission-envelope is normal - the value of the element *precedence* is 57

	- the value of the element incomplete-pathname is according to the bulletin file name as specified in section 5.1.4 .
EUR AMHS Manual Appendix D-UA ref:	CTUA1601, FTBP Capability

WXM205	**Delivery of an IPM including a bulletin consisting of SIGMET or VAA or TCA**
Test criteria	The test is successful if an IPM, including a bulletin consisting of SIGMET or VAA or TAF, sent by an MTA is received by the UA under test and the parameters specified by the profile defined in Appendix A of this document are properly received.
Scenario description	The MTA sends an IPM including a bulletin consisting of SIGMET. Check that the UA under test receives the IPM and the parameters described in test case WXM201 are received with the corresponding values, except that: - the *priority* abstract value of the P3 submission-envelope is normal - the value of the element *precedence* is 57 - the value of the element incomplete-pathname is according to the bulletin file name as specified in section 5.1.4. The test is repeated with the delivery of an IPM including a bulletin consisting of VAA. The test is repeated with the delivery of an IPM including a bulletin consisting of TCA.
EUR AMHS Manual Appendix D-UA ref:	CTUA1601, FTBP Capability

The execution of the delivery tests defined in EUR DOC 020 (EUR AMHS Manual) Appendix D-UA is encouraged.

However if this is not possible, the following test list from EUR DOC 020 (EUR AMHS Manual) Appendix D-UA is suggested.

Basic Delivery Operations (A2)	
CTUA201	**Deliver an IPM to the IUT – basic capability (A2)**
CTUA203	**Deliver an IPM containing optional-heading-information in the ATS-message-header**
CTUA204	**Deliver an IPM containing different kinds of recipient addresses**
CTUA206	**Deliver an IPM with invalid originator address similar to CAAS**
CTUA207	**Deliver an IPM with invalid originator address similar to XF**

Specific Delivery Operations	
CTUA401	**Deliver a non-delivery report (NDR) to an AMHS user**

Enhanced Delivery UA Capability	
CTUA601	**Deliver an IPM with the implemented capability of one body-part**

CTUA602	**Deliver an IPM with the implemented capability of two body-parts**

Delivery Operations (A2-IHE)	
CTUA1201	**Deliver an IPM with IHE to the IUT – basic capability (A2-IHE)**
CTUA1203	**Deliver an IPM with IHE, containing optional heading information**
CTUA1204	**Deliver an IPM with IHE, containing different kinds of recipient address**

Specific Submission Operations with IHE	
CTUA1303	**Checking of default envelope elements (flag setting) in submitted IPMs with IHE**

Specific Delivery Operations with IHE	
CTUA1401	**Deliver a non-delivery report (NDR) to an AMHS user**

Enhanced Delivery UA Capability with IHE	
CTUA1602	**Deliver an IPM with IHE with the implemented capability of two body-parts**

END

APPENDIX E

Plan and Roadmap for Meteorology in System Wide Information Management (SWIM)

Plan for Meteorology in System Wide Information Management (SWIM)

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First Edition — October 2018

International Civil Aviation Organization

RECORD OF REVISIONS

REVISIONS		
No.	Date	Description

FOREWORD

This first edition of the *Plan for Meteorology in System Wide Information Management (SWIM)* is published to complement the introduction of the *Manual on System Wide Information Management* (Doc 10039). This plan describes the role of meteorological information in a SWIM environment, and the relationship of MET SWIM to other components of the overall system.

As of November 2016, many aeronautical meteorology products from ICAO Annex 3 – *Meteorological Service for International Air Navigation* are recommended for exchange in ICAO Meteorological Information Exchange Model (IWXXM) form by States. This exchange will initially take place outside of a SWIM environment of Service Oriented Architecture (SOA) and web services, but as SWIM implementation takes place these exchanges will be transitioned to a SWIM environment.

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LIST OF ABBREVIATIONS AND ACRONYMS

AIM	Aeronautical information management
AIXM	Aeronautical information exchange model
AMQP	Advanced message queuing protocol
Annex 3	Annex 3 – *Meteorological Service for International Air Navigation*
ASBU	Aviation system block upgrade
ASP	ATM service provider
ATM	Air traffic management
CRS	Coordinate reference system
FIXM	Flight information exchange model
FL	Flight Level
GANP	ICAO Doc 9750 – *Global Air Navigation Plan*
GML	Geography markup language
GRIB	Gridded binary format
HTTP	Hypertext transfer protocol
ICAO	International Civil Aviation Organization
ISO	International Organization for Standardization
IWXXM	ICAO meteorological information exchange model
MET	Meteorology or Meteorological
METAR	Aerodrome routine meteorological report (in meteorological code)
NetCDF	Network common data form
OGC	Open Geospatial Consortium
OPMET	Operational meteorology, usually operationally-used aeronautical meteorology data products
SOA	Service-oriented architecture
SOAP	Simple object access protocol
SWIM	System-wide information management
TAC	Traditional alphanumeric codes
TCP/IP	Transmission control protocol / internet protocol
WCS	Web coverage service
WFS	Web feature service
WMS	Web map service
XML	Extensible markup language

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GLOSSARY OF TERMS

When the subsequent terms are used in this manual, they have the following meanings:

Authorization. Permission to engage in a specific activity. A SWIM-enabled application is authorized if it has permission to engage in a specific activity, such as subscribing to a publication service.
Consumer. See *Information consumer*.
Core Services. Functional capabilities of the SWIM Infrastructure such as interface management, request-reply and publish-subscribe messaging, service security, and enterprise service management.
Discoverable. An information service that may be discovered by a potential user is discoverable.
Discovery. See *Service Discovery.*
Information Dissemination. The act of distributing information to one or more recipients.
Domain. A set of business activities that: (a) have a common mission or purpose; (b) share common operational and functional requirements and capabilities; and (c) needs to be considered separately from other activities, while maintaining the relevant relationships with them. For example, the MET and AIM information domains
Enterprise. See *SWIM Enterprise.*
Enterprise Service Management (ESM). The SWIM core service addressing the management of SWIM-enabled services, including performance and availability. ESM provides the ability to monitor, manage, and scale services within the enterprise to ensure the capability offerings are available, responsive and scalable to the operational environment supported.
Expose. To make a service interface discoverable. In SWIM, information services are exposed via one or more SWIM Service Registries.
Information Consumer. The person, application or system consuming an information service. Also called *consumer*.
Information Domain. Focused on identifying, defining, and satisfying the information needs of the set of business activities associated with a specific domain.
Information Exchange Model. An Information Exchange Model is designed to enable the management and distribution of information services data in digital format. Normally this is defined for a specific domain such as aeronautical information.
Information Model. An information model is a representation of concepts and the relationships, constraints, rules, and operations to specify data semantics for a chosen domain.
Information Producer. The person, application or system producing an information service. Also called producer.
Information Provider. Information service provider. Also called provider.
Information Service. An information service is a web service which provides information consumers access to one or more applications or systems by means of the SWIM core services. It encapsulates a distinct set of operations logic within a well-defined functional boundary.
Infrastructure. The logical and physical (i.e., hardware and software) elements that together provide (SWIM) functionality.
Message. A structured information exchange package consisting of a header and payload.
Messaging. The SWIM core service that provides delivery of data and notifications between applications and systems.
Notification. An indication presented to a user regarding the status of a system or an element in a system. In a publish-subscribe system, a publication may consist of notifications about data rather than the data itself.
Operational Pattern. An operational pattern describes the essential flow of a SWIM-enabled service. It is based on the term pattern, which describes the essential features of a common solution to a common problem in software development.
Publication. An information service based on the publish-subscribe operational pattern.

Publisher. An information service provider utilizing the publish-subscribe operational pattern.
Publish-subscribe. A one-to-many operational pattern in which an information provider called a *publisher* makes its services available (i.e. publishes) on a subscription basis. An information consumer in this paradigm called a *subscriber* requests access to the publication service via a subscription request. Based on the nature of their subscriptions, subscribers will continue to receive updates from the publisher until they request the termination of their subscription.
Reliable Delivery. A characteristic of information transfer in which the transfer is either successful or the sender of the information is notified of the failure of the transfer.
Request/Reply. The operational pattern distinguished by a two-way interaction between a requesting entity and a responding entity. This pattern is also called request/response.
REST. A REpresentational State Transfer (REST) architecture is an alternative to SOAP for implementing web services over HTTP.
Security. The SWIM core service responsible for the protection of information, operation, assets and participants from unauthorized access or attack.
Service. Attention is drawn to the dual meaning of "service" in an ICAO context. In the context of SWIM and this document, "service" refers to a web service (also see *Information Service*) rather than an ICAO service which is provided by States or other ICAO organizations.
Service Discovery. The act of locating and accessing the metadata (such as a web address) for a specific information service. Also referred to as *discovery*.
Service-Oriented Architecture (SOA). An approach to integrate applications running on heterogeneous platforms using industry-wide acceptable standards. Each application is exposed as one or more web services where each information service provides a particular function. Information services (applications) communicate with each other in a coordinated sequence that is defined by a business process.
Service Provider. An organization or entity providing a service. Refers (in this document) to ASPs or vendors that provide network or other value-added services; distinct from an information provider.
Service Registration. The act of creating an entry in the SWIM Service Registry.
Service Registry. SWIM web service registry.
SOAP. A SOAP architecture is an alternative to REST for implementing web services over HTTP.
State. An ICAO Member State.
Subscriber. A consumer of a publication service.
Subscription. The process of becoming a subscriber to a publication service. Subscription consists of subscription administration and subscription activation.
Subscription Administration. The act of administering a subscription, including authorization, access list and other database updates, etc.
System-Wide Information Management (SWIM). SWIM consists of standards, infrastructure and governance enabling the management of ATM related information and its exchange between qualified parties via interoperable services.
SWIM Access Point. A SWIM access point is a logical entity which bundles a number of technical capabilities (e.g. messaging, security, logging, interface management, etc.).
SWIM core services. The fundamental SWIM mechanisms that enable information sharing: Interface Management, Messaging, Enterprise Service Management (ESM) and Security. These services are solution-agnostic (not limited to a single process or solution environment) and have a high degree of autonomy so that they support reuse. Also referred to as "core services".
SWIM core services infrastructure. Hardware and software elements that provide the SWIM core services. Also referred to as "core services infrastructure".
SWIM-enabled application. A SWIM enabled application consumes or provides SWIM information services using SWIM standards. Also referred to as "application".
SWIM-enabled service. An information service that may be accessed via SWIM.

SWIM Enterprise. A SWIM enterprise can be an ATM service provider (ASP), a group of ASPs, or an Airspace User, or an ATM support industry that has full control of the implementation planning and execution within the enterprise.

SWIM Region. A collection of SWIM enterprises that have agreed upon common regional governance and internal standards. A region will be delineated by the area of influence of a given governance structure that defines the standards, policies, etc. that are applicable to all the participants within the region.

SWIM Registry. A registry or directory containing entries with the information necessary to discover and access services. The Registry utilizes a formal registration process to store, catalog and manage metadata relevant to the services, thereby enabling the search, identification and understanding of resources. Also referred to as "Service Registry" or "Registry".

SWIM User. Depending on context, a person, organization or application authorized to provide and/or consume services via SWIM.

Web Service. A software system which provides request/reply support to consumers for querying data or generating results. Web services commonly communicate using HTTP and often work with and return XML, JSON, and binary data.

Chapter 1

INTRODUCTION

1.1 BACKGROUND

1.1.1 ICAO Doc 10039 - *Manual on System Wide Information Management (SWIM) Concept*, describes general SWIM concepts and characteristics. This document provides further detail on the role of aeronautical meteorology in SWIM, such as the relationship between meteorology and other SWIM domains (such as aeronautical information management (AIM)) in the system.

1.2 SCOPE

1.2.1 The scope of the plan is limited to the following:

a) identifying required infrastructure (IP network, security capabilities, etc.);
b) identifying interfaces and relationships with the other SWIM Air Traffic Management (ATM) information domains, such as AIM;
c) identifying technologies and required high-level capabilities (web services, XML, and messaging) required for MET SWIM information exchange;
d) describing information flows and high-level data types; and
e) describing the roles and responsibilities of aeronautical meteorological system stakeholders, such as regional centers and member states.

1.2.2 The scope of the plan excludes the detailed description of specific products. It is anticipated that data products will be able to be modified over time without substantial changes to the concepts and infrastructure described in this plan.

1.3 PURPOSE/OBJECTIVE

1.3.1 This document, the *Plan for Meteorology in System Wide Information Management (SWIM)*, describes the role of aeronautical meteorology (MET) in SWIM. In particular, approaches and concepts for the exchange of meteorological information (such as web services), high-level concepts regarding aeronautical meteorological information exchange models and XML/GML are discussed. This document supplements the broader SWIM concept described in the *Manual on System Wide Information Management (SWIM) Concept* (Doc 10039) with approaches and technologies specifically relevant to the exchange of meteorological information in SWIM.

1.4 TARGET AUDIENCE

1.4.1 This plan has been developed for ICAO States seeking information on integrating their MET SWIM information management within a global SWIM construct. The plan does not specifically address any individual member of the ATM community with interested parties to be found in all of the following communities:

a) ICAO;
b) regulatory authorities; and
c) States.

1.5 ORGANIZATION OF THE PLAN

1.5.1 The plan is organized as follows:

a) Chapter 1 gives the background and the purpose and scope of the document;
b) Chapter 2 considers the MET SWIM global interoperability framework and its details, including interoperability and governance at the information exchange services, the information exchange models and at the SWIM infrastructure level. The functions and representative standards are provided;
c) Chapter 3 considers the transition to MET SWIM and operations in a mixed environment; and
d) The appendices provide supporting material.

1.6 RELATIONSHIP TO OTHER DOCUMENTS

1.6.1 The *Global Air Traffic Management (ATM) Operational Concept* (Doc 9854) describes a future concept in which information is managed system-wide. Based upon this concept, the *Manual on Air Traffic Management System Requirements* (Doc 9882) explicitly identifies the implementation of SWIM as a requirement for the future ATM System.

1.6.2 The *Manual on Flight and Flow Information for a Collaborative Environment* (FF-ICE) (Doc 9965) provides a vision specifically for flight information that relies on SWIM as a mechanism for exchange of flight information while managing the consistency and timeliness of the information. The *Manual on Collaborative Air Traffic Flow Management* (Doc 9971) describes the importance of information exchange in establishing a collaborative environment.

1.6.3 There are two aviation system block upgrade (ASBU) modules within the *Global Air Navigation Plan* (GANP) (Doc 9750) that focus on SWIM development: B1-SWIM and B2-SWIM. The ASBU module B1-SWIM is termed ‘Performance Improvement through the application of SWIM’ and applies to the “implementation of SWIM services (applications and infrastructure) creating the aviation intranet based on standard data models, and internet-based protocols to maximize interoperability”. The ASBU module B2-SWIM is termed ‘Enabling Airborne Participation in collaborative ATM through SWIM’ and applies to the “connection of the aircraft as an information node in SWIM enabling participation in collaborative ATM processes with access to rich voluminous dynamic data including meteorology”.

1.6.4 The *Manual on System Wide Information Management (SWIM) Concept* (Doc 10039) describes the overall SWIM concept, along with key goals and characteristics of the system. This plan provides further detail on this general concept, and how aeronautical meteorological information is exchanged and used within the broader system.

1.6.5 The *Manual on the Digital Exchange of Aeronautical Meteorological Information* (Doc 10003) provides implementation guidance on aeronautical meteorological information exchange models and XML/GML. This plan addresses the long-term concept of the MET SWIM system beyond implementation of the information exchange models and beyond initial implementation of XML/GML and digital exchange.

Chapter 2

THE MET SWIM CONCEPT

2.1 MET SWIM CONCEPTS

2.1.1 Meteorological information exchange takes place in SWIM utilizing the core concepts described in Doc 10039. MET SWIM exchanges are enabled by the following more specialized concepts:

Information: The aeronautical meteorology contents being utilized and exchanged in SWIM. In the MET SWIM system there are three types of information: gridded data, non-gridded data, and imagery data. Information is exchanged using a data exchange format, of which one type is an Information Exchange Model. Further detail on the full range of MET information is provided in Section 2.3. Data exchange formats are typically returned from information exchange services (request/reply) or sent as a portion of publish/subscribe messages. The primary information exchange model in MET SWIM is the IWXXM.

Information Exchange Services: An information service which is used to exchange MET information. An information exchange service enables interoperability by following well-defined standards and governance specifications agreed upon by stakeholders and implemented via commonly agreed means. In the MET SWIM system, information exchange services are used to distribute, filter, and transform MET information for use in SWIM.

2.2 SWIM INTERFACES

2.2.1 MET SWIM is a portion of the larger SWIM system and will interface with other SWIM components. There are two primary relationships: a MET SWIM utilization and reliance upon SWIM infrastructure (such as reliable messaging); and MET SWIM use of AIM SWIM information services and data. MET SWIM utilizes the common SWIM infrastructure for TCP/IP network communications, publish/subscribe messaging, request/reply communications, security, registry and metadata, and other facilities.

2.2.2 MET SWIM may interface with AIM SWIM for the following:

a) meteorological observing station metadata at aerodromes (such as location);
b) aerodrome reference points;
c) aerodrome runways;
d) flight information region (FIR) data and locations; and
e) links to further metadata regarding aeronautical service providers such as: meteorological watch offices, air traffic service units, world area forecast centres volcanic ash advisory centres and tropical cyclone advisory centres.

2.3 INFORMATION AND DATA EXCHANGES

2.3.1 Traditional OPMET exchanges have relied on textual data formats, also known as Traditional Alphanumeric Codes (TAC). TAC data exchanges are being replaced by IWXXM XML exchanges in MET SWIM, and new data forms will be exchanged.

2.3.2 INFORMATION EXCHANGE MODELS (NON-GRIDDED DATA)

2.3.2.1 MET SWIM will utilize IWXXM for information exchanges, one of several existing XML/GML exchange models intended for use in the aeronautical domain. As MET SWIM implementation proceeds, current data products in IWXXM will migrate away from the restrictions of traditional alphanumeric code (TAC) towards the exchange of observations, forecasts and warnings with broader utility. One example of such a change is the reporting of the raw observed meteorological values coming from the sensor instead of "binned" data values, such as is reported today with METAR ceiling values. These types of improvements allow for multiple uses of MET SWIM data products, including different visualizations, ready ingest into weather forecast models and direct utilization by both information exchange web services and potentially higher-level decision support web services.

2.3.3 GRIDDED DATA

2.3.3.1 While many data products are adequately specified with non-gridded exchange models, MET SWIM stakeholders will also need to exchange gridded data. Gridded data (also known as raster data) is often, but not always, a regularly spaced set of values such as a satellite image or a set of temperature values over a large geographic area. While gridded data values may also be represented in exchange models in XML format, gridded data is generally too voluminous to be transported efficiently in XML.

2.3.3.2 A graphic showing gridded data with nearby map location information (such as highways) is shown in Figure 1. The individual grid cells are visible, as is the regular spacing of each data value. Gridded data is geo-located on a CRS, such as the world geodetic system (WGS-84) geographic CRS (latitude/longitude) or a Mercator projection CRS.

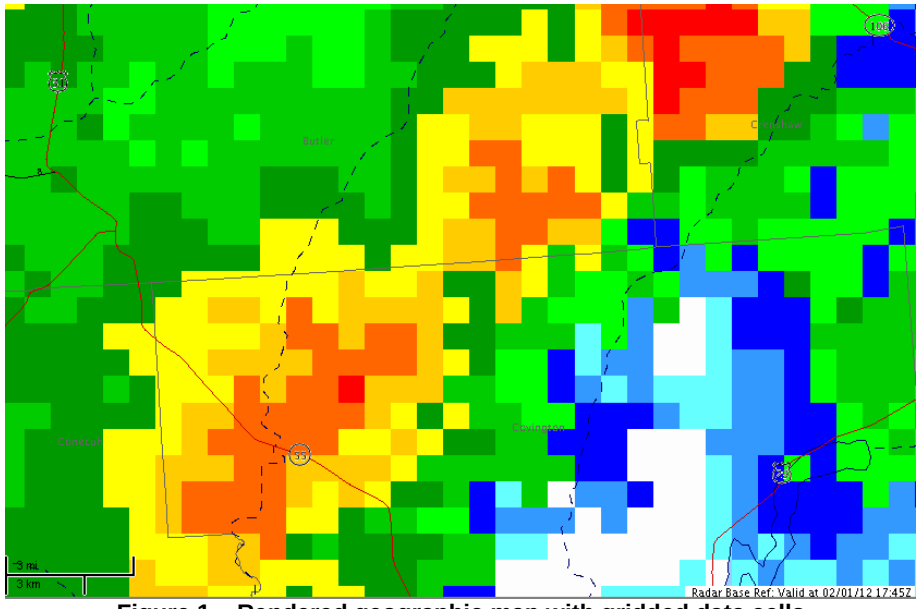

Figure 1 – Rendered geographic map with gridded data cells

2.3.3.3 Gridded data is an efficient representation of raw data values (i.e., not rendered values such as the colored pixels seen in imagery) representing data values from data types such as satellite, radar and numerical weather models, including fields such as wind speed and air temperature.

2.3.3.4 In aeronautical meteorology, gridded data is often exchanged in either the GRIB or netCDF file formats. While other formats are used, few of these are as broadly utilized. Gridded data in the meteorological domain is usually updated over time and is comprised of either two or three spatial dimensions (2-D or 3-D) depending upon whether there is a vertical component.

2.3.4 IMAGE DATA

2.3.4.1 While most of the MET SWIM requirements are met with the raw data values exchanged within gridded and non-gridded data, some MET SWIM products may be disseminated as rendered, geo-located images. Examples of image data formats include JPEG, PNG, and SVG files, such as those seen embedded in web mapping tools and other web sites. Image data may be useful in cases where data consumers need an authoritative and/or globally consistent visualization of raw data.

2.3.4.2 Image data can be used to visualize both gridded and non-gridded data. An example of both types of data can be seen in Figure 1, which shows the rendered gridded radar values overlain with non-gridded road and political boundaries. Due to the simple representation of images it can easily be combined with other images (layered) with little effort or much knowledge of the details of the data being represented.

2.4 REGISTRIES AND METADATA

2.4.1 Doc 10039 describes the need for a registry for use in SWIM. The fundamental purpose of the SWIM registry (also known as a catalog) is to provide a repository of information about who are the available data service providers, what data services they each provide and what data sets they each provide. MET SWIM will utilize many of the resources identified for the SWIM registry, including:

a) web service instances (list of services available in SWIM from the various SWIM information service providers);
b) web service description documents;
c) reference models (common models for the implementation of services and information structures, i.e., the Aeronautical information reference model - AIRM);
d) information exchange standards (e.g., AIXM, IWXXM, FIXM);
e) policies (constraints to be respected in SWIM for security or other purposes);
f) compliance (describe levels of conformity e.g., SWIM compliance); and
g) participants (e.g., information service providers).

2.4.2 In addition, MET SWIM will store and access aeronautical meteorology-specific metadata in the SWIM registry for the following:

a) meteorological data products (e.g., update rate, data quality characteristics, data lineage, detailed data structure descriptions, list of included data fields);
b) static publish/subscribe messaging topics and/or queues available from providers;
c) sensor metadata (e.g., location, quality characteristics); and
d) semantic metadata relating to web services and data products available in the MET SWIM system.

2.5 INFORMATION EXCHANGE SERVICES (WEB SERVICES)

2.5.1 There are two main mechanisms by which data will flow from producers to consumers: data which may be requested through web services as needed, and on-going real-time feeds of messages (notifications or actual data). The former describes the request/reply message exchange pattern described in this section, and the latter the publish/subscribe or messaging exchange pattern discussed in the next section. Both mechanisms will be utilized in MET SWIM.

2.5.2 MET SWIM information exchange services will be utilized to exchange and filter data. MET SWIM information exchanges can be quite voluminous and information exchange services can be utilized to trim down exchanged data to the exact needs of consumers. Due to the different nature of data being exchanged (gridded, imagery, and non-gridded) a specialized information exchange service is required for each. MET SWIM will utilize the OGC Web Feature Service (WFS) for non-gridded data, the OGC Web Coverage Service (WCS) for gridded data, and the OGC Web Map Service (WMS) for image data.

2.5.3 For all information exchange web services (gridded, non-gridded, and imagery web services) the following capabilities are supported:

- Requesting the set of data product(s) offered by the web service;
- Requesting the high-level capabilities of the web service;
- Requesting the detailed structure and content of the offered data products, such as geographic region of the data and the structure of offered data (such as the XML schema that describes offered non-gridded data);
- Requesting metadata regarding the data provider, such as contact information and organization name; and
- Requesting metadata regarding the operational status of the web service and/or data product, such as metadata indicating experimental products.

2.5.4 For non-gridded information exchange using the Web Feature Service, the following capabilities are supported in addition to the common capabilities identified above:

- Requesting data filtered by a geographic bounding box;
- Requesting data within a time range or at a time instant;
- Requesting data within a fixed distance from a route of flight; and
- Requesting data that matches free-form queries, such as all aircraft observations where altitude is greater than FL400 and where the aircraft type is ‘Boeing 747’.

2.5.5 For gridded information exchange using the Web Coverage Service, the following capabilities are supported in addition to the common capabilities identified above:

- Requesting data filtered by a geographic bounding box;
- Requesting data within a time range or at a time instant;
- Requesting data which was generated at a specific forecast run time (for forecast model run data);
- Requesting data within a fixed distance from a route of flight (i.e., returning a vertical cross section, 4-D corridor, or horizontal slice); and
- Requesting data that is re-sampled to a new grid spacing.

2.5.6 For imagery information exchange using the Web Map Service, the following capabilities are supported in addition to the common capabilities identified above:

- Requesting data filtered by a geographic bounding box;

- Requesting data within a time range or at a time instant;
- Requesting data which was generated at a specific forecast run time (for gridded forecast model run data);
- Requesting imagery that is at a different image resolution than the original data;
- Requesting data with custom rendering options such as color ranges, transparency, and symbology; and
- Requesting data in different image formats, such as SVG, JPEG, and PNG.

2.5.7 While the information exchange services as described above address the basic needs for the data exchange requirements of MET SWIM, other more specialized web services are also possible in a MET SWIM environment. These web services can be built to utilize data from the information exchange web services to address more specialized requirements. Because these web services are built atop of the data made available from the information exchange services, information exchange web services may be considered the first tier (Tier 1) and a necessary building block for a second tier (Tier 2) of specialized web services.

2.5.8 An example of one such "Tier 2" web service is a warning service which would enable customized warnings to be pushed (over publish/subscribe communications) to consumers. The warning web service would allow consumers to receive crucial information for decision-making without needing access to large amounts of raw aeronautical meteorology information. As MET SWIM information is updated, thresholds and geographic areas would be checked and warnings pushed to consumers as appropriate. Consumers could submit the following to the warning web service:

- any number of data variable names (such as composite reflectivity or observed wind speed);
- geographic area(s) of interest (bounding box, flight path and distance, or polygon area);
- time period(s) of interest; and
- rules describing when warnings are issued, such as the relationships between data variables, upper and lower data variable thresholds, geographic areas, and time periods.

2.5.9 Another example of a "Tier 2" web service would enable authoritative conversion from XML to TAC for transition purposes and human display. This would remove potential ambiguities in the conversion process, and assist with a smooth transition away from TAC having the role of an data exchange format towards TAC having the role of a display format (potentially among many).

2.5.10 Tier 2 web services can be used to address global needs for complex decision-making, authoritative and consistent decisions, and/or a synthesis of multiple sources of SWIM data including data from outside the MET domain, such as AIM. Due to their dependence upon Tier 1 information exchange services for basic data access, implementation of Tier 2 web services in the MET SWIM system will follow the deployment of Tier 1 web services. Given the unique and aviation-specific nature of these web services, they may not fit well into existing standardized web service protocols such as WCS, WFS, and WMS, but will be implemented using web services and fit into the general SWIM architecture.

2.6 MESSAGING AND PUBLISH/SUBSCRIBE

2.6.1 While information exchange services provide advanced capabilities for accessing MET data, they are insufficient to address all MET SWIM scenarios of real-time information exchange. The *Manual on System Wide Information Management* (Doc 10039) describes common messaging capabilities (the publish/subscribe messaging pattern) to be used throughout SWIM and MET SWIM will utilize this capability to reliably distribute data, notifications, and status updates. Messaging is particularly useful with

data that is issued at an unpredictable rate, data that must be delivered as quickly as possible, or data that represents a series of frequent and small updates. Publish/subscribe messaging technology is generally not well suited to distributing large data files/messages directly, and as such will be utilized in MET SWIM for:

- notifying data consumers that data is available for access through a web service such as when a new gridded forecast is available for retrieval;
- pushing relatively small data files directly to consumers as they become available on the provider, such as non-gridded data like aerodrome observations; and
- mission-critical service updates to data consumers, such as notifications of a web service outage, data outage, service/maintenance windows, or degraded provider capabilities.

2.6.2 There are many messaging broker implementations, such as ActiveMQ and RabbitMQ, but relatively few open and standard messaging protocols. As a programming application program interface (API), the Java Message Service (JMS) does not provide network level interoperability between implementations, merely a convenient way for software written in the Java programming language to be written to operate against different messaging broker implementations.

2.6.3 While messaging capabilities are considered a cross-cutting SWIM capability, States and other SWIM participants will communicate directly with other participants. No central messaging brokers will be utilized, and similarly to other SWIM components will be built upon standards that support heterogeneous information exchanges between multiple broker and/or client implementations. Of the messaging protocol standards, the Advanced Message Queueing Protocol (AMQP) is the most general-purpose and well suited to support MET SWIM requirements, and is supported by many existing messaging broker implementations. MET SWIM publish/subscribe messaging will utilize AMQP directly between SWIM participants, which allows stakeholders to choose their message broker and client software as appropriate for their requirements but allow for broad system-wide interoperability.

2.6.4 Publish/subscribe messaging can be utilized to publish information in either a static or dynamic fashion. Static publish/subscribe configurations may be considered a design-time configuration regarding what information is published to predefined topics and/or queues. In the case of static configurations, SWIM providers publish to a fixed set of topics and/or queues which do not change while the system is running. With a dynamic publish/subscribe configuration, the set of published data and the destination topics and/or queues can be modified as the SWIM system is running. For example, a filtered meteorological observation within a specific geographic area could be delivered to a small group of interested Consumers as needed. Dynamic configuration requires an additional request/reply web service on each SWIM Provider to allow modifications to published information at runtime such as described in the OASIS WS-Notification and OGC Publish/Subscribe Interface standards. There are currently no identified requirements for dynamic subscription capabilities, and as such all publish/subscribe messaging will be published in a static, pre-defined manner.

2.7 TESTING AND VALIDATION

2.7.1 As advanced capabilities (and particularly web services) are implemented in SWIM, they introduce the possibility of new types of interoperability problems when implemented incompletely or incorrectly. Therefore, as States and Regional OPMET Centres (ROCs) implement MET SWIM capabilities testing software will be available for evaluating the correct functioning of both web services and data products.

2.7.2 Testing and validation will occur on all components of the system, including web services, messaging capabilities, real-time data flow, and data products. The specific techniques to evaluate the

correct functioning of MET SWIM services are beyond the scope of this document, but will be developed and described in a subsequent document.

Appendix A

MET SWIM Standards

This appendix describes the MET SWIM standards which should be implemented by MET States and Regions.

A.1 Standards

Capability	Standard
Request/reply network connectivity	Transmission Control Protocol version 4 (IETF RFC 793) Internet Protocol version 6 (IETF RFC 2460) and Internet Protocol version 4 (IETF RFC 791) Hypertext Transfer Protocol -- HTTP/1.1 (IETF RFC 2616)
Publish/subscribe network connectivity	Advanced Message Queuing Protocol (AMQP) 1.0
Gridded information exchange	OGC Web Coverage Service Interface Standard – Core v2.0.1 OGC Web Coverage Service Interface Standard – Range Subsetting Extension v1.0.0 OGC Web Coverage Service Interface Standard – Scaling Extension v1.0.0 OGC Web Coverage Service Interface Standard – CRS Extension v1.0.0 OGC Web Coverage Service Interface Standard – Interpoation Extension v1.0.0 OGC Web Coverage Service Interface Standard – XML/SOAP Protocol Binding Extension v1.0.0 OGC Web Coverage Service Interface Standard – Key Value Pair (KVP) Protocol Binding Extension v1.0.1
Non-gridded information exchange	OGC Web Feature Service Interface Standard v2.0.0 (also ISO 19142)
Imagery information exchange	OGC Web Map Service Implementation Specification v1.3.0 OGC Styled Layer Descriptor (SLD) Profile of the Web Map Service Specification v1.1.0 OGC Symbology Encoding Implementation Specification v1.1.0

— END —

Roadmap for Meteorology in System Wide Information Management (SWIM)

2 October 2018

Version 1.3

International Civil Aviation Organization

RECORD OF REVISIONS

Revisions		
No.	Date	Description
1.0	6 September 2016	Initial version developed by the ICAO Meteorological Information Exchange (MIE) Working Group
1.1	6 April 2018	WG-MIE updated based on GANP changes and discussions with the Communications and Information Management Panels
1.2	19 June 2018	Updated based on the outcomes of WG-MIE/4. Additional detail added on timelines and implementation plans
1.3	2 October	Updated based on METP/4 feedback

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LIST OF ABBREVIATIONS AND ACRONYMS

AFTN	Aeronautical Fixed Telecommunication Network
AMHS	Aeronautical Message Handling System
AMQP	Advanced message queuing protocol
ASBU	Aviation system block upgrade
FTBP	File Transfer Body Part
GANP	Global Air Navigation Plan (Doc 9750)
HTTP	Hypertext transfer protocol
IP	Internet protocol
IROG	International Regional OPMET Gateway
IWXXM	ICAO meteorological information exchange model
MET	Meteorology or Meteorological
MWO	Meteorological Watch Office
NOC	National OPMET Centre
RHWAC	Regional Hazardous Weather Advisory Centre
ROC	Regional OPMET Centre
RODB	Regional OPMET Data Bank
RQM	Request/reply query for meteorological databank data in TAC format
SWXC	Space Weather Centre
SWIM	System-wide Information Management
TAC	Traditional Alphanumeric Code
TCAC	Tropical Cyclone Advisory Centre
VAAC	Volcanic Ash Advisory Centre
WAFC	World Area Forecast Centre
WCS	Web Coverage Service
WFS	Web Feature Service
WMS	Web Map Service

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Chapter 1 – MET SWIM Roadmap

1.1 INTRODUCTION

1.1.1 The System Wide Information Management (SWIM) will complement human-to-human communications with machine-to-machine communications and improve data distribution and accessibility. However, the flexibility inherent in human communication is not intrinsically included in Information Technology (IT) systems and must be specified and included in the system design. To enable the desired flexibility, IT systems will increasingly need to "ask for / discover" operationally relevant facts, depending on the circumstances, rather than remain "being informed" by pre- agreed messages. Increased machine-to-machine capabilities will enable many new software applications while continuing to support existing human usages.

1.1.2 ICAO Doc 10039 - *Manual on System Wide Information Management (SWIM),* describes general SWIM concepts and characteristics. The MET SWIM Plan – *Plan for Meteorology in System Wide Information Management (SWIM)* - provides further detail on the role of aeronautical meteorology in SWIM, such as the relationship between meteorology and other SWIM domains (such as aeronautical information management (AIM)) in the system, along with design concepts.

1.1.3 This document, the MET SWIM Roadmap, describes the transition plan and associated timelines for implementing MET in SWIM, including the necessary timelines and strategies for implementing necessary non-MET components such as IP networking and HTTP support.

1.1.4 Transition to MET SWIM can be summarized as the following phases:

a) Provision of meteorological products in ICAO Meteorological Exchange Model (IWXXM) format;
b) Provision of meteorological via MET SWIM information exchange services, including Web Feature Service (WFS), Web Coverage Service (WCS), and Web Map Service (WMS), over HTTP;
c) Additional data types beyond IWXXM (non-gridded), including gridded data and imagery;
d) Replacement of AFTN and AMHS "message push" communications with AMQP; and
e) Additional data products beyond those currently distributed in IWXXM.

1.2 TRANSITION PLAN

1.2.1 MET SWIM implementation and transition will proceed based upon the Global Air Navigation Plan (GANP) Block upgrade schedule. IWXXM messages will also become a standard practice in 2020.

1.2.2 There are several components of the MET SWIM transition: physical network connectivity, communications protocols (AFTN, AMHS, AMQP, HTTP), information exchange services (WCS, WFS, WMS), and data types exchanged (gridded, non-gridded, and imagery). The following table summarizes the MET SWIM implementation timeline, this is expanded upon in sections below.

Table 1 - MET SWIM Timeline

	Block 0	Block 1	Block 2	Block 3
Communication protocols (AFTN, AMHS, AMQP)	AFTN (legacy) AMHS FTBP (transitional) AMQP/HTTP (optional)	AFTN (legacy) AMHS FTBP (transitional) AMQP/HTTP (optional)	AFTN (legacy) AMHS (legacy) AMQP/HTTP	AMQP/HTTP
Request/Reply at Regional OPMET Data Banks (RODBs)	AFTN/AMHS request/reply	AFTN request/reply (legacy) WFS, WCS, WMS (optional) AMHS request/reply	AMHS request/reply (legacy) WFS, WCS, WMS	WFS, WCS, WMS
Data Types	Non-gridded	Non-gridded Gridded (optional) Imagery (optional)	Non-gridded Gridded Imagery	Non-gridded Gridded Imagery
Data Addressing	NOC, ROC, RODB, IROG	NOC, ROC, RODB, IROG	IP and SWIM Registry	IP and SWIM Registry

1.2.3 In addition to the technology changes, a transition to MET SWIM will also result in modifications to the organizational roles involved in aeronautical meteorological exchanges. The most significant changes are:

a) IP communications and the SWIM Registry will greatly reduce the need for data aggregation; and
b) More organizations (especially States) will offer web services and data directly to data consumers.

Table 2 - MET SWIM Roles

Function/Role	Block 0	Block 1	Block 2
Data Producer	MWO, VAAC, TCAC, WAFC	MWO, VAAC, TCAC, WAFC, SWXC, RHWAC	MWO, VAAC, TCAC, WAFC, SWXC, RHWAC
Data Aggregator and Validator	NOC, ROC, RODB, IROG	NOC, ROC, RODB, IROG	NOC, ROC, RODB
Data Repository	WAFC, RODB	WAFC, RODB	WAFC, RODB, and State/NOC

Block 0: Current System

1.2.4 The current, mixed system of AFTN and AMHS communications will continue through the end of Block 0. States, ROCs, RODBs, and IROGs in a position to implement AMQP communications in addition to AMHS File Transfer Body Part (FTBP) may do so for IWXXM dissemination. AMHS is considered a transitional communications technique and AMQP implementation plans should be prioritized.

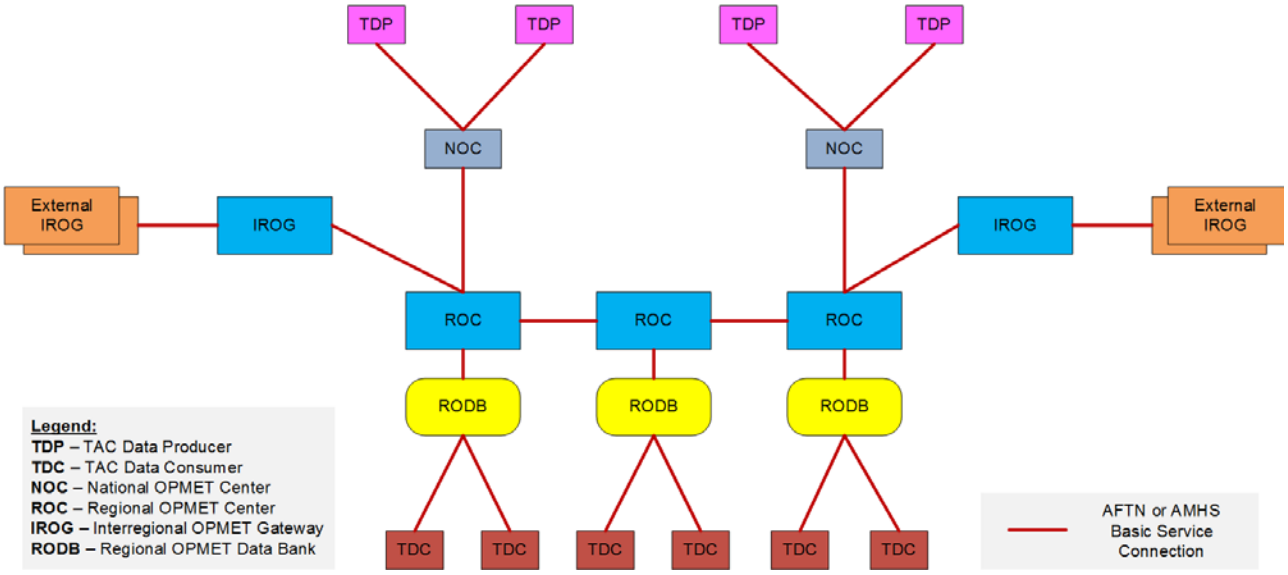

Figure 1 - MET SWIM Block 0

1.2.5 RODBs will utilize the existing RQM method for providing request/reply access to data, and States/RODBs may also offer information exchange services. Most States should be exchanging non-gridded IWXXM and TAC messages and some States may have commenced gridded and imagery information services.

Block 1 and 2: Transition to MET SWIM

1.2.6 States, ROCs, RODBs, and others may commence SWIM technology adoption in Block 1. As a transition Block, both legacy and SWIM communications technologies, data formats, and technology will co-exist for the duration. States, ROCs, RODBs, and others should commence and complete SWIM technology adoption in Block 2. Due to the transition being undertaken in both of these Blocks, the technology will be a mixture of traditional and SWIM-based approaches throughout both Blocks.

1.2.7 States shall implement IWXXM message production as of 2020, but TAC message production will continue throughout Block 1. States, ROCs, and RODBs in a position to do so will introduce gridded and imagery product dissemination on a regional basis.

1.2.8 For those RODBs and States in a position to do so, adoption of AMQP and HTTP (SWIM) communications should be adopted with a preference over AMHS-related communications for publish/subscribe messages and request/reply communications in Block 1. Specifically, ROCs and IROGs should prioritize the adoption of AMQP communications to facilitate State SWIM progress, RODBs should utilize Web Feature Services for request/reply access as an alternative to the AFTN and AMHS FTBP request response interface, and IWWXM data consumers should use the Web Feature Service to consume messages from RODBs and implement AMQP message consumption.

1.2.9 By the end of Block 2, adoption of AMQP and HTTP (SWIM) communications will be complete. ROC and IROG adoption of AMQP communications will be complete, RODBs will utilize Web Feature Services for request/reply access, and IWWXM data consumers will use the Web Feature Service to consume messages from RODBs and implement AMQP message consumption.

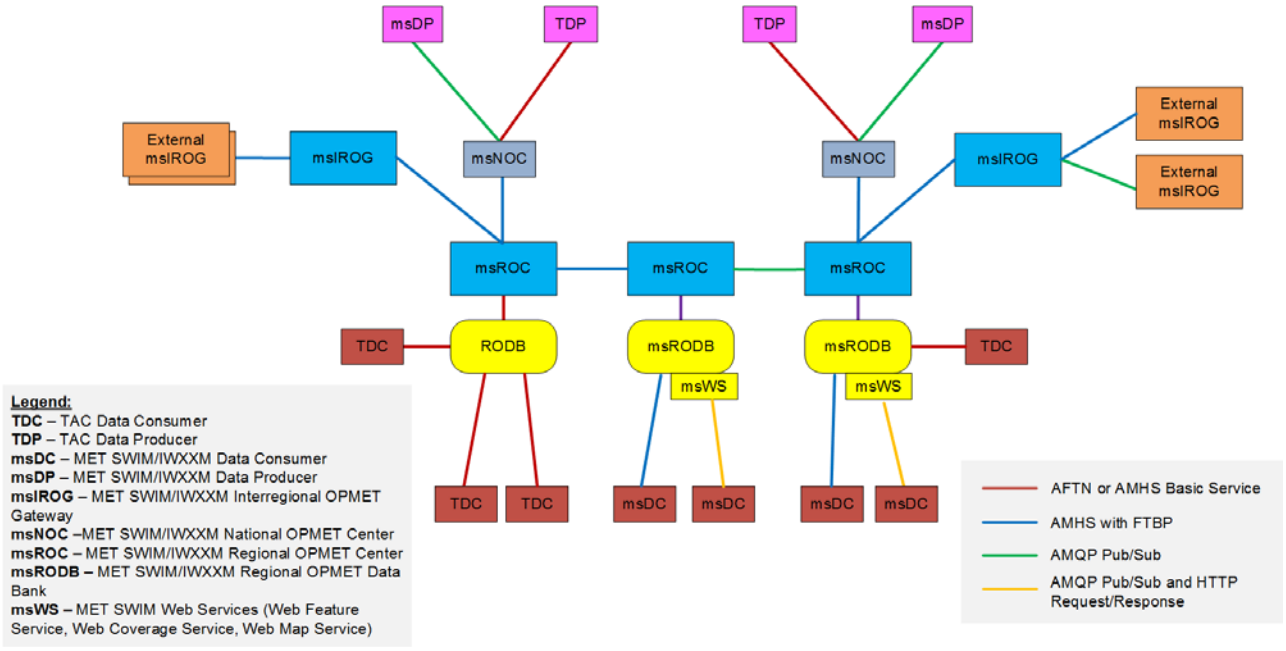

Figure 2 - MET SWIM Block 1 and 2

Block 3: MET SWIM Implementation

1.2.10 In Block 2 the protocol and data exchange transitions are completed and both IWXXM messages and gridded/image data notifications are distributed with AMQP. Gridded and image data consumers retrieve data using HTTP request/response to MET SWIM information exchange services.

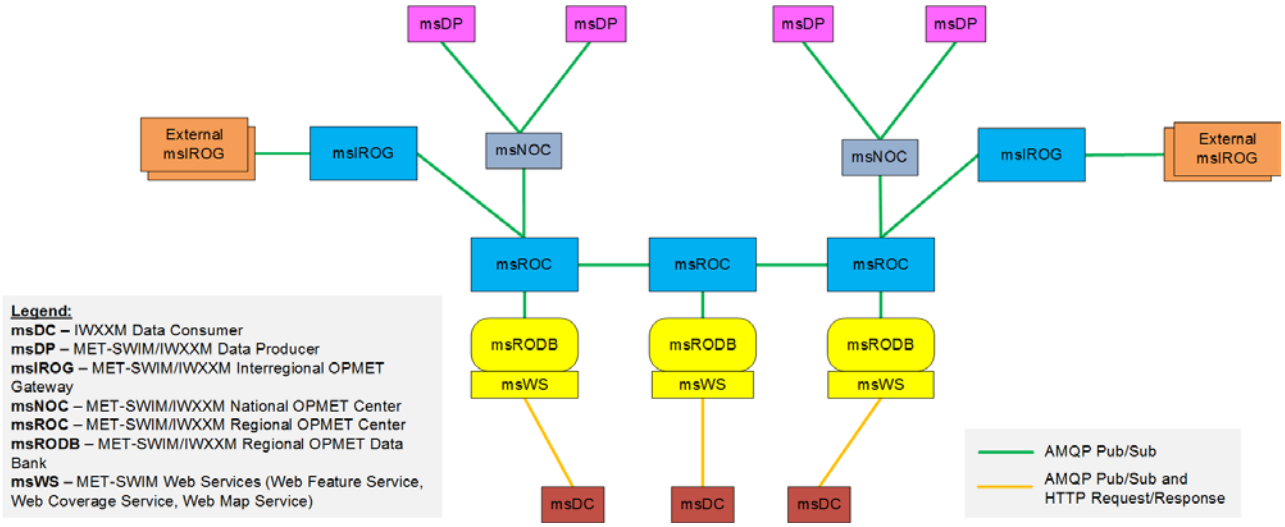

Figure 3 - MET SWIM Block 3

1.3 TIMELINES

1.3.1 As part of the SWIM activity and as part of the Global Air Navigation Plan, MET SWIM implementation will proceed in accordance with the GANP and ASBU schedule. The current ASBU timelines are as follows:

ASBU Block 0 – 2013 to 2018
ASBU Block 1 – 2019 to 2024: B1-SWIM and B1-AMET
ASBU Block 2 – 2025 to 2030: B2-SWIM and B2-AMET
ASBU Block 3 – 2031 and beyond

1.3.2 All MET SWIM pre-requisite interfaces are included in ASBU Module B1-SWIM and therefore MET SWIM Phase 1 can proceed concurrently with ASBU Module B1-SWIM.

Table 3 - MET SWIM Implementation Timelines

	ASBU Module	Implementation Start	Implementation End
SWIM Registry	**B1-SWIM**	2019	2024
Service security	**B1-SWIM**	2019	2024
MET SWIM Block 1 (Early Adoption/Transition)	**B1-AMET**	2019	2024
MET SWIM Block 2 (Transition)	**B2-AMET**	2025	2030
MET SWIM Phase 3 (Operation)	**B3-AMET**	2031	-

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APPENDIX F
REGIONAL SIGMET GUIDE (UPDATES)

INTERNATIONAL CIVIL AVIATION ORGANIZATION

<<INSERT REGION>> REGIONAL SIGMET GUIDE

<<INSERT EDITION NO.>> EDITION — <<INSERT MONTH AND YEAR>>

Note: This template includes changes agreed for Amendment 78 to Annex 3 (applicable Nov 2018)

(79 pages)

RECORD OF AMENDMENTS AND CORRIGENDA

Amendments			
No.	Date of issue	Date entered	Entered by

Corrigenda			
No.	Date of issue	Date entered	Entered by

— — — — — — — — —

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1. INTRODUCTION

1.1. General

1.1.1. The main purpose of this regional SIGMET guide is to provide guidance for standardization and harmonization of the procedures and formats related to the preparation and issuance of aeronautical meteorological information pertaining to specified en-route hazardous weather, and other phenomena in the atmosphere, which may affect safety of aircraft operations, known as SIGMET. The guidance is complementary to Annex 3 to the Convention on International Civil Aviation – *Meteorological Services for International Air Navigation*, the Standards and Recommended Practices (SARPs) contained therein regarding SIGMET, and to the SIGMET-related provisions in ICAO Regional Air Navigation Plans (ANPs).

1.1.2. The guidance is specifically provided for the provision of SIGMET in traditional alphanumeric code (TAC) form. As the provision and use of SIGMET data in digital form (IWXXM XML/GML) is used increasingly across ICAO communications networks it is expected that the conventions of the digital form will result in more compliant and less ambiguous SIGMET messages. During the period of transition, where it is likely that originating MWOs will issue both TAC and digital forms of SIGMET and until TAC SIGMET is formally retired, it is considered necessary to make available a guidance document of this form.

1.1.3. ICAO provisions concerning the preparation and issuance of SIGMET information are primarily contained in:

- Annex 3 - *Meteorological Service for International Air Navigation*, Part I, Chapters 3 and 7 and Part II, Appendix 6;
- Annex 11 - *Air Traffic Services*, Chapter 4, 4.2.1 and Chapter 7, 7.1;
- Regional Air Navigation Plans, Basic ANP, Part VI - Meteorology (MET);
- Regional Air Navigation Plans, Volume II, FASID, Part VI – Meteorology (MET) FASID, Tables MET 1B, MET 3A and MET 3B;
- *Procedures for Air Navigation Services – Air Traffic Management (PANS-MET*, Doc 4444*)*, Chapter 9, 9.1.3.2;
- Regional Supplementary Procedures (Doc 7030), Chapter 6, 6.13.2;
- *ICAO Abbreviations and Codes* (Doc 8400);
- *Handbook on the International Airways Volcano Watch (IAVW) – Operational Procedures and Contact List* (Doc 9766);
- *Manual of Aeronautical Meteorological Practice* (Doc 8896), Chapters 1 and 4;
- *Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services* (Doc 9377).

1.1.4. This regional SIGMET guide is primarily intended to assist meteorological watch offices (MWOs) in preparing and disseminating SIGMET information in conformance with the format prescribed in Annex 3. The explanations of the format to be used are accompanied by examples. The regional SIGMET guide also provides information regarding the necessary coordination between the MWOs, air traffic services (ATS), volcanic ash advisory centres (VAACs), tropical cyclone advisory centres (TCACs) and pilots, and their respective responsibilities.

1.1.5. To support regional management of SIGMET issuance and dissemination, Appendix C of the regional SIGMET guide contains guidance on the purpose, scope and procedures for conducting regional SIGMET tests.

2. RESPONSIBILITIES AND COORDINATION

2.1. General

2.1.1. SIGMET messages provide information on hazardous meteorological and other phenomena which may affect safety of aircraft operations; hence they are considered a high priority among other types of meteorological information provided to the aviation users. The primary purpose of SIGMET is for in-flight service, which requires timely transmission of the SIGMET messages to pilots by the ATS units and/or through VOLMET and D-VOLMET. Further information on the responsibilities of each party involved in the SIGMET process can be found in the *Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services* (Doc 9377).

2.1.2. Airlines are the main users of the SIGMET information. They contribute to the effectiveness of the SIGMET service through issuance of special air-reports reported by pilots to the ATS units. Special air-reports are among the most valuable sources of information for the MWOs in the preparation of SIGMET. The ATS units receiving special air-reports should forward them to their associated MWOs without delay.

2.1.3. In view of the foregoing, it should be well understood that the effectiveness of the SIGMET service depends strongly on the level of collaboration between the MWOs, ATS units, pilots, TCACs, VAACs and State volcano observatories. That is why, close coordination between these parties, as well as mutual understanding of their needs and responsibilities are essential for the successful implementation of the SIGMET service.

2.1.4. For the special cases of SIGMET for volcanic ash and tropical cyclones, the MWOs are provided with advisories from VAACs and TCACs respectively, as designated in the regional ANPs.

2.1.5. SIGMET is also used for flight planning. This requires global dissemination of SIGMET through the regional OPMET data banks (RODBs), the Internet-based SADIS FTP service and the WAFS Internet File Service (WIFS). SIGMET should also be distributed to the World Area Forecast Centres (WAFCs) London and Washington for use in the preparation of the significant weather (SIGWX) forecasts.

2.2. Meteorological watch office (MWO) responsibilities

2.2.1. SIGMET is to be issued by the MWO in order to provide timely information on the occurrence or expected occurrence of specified en-route weather and other phenomena in the atmosphere affecting the safety of the flight operations in the MWO's area of responsibility. SIGMET provides information concerning the location, extent, intensity and expected evolution of the specified phenomena.

2.2.2. Information about the provision of the SIGMET service, including details on the designated MWO(s), is to be included in the State's Aeronautical Information Publication (AIP) as required by Annex 15 – *Aeronautical Information Service*, Appendix 1, GEN 3.5.8.

2.2.3. If a State is temporarily unable to meet its obligations for establishing MWO(s) and for provision of SIGMET, arrangements have to be made for another State to assume this responsibility. Such delegation of responsibilities is to be agreed by the meteorological authority of each State concerned and should be notified by a NOTAM, within the State's AIP and in a letter to the ICAO Regional Office concerned.

2.2.4. The meteorological authority concerned should ensure that the MWO obligations and responsibilities are clearly defined and assigned to the unit designated to serve the MWO. Corresponding operational procedures should be established and the meteorological staff should be trained accordingly.

2.2.5. In preparing SIGMET information MWOs should follow the format prescribed in Annex 3, Appendix 6, Table A6-1A. Whilst Table A6-1A is the authoritative source, Appendix A of this regional SIGMET guide, includes an enhanced SIGMET specific guidance based on Table A6-1A and provides more specific instructions on how SIGMET should be compiled. The aim is to ensure that SIGMET is produced reliably and consistently worldwide.

2.2.6. SIGMET must be issued only for those phenomena listed in Annex 3, Appendix 6, 1.1.4 and only when specified criteria for their intensity and spatial extent are met.

2.2.7. The MWOs should be adequately equipped in order to be able to identify, analyze and forecast those phenomena for which SIGMET is required. The MWO should make use of all available sources of information including:

- special air-reports passed to the MWO from ATS (voice communication);
- special air-reports received from automated downlink;
- numerical Weather Prediction (NWP) data, especially high resolution models where available;
- meteorological observations, including those from automatic weather stations and human observers;
- upper wind information;
- information from meteorological satellites;
- weather radar (including Doppler radar);
- State volcano observatories;
- International Atomic Energy Agency (IAEA) through the relevant World Meteorological Organization (WMO) Regional Specializes Meteorological Centre (RSMC) for radioactive cloud;
- local knowledge;
- volcanic ash or tropical cyclone advisory messages.

2.2.8. On receipt of a special air-report from the associated ACC or FIC, the MWO shall:

a) issue SIGMET information based on the special-air report; or

b) send the special air-report for onward transmission to MWOs, WAFCs and other meteorological offices in accordance with regional air navigation agreement in the case that the issuance of SIGMET information is not warranted (e.g., the phenomenon concerned is of transient nature).

2.2.9. Appropriate telecommunication means should be available at the MWO in order to ensure timely dissemination of SIGMET according to a dissemination scheme, which should include transmission to:

- local ATS users;
- aerodrome MET offices within its area of responsibility, where SIGMET is required for briefing and/or flight documentation;
- other MWOs in accordance with regional air navigation plans;
- Centres designated for transmission of VOLMET or D-VOLMET where SIGMET is required for those transmissions;
- responsible ROBEX centres and regional OPMET data bank (RODB). It should be arranged that, through the ROBEX scheme, SIGMETs are sent to the designated RODB in the other ICAO regions, to the WAFCs and to the SADIS and WIFS providers;

2.2.10. In issuing SIGMET for tropical cyclones or volcanic ash, the MWOs should include as appropriate the advisory information received from the responsible TCAC or VAAC. In addition to the information received from the TCAC and VAAC, the MWOs may use the available complementary information from other reliable sources.

2.3. Air traffic service (ATS) unit responsibilities

2.3.1. Close coordination should be established between the MWO and the corresponding ATS unit (ACC or FIC) and arrangements should be in place to ensure:

- receipt without delay and display at the relevant ATS units of SIGMET issued by the associated MWO;
- receipt and display at the ATS unit of SIGMETs issued by MWOs responsible for the adjacent FIRs/ACCs if these SIGMETs are required according to 2.3.4 below; and
- transmission without delay by the ATS unit of special air-reports received through voice communication to the associated MWO.

2.3.2. SIGMET information should be transmitted to aircraft with the least possible delay on the initiative of the responsible ATS unit, by the preferred method of direct transmission followed by acknowledgement or by a general call when the number of aircraft would render the preferred method impracticable.

2.3.3. SIGMET information transmitted to aircraft-in-flight should cover a portion of the route up to two hours flying time ahead of the aircraft. SIGMET should be transmitted only during the time corresponding to their period of validity.

2.3.4. Air traffic controllers should ascertain whether any of the currently valid SIGMETs may affect any of the aircraft they are controlling, either within or outside the FIR/CTA boundary, up to two hours flying time ahead of the current position of the aircraft. If this is the case, the controllers should at their own initiative transmit the SIGMET promptly to the aircraft-in-flight likely to be affected. If necessary, the controller should pass to the aircraft available SIGMETs issued for the adjacent FIR/CTA, which the aircraft will be entering, if relevant to the expected flight route.

2.3.5. The ATS units concerned should also transmit to aircraft-in-flight the special air-reports received, for which SIGMET has not been issued. Once a SIGMET for the weather phenomenon reported in the special air report is made available this obligation of the ATS unit expires.

2.4. Pilot responsibilities

2.4.1. Timely issuance of SIGMET information is largely dependent on the prompt receipt by MWOs of special air-reports. It is essential that pilots prepare and transmit such reports to the ATS units whenever any of the specified en-route hazardous conditions are encountered or observed.

2.4.2. It should be emphasized that, even when automatic dependent surveillance (ADS) is being used for routine air-reports, pilots should continue to make special air-reports.

2.4.3. Pilots should compile special air-reports and disseminate to ATS by air-ground data link as per Annex 3, Appendix 4, 1.2 and *Procedures for Air Navigation Services – Air Traffic Management* (PANS-ATM, Doc 4444), 4.12.3.2, or by voice communication as per Annex 3, Appendix 4, 1.3 and PANS-ATM (Doc 4444), 4.12.3.3.

Note. — The MWO will compile special air-reports for uplink as per Annex 3, Appendix 6, and as reported using the instructions given PANS-ATM, Appendix 1.

2.5. Coordination between MWOs and ATS units

2.5.1. To achieve the best service to aviation and as part of the collaborative decision-making process, close coordination between the MWO and the ATS units is required. This is of particular importance for the avoidance of hazardous weather.

2.5.2. A Letter of Agreement between the ATS authority and the meteorological authority is also recommended (as per Annex 3, 4.2) to outline the responsibilities and coordination processes between the MWOs and ATS units.

2.6. Coordination between MWOs, VAACs, TCACs and State volcano observatories

2.6.1. Amongst the phenomena for which SIGMET information is required, volcanic ash and tropical cyclones are of particular importance.

2.6.2. Since the identification, analysis and forecasting of volcanic ash and tropical cyclones requires considerable scientific and technical resources, normally not available at each MWO, VAACs and TCACs have been designated to provide volcanic ash advisories and tropical cyclone advisories respectively to the users and assist the MWOs in the preparation of SIGMETs for those phenomena. Close coordination should be established between the MWO and its responsible VAAC and/or TCAC.

2.6.3. Information regarding the VAACs and TCACs areas of responsibility and lists of MWOs and ACC/FICs to which advisories are to be sent is provided in the regional ANPs FASID Tables MET 3A and MET 3B. Volcanic ash advisories and tropical cyclone advisories are required for global exchange through SADIS and WIFS as they are used by the operators during the pre-flight planning. Nevertheless, it should be emphasized that SIGMET information is still required especially for in-flight re-planning. SIGMETs should be transmitted to aircraft-in-flight through voice communication, VOLMET or D-VOLMET, thus providing vital information for making in-flight decisions regarding large-scale route deviations due to volcanic ash clouds or tropical cyclones.

2.6.4. Information from State volcano observatories is an important part of the process for issuance of volcanic ash advisories and SIGMETs. Information from a State volcano observatory should be in the form of a Volcano Observatory Notification for Aviation (VONA) and include information on significant pre-eruption volcanic activity, volcanic eruptions or the presence of volcanic ash clouds. Guidance including responsibilities for the issuance of the VONA is given in the *Handbook on the International Airways Volcano Watch (IAVW) – Operational Procedures and Contact List* (Doc 9766); the format of the VONA is given in Appendix E of the Doc 9766.

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3. PROCEDURES FOR PREPARATION OF SIGMET INFORMATION

3.1. General

3.1.1. SIGMET is intended for transmission to aircraft in flight either by ATC or by VOLMET or D-VOLMET, and therefore, SIGMET messages should be kept concise. To this end, SIGMET information is prepared using approved ICAO abbreviations, a limited number of non-abbreviated words and, numerical values of a self-explanatory nature.

3.1.2. The increasing use of automated systems for handling the aeronautical meteorological information by the users makes it essential that all types of OPMET information, including SIGMET messages, are prepared and issued in the prescribed standardized format. Therefore, the format of the SIGMET message, as specified in Annex 3, Appendix 6, should be strictly followed by the MWOs.

3.1.3. The MWO should maintain watch over the evolution of the phenomenon for which a SIGMET has been issued. If the phenomenon persists or is expected to persist beyond the period of validity of the SIGMET, another SIGMET message for a further period of validity should be issued with updated information. SIGMETs for volcanic ash and tropical cyclone should be updated at least every 6 hours, while SIGMET for all other phenomena should be updated at least every 4 hours.

3.1.4. SIGMET should be promptly cancelled when the phenomenon is no longer occurring or no longer expected to occur in the MWO's area of responsibility.

3.1.5. Some SIGMET are generated using information from special air-reports (received by voice communications or data link (downlink)). The reporting of turbulence and icing used in special air-reports includes both moderate and severe categories (as per Doc 4444, Appendix 1).

Note. — Although the categories for the reporting, by pilots, of moderate and severe turbulence in special air-reports is provided in PANS-ATM (Doc 4444), some pilots report turbulence as "moderate to severe". A MWO is then faced with determining which category to use in a special air-report (uplink) or in a SIGMET message for severe turbulence. Some States elect to treat such "moderate to severe" observations as 'severe' in the context of using the report to prompt the issuance of a special air-report (uplink) or a SIGMET message.

3.2. SIGMET phenomena

3.2.1. SIGMET shall only be issued for the phenomena listed in Table 1 below and only using the abbreviations as indicated.

Phenomena Abbreviation	Description
OBSC TS	Thunderstorms that are obscured by haze or smoke or cannot be readily seen due to darkness.
EMBD TS	Thunderstorms that are embedded within cloud layers and cannot be readily recognized by the pilot in command
FRQ TS	Frequent thunderstorms where, within the area of thunderstorms, there is little no separation between adjacent thunderstorms with a maximum spatial coverage greater than 75%.
SQL TS	A squall line indicating that a line of thunderstorms with little or no space between individual cumulonimbus clouds (CB).
OBSC TSGR	Thunderstorms with hail that are obscured by haze or smoke or cannot be readily seen due to darkness.
EMBD TSGR	Thunderstorms with hail that are embedded within cloud layers and cannot be readily recognized.
FRQ TSGR	Frequent thunderstorms with hail, within the area of thunderstorms, there is little or no separation between adjacent thunderstorms with a maximum spatial coverage greater than 75%.
SQL TSGR	A squall line indicating that a line of thunderstorms with hail with little or no space between cumulonimbus clouds (CB).
TC	A tropical cyclone with a 10 minute mean surface wind speed of 17m/s (34 kt) or more.
SEV TURB	Severe turbulence referring to: • low-level turbulence associated with strong surface winds; • rotor streaming; or • clear air turbulence, whether in cloud or not in cloud. *Note. — Turbulence should not be used in connection with convective clouds. Severe turbulence shall be considered whenever the peak value of the cube root of EDR exceeds 0.7.*
SEV ICE	Severe icing not associated with convective cloud.
SEV ICE (FZRA)	Severe icing caused by freezing rain and not associated with convective cloud.
SEV MTW	Severe mountain wave the accompanying downdraft is 3 m/s (600 ft/min) or more or when severe turbulence is observed or forecast.
HVY DS	Heavy duststorm where the visibility is below 200 m and the sky is obscured.
HVY SS	Heavy sandstorm where the visibility is below 200 m and the sky is obscured.
VA	Volcanic ash
RDOACT CLD	Radioactive cloud

Table 1: *SIGMET phenomena abbreviations and descriptions*

3.3. Allowable abbreviations

3.3.1. Abbreviations that can be used in the meteorological section of SIGMET are given in Table 1 above and in Table 2 below.

Abbreviation	Meaning		Abbreviation	Meaning
ABV	Above		NE	North-east
AT	At (followed by time)		NNE	North-north-east
BLW	Below		NNW	North-north-west
BTN	Between		NM	Nautical miles
CB	Cumulonimbus cloud		NO	No
CLD	Cloud		NW	North-west
CNL	Cancel or cancelled		OBS	Observe or observed or observation
E	East or eastern longitude		PSN	Position
ENE	East-north-east		S	South or southern latitude
ESE	East-south-east		SE	South-east
EXP	Expect or expected or expecting		SFC	Surface
FCST	Forecast		SSE	South-south-east
FIR	Flight information region		SSW	South-south-west
FL	Flight level		STNR	Stationary
FT	Feet		SW	South-west
INTSF	Intensify or intensifying		TO	To
KM	Kilometres		TOP	Cumulonimbus cloud top (height)
KT	Knots		W	West or western longitude
M	Metres		WID	Width or wide
MOV	Move or moving or movement		WKN	Weaken or weakening
MT	Mountain		WNW	West-north-west
N	North or northern latitude		WSW	West-south-west
NC	No change		Z	Coordinated Universal Time

Table 2: *SIGMET phenomena abbreviations and descriptions.*

3.4. SIGMET structure

3.4.1. A SIGMET message consists of:

- ***WMO Abbreviated Heading Line (WMO AHL)*** – all SIGMETs are preceded by an appropriate WMO AHL;
- ***First line***, containing location indicators of the respective ATS unit and MWO, sequential number and period of validity;
- ***SIGMET main body***, containing information concerning the observed or forecast phenomenon for which the SIGMET is issued together with its expected evolution within the period of validity;

3.5. SIGMET format

Note. — In the following text, square brackets - [ ] - are used to indicate an optional or conditional element, and angled brackets - < > - for symbolic representation of a variable element, which in a real SIGMET accepts a discrete numerical value.

3.5.1. WMO header

$T_1T_2A_1A_2$ii CCCC YYGGgg [BBB]

3.5.1.1. The group **$T_1T_2A_1A_2$ii** is the bulletin identification (WMO AHL) for the SIGMET message. It is constructed in the following way:

T_1T_2	Data type designator	**WS** – for SIGMET for phenomena other than volcanic ash cloud or tropical cyclone **WC** – for SIGMET for tropical cyclone **WV** – for SIGMET for volcanic ash
A_1A_2	Country or territory designators	Assigned according to Table C1, Part II of *Manual on the Global Telecommunication System*, Volume I – *Global Aspects* (WMO Publication No. 386)
ii	Bulletin number	Assigned on national level according to p 2.3.2.2, Part II of *Manual on the Global Telecommunication System*, Volume I – *Global Aspects* (WMO Publication No. 386)

Table 3: *Specification of the WMO Abbreviated Header Line for SIGMET*

Note .1 — Tropical cyclone and volcanic ash cloud SIGMETs will be referred to hereafter as WC SIGMET (due to the T_1T_2 section of the WMO AHL being set to WC) and WV SIGMET (due to the T_1T_2 section of the WMO AHL being set to WV) respectively. All other SIGMET types will be referred to by WS (due to the T_1T_2 section of the WMO AHL being set to WS).

Note 2. — WMO AHLs for SIGMET bulletins used by [INSERT REGION NAME] MWOs are listed in Appendix D to this SIGMET Guide.

3.5.1.2. **CCCC** is the ICAO location indicator of the communication centre disseminating the message (this may be the same as the MWO location indicator).

3.5.1.3. **YYGGgg** is the date/time group; where **YY** is the day of the month and **GGgg** is the time of transmission of the SIGMET in hours and minutes UTC (normally this time is assigned by the disseminating (AFTN) centre).

Examples:

WSTH31 VTBS 121200

WVJP31 RJTD 010230

WCNG21 AYPY 100600

3.5.2. First line of SIGMET

CCCC SIGMET [n][n]n VALID YYGGgg/YYGGgg CCCC-

3.5.2.1. The meaning of the groups in the first line of the SIGMET is as follows:

CCCC	ICAO location indicator of the ATS unit serving the FIR or CTA to which the SIGMET refers
SIGMET	Message identifier
[n][n]n	Daily sequence number (see 3.5.2.2)
VALID	Period of validity indicator
YYGGgg/YYGGgg	Validity period of the SIGMET given by date/time group of the beginning and date/time group of the end of the period (see 3.5.2.3)
CCCC	ICAO location indicator of the issuing MWO
-	Mandatory **hyphen** to separate the preamble from the text

Table 4: *Elements making up the first line of SIGMET*

3.5.2.2. The numbering of SIGMETs starts every day at 0001 UTC. The sequence number should consist of up to three alphanumeric characters and may be a combination of letters and numbers, such as:

- **1**, **2**, …
- **01**, **02**, …
- **A01**, **A02**, …

Examples:

RPMM SIGMET 3 VALID 121100/121700 RPLL-
WSJC SIGMET A04 VALID 202230/210430 WSSS-

*Note 1. — No other combinations should be used, like "***CHARLIE 05***" or "***NR7***".*

Note 2. — Correct numbering of SIGMET is very important since the number is used for reference in communication between ATC and pilots and in VOLMET and D-VOLMET.

Note 3. — In accordance with Annex 5 – Units of Measurement to be Used in Air and Ground Operations, *when the validity period begins or ends at midnight, YY should be set for the following day and GGgg should be '0000'. i.e. SIGMET validity ending at midnight on the 23rd day of the month should be expressed as '240000'.*

Note 4. - The sequence number is the sequence number for all SIGMET messages types (WS, WV and WC) for one flight information region

3.5.2.3. The following regulations apply when determining the validity period:

- The period of validity of a **WS** SIGMET should not be more than 4 hours;
- The period of validity of a **WC** or **WV** SIGMET should not be more than 6 hours;
- In case of a SIGMET for an observed phenomenon, the filing time (date/time group in the WMO header) should be the same or very close to the time in the date/time group indicating the start of the SIGMET validity period;

- When the SIGMET is issued for a forecast phenomenon:
  - the beginning of validity period should be the time of the expected commencement (occurrence) of the phenomenon in the MWO area of responsibility;
  - the time of issuance of a **WS** SIGMET should not be more than 4 hours before the start of validity period (i.e., expected time of occurrence of the phenomenon); and for **WC** (tropical cyclone) and **WV** (volcanic ash) SIGMET the lead time should not be more than 12 hours.

3.5.2.4. The period of validity is that period during which the SIGMET information is valid for transmission to aircraft in flight.

Examples:

1) First two lines of a SIGMET for an observed phenomenon:

```
WSTH31 VTBS 241120
VTBB SIGMET 3 VALID 241120/241500 VTBS–
```

2) First two lines of a SIGMET for a forecast phenomenon (expected time of occurrence 1530)

```
WSSR20 WSSS 311130
WSJC SIGMET 1 VALID 311530/311930 WSSS-
```

3.5.3. Structure of the meteorological part of SIGMET

3.5.3.1. The meteorological part of a SIGMET for the phenomena consists of elements as shown in the table below.

Start of the second line of the message

1	2	3	4	5	6
Name of the FIR/UIR or CTA (M)	TEST or EXERCISE (C)	Phenomenon (M)	Observed or forecast phenomenon (M)	Location (C)	Level (C)
See 3.5.3.2	See 3.5.3.3	See 3.5.3.4	See 3.5.3.5	See 3.5.3.6	See 3.5.3.7

7	8	9	10	11	12
Movement *or* expected movement (C)	Changes in intensity (C)	Forecast time (C)	TC Forecast position (C)	Forecast position (C)	Repetition of elements (C)
See 3.5.3.8	See 3.5.3.9	See 3.5.3.10	See 3.5.3.11	See 3.5.3.12	See 3.5.3.13

Table 5: *Elements making up the meteorological part of SIGMET.*

Note 1) Item 2, 'TEST or EXERCISE' should only be used if the SIGMET message is for TEST or EXERCISE purposes.
Note 2) Item 7, 'Movement or expected movement' should not be used if the 'forecast time' and 'forecast position' elements are used.
Note 3) M = inclusion mandatory, part of every message. C = inclusion conditional, include whenever applicable.

3.5.3.2. Name of the FIR/UIR or CTA

CCCC <name> FIR[/UIR]

or

CCCC <name> CTA

The ICAO location indicator and the name of the FIR/CTA are given followed by the appropriate abbreviation: FIR, FIR/UIR or CTA. The name may consist of up to 10 characters.

Examples:

VTBB BANGKOK FIR

3.5.3.3. TEST or EXERCISE (applicable 7 Nov 2019]

This field will only be used if the SIGMET message is intended to be used for TEST or EXERCISE purposes. The omission of this field indicates that the SIGMET is intended for operational decision making.

When used, the SIGMET message may either end immediately after the word TEST or EXERCISE. Alternatively, depending on the nature of the TEST and under most EXERCISE circumstances the SIGMET message may contain realistic, although not necessarily valid content (the nature of TESTs and EXERCISES may require historical data to be used).

3.5.3.4. Phenomenon

The phenomenon description consists of a qualifier and a phenomenon abbreviation. SIGMET should be issued only for the following phenomena observed and forecast to persist for more than a transitory period.:

- thunderstorms – if they are **OBSC**, **EMBD**, **FRQ** or **SQL** with or without hail (**GR**);
- turbulence – only **SEV**
- icing – only **SEV** with or without **FZRA**
- mountain waves – only **SEV**
- dust storm – only **HVY**
- sand storm – only **HVY**
- radioactive cloud – **RDOACT CLD**

For volcanic ash SIGMET (WV) only, the following conventions should be used

a) In the case when the eruption is from a previously unknown or un-named volcano.

VA ERUPTION PSN Nnn[nn] or Snn[nn] Ennn[nn] or Wnnn[nn] VA CLD

b) In the case when the eruption is from a known and named volcano. The name may be up to 10 alphanumeric characters.

VA ERUPTION MT nnnnnnnnnn PSN Nnn[nn] or Snn[nn] Ennn[nn] or Wnnn[nn] VA CLD

c) In the case when a region of volcanic ash cloud is known to exist, but the precise origin of its source is unknown (the ash cloud may be of large horizontal extent, and obscuring the precise vent from which it emanates, and is otherwise in an area sparse of observation to identify the source).

VA CLD

For tropical cyclone SIGMET (WC) only, the following conventions should be used

a) In the case when the tropical cyclone is known and named. The name may be up to 10 alphanumeric characters.

TC nnnnnnnnnn PSN Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] CB

b) In the case when the tropical cyclone is not yet named.

TC NN PSN Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] CB

The appropriate abbreviations and combinations, and their meaning are given in Table 1.

3.5.3.5. Indication whether the phenomenon is observed or forecast

OBS

or

OBS AT GGggZ

or

FCST

or

FCST AT GGggZ

The indication whether the phenomenon is observed or forecast is given by using the abbreviations **OBS** or **FCST**. **OBS AT** and **FCST AT** may be used, in which case they are followed by a time group in the form **GGggZ**. If the phenomenon is observed, **GGggZ** is the time of the observation in hours and minutes UTC. If the exact time of the observation is not known the time is not included. When the phenomenon is based on a forecast without a reported observation, the time given for **GGggZ** represents the time of commencement of the validity period**.**

Examples:

OBS

OBS AT 0140Z

FCST

FCST AT 0200Z

3.5.3.6. Location of the phenomenon

The location of the phenomenon is given with reference to geographical coordinates (latitude and longitude). Latitude and longitude may be reported in degrees, or in degrees and minutes. When reporting in degrees the format will be **Nnn** or **Snn** for latitude, and **Ennn** or **Wnnn** for longitude. When reporting in degrees and minutes the format will be **Nnnnn** or **Snnnn** for latitude, and **Ennnnn** or **Wnnnnn** for longitude. The MWOs should try to be as specific as possible in reporting the location of the phenomenon and, at the same time, to avoid overwhelming the SIGMET with too many coordinates, which may be difficult to process or follow when transmitted by voice radio.

The following are the possible ways to describe the location of the phenomenon:

1) An area of the FIR defined by a polygon. Minimum 4 coordinates[1], and not normally more than 7 coordinates. This is the format preferred operationally by users.

   Symbolically, this is indicated as:

   ```
   WI <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or <Ennn[nn]> -
   <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or <Ennn[nn]> -
   <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or <Ennn[nn]> -
   <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or <Ennn[nn]> -
   <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or <Ennn[nn]> -
   <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or <Ennn[nn]> -
   <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or <Ennn[nn]>
   ```

   For example:

   WI N6030 E02550 – N6055 E02500 – N6050 E02630 – N6030 E02550

   WI N60 E025 – N62 E027 - N58 E030 - N59 E026 - N60 E025

Note 1. — The points of a polygon should be provided in a clockwise order, and the end point should be a repeat of the start point.

Note 2. - The location of phenomenon given at the beginning of the SIGMET is referring to the beginning of the validity period if the exact time group of OBS or FCST phenomenon is not included

Use of polygons with complex FIR boundaries.

Annex 3 (19th Edition, July 2016) specifies that the points of a polygon '... should be kept to a minimum and should not normally exceed seven'. However, some FIR boundaries are complex, and it would be unrealistic to expect that a polygon would be defined that followed such boundaries exactly. As such, some States have determined that the polygon points be chosen in relation to the complex boundary such that the FIR boundary approximates, but is wholly encompassed by, the polygon, and that any additional area beyond the FIR boundary be the minimum that can be reasonably and practically described. Caution should however be exercised in those instances where international

[1] Including the last point as a repeat of the first point to explicitly close the polygon

*aerodromes are located in close proximity to such a complex FIR boundary. **Appendix B** provides examples and advice with regard to describing such areas.*

2a) In a sector of the FIR defined relative to a specified line, or single series of up to three connected lines, with start and end points on the FIR boundary (or so close to the FIR boundary so as to leave no doubt that the intent is for the line to connect to the FIR boundary at that point).

Symbolically this is indicated as:

```
<N OF> or <NE OF> or <E OF> or <SE OF> or <S OF> or
<SW OF> or <W OF> or <NW OF> LINE <Nnn[nn]> or
<Snn[nn]> <Wnnn[nn]> or <Ennn[nn]> - <Nnn[nn]> or
<Snn[nn]> <Wnnn[nn]> or <Ennn[nn]>
```

For example:

NE OF LINE N2500 W08700 – N2000 W08300

W OF LINE N20 E042 – N35 E045

2b) In a sector of the FIR defined as being between two lines of latitude, or between two lines of longitude.

Symbolically this is indicated as:

```
<N OF> or <S OF> <Nnn[nn]> or <Snn[nn]> AND <N OF> or
<S OF> <Nnn[nn]> or <Snn[nn]>

<W OF> or <E OF> <Wnnn[nn]> or <Ennn[nn]> AND <W OF>
or <E OF> <Wnnn[nn]> or <Ennn[nn]>
```

Chosen so that the affected area is BETWEEN lines of latitude or BETWEEN lines of Longitude

For example:

N OF N1200 AND S OF N2530

W OF W060 AND E OF W082

2c) In a sector of the FIR defined as being **between** two specified lines, or **between** two series of up to three connected lines, each with start and endpoints on the FIR boundary (or start and endpoints so close to the FIR boundary so as to leave no doubt that the intent is for the line to connect to the FIR boundary at those points).

```
<N OF> or <NE OF> or <E OF> or <SE OF> or <S OF> or
<SW OF> or <W OF> or <NW OF> LINE <Nnn[nn]> or
<Snn[nn]> <Wnnn[nn]> or <Ennn[nn]> - <Nnn[nn]> or
<Snn[nn]> <Wnnn[nn]> or <Ennn[nn]>[ - <Nnn[nn]> or
<Snn[nn]> <Wnnn[nn]> or <Ennn[nn]>][ - <Nnn[nn]> or
<Snn[nn]> <Wnnn[nn]> or <Ennn[nn]>] AND <N OF> or <NE
OF> or <E OF> or <SE OF> or <S OF> or <SW OF> or <W
OF> or <NW OF> LINE <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]>
or <Ennn[nn]> - <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or
```

<Ennn[nn]> [- <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or
<Ennn[nn]>][- <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or
<Ennn[nn]>]

For example:

NE OF LINE N2500 W08700 – N2000 W08300 AND SW OF LINE N2800 W08500 – N2200 W08200

W OF LINE N20 E042 – N35 E045 AND E OF LINE N20 E039 – N35 E043

2d) In a sector of the FIR defined relative to a line of latitude and a line of longitude (effectively a quadrant);

Symbolically this is indicated as:

<N OF> or <S OF> <Nnn[nn]> or <Snn[nn]> AND
<E OF> or <W OF> <Wnnn[nn]> or <Ennn[nn]>

For example:

N OF N1200 AND E OF W02530

S OF N60 AND W OF E120

2e) In a sector of the FIR defined relative to a line of latitude or longitude (effectively a segment), where a coordinate of latitude (or longitude) defines a line, and the preceding descriptor defines on which side of the line the phenomena is expected

Symbolically, this is indicated as:

<N OF> or <S OF> <Nnn[nn]> or <Snn[nn]> or
<E OF> or <W OF> <Wnnn[nn]> or <Ennn[nn]>

For example:

N OF S2230

W OF E080

3) Defined by a ‘corridor’ of specified width, centred upon a line, of up to three connected segments, described by;

nnKM WID LINE BTN <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or
<Ennn[nn]> - <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or
<Ennn[nn]>[- <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or
<Ennn[nn]>][- <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or
<Ennn[nn]>]

or

nnNM WID LINE BTN <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or
<Ennn[nn]> - <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or

<Ennn[nn]>[- <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or <Ennn[nn]>][- <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or <Ennn[nn]>]

4) At a specific point within the FIR, indicated by a single coordinate of latitude and longitude.

Symbolically, this is indicated as:

<Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or <Ennn[nn]>

For example:

N5530 W02230

S23 E107

5) Within a specified radius of the centre of a tropical cyclone.

Symbolically, this is indicated as:

WI nnnKM OF TC CENTRE

WI nnnNM OF TC CENTRE

6) Within a specified radius of the location of a radioactive release event.

Symbolically, this is indicated as:

WI nnKM OF <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or <Ennn[nn]>
WI nnNM OF <Nnn[nn]> or <Snn[nn]> <Wnnn[nn]> or <Ennn[nn]>

When detailed information on the release is not available, a radius of up to 30 kilometres (or 16 nautical miles) from the source may be applied; and a vertical extent from surface (SFC) to the upper limit of the flight information region/upper flight information region (FIR/UIR) or control area (CTA) is to be applied. [Applicable 7 November 2019].

7) A reference to the whole FIR, FIR/UIR, or CTA .

Symbolically, this is indicated as:

ENTIRE FIR

ENTIRE UIR

ENTIRE FIR/UIR

ENTIRE CTA

More detail on reporting the location of the phenomenon is given in the examples provided in **Appendix B** to this guide.

3.5.3.7. Flight level

Symbolically, the options permitted are:

FLnnn

or

nnnnM

or

[n]nnnnFT

or

SFC/FLnnn

or

SFC/nnnnM

or

SFC/[n]nnnnFT

or

FLnnn/nnn

or

TOP FLnnn or TOP [n]nnnnFT

or

ABV FLnnn

or

TOP ABV FLnnn or TOP ABV [n]nnnnFT

or

TOP BLW FLnnn (only to be used for tropical cyclone)

or

nnnn/nnnnM

or

[n]nnnn/[n]nnnnFT

or

nnnnM/FLnnn

or

[n]nnnnFT/FLnnn

In more detail, the location or extent of the phenomenon in the vertical is given by one or more of the above methods, as follows:

1) reporting at a single flight level

For example: **FL320**

2) reporting at a single geometric level, in metres or feet

For example: **4500M or 8250FT or 12000FT**

3) reporting a layer extending from the surface to a given height in meters, feet or flight level

For example: **SFC/3000M or SFC/9900FT or SFC/11000FT or SFC/FL350**

4) reporting a layer extending from a given FL to a higher flight level

For example: **FL250/290**

5) reporting a layer where the base is unknown, but the top is given:

For example: **TOP FL350**

6) reporting phenomenon above a specified flight level, but where the upper limit is unknown:

For example: **ABV FL350**

7) reporting phenomenon that has an unknown lower limit, but has an upper limit that is known to extend above a known flight level:

For example: **TOP ABV FL350**

8) reporting phenomenon expected between a lower and upper geometric level expressed in metres or feet:

For example: **3500/9000M or 8000/12000FT or 11000/14000FT**

9) reporting phenomenon expected between a lower geometric level expressed in metres or feet and a higher flight level:

For example: **4000M/FL220 or 6000FT/FL140 or 11000FT/FL190**

10) reporting the CB upper limit for tropical cyclone SIGMET

For example: **TOP BLW FL450**

Additional examples:

EMBD TS … TOP ABV FL340
SEV TURB … FL180/210
SEV ICE … SFC/FL150
SEV MTW … FL090

3.5.3.8. Movement

Note. — Footnote 24 to Table A6-1A of ICAO Annex 3 states that "The elements 'Forecast Time' and 'Forecast Position' are not to be used in conjunction with the element 'Movement or Expected Movement'".

Rate of movement is indicated in the following way:

MOV <direction> <speed>KMH[KT]

or

STNR

Direction of movement is given with reference to one of the sixteen points of compass (**N**, **NNE**, **NE**, **ENE**, **E**, **ESE**, **SE**, **SSE**, **S**, **SSW**, **SW**, **WSW**, **W**, **WNW**, **NW**, **NNW**). Speed is given in **KMH** or **KT**. The abbreviation **STNR** is used if no significant movement is expected.

For example:

MOV NNW 30KMH

MOV E 25KT

STNR

Note – Movement information should not be provided when a forecast position is explicitly given

3.5.3.9. Expected changes in intensity

The expected evolution of the phenomenon's intensity is indicated by one of the following abbreviations:

INTSF

or

WKN

or

NC

3.5.3.10. Forecast time

This section is used, with 'Forecast position' to explicitly provide a forecast of the position of the phenomena at the time specified. The format is fixed, and is of the form

FCST AT nnnnZ

For example

FCST AT 1600Z

Where the forecast time is the same as the SIGMET validity end time.

Note. — In accordance with Annex 5 – Units of Measurement to be Used in Air and Ground Operations, *when the validity period ends at midnight, YY should be set for the following day and GGgg should be '0000'. i.e. SIGMET validity ending at midnight on the 23rd day of the month should be expressed as '240000'.*

3.5.3.11. TC Forecast position

Only to be used for tropical cyclones, and used to indicate the location of the centre of the tropical cyclone.

The forecast centre position of a tropical cyclone is given by:

TC CENTRE PSN Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]

For example

TC CENTRE PSN N2740 W07345

3.5.3.12. Forecast position of the hazardous phenomenon at the end of the validity period of the SIGMET message

The available methods of describing the forecast position of the phenomenon in the 'Forecast position' section is exactly as detailed in section 3.5.3.6 with the addition of :

a) For volcanic ash which is not expected to be present within the FIR at the end of the validity of the SIGMET, the following is permitted:

NO VA EXP

Note. — Currently, there is no provision for indicating changes to the levels affected by phenomena between the initial position and the forecast position. As such, and as per footnote 28 to Table A6-1A of Annex 3 (19th Edition, July 2016), it should be assumed that the levels affected remain the same for both initial and forecast positions. If levels differ significantly then separate SIGMET should be issued.

3.5.3.13. Repetition of elements (volcanic ash and tropical cyclone SIGMET only)

Elements can be repeated when there are instances of two volcanic ash clouds, or two areas of cumulonimbus cloud associated with a tropical cyclone.

Note. — This is must not be used for two separate tropical cyclones that are present in a FIR, or UIR.

With regard to the portrayal of complex volcanic ash events (which implies areas of volcanic ash at different levels) guidance in this regard is provided in Appendix B, example 9.

With regard to the portrayal of two areas of cumulonimbus clouds associated with a tropical cyclone, guidance is provided in Appendix B, example 10.

3.5.4. Cancellation of SIGMET

Annex 3, 7.1.2 requires that "*SIGMET information shall be cancelled when the phenomena are no longer occurring or are no longer expected to occur in the area*".

As such, it is mandatory for an MWO to cancel any SIGMET that is currently valid but for which the specified phenomena no longer exists or is expected to exist.

The cancellation is done by issuing the same type of SIGMET (i.e. WS, WV or WC) with the following structure:

- WMO heading with the same data type designator;
- First line, including the next sequence number followed by a new validity period that represents the remaining time of the original period of validity, and
- Second line, which contains the name of the FIR or CTA, the combination CNL SIGMET, followed by the sequence number of the original SIGMET and its original validity period.

A cancellation SIGMET should have a unique sequence number, and should follow the format below.

As an example, an original SIGMET of:

```
YMMM SIGMET A01 VALID 260300/260700 YPRF-
YMMM MELBOURNE FIR EMBD TS FCST WI S4000 E12000 – S3830 E12200
– S4200 E12100 – S4000 E12000 TOP FL450 MOV SW 05KT INTSF=
```

If it were to be cancelled early (i.e. prior to 0700 UTC), then the following would be appropriate:

```
YMMM SIGMET A02 VALID 260600/260700 YPRF-
YMMM MELBOURNE FIR CNL SIGMET A01 260300/260700=
```

Where:

- the sequence number will be the next incrementing, unique sequence number.
- the validity time will be the time remaining between issuance and the end time of the original SIGMET.
- the sequence number of the original (and to be cancelled) SIGMET shall follow '`CNL SIGMET `'.
- the original validity time of the original (and to be cancelled) SIGMET shall be included in the message after the reference to the original SIGMET's sequence number.

For SIGMET for volcanic ash only, the following is permitted:

```
WSAU21 ADRM 202155
YBBB SIGMET E03 VALID 202155/210000 YPDM-
YBBB BRISBANE FIR CNL SIGMET E01 202000/210000 VA MOV TO WXYX
FIR=
```

Where the FIR (`WXYZ` in the example) into which the volcanic ash has moved is indicated.

3.5.5. Amendment/correction of SIGMET

If it is known that an existing SIGMET no longer accurately describes the existing or expected future evolution of the phenomena a new SIGMET, correctly describing the hazard should be issued, followed immediately by a cancellation of the original, erroneous SIGMET. The new SIGMET should be issued before the cancellation in order to ensure there is always a SIGMET in force and that the cancellation is not mistakenly understood to mean that the hazard has completely dissipated.

Originally issued SIGMET, later determined to no longer be accurate (bold text identifies points that will be changed):

```
WSAU21 ADRM 201855
YBBB SIGMET E01 VALID 202000/210000 YPDM-
YBBB BRISBANE FIR SEV TURB FCST WI S1530 E13700 - S1900 E13730
– S2000 E13130 - S1600 E13500 - S1530 E13700 SFC/FL120 MOV SE
12KT WKN=
```

Updated SIGMET (bold text identifies points that have been changed):

```
WSAU21 ADRM 202155
YBBB SIGMET E02 VALID 202200/210000 YPDM-
YBBB BRISBANE FIR SEV TURB FCST WI S1530 E13700 - S2000 E13750
– S2045 E13245 - S1600 E13500 - S1530 E13700 SFC/FL120 MOV SE
12KT WKN=
```

Cancellation SIGMET (this cancels the original SIGMET):

```
WSAU21 ADRM 202156
YBBB SIGMET E03 VALID 202155/210000 YPDM-
YBBB BRISBANE FIR CNL SIGMET E01 202000/210000=
```

Note, it is essential that the times of issuance of the updated (correct) SIGMET and the cancellation are separated by at least one minute to prevent inadvertent suppression by message switches. However, it is also important that the minimum delay between issuance of the updated and the cancellation messages.

3.6. Dissemination of SIGMET

3.6.1. SIGMET is part of operational meteorological (OPMET) information. According to Annex 3, the telecommunication facilities used for the exchange of the operational meteorological information should be the aeronautical fixed service (AFS).

3.6.2. The AFS consists of a terrestrial segment, AFTN or ATN (AMHS), as well as the Internet-based SADIS FTP and WIFS services provided by WAFC London and WAFC Washington respectively. Note that SIGMET priority indicator is **FF** for flight safety messages (Annex 10, Volume II, 4.4.1.1.3 refers).

3.6.3. Currently, AFTN links should be used by the MWOs to send the SIGMET, as follows:

- to the adjacent MWOs and ACCs[2] using direct AFTN addressing;
- when required for VOLMET or D-VOLMET, SIGMET should be sent to the relevant centre providing the VOLMET service;
- SIGMET should be sent to all regional OPMET Data Banks (RODB);
- it should be arranged that SIGMET is relayed to the SADIS and WIFS providers for satellite/public internet dissemination, as well as to the WAFCs London and Washington, either through the ROBEX scheme, or directly by the issuing MWO;
- SIGMET for volcanic ash should be disseminated to the responsible VAAC.

3.6.4. Through SADIS and WIFS, SIGMET is disseminated to all authorised users. In this way, SIGMET is available on a global basis, meeting the aeronautical requirements.

— — — — — — — —

[2] For this dissemination it is required that SIGMET is available at the ACCs for transmission to aircraft in flight for the route ahead up to a distance corresponding to two hours flying time.

APPENDIX A

ENHANCED SIGMET GUIDANCE TABLE DEVELOPED FROM ANNEX 3 TABLE A6-1A

Note. — The table below seeks to provide more detailed guidance than that given in Table A6-1A of Annex 3 (19th Edition, July 2016). It does this by removing all references to the AIRMET message. Table A6-1A. The table below simplifies the available options and provides more specific expansion of the symbolic structure of SIGMET messages, with guidance sub-titles where appropriate. It should be noted that Annex 3, Appendix 6, Table A6-1A remains the authoritative reference.

Ref No.	Element as specified in Chapter 5 and Appendix 6	Detailed Content	Expanded symbolic - These 'expanded' symbolic representations of the various SIGMET code elements represent the interpretation of Table A6-1A of Annex 3. MWOs are encouraged to align their SIGMETs with the guidelines below.	Examples. These examples of various SIGMET code elements represent the interpretation A6-1A of Annex 3. MWOs are encouraged to align their SIGMETs with the examples below.
1.1	Location indicator of FIR/CTA (M)[1]	ICAO location indicator of the ATS unit serving the FIR or CTA to which the SIGMET refers	Nnnn	YUCC[2] YUDD[2]
1.2	Identification (M)	Message identification and sequence number[3]	SIGMET n SIGMET nn SIGMET nnn	SIGMET 1 SIGMET 01 SIGMET A01
1.3	Validity period (M)	Day-time groups indicating the period of validity in UTC	VALID nnnnnn/nnnnnn	VALID 010000/010400 VALID 221215/221600 VALID 101520/101800 VALID 251600/252200 VALID 152000/160000 VALID 192300/200300 VALID 122200/130400 (6 hour validity applicable to TC or VA only)
1.4	Location indicator of MWO (M)	Location indicator of MWO originating the message with a separating hyphen	nnnn-	YUDO–[2] YUSO–[2]
1.5	Name of the FIR/CTA (M)	Location indicator and name of the FIR/CTA[4] for which the SIGMET is issued	nnnn nnnnnnnnnn FIR nnnn nnnnnnnnnn UIR nnnn nnnnnnnnnn FIR/UIR nnnn nnnnnnnnnn CTA	YUCC AMSWELL FIR[2] YUDD SHANLON FIR/UIR[2] YUDD SHANLON FIR[2] YUCC AMSWELL CTA[2]
1.6	Status indicator[5] (C)*	Indicator of test or exercise	TEST *or* EXER	TEST EXER

Ref No.	Element as specified in Chapter 5 and Appendix 6	Detailed Content	Expanded symbolic - These 'expanded' symbolic representations of the various SIGMET code elements represent the interpretation of Table A6-1A of Annex 3. MWOs are encouraged to align their SIGMETs with the guidelines below.	Examples. These examples of various SIGMET code elements represent the interpretation A6-1A of Annex 3. MWOs are encouraged to align their SIGMETs with the examples below.
2.1	Phenomenon (M)[6]	Description of phenomenon causing the issuance of SIGMET	OBSC[7] TS OBSC[7] TSGR[8] EMBD[9] TS EMBD[9] TSGR[8] FRQ[10] TS FRQ[10] TSGR[8] SQL[11] TS SQL[11] TSGR[8] TC nnnnnnnnn PSN Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] CB TC NN[12] PSN Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] CB SEV TURB[13] SEV ICE[14] SEV ICE (FZRA)[14] SEV MTW[15] HVY DS HVY SS VA ERUPTION PSN Nnn[nn] *or* Snn[nn] Ennn[nn] *or* Wnnn[nn] VA CLD VA ERUPTION MT nnnnnnnnn PSN Nnn[nn] *or* Snn[nn] Ennn[nn] *or* Wnnn[nn] VA CLD VA CLD RDOACT CLD	OBSC TS OBSC TSGR EMBD TS EMBD TSGR FRQ TS FRQ TSGR SQL TS SQL TSGR TC GLORIA PSN N2215 W07500 CB TC NN PSN S26 E150 CB SEV TURB SEV ICE SEV ICE (FZRA) SEV MTW HVY DS HVY SS VA ERUPTION PSN N27 W017 VA CLD VA ERUPTION PSN S1200 E01730 VA CLD VA ERUPTION MT ASHVAL[2] PSN S15 E073 VA CLD VA ERUPTION MT VALASH[2] PSN N2030 E02015 VA CLD VA CLD RDOACT CLD
2.2	Observed or forecast phenomenon (M)	Indication whether the information is observed and expected to continue, *or* forecast	OBS OBS AT nnnnZ FCST FCST AT nnnnZ	OBS OBS AT 1210Z FCST FCST AT 1815Z

Ref No.	Element as specified in Chapter 5 and Appendix 6	Detailed Content	Expanded symbolic - These 'expanded' symbolic representations of the various SIGMET code elements represent the interpretation of Table A6-1A of Annex 3. MWOs are encouraged to align their SIGMETs with the guidelines below.	Examples. These examples of various SIGMET code elements represent the interpretation A6-1A of Annex 3. MWOs are encouraged to align their SIGMETs with the examples below.
2.3	Location (C)[20]	Location (referring to latitude and longitude (in degrees and minutes))	1) An area of the FIR defined by a polygon. The end point shall be a repeat of the start point. Minimum 4 coordinates (including the last point as a repeat of the first), and not normally more than 7 coordinates. WI[21, 22] Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] – Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] – Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] – Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] [- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] [– Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]][- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] *or* 2a) In a sector of the FIR defined relative to a specified line, or single series of up to three connected lines, with start and endpoints on the FIR boundary (or so close to the FIR boundary so as to leave no doubt that the intent is for the line to connect to the FIR boundary at those points). [N][NE][E][SE][S][SW][W][NW] OF LINE[21] Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] – Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] [- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] [- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] *or* 2b) In a sector of the FIR defined as being **between** two lines of latitude, or **between** two lines of longitude. N OF Nnn[nn] or N OF Snn[nn] AND S OF Nnn[nn] or S OF Snn[nn] *or* W OF Wnnn[nn] or W OF Ennn[nn] AND E OF Wnnn[nn] or E OF Ennn[nn]	1) An area of the FIR defined by a polygon. The end point shall be a repeat of the start point. Minimum 4 coordinates (including the last point as a repeat of the first), and not normally more than 7 coordinates. WI N6030 E02550 – N6055 E02500 – N6050 E02630 - N6030 E02550 WI N30 W067 – N32 W070 – N35 W068 - N30 W067 *or* 2a) In a sector of the FIR defined relative to a specified line, or single series of up to three connected lines, with start and endpoints on the FIR boundary (or so close to the FIR boundary so as to leave no doubt that the intent is for the line to connect to the FIR boundary at those points). NE OF LINE N2515 W08700 – N2000 W08330 S OF LINE S14 E150 – S14 E155 *or* 2b) In a sector of the FIR defined as being **between** two lines of latitude, or **between** two lines of longitude. N OF N45 AND S OF N50 *or* W OF E04530 AND E OF E04000

			or 2c) In a sector of the FIR defined as being **between** two specified lines, or **between** two series of up to three connected lines, each with start and endpoints on the FIR boundary (or start and endpoints so close to the FIR boundary so as to leave no doubt that the intent is for the line to connect to the FIR boundary at those points). [N][NE][E][SE][S][SW][W][NW] OF LINE[21] Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] – Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] [- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] [- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] AND [N][NE][E][SE][S][SW][W][NW] OF LINE Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] – Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] [- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] [- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] 2d) In a sector of the FIR defined relative to a line of latitude and a line of longitude (effectively a quadrant); N OF Nnn[nn] AND W OF Wnnn[nn] *or* N OF Nnn[nn] AND E OF Wnnn[nn] *or* S OF Nnn[nn] AND W OF Wnnn[nn] *or* S OF Nnn[nn] AND E OF Wnnn[nn] *or* N OF Snn[nn] AND W OF Ennn[nn] *or* N OF Snn[nn] AND E OF Ennn[nn] *or* S OF Snn[nn] AND W OF Ennn[nn] *or* S OF Snn[nn] AND E OF Ennn[nn] *or* *or* 2e) In a sector of the FIR defined relative to a line of latitude or longitude (effectively a segment); N OF Nnn[nn] *or* S OF Nnn[nn] *or* N OF Snn[nn] *or* S OF Snn[nn] *or* W OF Wnnn[nn] *or* E OF Wnnn[nn] *or* W OF Ennn[nn] *or* E OF Ennn[nn]	or 2c) In a sector of the FIR defined as being **between** two specified lines, or **between** two series of up to three connected lines, each with start and endpoints on the FIR boundary (or start and endpoints so close to the FIR boundary so as to leave no doubt that the intent is for the line to connect to the FIR boundary at those points). SW OF LINE N50 W020 – N45 E010 AND NE OF LINE N45 W020 – N40 E010 2d) In a sector of the FIR defined relative to a line of latitude and a line of longitude (effectively a quadrant); S OF N3200 AND E OF E02000 S OF S3215 AND W OF E10130 S OF N12 AND W OF E040 N OF N35 AND E OF E078 *or* 2e) In a sector of the FIR defined relative to a line of latitude or longitude (effectively a segment); N OF S2230 S OF S43 E OF E01700 E OF W005

			or 3) Defined by a 'corridor' of specified width, centred upon a line, of up to three connected segments, described by; nnKM WID LINE[21] BTN Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] – Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] [– Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] [– Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] nnNM WID LINE[21] BTN Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] – Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] [– Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] [– Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] *or* 4) At a specific point within the FIR; Nnn[nn] Wnnn[nn] *or* Nnn[nn] Ennn[nn] *or* Snn[nn] Wnnn[nn] *or* Snn[nn] Ennn[nn] *or* 5) tropical cyclone; WI nnnKM (or nnnNM) OF TC CENTRE[22] 6) A cylinder of specified radius; [29] WI nnKM (or nnNM) OF Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]	*or* 3) Defined by a 'corridor' of specified width, centred upon a line, of up to three connected segments, described by; 50KM WID LINE BTN N64 W017 – N60 W010 – N57 E010 – N60 E015 50NM WID LINE BTN S1530 W09500 – S1815 W10130 – S2000 W10300 *or* 4) At a specific point within the FIR; N5530 W02230 S12 E177 *or* 5) tropical cyclone; WI 400KM OF TC CENTRE WI 250NM OF TC CENTRE 6) A cylinder of specified radius; [29] WI 30 KM OF N6030 E02550 WI 50 NM OF S2000 E04000

			or 7) A reference to the whole FIR, FIR/UIR, or CTA ENTIRE FIR ENTIRE FIR/UIR ENTIRE UIR ENTIRE CTA	*or* 7) A reference to the whole FIR, FIR/UIR, or CTA ENTIRE FIR ENTIRE FIR/UIR ENTIRE UIR ENTIRE CTA
2.4	Level (C)[20]	Flight level or altitude	1) Generic height/range descriptors to be used when 'Location' descriptors above are used. FLnnn nnnnFT nnnnnFT nnnnM SFC/FLnnn SFC/nnnnM SFC/nnnnFT SFC/nnnnnFT FLnnn/nnn TOP FLnnn ABV FLnnn TOP ABV FLnnn ABV [n]nnnnFT TOP ABV [n]nnnnFT nnnn/nnnnM [n]nnnn/[n]nnnnFT nnnnM/FLnnn [n]nnnnFT/FLnnn *or*[23] TOP BLW FLnnn *or*[23] TOP ABV FLnnn	1) Generic height/range descriptors to be used when 'Location' descriptors above are used. FL180 7000FT 10000FT 600M 1200M SFC/FL070 SFC/9000FT SFC/10000FT SFC/2500M FL050/080 FL310/450 TOP FL390 ABV FL280 ABV 7000FT TOP ABV FL100 TOP ABV 9000FT TOP ABV 10000FT 3000M 2000/3000M 8000FT 6000/12000FT 11000/14000FT 2000M/FL150 8000FT/FL190 10000FT/FL250 *or*[23] TOP BLW FL450 *or*[23] TOP ABV FL360

2.5	Movement *or* expected movement (C)[20, 24]	Movement *or* expected movement (direction and speed) with reference to one of the sixteen points of compass, *or* stationary	MOV[N][NNE][NE][ENE][E][ESE][SE][SSE][S][SSW][SW][WSW][W][WNW][NW][NNW] nnKMH *or* MOV[N][NNE][NE][ENE][E][ESE][SE][SSE][S][SSW][SW][WSW][W][WNW][NW][NNW] nnKT *or* STNR	MOV E 40KMH MOV E 20KT MOV SE 20KT STNR
2.6	Changes in intensity [20]	Expected changes in intensity (C)	INTSF *or* WKN *or* NC	INTSF WKN NC
2.7	Forecast time (C)[25]	Indication of the forecast time of the phenomena	FCST AT nnnnZ	FCST AT 2200Z FCST AT 0000Z
2.8	TC forecast position (C)[23]	Forecast position of TC centre at the end of the validity period of the SIGMET message	TC CENTRE PSN Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]	TC CENTRE PSN N1030 E1600015
2.9	Forecast position (C)[20, 25, 26]	Forecast position of volcanic ash cloud *or* the centre of the TC *or* other hazardous phenomena at the end of the validity period of the SIGMET message (C)	1) An area of the FIR defined by a polygon. The end point shall be a repeat of the start point. Minimum 4 coordinates (including the last point as a repeat of the first), and not normally more than 7 coordinates. WI[21, 22] Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] – Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] – Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] – Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] [- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] [– Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]][- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]]	1) An area of the FIR defined by a polygon. The end point shall be a repeat of the start point. Minimum 4 coordinates (including the last point as a repeat of the first), and not normally more than 7 coordinates. WI N6030 E02550 – N6055 E02500 – N6050 E02630 - N6030 E02550 WI N30 W067 – N32 W070 – N35 W068 - N30 W067

			or 2a) In a sector of the FIR defined relative to a specified line, or single series of up to three connected lines, with start and endpoints on the FIR boundary (or so close to the FIR boundary so as to leave no doubt that the intent is for the line to connect to the FIR boundary at those points). [N][NE][E][SE][S][SW][W][NW] OF LINE[21] Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] – Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] [- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] [- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] *or* 2b) In a sector of the FIR defined as being **between** two lines of latitude, or **between** two lines of longitude. N OF Nnn[nn] or N OF Snn[nn] AND S OF Nnn[nn] or S OF Snn[nn] *or* W OF Wnnn[nn] or W OF Ennn[nn] AND E OF Wnnn[nn] or E OF Ennn[nn] or 2c) In a sector of the FIR defined as being **between** two specified lines, or **between** two series of up to three connected lines, each with start and endpoints on the FIR boundary (or start and endpoints so close to the FIR boundary so as to leave no doubt that the intent is for the line to connect to the FIR boundary at those points). [N][NE][E][SE][S][SW][W][NW] OF LINE[21] Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] – Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] [- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] [- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] AND [N][NE][E][SE][S][SW][W][NW] OF LINE Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] – Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] [- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] [- Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]]	*or* 2a) In a sector of the FIR defined relative to a specified line, or single series of up to three connected lines, with start and endpoints on the FIR boundary (or so close to the FIR boundary so as to leave no doubt that the intent is for the line to connect to the FIR boundary at those points). NE OF LINE N2515 W08700 – N2000 W08330 S OF LINE S14 E150 – S14 E155 *or* 2b) In a sector of the FIR defined as being **between** two lines of latitude, or **between** two lines of longitude. N OF N45 AND S OF N50 W OF E04530 AND E OF E04000 or 2c) In a sector of the FIR defined as being **between** two specified lines, or **between** two series of up to three connected lines, each with start and endpoints on the FIR boundary (or start and endpoints so close to the FIR boundary so as to leave no doubt that the intent is for the line to connect to the FIR boundary at those points). SW OF LINE N50 W020 – N45 E010 AND NE OF LINE N45 W020 – N40 E010 2d) In a sector of the FIR defined relative to a line of latitude and a

			2d) In a sector of the FIR defined relative to a line of latitude and a line of longitude (effectively a quadrant); N OF Nnn[nn] AND W OF Wnnn[nn] *or* N OF Nnn[nn] AND E OF Wnnn[nn] *or* S OF Nnn[nn] AND W OF Wnnn[nn] *or* S OF Nnn[nn] AND E OF Wnnn[nn] *or* N OF Snn[nn] AND W OF Ennn[nn] *or* N OF Snn[nn] AND E OF Ennn[nn] *or* S OF Snn[nn] AND W OF Ennn[nn] *or* S OF Snn[nn] AND E OF Ennn[nn] *or* *or* 2e) In a sector of the FIR defined relative to a line of latitude or longitude (effectively a segment); N OF Nnn[nn] *or* S OF Nnn[nn] *or* N OF Snn[nn] *or* S OF Snn[nn] *or* W OF Wnnn[nn] *or* E OF Wnnn[nn] *or* W OF Ennn[nn] *or* E OF Ennn[nn] *or* 3) Defined by a 'corridor' of specified width, centred upon a line, of up to three connected segments, described by; nnKM WID LINE[21] BTN Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] – Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] [– Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] [– Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] nnNM WID LINE[21] BTN Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] – Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn] [– Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]] [– Nnn[nn] *or* Snn[nn] Wnnn[nn] *or* Ennn[nn]]	line of longitude (effectively a quadrant); S OF N3200 AND E OF E02000 S OF S3215 AND W OF E10130 S OF N12 AND W OF E040 N OF N35 AND E OF E078 *or* 2e) In a sector of the FIR defined relative to a line of latitude or longitude (effectively a segment); N OF S2230 S OF S43 E OF E01700 E OF W005 *or* 3) Defined by a 'corridor' of specified width, centred upon the line described; 50KM WID LINE BTN N64 W017 – N60 W010 – N57 E010 – N60 E015 50NM WID LINE BTN S1530 W09500 – S1815 W10130 – S2000 W10300 *or*

			or
			
			4) At a specific point within the FIR;
			
			`Nnn[nn] Wnnn[nn]` *or*
			`Nnn[nn] Ennn[nn]` *or*
			`Snn[nn] Wnnn[nn]` *or*
			`Snn[nn] Ennn[nn]`
			
			or
			
			5) A cylinder of specified radius; [24]
			
			`WI nnKM OF Nnn[nn]` *or* `Snn[nn] Wnnn[nn]` *or* `Ennn[nn]`
			
			`WI nnNM OF Nnn[nn]` *or* `Snn[nn] Wnnn[nn]` *or* `Ennn[nn]`
			
			6) In the vicinity of a tropical cyclone
			
			`WI nnnKM (or nnnNM) of TC CENTRE`
			
			or
			
			7) A reference to the whole FIR, FIR/UIR, or CTA
			
			`ENTIRE FIR`
			`ENTIRE FIR/UIR`
			`ENTIRE UIR`
			`ENTIRE CTA`
			
			or
			
			7) No volcanic ash expected[27]
			
			`NO VA EXP`
				4) At a specific point within the FIR;
				
				`N5530 W02230`
				`S12 E177`
				
				or
				
				5) A cylinder of specified radius; [24]
				
				`WI 30 KM OF N6030 E02550`
				
				`WI 50 NM OF S2000 E04000`
				
				6) In the vicinity of a tropical cyclone
				
				`WI 400KM OF TC CENTRE`
				
				`WI 250NM OF TC CENTRE`
				
				or
				
				7) A reference to the whole FIR, FIR/UIR, or CTA
				
				`ENTIRE FIR`[18]
				`ENTIRE FIR/UIR`
				`ENTIRE UIR`
				`ENTIRE CTA`[18]
				
				or
				
				7) No volcanic ash expected
				
				`NO VA EXP`

3.0	Repetition of elements (C)[28]	Repetition of elements included in a SIGMET message for volcanic ash cloud or tropical cyclone	`[AND]`[28]	`AND`

4.0	Cancellation of SIGMET (C)[29]	Cancellation of SIGMET referring to its identification	CNL SIGMET n nnnnnn/nnnnnn CNL SIGMET nn nnnnnn/nnnnnn CNL SIGMET nnn nnnnnn/nnnnnn *or* CNL SIGMET n nnnnnn/nnnnnn VA MOV TO nnnn FIR[18] CNL SIGMET nn nnnnnn/nnnnnn VA MOV TO nnnn FIR[18] CNL SIGMET[27] nnn nnnnnn/nnnnnn VA MOV TO nnnn FIR	CNL SIGMET 2 102000/110000 CNL SIGMET 12 101200/101600 CNL SIGMET A12 031600/032000 *or* CNL SIGMET 3 251030/251630 VA MOV TO YUDO FIR CNL SIGMET 06 191200/191800 VA MOV TO YUDO FIR CNL SIGMET B10 030600/031200 VA MOV TO YUDO FIR

Table A-1: Expanded SIGMET template

Footnotes to table: (note, in order to ensure consistency between this document and ICAO Annex 3, Table 6-1A, any footnote in Table 6-1A that refers to AIRMET only is identified as such below.

1. See 4.1. "**Recommendation.—** *In cases where the airspace is divided into a flight information region (FIR) and an upper flight information region (UIR), the SIGMET should be identified by the location indicator of the air traffic services unit serving the FIR. Note.— The SIGMET message applies to the whole airspace within the lateral limits of the FIR, i.e. to the FIR and to the UIR. The particular areas and/or flight levels affected by the meteorological phenomena causing the issuance of the SIGMET are given in the text of the message.*"
2. Fictitious location.
3. In accordance with 1.1.3 "The sequence number referred to in the template in Table A6-1A shall correspond with the number of SIGMET messages issued for the flight information region since 0001 UTC on the day concerned. The meteorological watch offices whose area of responsibility encompasses more than one FIR and/or control area (CTA) shall issue separate SIGMET messages for each FIR and/or CTA within their area of responsibility."
4. AIRMET only – not SIGMET
5. Only used when a message is issued to indicate that a test or exercise taking place. When the word "TEST" or the abbreviation "EXER" is included, the message may contain information that should not be used operationally or will otherwise end immediately after the word "TEST". [Applicable 7 November 2019]
6. As per 1.1.4 "In accordance with the template in Table A6-1A, only one of the following phenomena shall be included in a SIGMET message, using the abbreviations as indicated below [list of SIGMET phenomena follows in section 1.1.4 – see section]"
7. In accordance with 4.2.1 a) "*obscured (OBSC) if it is obscured by haze or smoke or cannot be readily seen due to darkness*".
8. In accordance with 4.2.4 "*Hail (GR) should be used as a further description of the thunderstorm, as necessary*"
9. accordance with 4.2.1 b) "*embedded (EMBD) if it is embedded within cloud layers and cannot be readily recognized*"
10. In accordance with 4.2.2 "**Recommendation.—** An area of thunderstorms should be considered frequent (FRQ) if within that area there is little or no separation between adjacent thunderstorms with a maximum spatial coverage greater than 75 per cent of the area affected, or forecast to be affected, by the phenomenon (at a fixed time or during the period of validity)"
11. In accordance with 4.2.3 "**Recommendation.—** Squall line (SQL) should indicate a thunderstorm along a line with little or no space between individual clouds."
12. Used for unnamed tropical cyclones.
13. In accordance with 4.2.5 and 4.2.6 "**Recommendation.—** Severe turbulence (TURB) should refer only to: low-level turbulence associated with strong surface winds; rotor streaming; or turbulence whether in cloud or not in cloud (CAT). Turbulence should not be used in connection with convective clouds." and "Turbulence shall be considered: a) severe whenever the peak value of the cube root of EDR exceeds 0.7"
14. In accordance with 4.2.7 "**Recommendation.—** Severe icing (ICE) should refer to icing in other than convective clouds. Freezing rain (FZRA) should refer to severe icing conditions caused by freezing rain".

15. In accordance with 4.2.8 "**Recommendation.—** A mountain wave (MTW) should be considered: a) severe whenever an accompanying downdraft of 3.0 m/s (600 ft/min) or more and/or severe turbulence is observed or forecast; and *b) moderate whenever an accompanying downdraft of 1.75–3.0 m/s (350–600 ft/min) and/or moderate turbulence is observed or forecast.*"
16. AIRMET only – not SIGMET
17. AIRMET only – not SIGMET
18. AIRMET only – not SIGMET
19. AIRMET only – not SIGMET
20. In the case of volcanic ash cloud or cumulonimbus clouds associated with a tropical cyclone covering more than one area within the FIR, these elements can be repeated, as necessary.
21. A straight line is to be used between two points drawn on a map in the Mercator projection or between two points which crosses lines of longitude at a constant angle.
22. The number of coordinates should be kept to a minimum and should not normally exceed seven.
23. Only for SIGMET messages for tropical cyclones.
24. Only for SIGMET messages for radioactive cloud. When detailed information on the release is not available, a radius of up to 30 kilometres (or 16 nautical miles) from the source may be applied; and a vertical extent from surface (SFC) to the upper limit of the flight information region/upper flight information region (FIR/UIR) or control area (CTA) is to be applied. [Applicable 7 November 2019].
25. The elements "forecast time" and "forecast position" are not to be used in conjunction with the element "movement or expected movement".
26. The levels of the phenomena remain fixed throughout the forecast period.
27. Only for SIGMET messages for volcanic ash.
28. To be used for two volcanic ash clouds or two areas of cumulonimbus cloud associated with a tropical cyclone simultaneously affecting the FIR concerned.
29. End of the message (as the SIGMET message is being cancelled).

Additional notes (not specifically identified in footnotes to Table 6-1A):

In accordance with 4.2.9 "Sandstorm/duststorm should be considered: a) heavy whenever the visibility is below 200 m and the sky is obscured; and b) moderate whenever the visibility is: 1) below 200 m and the sky is not obscured; or 2) between 200 m and 600 m." (no footnote in Annex 3, but this is applicable reference)

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APPENDIX B

SIGMET EXAMPLES

Note. — The figures used in this appendix are intended simply to clarify the intent of the SIGMET message in abbreviated plain language, and therefore how each SIGMET should be ***constructed*** *by MWOs and also* ***interpreted*** *by users. The figures used are* <u>not</u> *intended to give guidance on how a SIGMET in graphical format should be produced.*

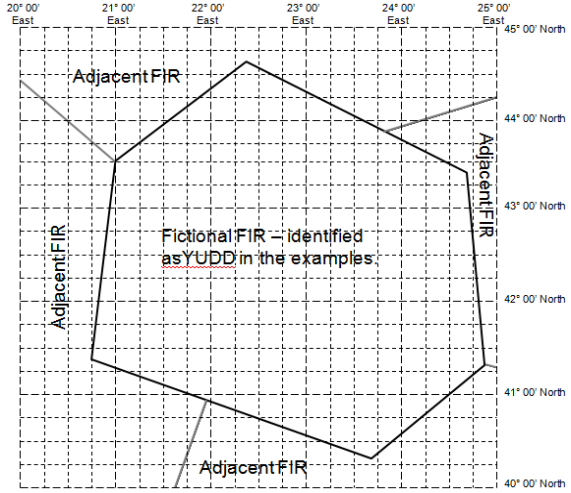
Examples of '**WS**' SIGMET. See the sections for SIGMET for volcanic ash only (WV) and SIGMET for tropical cyclone only (WC) for examples specific to those phenomena.

Contents

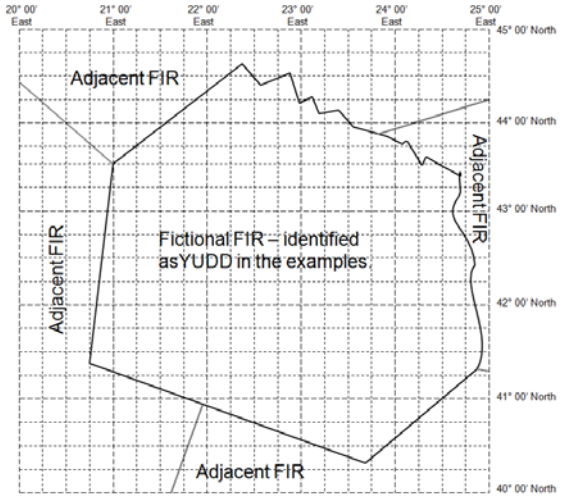
General

Explanation of “fictional FIR”.

In each of the examples below, a fictional FIR area is indicated, with portions of adjacent fictional FIRs also indicated. The FIR areas are overlaid on a coordinate grid, in order that the example plain language SIGMETs can be explicitly related to the intended meaning.



For some cases, examples are given where the FIR has boundaries that are complex (country borders for example, especially when defined by rivers)



Fictional FIR ‘Shanlon = YUDD’ is used for the examples.

Repetition of start point as last coordinate.

> In accordance with practices and procedures laid down for other aeronautical bulletins (i.e. NOTAM), it is recommended that the last point of a polygon is a repeat of the first point of the polygon. This will ensure that the polygon has been closed, and that no points have been accidentally omitted.

'Direction' of encoding of the points of a polygon

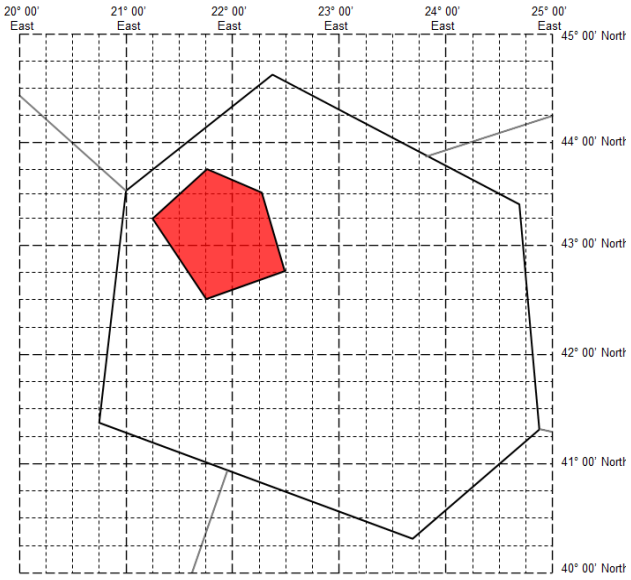
In accordance with practices and procedures laid down for other aeronautical bulletins and international practice (e.g. BUFR encoding of WAFS significant weather (SIGWX) forecasts), it is recommended that the points of a polygon are provided in a 'clockwise' sense. This assists automated systems in determining the 'inside' of polygons.

Use of ‘Expected Movement’ and ‘Forecast Position’/’Forecast Time’.

With applicability of Amendment 77, the ‘Expected Movement’ element of SIGMET should not be used if the ‘Forecast Position’/’Forecast Time’ element is being used, and vice versa. This is to prevent duplication at best and inconsistencies at worst.

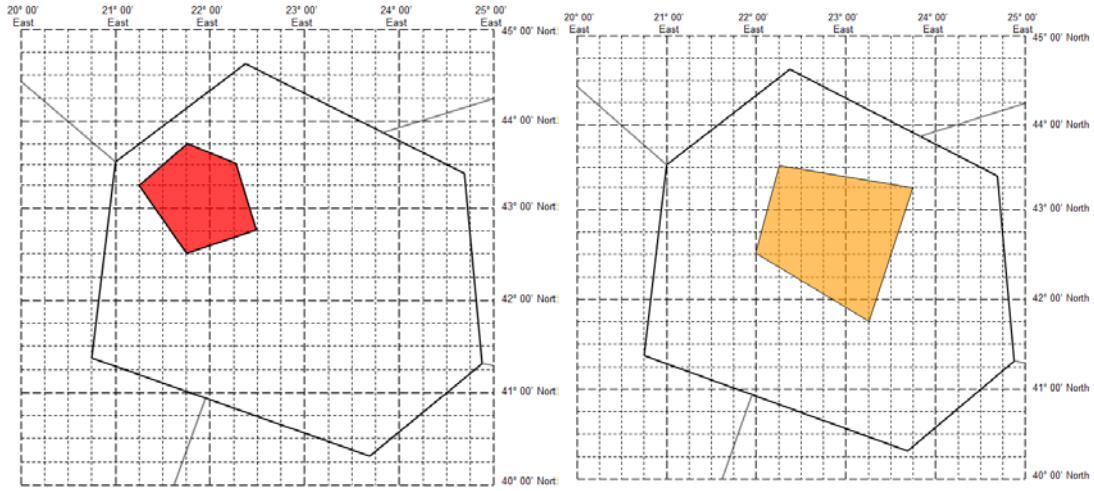
1) An area of the FIR defined by a polygon. The end point should be a repeat of the start point.

When the SIGMET does not include a 'forecast position' section.



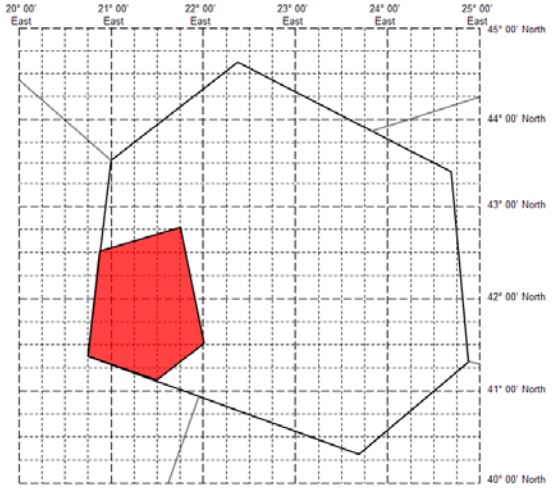

```
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST WI N4230 E02145 – N4315 E02115 –
N4345 E02145 – N4330 E02215 – N4245 E02230 - N4230 E02145 FL250/370
MOV ESE 20KT INTSF=
```

With an explicit forecast position:



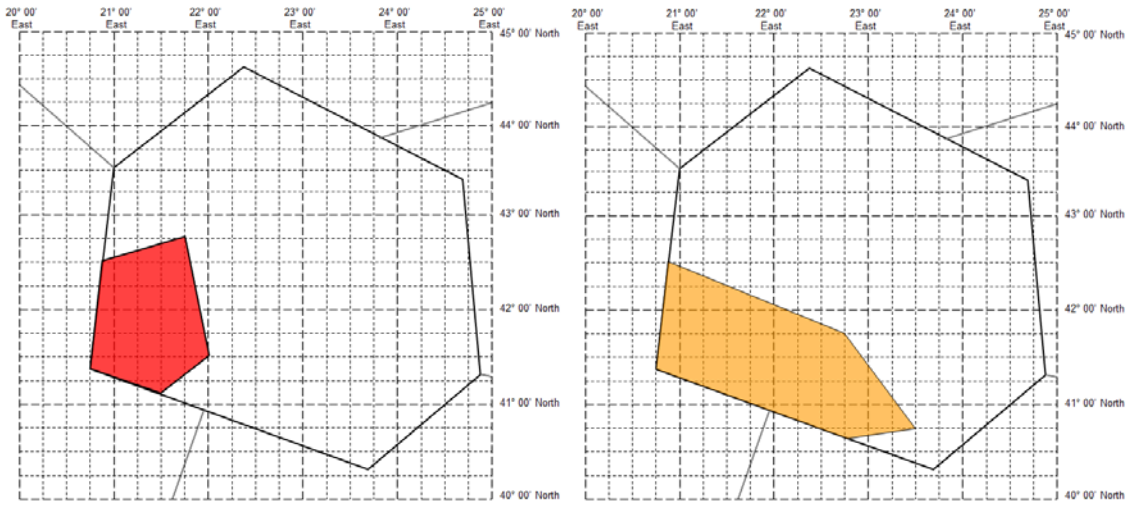

```
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST WI N4230 E02145 – N4315 E02115 –
N4345 E02145 – N4330 E02215 – N4245 E02230 - N4230 E02145 FL250/370
INTSF FCST AT 1600Z WI N4145 E02315 – N4230 E02200 – N4330 E02215 –
N4315 E02345 - N4145 E02315=
```

When the SIGMET does not include a ‘forecast position’ section.



YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST WI N4230 E02052 – N4245 E02145 – N4130 E02200 – N4107 E02130 – N4123 E02045 - N4230 E02052 FL250/370 MOV SE 30KT WKN=

With an explicit forecast position:



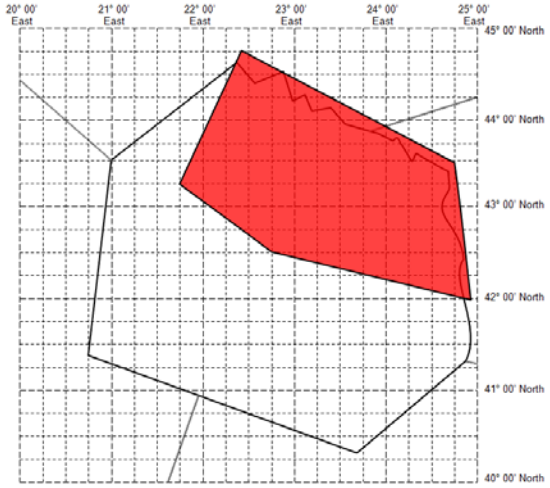
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST WI N4230 E02052 – N4245 E02145 – N4130 E02200 – N4107 E02130 – N4123 E02045- N4230 E02052 FL250/370 WKN FCST AT 1600Z WI N4230 E02052 – N4145 E02245 – N4045 E02330 – N4040 E02248 – N4123 E02045- N4230 E02052=

Use of polygons with complex FIR boundaries.

Annex 3 (19th Edition, July 2016) specifies that the points of a polygon '... should be kept to a minimum and should not normally exceed seven'. However, some FIR boundaries are complex, and it would be unrealistic to expect that a polygon would be defined that followed such boundaries precisely. As such, some States have determined that the polygon points be chosen in relation to the complex boundary such that the FIR boundary approximates, but is wholly encompassed by, the polygon, and that any additional area beyond the FIR boundary be the minimum that can be reasonably and practically described. Caution should however be exercised in those instances where international aerodromes are located in close proximity to such a complex FIR boundary.

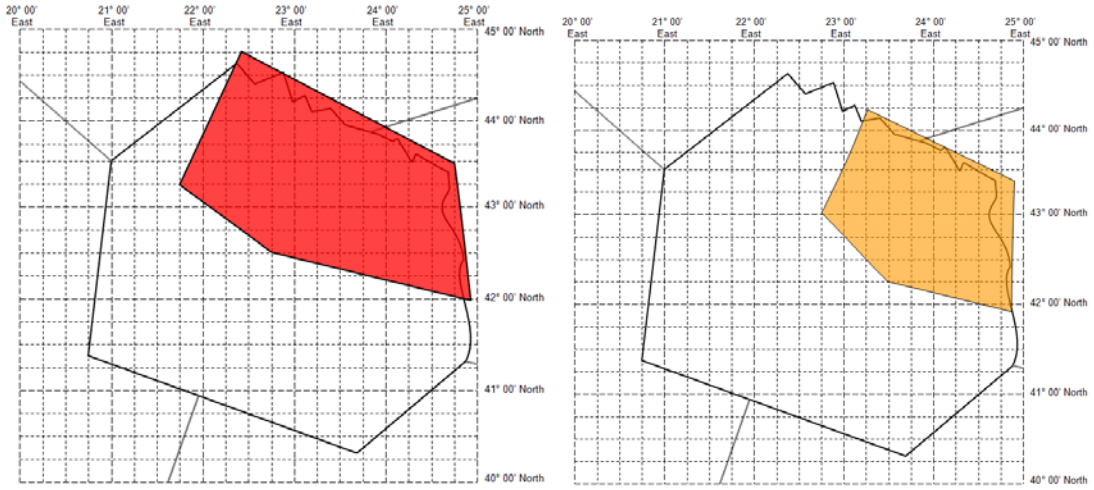
In the examples below, it would not be practical to follow the northeastern boundary of the FIR exactly. The point close to N4330 E02245 is obviously a 'major' turning point along the FIR boundary, but the other, numerous and complex turning points can only be approximated when constrained to seven points.

<u>When the SIGMET does not include a ‘forecast position’ section.</u>



YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST WI N4315 E02145 – N4445 E02245 – N4330 E02445 – N4200 E02455 – N4230 E02245- N4315 E02145 FL250/370 MOV SE 20KT WKN=

With an explicit forecast position:

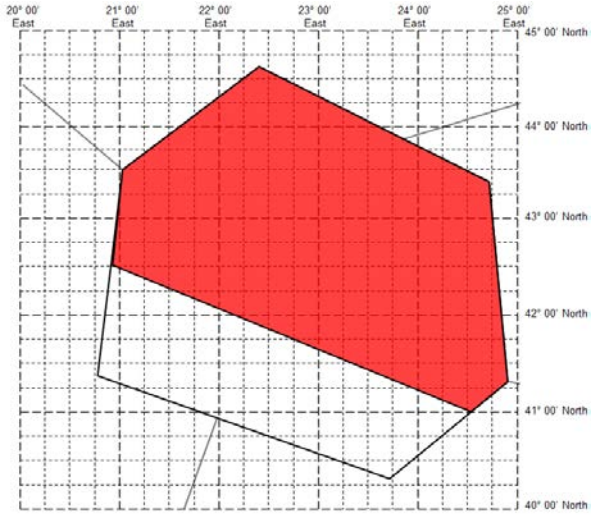


YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST WI N4315 E02145 – N4445 E02245 – N4330 E02445 – N4200 E02455 – N4230 E02245- N4315 E02145 FL250/370 WKN FCST AT 1600Z WI N4300 E02245 – N4415 E02315 – N4322 E02452 – N4155 E02445 – N4215 E02330- N4300 E02245=

2a) In a sector of the FIR defined relative to a specified line, or single series of up to three connected lines, with start and end points on the FIR boundary (or so close to the FIR boundary so as to leave no doubt that the intent is for the line to connect to the FIR boundary at that point).

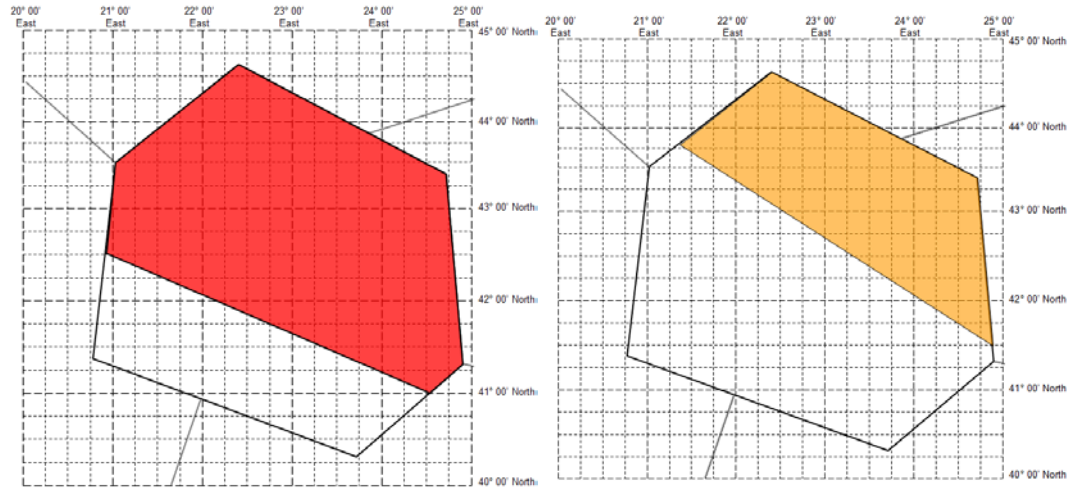
The specified points shall be on the FIR boundary (or so close to the FIR boundary so as to leave no doubt that the intent is for the line to connect to the FIR boundary at that point)

When the SIGMET does not include a 'forecast position' section.



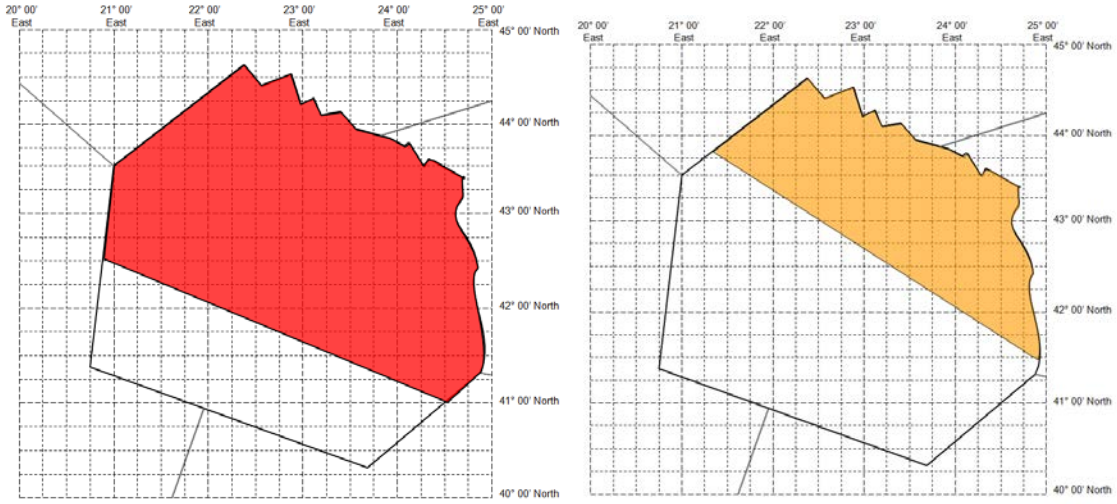
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR SEV TURB FCST NE OF LINE N4230 E02052 – N4100 E02430 FL250/370 MOV NE 15KT WKN=

With an explicit forecast position:



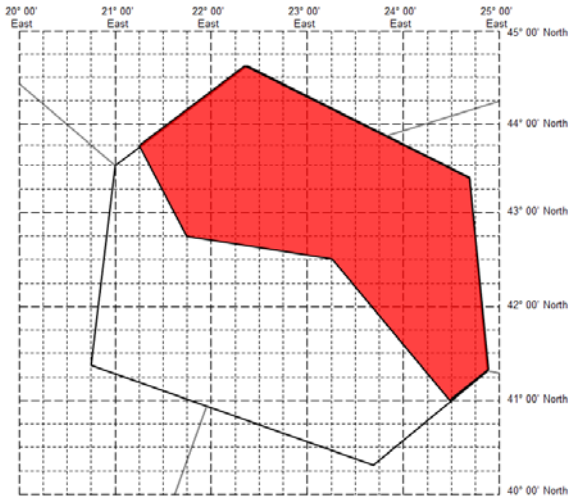
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR SEV TURB FCST NE OF LINE N4230 E02052 – N4100 E02430
FL250/370 WKN FCST AT 1600Z NE OF LINE N4346 E02122 – N4130 E02452=

A separate example is provided below illustrating a case where the northeastern boundary is complex.



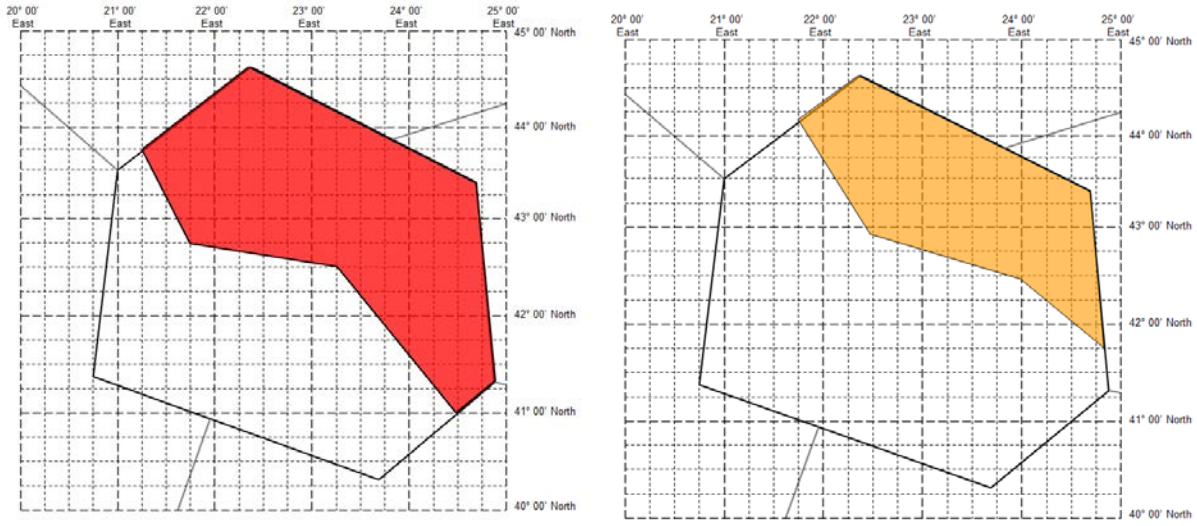
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR SEV TURB FCST NE OF LINE N4230 E02052 – N4100 E02430
FL250/370 WKN FCST AT 1600Z NE OF LINE N4346 E02122 – N4130 E02457=

For a series of connected lines when the SIGMET does not include a ‘forecast position’ section.



YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR SEV TURB FCST NE OF LINE N4345 E02115 – N4245 E02145 - N4230 E2315 – N4100 E2430 FL250/370 MOV NE 20KT WKN=

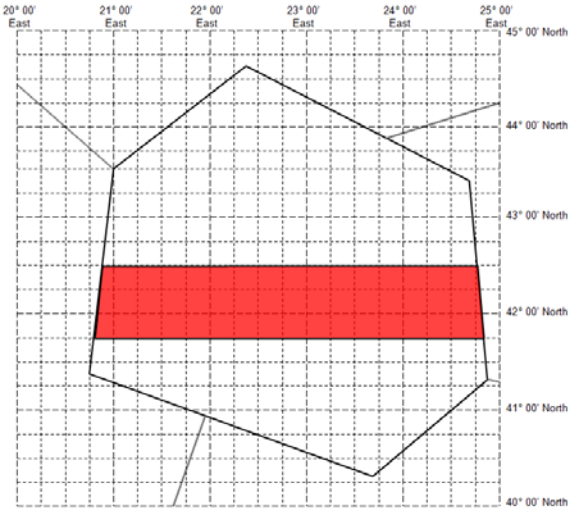
With an explicit forecast position:



YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR SEV TURB FCST NE OF LINE N4345 E02115 – N4245 E02145 - N4230 E2315 – N4100 E2430 FL250/370 WKN FCST AT 1600Z NE OF LINE N4411 E02145 – N4255 E02228 - N4228 E2400 – N4130 E2450=

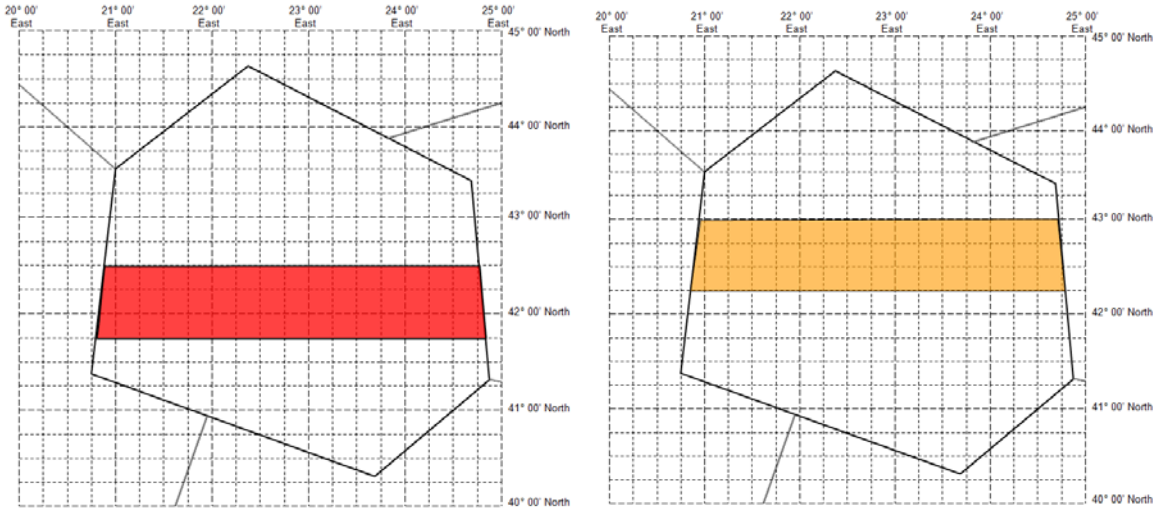
2b) In a sector of the FIR defined as being *between* two lines of latitude, or between two lines of longitude.

When the SIGMET does not include a 'forecast position' section.



YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR SEV TURB FCST N OF N4145 AND S OF N4230 FL250/370 MOV N 30KT WKN=

With an explicit forecast position:



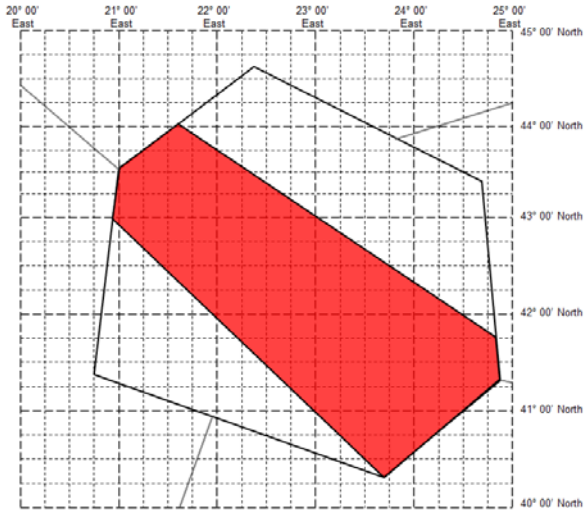
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR SEV TURB FCST N OF N4145 AND S OF N4230 FL250/370 WKN FCST AT 1600Z N OF N4215 AND S OF N4300=

(similar constructions can be used for specifying areas between lines of longitude)

2c) In a sector of the FIR defined as being *between* two specified lines, or *between* two series of up to three connected lines, each with start and endpoints on the FIR boundary (or start and endpoints so close to the FIR boundary so as to leave no doubt that the intent is for the line to connect to the FIR boundary at those points).

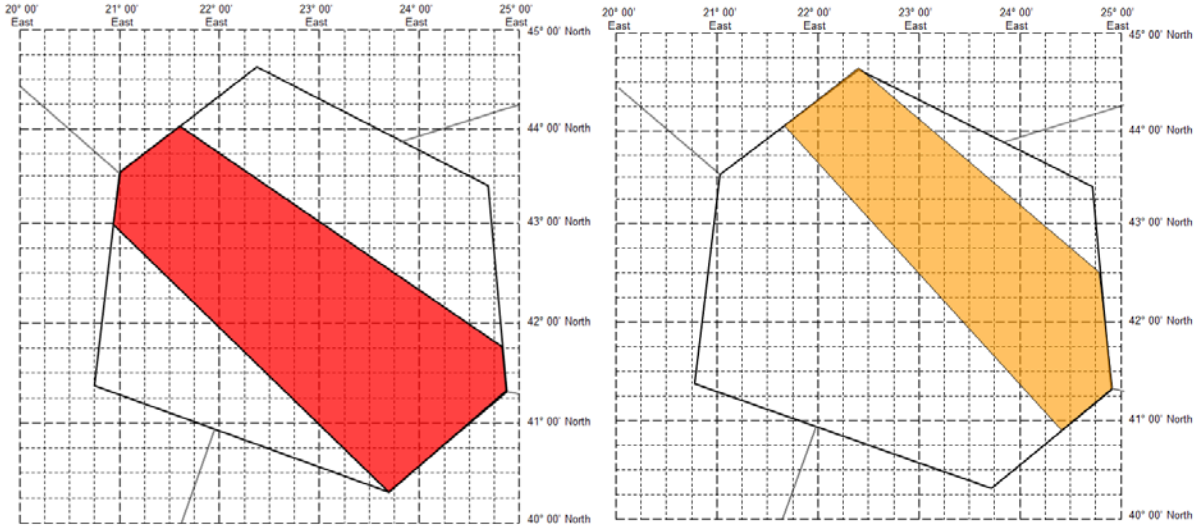
The specified points shall be on the FIR boundary (or so close to the FIR boundary so as to leave no doubt that the intent is for the line to connect to the FIR boundary at that point)

When the SIGMET does not include a 'forecast position' section.



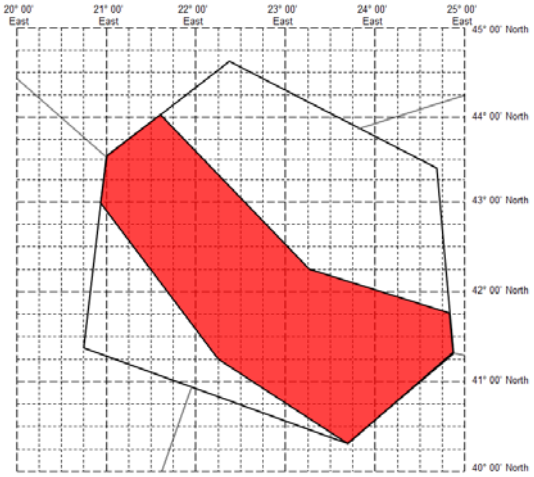
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR SEV TURB FCST NE OF LINE N4300 E02057 – N4020 E02340 AND SW OF LINE N4402 E02142 – N4145 E02450 FL250/370 MOV NE 20KT WKN=

With an explicit forecast position:



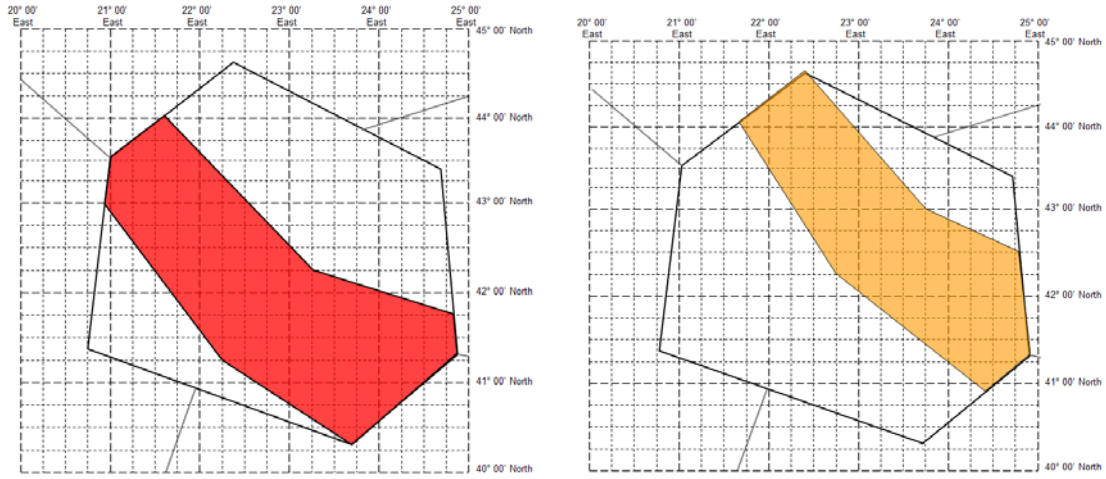
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR SEV TURB FCST NE OF LINE N4300 E02057 – N4020 E02340 AND SW OF LINE N4402 E02142 – N4145 E02450 FL250/370 WKN FCST AT 1600Z NE OF LINE N4403 E02140 – N4055 E02422 AND SW OF LINE N4437 E02222 – N4230 E02447=

For a series of connected lines when the SIGMET does not include a ‘forecast position’ section.



YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR SEV TURB FCST NE OF LINE N4300 E02057 – N4115 E02215 – N4020 E02340 AND SW OF LINE N4402 E02142 – N4215 E02315 - N4145 E02450 FL250/370 MOV NE 20KT WKN=

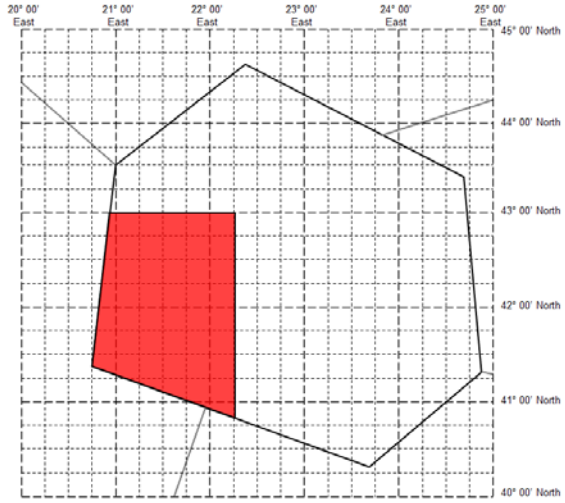
With an explicit forecast position:



YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR SEV TURB FCST NE OF LINE N4300 E02057 – N4115 E02215 – N4020 E02340 AND SW OF LINE N4402 E02142 – N4215 E02315 - N4145 E02450 FL250/370 WKN FCST AT 1600Z NE OF LINE N4403 E02140 N4215 E02245 – N4055 E02422 AND SW OF LINE N4437 E02222 – N4300 E02345– N4230 E02447=

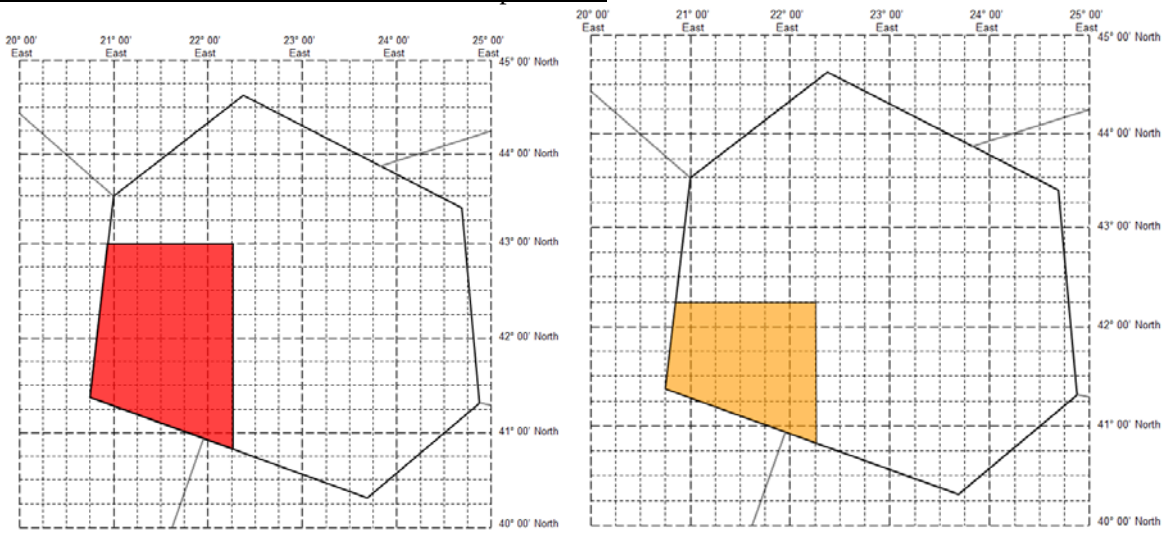
2d) In a sector of the FIR defined relative to a line of latitude and a line of longitude (effectively a quadrant)

When the SIGMET does not include a ‘forecast position’ section.



YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST S OF N4300 AND W OF E02215 FL250/370 MOV S 12KT WKN=

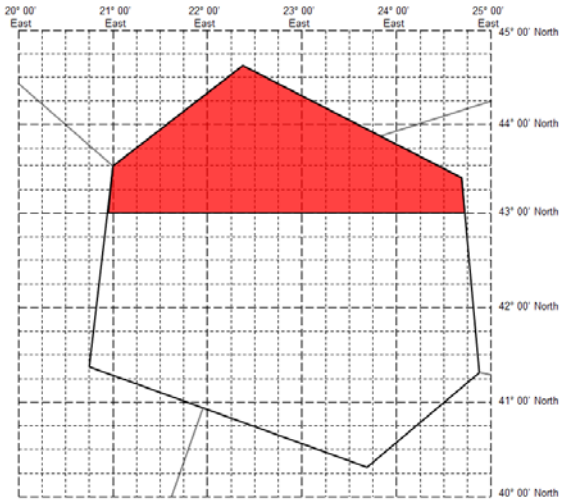
When the SIGMET does include a ‘forecast position'.



YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST S OF N4300 AND W OF E02215 FL250/370 WKN FCST AT 1600Z S OF N4215 AND W OF E02215=

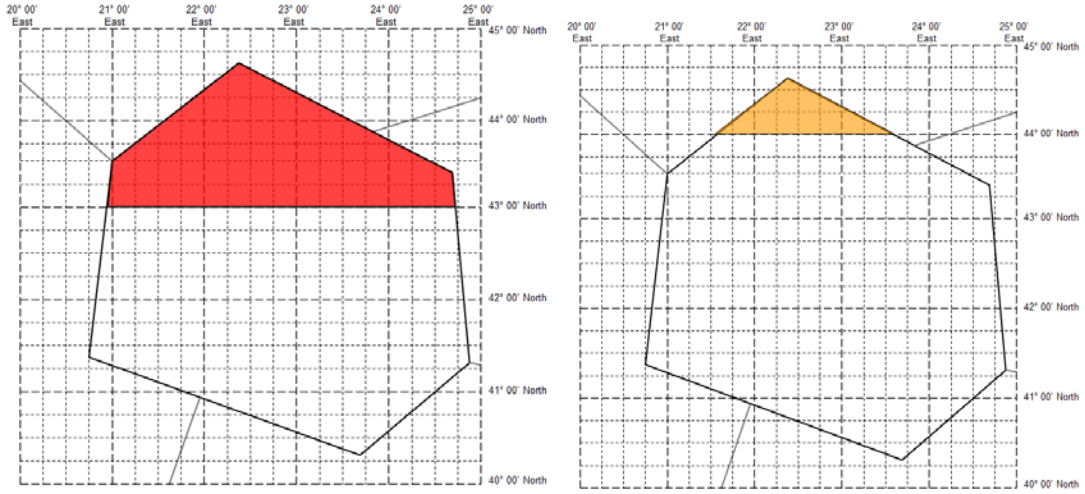
2e) In a sector of the FIR defined relative to a line of latitude or longitude (effectively a segment)

When the SIGMET does not include a 'forecast position' section.



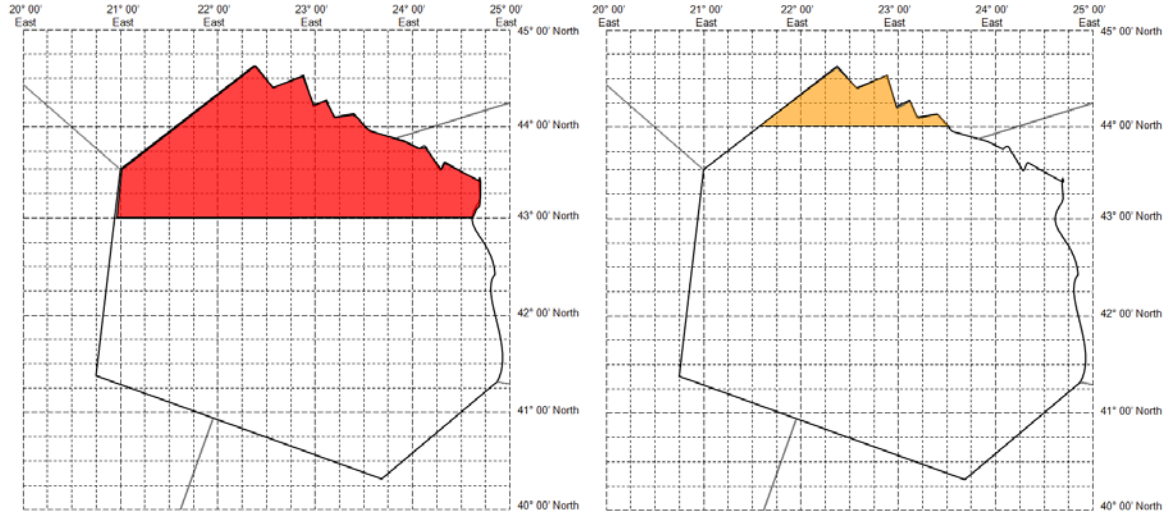
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST N OF N43 FL250/370 MOV N 15KT WKN=

When the SIGMET does include a 'forecast position' section.



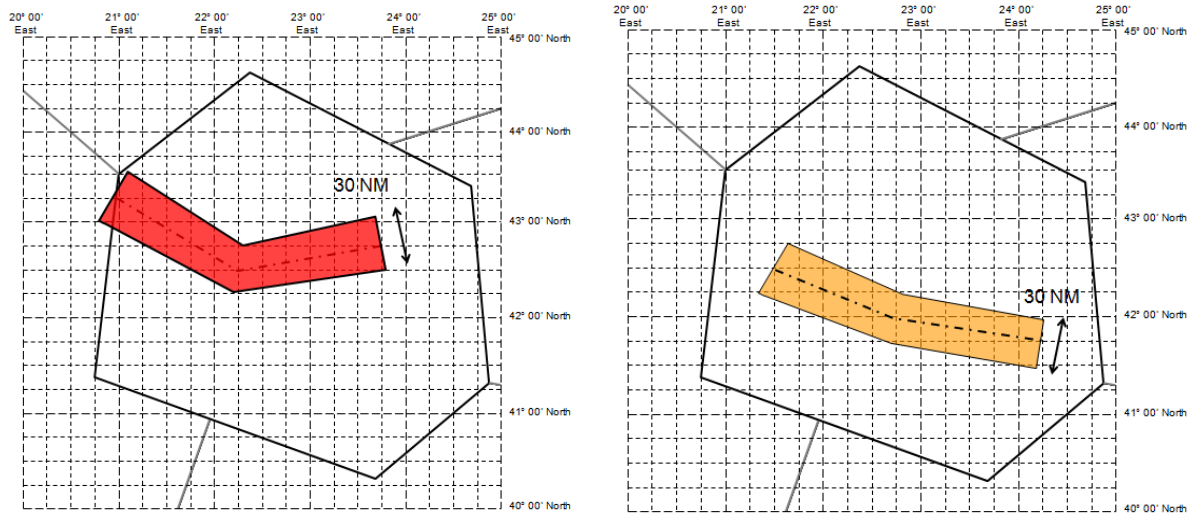
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST N OF N43[3] FL250/370 WKN FCST AT 1600Z N OF N44=

[3] It would be equally valid to use 'N4300'.



YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST N OF N43[4] FL250/370 WKN FCST AT 1600Z N OF N44=

3) Defined by a 'corridor' of specified width, centred upon the line described;



YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST WI 30NM WID LINE BTN N4315 E02100 – N4230 E02215 – N4245 E02345 FL250/370 WKN FCST AT 1600Z WI 30NM WID LINE BTN N4230 E02130 – N4200 E02245 – N4145 E02415=

Note: The nature of this option means that, as at N4315 E02100, it is inferred that there is some encroachment into the neighbouring FIR.

[4] It would be equally valid to use 'N4300'.

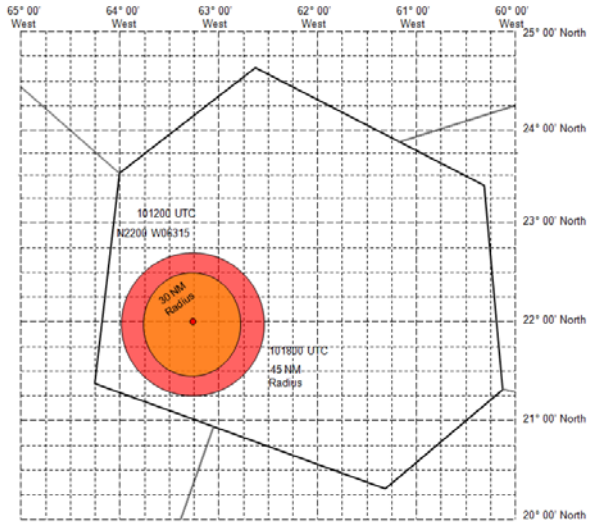
4) At a specific point within the FIR;

<u>When the SIGMET does not include a ‘forecast position’ section.</u>

```
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB OBS N4245 E02230 FL250/370 STNR WKN=
```

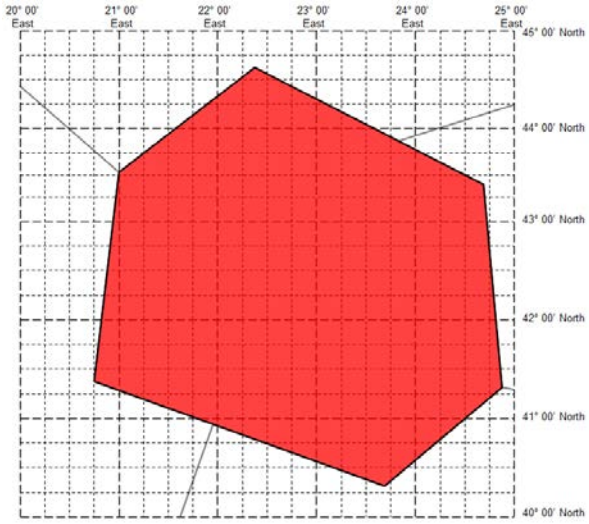
5) A vertical cylinder of specified radius.

Where the surface position at the centre of the cylinder does not change, but the radius increases.




```
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR RDOACT CLD OBS AT 1150Z WI 30NM OF N2200 W06315
SFC/3000FT NC FCST AT 1600Z WI 45NM OF N2200 W06315=
```

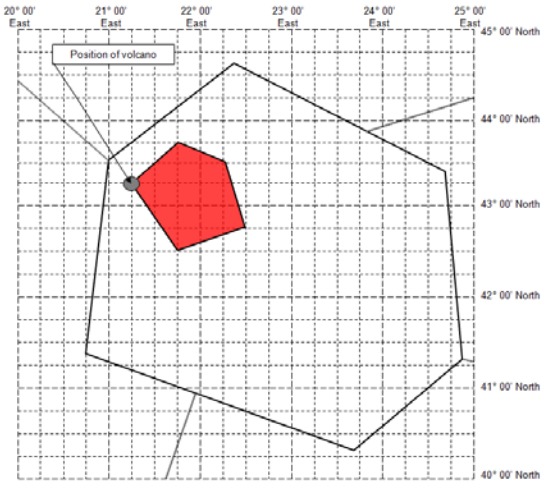
6) Covering entire FIR.




```
YUDD SIGMET 2 VALID 101200/101600 YUSO –
YUDD SHANLON FIR/UIR VA CLD FCST AT 1200Z ENTIRE FIR FL250/370 STNR
WKN=
```

7) Additional examples using volcanic ash references applicable to volcanic ash SIGMET only

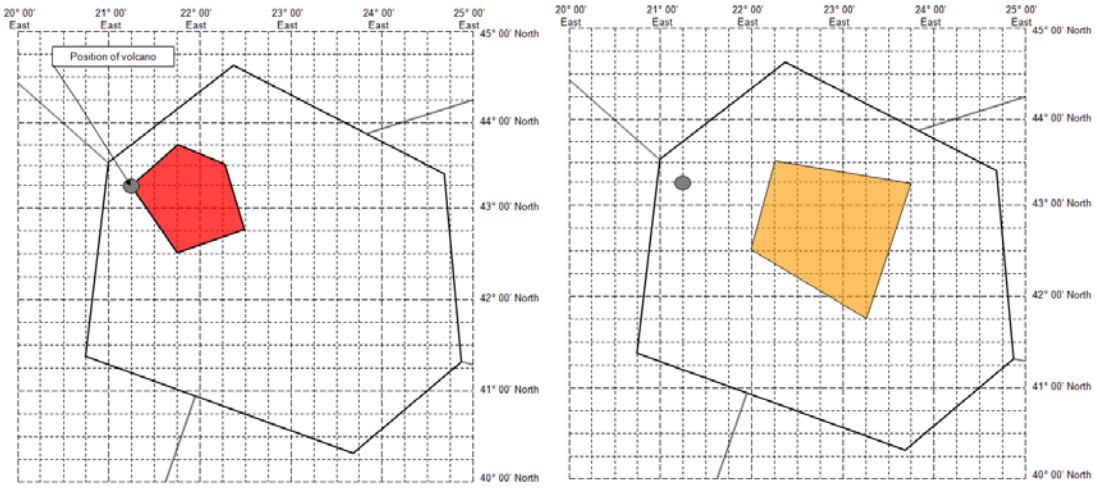
When the VA SIGMET does not include a 'forecast position' section.



YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR VA ERUPTION MT ASHVAL PSN N4315 E02115 VA CLD OBS AT 1200Z WI N4315 E02115 – N4345 E02145 - N4330 E02215 – N4245 E02230 – N4230 E02145 - N4315 E02115 FL250/370 MOV ESE 20KT NC=

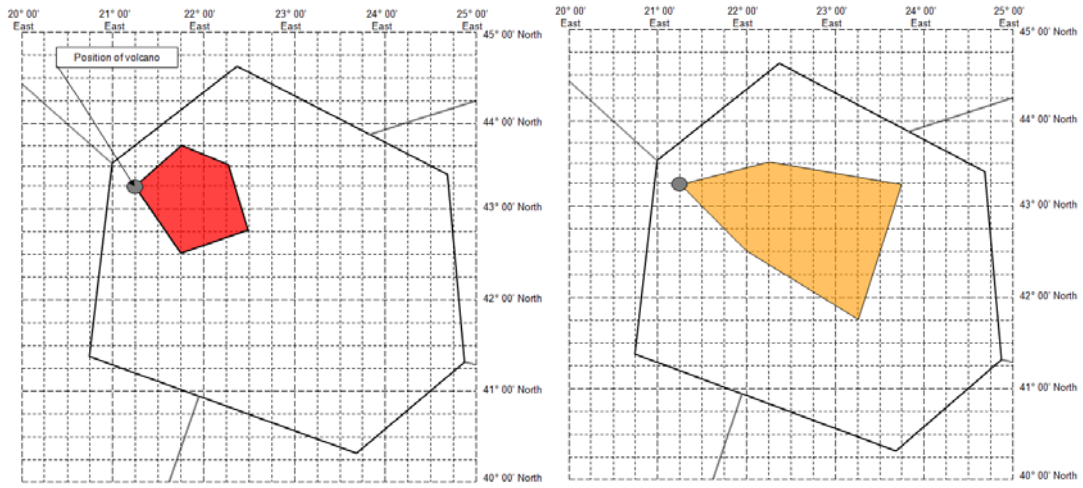
When the SIGMET does include a 'forecast position' section (no rate of movement).

For VA (eruption ceased, ash cloud persists downwind):



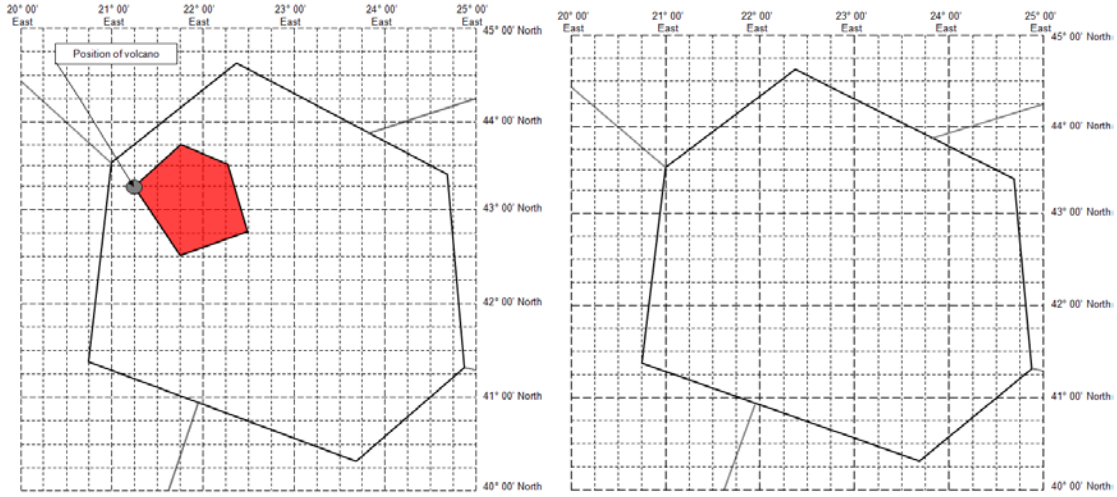
YUDD SIGMET 2 VALID 101200/101800 YUSO–
YUDD SHANLON FIR/UIR VA ERUPTION MT ASHVAL PSN N4315 E02115 VA CLD OBS AT 1200Z WI N4315 E02115 – N4345 E02145 N4330 E02215 – N4245 E02230 – N4230 E02145 - N4315 E02115 FL250/370 NC FCST AT 1800Z WI N4330 E02215 – N4315 E02345 – N4145 E02315 – N4230 E02200 - N4330 E02215=

For VA (eruption on-going):



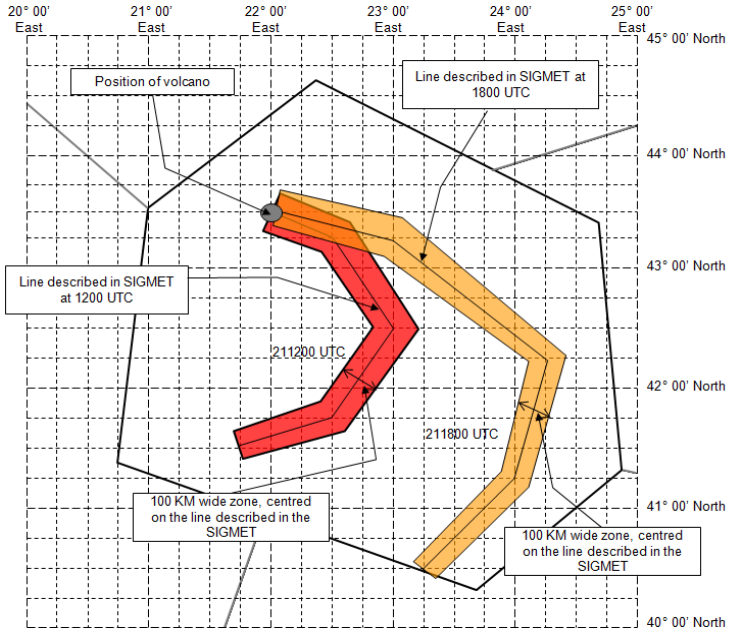
YUDD SIGMET 2 VALID 101200/101800 YUSO –
YUDD SHANLON FIR VA ERUPTION MT ASHVAL PSN N4315 E02115 VA CLD OBS AT 1200Z WI N4315 E02115 - N4345 E02145 – N4330 E02215 – N4245 E02230 – N4230 E02145 – N4315 E2115 FL250/370 NC FCST AT 1800Z WI N4315 E02115 - N4330 E02215 – N4315 E02345 – N4145 E02315 – N4230 E02200 – N4315 E02115=

For VA (eruption ceasing, ash dispersing):



YUDD SIGMET 2 VALID 101200/101800 YUSO–
YUDD SHANLON FIR VA ERUPTION MT ASHVAL PSN N4315 E02115 VA CLD OBS AT 1200Z WI N4315 E02115 - N4345 E02145 – N4330 E02215 – N4245 E02230 - N4230 E02145 - N4315 E02115 FL250/370 WKN FCST AT 1800Z NO VA EXP=

For VA (eruption on-going), defining the area affected as a corridor of specified width;

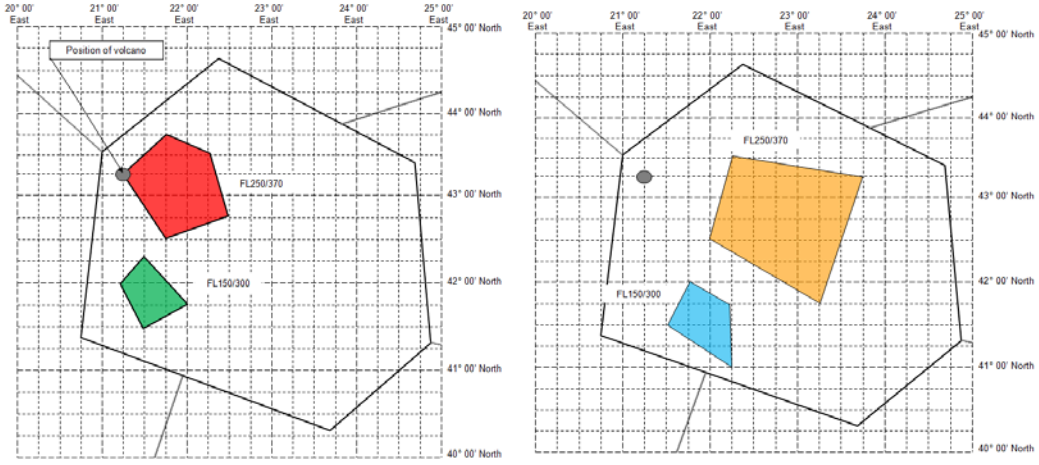


YUDD SIGMET 2 VALID 211200/211800 YUSO –
YUDD SHANLON FIR/UIR VA ERUPTION MT ASHVAL PSN N4330 E02200 VA CLD FCST AT 1200Z APRX 100KM WID LINE BTN N4330 E02200 – N4315 E02230 – N4230 E02300 – N4145 E02230 – N4130 E02145 FL310/450 NC FCST AT 1800Z APRX 100KM WID LINE BTN N4330 E02200 – N4315 E02300 – N4215 E02415 – N4115 E02400 – N4030 E02315=

8) Additional examples using volcanic ash references applicable to multiple areas in SIGMET for volcanic ash.

The only way to include a second instance of a volcanic ash cloud in a SIGMET message is to use the 'AND' option after the 'Forecast position' section.

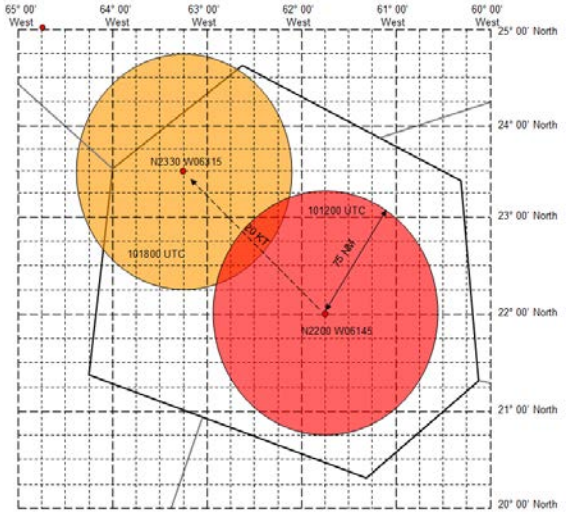
In the example below, two areas of volcanic ash cloud (at different levels) are forecast to move as described. The normal courier font refers to the northernmost areas of ash, and the italicised font refers to the southernmost areas of ash during the period. 'AND' is highlighted in **bold** to identify the separation of the two features.



YUDD SIGMET 2 VALID 101200/101800 YUSO –
YUDD SHANLON FIR VA ERUPTION MT ASHVAL PSN N4315 E02115 VA CLD OBS AT 1200Z WI N4315 E02115 – N4345 E02145 N4330 E02215 – N4245 E02230 – N4230 E02145 - N4315 E02115 FL250/370 NC FCST AT 1800Z WI N4330 E02215 – N4315 E02345 – N4145 E02315 – N4230 E02200 - N4330 E02215 **AND** WI *N4200 E02115 – N4217 E02130 – N4145 E02200 – N4130 E02130 – N4200 E02100 FL150/300 NC FCST AT 1800Z WI N4200 E02145 – N4145 E02215 – N4100 E02215 - N4130 E02130 - N4200 E02145*=

The above only works if there are two instances of ash at the start and end of the period. If the number of ash areas is different at the start and end, it is recommended that separate SIGMETs be issued as necessary.

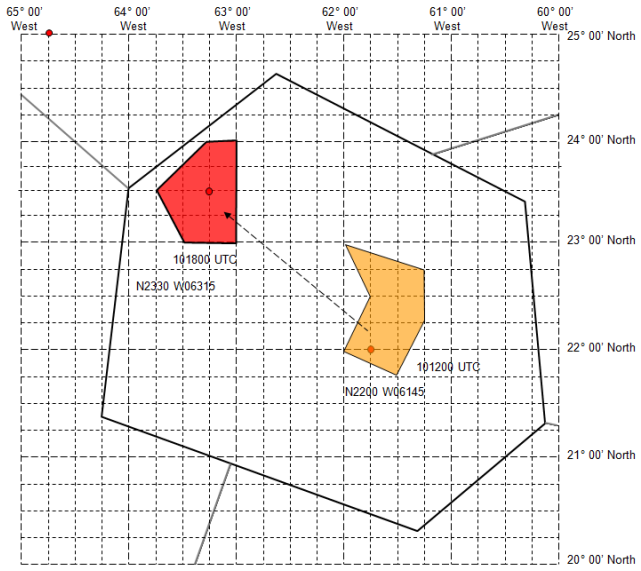
9) Additional example illustrating use of "WI nnnKM (or nnnNM) OF TC CENTRE " in Tropical Cyclone SIGMET Only



YUDD SIGMET 2 VALID 101200/101800 YUSO–
YUDD SHANLON FIR TC GLORIA PSN N2200 W06145 CB OBS AT 1200Z WI 75NM OF TC CENTRE TOP BLW FL500 MOV NW 20KT WKN=

YUDD SIGMET 2 VALID 101200/101800 YUSO–
YUDD SHANLON FIR TC GLORIA PSN N2200 W06145 CB OBS AT 1200Z WI 75NM OF TC CENTRE TOP BLW FL500 WKN FCST AT 1800Z TC CENTRE PSN N2330 W06315=

It is acceptable to use the other 'Location' options to describe the area affected by the CB of a Tropical Cyclone:

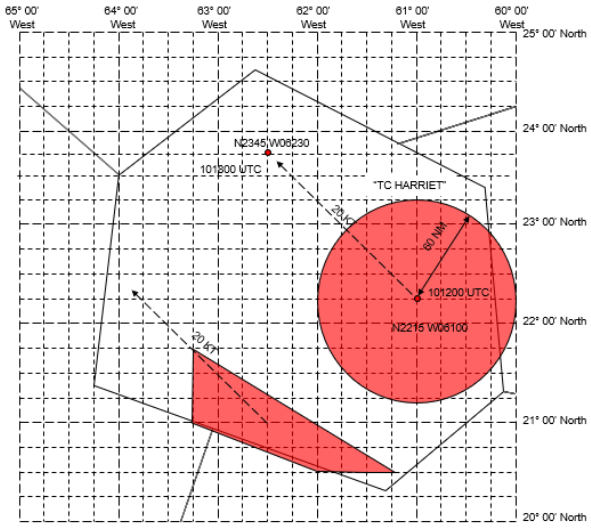



```
YUDD SIGMET 2 VALID 101200/101800 YUSO–
YUDD SHANLON FIR TC GLORIA PSN N2200 W06145 CB OBS AT 1200Z WI N2200
W06200 – N2230 W06215 – N2300 W06200 - N2245 W06245 – N2215 W06245 –
N2145 W06230 –N2200 W06200 TOP BLW FL500 WKN FCST AT 1800Z TC CENTRE
PSN N2330 W06315 WI N2300 W06300 – N2400 W06300 – N2400 W06315 -
N2330 W06345 – N2300 W06330 – N3300 W06300=
```

10) Additional example for two cumulonimbus areas in SIGMET for associated with a single tropical cyclone.

The only way to include a second instance of CB associated with a tropical cyclone in a SIGMET is to use the 'AND' option following the 'Forecast position' section.

The example below demonstrates how two separate CB areas associated with TC Harriet, the CB within a specified radius of the centre and the CB dissociated from the TC centre, can be described. 'AND' is highlighted in **bold** to identify the separation between information for the two features.

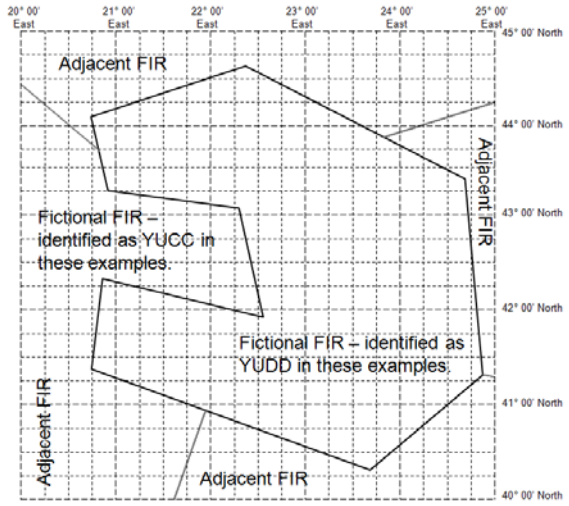


YUDD SIGMET 2 VALID 101200/101800 YUSO–
YUDD SHANLON FIR TC HARRIET PSN N2215 W06100 CB OBS AT 1200Z WI 60NM OF TC CENTRE **AND** N2030 W06115 – N2030 W06200 – N2100 W06315 – N2145 W06315 - N2030 W06115 TOP FL500 MOV NW 20KT WKN FCST AT 1800Z TC CENTRE N2345 W06230 =

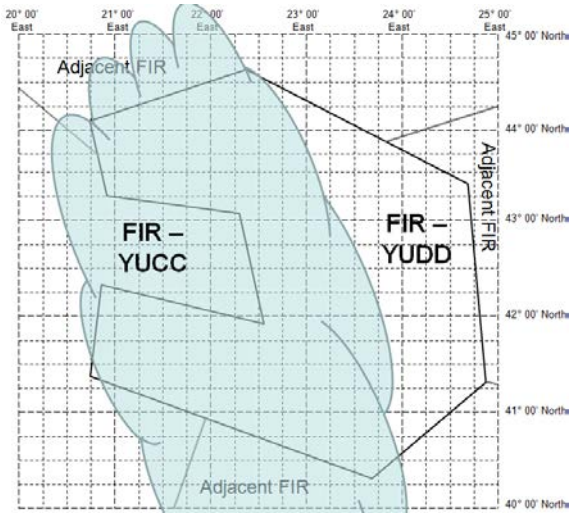
11) Additional examples of SIGMETs relating to 'concave' or 'horseshoe' shaped FIR's

There are examples of FIRs that partially surround adjacent FIRs and are what might be described as concave or 'horseshoe' shaped. An example is given below.

a) Considering a concave, 'horseshoe' shaped FIR partially surrounding another FIR with 'legs' of similar different size



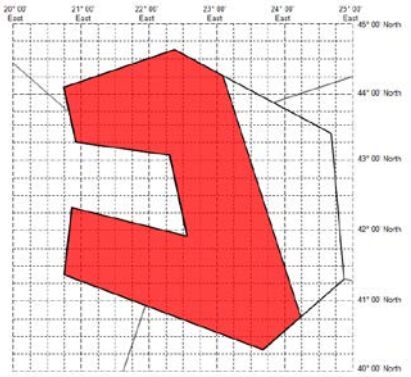
The question arises as to how to encode a SIGMET under circumstances where the hazard affects the outer FIR (YUDD in this case) and the FIR that is partially enclosed (YUCC in this case).



With due regard to removing any possible ambiguity, and also with regard to consistency with protocols for iWXXM versions of SIGMET, the following best practice is provided.

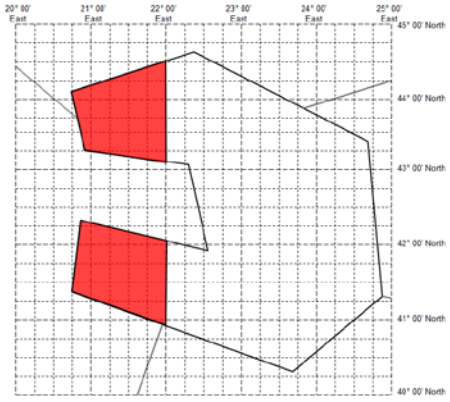
In the examples below, the area indicated in red is taken as representing the meteorological hazard.

Example 1) In this example, it is considered that the situation below could be encoded as a single, simple SIGMET. Users would be expected to interpret the SIGMET as indicating the area identified in red was affected by the hazard within the YUDD FIR.



YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST SW OF LINE N4415 E02305 – N4045 E02415 FL250/370 MOV SW 15KT WKN=

Example 2) In this example, in order to prevent any possible ambiguity and to prevent complications and inconsistencies with equivalent iWXXM versions of SIGMET then two separate SIGMETs should be issued.



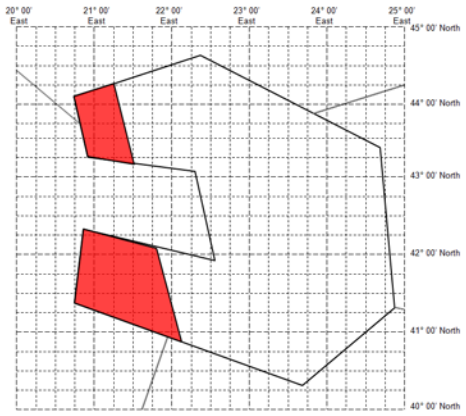
In this case, the following is recommended:

One SIGMET (northern extension of the 'horseshoe' shape)
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST W OF LINE N4430 E02200 – N4307 E02200 FL250/370 MOV W 15KT WKN=

AND a second SIGMET (southern extension of the 'horseshoe' shape)

YUDD SIGMET 3 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST W OF LINE N4203 E02200 – N4058 E02200 FL250/370 MOV W 15KT WKN=

Where the line delineating the hazard is not a line of latitude or longitude, a similar process should be followed



One SIGMET (northern extension of the 'horseshoe' shape)

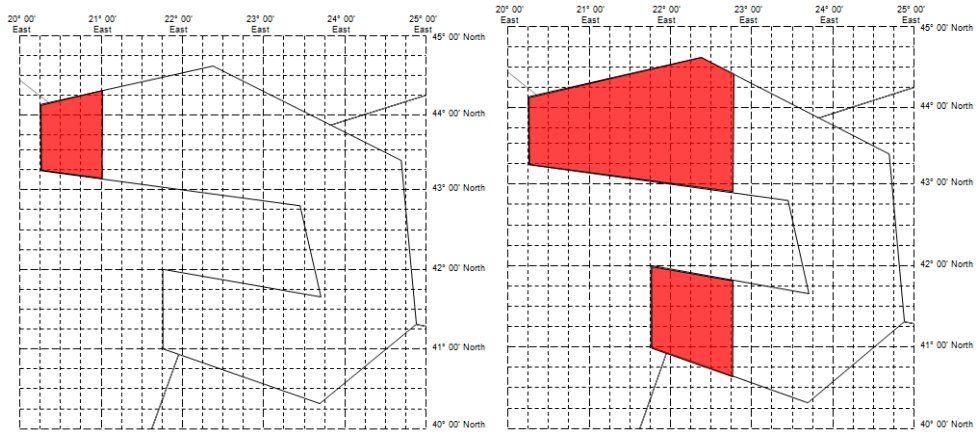
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST SW OF LINE N4415 E02115 – N4312 E02130 FL250/370 MOV W 15KT WKN=

AND a second SIGMET (southern extension of the 'horseshoe' shape)

YUDD SIGMET 3 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST SW OF LINE N4205 E02147 – N4052 E02206 FL250/370 MOV W 15KT WKN=

b) Considering a concave, 'horseshoe' shaped FIR partially surrounding another FIR with 'legs' of very different size.

If the southern 'leg' is expected to be affected during the forecasted validity period, as the example below then 2 SIGMETs should be issued.



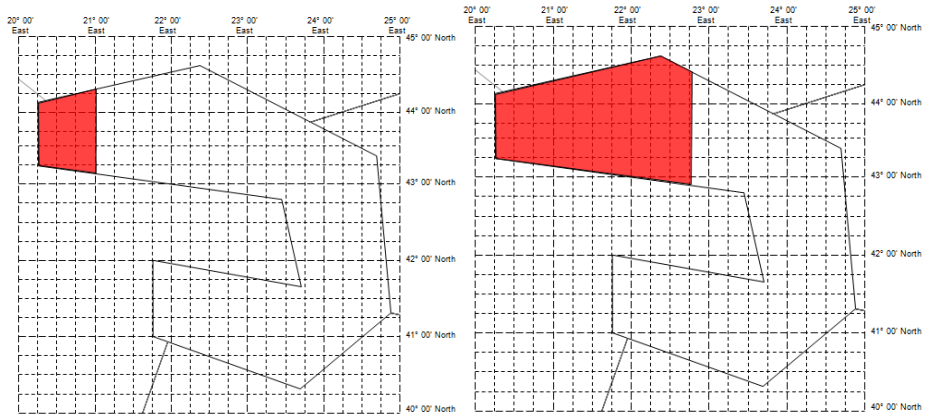
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST AT 1200Z W OF LINE N4416 E02100 – N4307 E02100 FL250/370 MOV E 25KT WKN FCST 1600Z W OF LINE N4427 E02245 – N4252 E02245=

AND a second SIGMET

YUDD SIGMET 3 VALID 101330/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST AT 1330Z W OF LINE N4200 E02145 – N4100 E02145 FL250/370 MOV E 25KT WKN FCST 1600Z W OF LINE N4147 E02245 – N4038 E02245=

Note, the validity time (highlighted) of the second SIGMET commences sometime after that of the first since the southern extension of the horseshoe shape is not as far west.

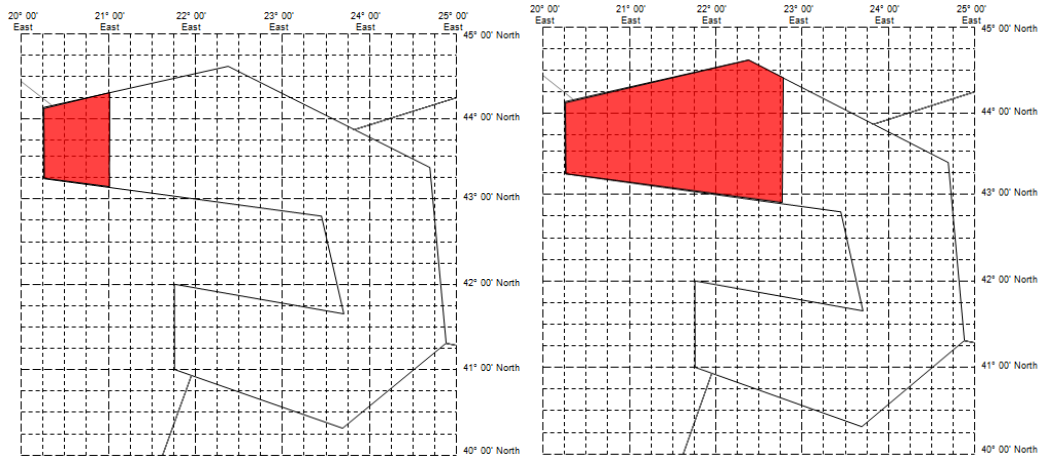
If the southern leg of the FIR is not expected to be affected, as in the example below,



Then a single SIGMET could be issued.

YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST AT 1200Z W OF LINE N4415 E02100 – N4307 E02100 FL250/370 MOV E 25KT WKN=

However, to remove any possible doubt it is better to include an explicit forecast position,



YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR SEV TURB FCST AT 1200Z W OF LINE N4415 E02100 – N4307 E02100 FL250/370 MOV E 25KT WKN FCST 1600Z W OF LINE N4427 E02245 – N4252 E02245=

It should also be noted that in all of these examples relating to concave, horseshoe shaped FIRs, polygons could also be used to explicitly define the areas affected. The above examples are intended to show that the principle under such circumstances is that two SIGMETs should be issued. This, as noted, will prevent ambiguity and will permit straightforward translation of alphanumeric SIGMET into iWXXM versions of SIGMET.

12) Examples using TEST and EXERCISE indicators.

The principles of using the TEST and EXERCISE indicators are straightforward.
The fundamental and overriding principle is that SIGMET bulletins marked as TEST or EXERCISE through the use of these indicators MUST NOT be used for operational decision making.

When using TEST, depending on the circumstances, the SIGMET may be truncated immediately after the TEST indicator, and this approach may be useful when simply testing routing of messages.

Alternatively, and again depending on the circumstances, realistic (although not necessarily valid) data may be included.

With regard to EXERCISE, it is expected that the SIGMET will contain realistic although not necessarily valid data. This will permit exercises at national or regional level to be undertaken.

In all instances, by including the TEST or EXERCISE indicators at a specified point in the SIGMET message, users and systems can immediately identify if the message should be used for operational decision making.

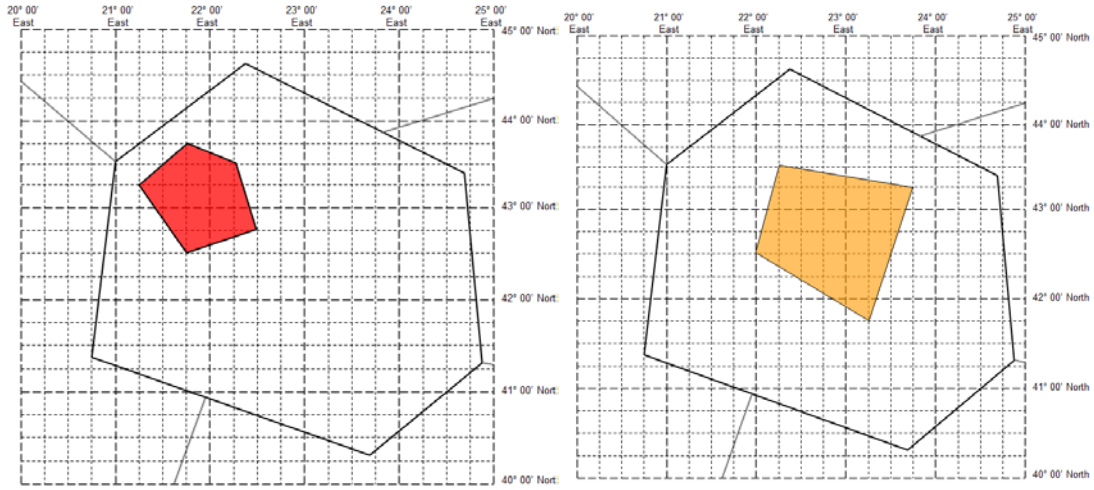
THIS DOES NOT REMOVE THE REQUIREMENT FOR ALL STAKEHOLDERS TO APPLY APPROPRIATE RIGOUR AND QUALITITY CONTROL WITH REGARD TO CORRECT IDENTIFICATION AT ORIGINATION AND CORRECT USE ON RECEIPT/PROCESSING

TEST SIGMET message, with minimum content:

The example below may be used for ad hoc testing of routing, or for regional SIGMET routing tests.

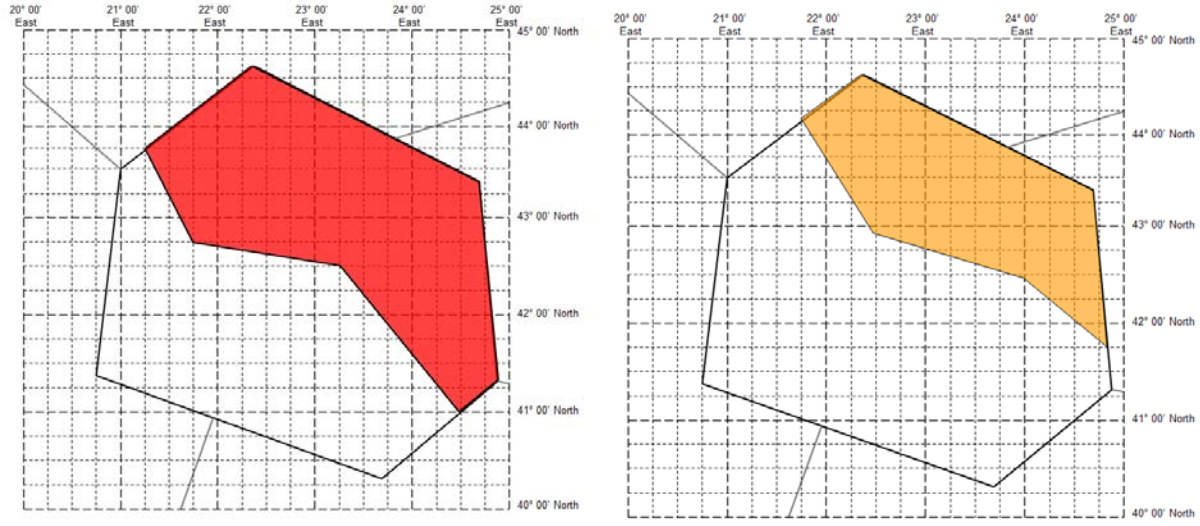
```
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR TEST=
```

TEST SIGMET message, with realistic (though not necessarily valid) content:



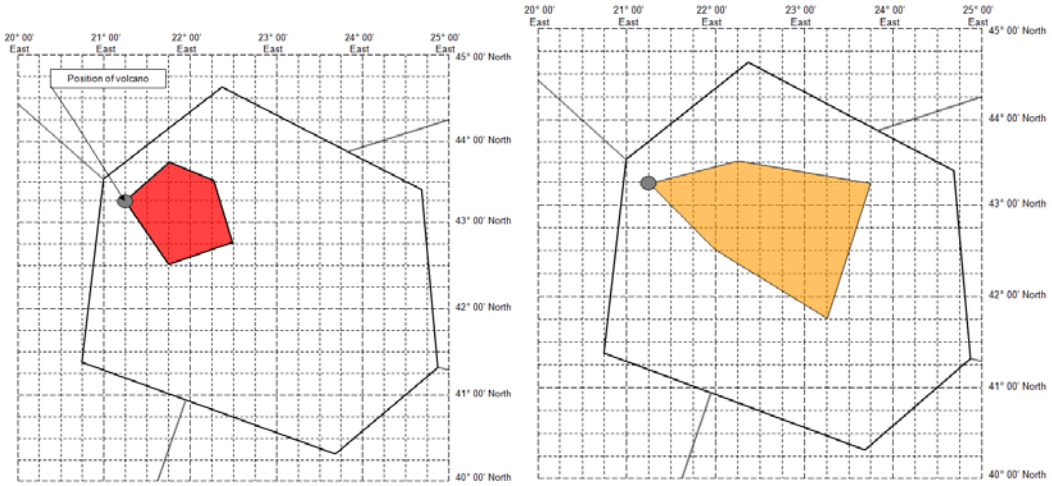

```
YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR/UIR TEST SEV TURB FCST WI N4230 E02145 – N4315
E02115 – N4345 E02145 – N4330 E02215 – N4245 E02230 - N4230 E02145
FL250/370 INTSF FCST AT 1600Z WI N4145 E02315 – N4230 E02200 – N4330
E02215 – N4315 E02345 - N4145 E02315=
```

EXERCISE SIGMET message, with realistic (though not necessarily valid) content:



YUDD SIGMET 2 VALID 101200/101600 YUSO–
YUDD SHANLON FIR EXERCISE SEV TURB FCST NE OF LINE N4345 E02115 – N4245 E02145 - N4230 E2315 – N4100 E2430 FL250/370 WKN FCST AT 1600Z NE OF LINE N4411 E02145 – N4255 E02228 - N4228 E2400 – N4130 E2450=

The most common, organised EXERCISE – especially at regional level – is likely to be related to volcanic ash. On such occasions, 'historical' data is used in order to practice procedures over specific areas.



YUDD SIGMET 2 VALID 101200/101800 YUSO –
YUDD SHANLON FIR EXERCISE VA ERUPTION MT ASHVAL PSN N4315 E02115 VA CLD OBS AT 1200Z WI N4315 E02115 - N4345 E02145 – N4330 E02215 – N4245 E02230 – N4230 E02145 – N4315 E2115 FL250/370 NC FCST AT 1800Z WI N4315 E02115 - N4330 E02215 – N4315 E02345 – N4145 E02315 – N4230 E02200 – N4315 E02115=

— — — — — — — —

APPENDIX C

SIGMET TEST PROCEDURES

CHAPTER 1 — REGIONAL SIGMET TEST PROCEDURES

1. Introduction

1.1. The Meteorology Divisional Meeting (2002) formulated Recommendation 1/12 b), *Implementation of SIGMET requirements*, which called, *inter alia*, for the relevant planning and implementation regional groups (PIRGs) to conduct periodic tests of the issuance and reception of SIGMET messages, especially those for volcanic ash.

1.2. This document describes the procedures for conducting regional SIGMET tests. The test procedures encompass all the three types of SIGMET, as follows:

- SIGMET for volcanic ash (WV SIGMET);
- SIGMET for tropical cyclone (WC SIGMET); and
- SIGMET for other weather phenomena (WS SIGMET).

1.3. The requirements for dissemination of SIGMET are specified in Annex 3, Appendix 6, 1.2 and in this guide <<Insert page reference>>.

1.4. Tropical cyclone and volcanic ash cloud SIGMETs will be referred to hereafter as **WC** SIGMET (due to the $\mathbf{T_1T_2}$ section of the WMO AHL being set to **WC**) and **WV** SIGMET (due to the $\mathbf{T_1T_2}$ section of the WMO AHL being set to **WV**) respectively. All other SIGMET types will be referred to by **WS** (due to the $\mathbf{T_1T_2}$ section of the WMO AHL being set to **WS**).

2. Purpose and scope of regional SIGMET tests

2.1. The purpose of the regional SIGMET tests is to check the awareness of participating MWOs of the ICAO requirements for the issuance of SIGMET and the compliance of the States' procedures for preparation and dissemination of SIGMET bulletins with the relevant ICAO Standards and Recommended Practices (SARPs) and regional procedures.

2.2. Note, an MWO is at liberty to issue SIGMET test messages for local reasons (i.e. testing of local systems/routing etc.). Whilst such tests may not involve other MWOs or agencies directly, it is recommended that the general principles of this guide be followed with regard to local, ad hoc testing.

2.3. Hereafter, references to 'SIGMET tests' or 'tests' should be understood to refer to regional SIGMET tests.

2.4. The scope of the tests is to check also the interaction (where appropriate, depending on regional requirements) between the tropical cyclone advisory centres (TCAC) and volcanic ash advisory centres (VAAC), and the MWOs in their areas of responsibility. Therefore, where the issuance of **WC** and **WV** SIGMET is being tested, the TEST SIGMET messages initiated by the MWO should normally be triggered by a test advisory issued by the respective TCAC or VAAC.

2.5. The regional OPMET data banks (RODB) will monitor the dissemination by filing all TEST SIGMETs and advisories and the corresponding reception times. The monitoring results for **WC**, **WV** and **WS** SIGMET will be provided in the form of summaries to the SIGMET test focal points given in section 3.4.1.3 with a copy to the Regional Office concerned

2.6. A consolidated summary report will be prepared by both the SIGMET test focal points and submitted to the ICAO regional office concerned. The report will include recommendations for improvement of the SIGMET exchange and availability. The results of the tests should be reported to the appropriate regional OPMET bulletin exchange/data management group and MET Sub-group meetings.

2.7. Participating States, for which discrepancies of the procedures or other findings are identified by the tests, will be advised by the ICAO Regional Office and requested to take necessary corrective action.

3. SIGMET test procedures

3.1. Procedures for WC and WV SIGMET tests

3.1.1. Participating units

3.1.1.1. **Tropical Cyclone Advisory Centres (TCAC):**
<<Insert TCACs as necessary>>

3.1.1.2. **Volcanic Ash Advisory Centres (VAAC):**
<<Insert VAACs as necessary>>

3.1.1.3. **Regional OPMET Data Banks (RODB):**
<<Insert RODBs as necessary>>

3.1.1.4. **Meteorological Watch Offices (MWO):**
<<Insert MWOs as necessary>>

3.1.1.5 **World Area Forecast Centres (WAFCs):**
London
Washington

3.1.2. WV/WC SIGMET test messages

3.1.2.1. On the specified date for the test <<Time (UTC) to be agreed appropriate to Region>> the participating VAAC and TCAC should issue a TEST VA or TC advisory[5]. The structure of the TEST advisories should follow the standard format given in Annex 3 with indication that it is a test message using the TEST indicator at the appropriate position of the SIGMET, and as shown on pages <<XX-5>>.

3.1.2.2. MWOs, upon receipt of the TEST VA or TC advisory, should issue a TEST SIGMET for volcanic ash (**WV**) or tropical cyclone (**WC**), respectively, and send it to all participating RODBs. The WMO AHL, the first line of the SIGMET, and the FIR reference in the second line of the SIGMET should be valid entries. The remainder of the body of the message should contain only the specified 'TEST' indicator. TEST SIGMETs should normally have short validity periods (10 minutes), but where

[5] Note, although not within the scope of this document, the VA and TC advisory messages also include TEST and EXERCISE Indicators with effect from Amendment 78. Consult ICAO Annex 3 Table A2-1 and A2-2 accordingly.

appropriate TEST SIGMET may be issued with validity periods up to the maximum allowed (4 hours for **WS**, 6 hours for **WC** and **WV**').

3.1.2.3. If the MWO does not receive the TEST VA or TCA advisory within 30 minutes of the commencement time of the test then they should still issue a TEST SIGMET indicating that the VAA or TCA was not received. See <<XX-6>> for an example of the test message.

3.1.2.4. The use of the TEST indicator and the next sequence number will avoid over-writing of previously issued and valid SIGMETs. To avoid any possible risk of confusion during genuine volcanic eruptions or tropical cyclone events, then TEST SIGMET for VA or TC should not be sent in the case where there is a valid SIGMET of the same type for the MWO's area of responsibility. However, in this case the responsible MWO should notify the WV/WC SIGMET test focal point as given in 3.4.1.3 so that they can be excluded from the analysis.

3.2. **Procedures for WS SIGMET tests**

Note. — The WS SIGMET is initiated by the MWO at the designated time in 3.2.2. It is not initiated by an advisory as in the WC and WV SIGMET tests.

3.2.1. Participating units

Each Regional Office should develop its own list of participating units, using the template below:

3.2.1.1. **Regional OPMET Data Banks (RODB):**
<<Insert RODBs as necessary>>

3.2.1.2. **Meteorological Watch Offices (MWO):**
<<Insert MWOs as necessary>>

3.2.2. WS SIGMET Test Message

3.2.2.1. The MWOs should issue a TEST SIGMET during the 10-minute period between <<Time (UTC) to be agreed appropriate to Region>>.

3.2.2.2. The WMO AHL, the first line of the SIGMET, and the FIR reference in the second line of the SIGMET should be valid. The remainder of the body of the message should contain only the 'TEST' indicator. TEST SIGMETs should normally have short validity periods (10 minutes), but where appropriate TEST SIGMET may be issued with validity periods up to the maximum allowed (4 hours for **WS**, 6 hours for **WC** and **WV**'.

3.3. **Common procedures**

3.3.1. Special procedure to avoid overwriting of a valid WV/WC/WS SIGMET

3.3.1.1. It is vital to ensure that that the use of the 'TEST' indicator is intended to ensure that messages are correctly processed and not used for operational decision making. Accordingly, the next SIGMET sequence number should be used.

For example, a SIGMET test is scheduled for 0200 UTC on the 29th. 3 SIGMETs have already been issued for the FIR since 0001 UTC. The TEST SIGMET is issued as follows:

WSAU01 YBRF 290200
YBBB SIGMET 4 VALID 290200/290210 YBRF-
YBBB BRISBANE FIR TEST=

3.3.2. The test date and time

3.3.2.1. ICAO Regional Office will set a date and time for each SIGMET test after consultation with the participating VAACs, TCACs and RODBs. The information about the agreed date and time will be sent to all States concerned by a State letter and copied to the States' SIGMET Tests Focal Points.

3.3.2.2. Tests for different types of SIGMET should preferably be conducted on separate dates.

3.3.2.3. SIGMET tests for **WC**, **WV** and **WS** should be conducted at least yearly.

3.3.3. Dissemination of test SIGMETs and advisories

3.3.3.1. All TEST TC/VA advisories should be sent by the TCACs and VAACs to the participating units, as specified in the Regional Air Navigation Plan. The relevant AFTN addresses should be identified as part of the Region specific documentation.

3.3.3.2. All TEST SIGMETs should be sent by the MWOs to the participating units, as specified in the Regional Air Navigation Plan identified by each Regional Office. The relevant AFTN addresses should be identified as part of the Region specific documentation.

3.3.3.3. RODBs that are nominated as IROGs will relay the test bulletins to their corresponding IROG.

3.3.3.4. SIGMET tests should be terminated within 2 hours of the test start time. Exceptionally, where the test requires SIGMETs to be valid for up to 4 hours, then tests may be extended to a maximum of 4 hours for WS SIGMET and 6 hours for WC and WV SIGMET.

3.3.4. Coordination with the ATS units

3.3.4.1. MWOs should inform the associated ATS units of the forthcoming SIGMET tests by a suitable advanced notice.

3.4. **Processing of the test messages and results**

3.4.1. The RODBs should file all incoming TEST advisories and SIGMETs and perform an analysis of the availability, timeliness of arrival and the correctness of the WMO bulletin headings. A SIGMET TEST Summary Table, as shown on page <<XX-7>> of this guide, should be prepared by each RODB and sent to the regional SIGMET test focal point given in section 3.4.3, with a copy to the ICAO Regional Office.

3.4.2. The SIGMET test focal points should prepare the final report of the test and present to the ICAO Regional Office. A summary report should be submitted to the next regional OPMET bulletin exchange/data management group and MET Sub-group meetings.

3.4.3. The current SIGMET test focal points for the <<Insert region>> Region are as follows:

<<Insert region>> Region

<<To be completed as necessary>>

SIGMET TEST PROCEDURES

Format of TEST Advisories and SIGMETs

1. Format of TEST Volcanic Ash Advisory

```
VA ADVISORY
TEST
DTG:            YYYYMMDD/0200Z
VAAC:           <<NAME OF VAAC>>
VOLCANO:        TEST
PSN:            UNKNOWN
AREA:           <<NAME OF VAAC>> VAAC AREA
SUMMIT ELEV:    UNKNOWN
ADVISORY NR:    YYYY/nn
INFO SOURCE:    NIL
AVIATION COLOUR CODE: NIL
ERUPTION DETAILS:     NIL
OBS VA DTG:     DD/GGggZ
OBS VA CLD:     ASH NOT IDENTIFIABLE FROM SATELLITE DATA
FCST VA CLD +6 HR:    DD/0800Z SFC/FL600 NO ASH EXP
FCST VA CLD +12 HR:   DD/1400Z SFC/FL600 NO ASH EXP
FCST VA CLD +18 HR:   DD/2000Z SFC/FL600 NO ASH EXP
RMK: THIS IS A TEST VA ADVISORY. MWO SHOULD NOW ISSUE A TEST
SIGMET FOR VA,. PLEASE REFER TO THE LETTER FROM <<REGION>>
REGIONAL OFFICE DATED xxxxxxxxxx.
NXT ADVISORY: NO FURTHER ADVISORIES=
```

2. Format of TEST Tropical Cyclone Advisory

```
TC ADVISORY
TEST
DTG:            YYYYMMDD/0200Z
TCAC:           <<NAME OF TCAC>>
TC:             TEST
NR:             nn (actual number)
OBS PSN:        NIL
CB:             NIL
MOV:            NIL
C:              NIL
MAX WIND:       NIL
FCST PSN +06HR: NIL
FCST MAX WIND +06HR:  NIL
FCST PSN +12HR: NIL
```

```
FCST MAX WIND +12HR:  NIL
FCST PSN +18HR: NIL
FCST MAX WIND +18HR:  NIL
FCST PSN +24HR: NIL
FCST MAX WIND +24HR:  NIL
RMK: THIS IS A TEST TC ADVISORY. MWO SHOULD NOW ISSUE A TEST
SIGMET FOR TC. PLEASE REFER TO THE LETTER FROM <<REGION>>
REGIONAL OFFICE DATED xxxxxxxxxx.
NXT MSG: NIL=
```

3. Format of TEST SIGMET for Volcanic Ash

```
WVXXii CCCC YYGGgg
CCCC SIGMET <<NUMBER>> VALID YYGGgg/YYGGgg CCCC-
CCCC <<NAME>> FIR TEST=
```

or

```
WVXXii CCCC YYGGgg
CCCC SIGMET <<NUMBER>> VALID YYGGgg/YYGGgg CCCC-
CCCC <<NAME>> FIR TEST.  THIS IS A TEST MESSAGE, PLEASE
DISREGARD. TEST VA ADVISORY NUMBER YYYY/nn RECEIVED FM [name]
VAAC AT YYGGggZ=
```

or

```
WVXXii CCCC YYGGgg
CCCC SIGMET <<NUMBER>> VALID YYGGgg/YYGGgg CCCC-
CCCC <<NAME>> FIR TEST. THIS IS A TEST SIGMET, PLEASE DISREGARD.
TEST VA ADVISORY NOT RECIEVED FM [name] VAAC=
```

Examples:

```
WVJP31 RJTD 170205
RJJJ SIGMET Z99 VALID 170205/170215 RJTD-
RJJJ FUKUOKA FIR TEST=

WVJP31 RJTD 170205
RJJJ SIGMET 2 VALID 170205/170215 RJTD-
RJJJ FUKUOKA FIR TEST. THIS IS A TEST SIGMET, PLEASE DISREGARD.
VA ADVISORY NUMBER 2018/01 RECEIVED FM TOKYO VAAC AT 170200Z=

WVJP31 RJTD 170235
RJJJ SIGMET 4 VALID 170205/170215 RJTD-
RJJJ FUKUOKA FIR TEST. THIS IS A TEST SIGMET, PLEASE DISREGARD.
TEST VA ADVISORY NOT RECEIVED FM TOKYO VAAC=
```

4. Format of TEST SIGMET for Tropical Cyclone

```
WCXXii CCCC YYGGgg
CCCC SIGMET <<NUMBER>> VALID YYGGgg/YYGGgg CCCC-
CCCC <<NAME>> FIR TEST=
```

or

```
WCXXii CCCC YYGGgg
CCCC SIGMET <<NUMBER>> VALID YYGGgg/YYGGgg CCCC-
CCCC <<NAME>> FIR TEST. THIS IS A TEST SIGMET, PLEASE
DISREGARD.
TEST TC ADVISORY NUMBER xx RECEIVED FM [name] TCAC AT YYGGggZ=
```

```
WCXXii CCCC YYGGgg
CCCC SIGMET <<NUMBER>> VALID YYGGgg/YYGGgg CCCC-
CCCC <<NAME>> FIR TEST. THIS IS A TEST SIGMET, PLEASE DISREGARD.
TEST TC ADVISORY NOT RECEIVED FM [name] TCAC=
```

Example:

```
WCJP31 RJTD 100205
RJJJ SIGMET 1 VALID 100205/100215 RJTD-
RJJJ FUKUOKA FIR TEST=

WCJP31 RJTD 100205
RJJJ SIGMET Z99 VALID 100205/100215 RJTD-
RJJJ FUKUOKA FIR TEST. THIS IS A TEST SIGMET, PLEASE DISREGARD.
TEST TC ADVISORY NUMBER 1 RECEIVED FM TOKYO TCAC AT 180200Z=

WCJP31 RJTD 100235
RJJJ SIGMET Z99 VALID 100205/100215 RJTD-
RJJJ FUKUOKA FIR TEST. THIS IS A TEST SIGMET, PLEASE DISREGARD.
TEST TC ADVISORY NOT RECEIVED FM TOKYO TCAC=
```

5. Format of TEST SIGMET for other weather phenomena

```
WSXXii CCCC YYGGgg
CCCC SIGMET <<number>> VALID YYGGgg/YYGGgg CCCC-
CCCC <<NAME>> FIR TEST=
```

or

WSXXii CCC YYGGgg
CCCC SIGMET <<number>> VALID YYGGgg/YYGGgg CCCC-
CCCC <<NAME>> FIR TEST. THIS IS A TEST SIGMET, PLEASE DISREGARD=

Example:

```
WSJP31 RJTD 240205
RJJJ SIGMET A2 VALID 240205/240215 RJTD-
RJJJ FUKUOKA FIR TEST.  THIS IS A TEST SIGMET, PLEASE DISREGARD=
```

CHAPTER 2 — SAMPLE TABLE TO USED BY REGIONAL OPMET DATA BANKS

Name of RODB Tokyo
Date of Test 2011/11/17
Target (VA or TC) VA

VA Advisories (FV)

TTAAii	*CCCC*	*YYGGgg*	*Received Time(UTC)*	*Comments/Remarks*
FVAK23	PAWU	170159	01:59:29	
FVAU01	ADRM	170201	02:01:53	
FVFE01	RJTD	170200	02:00:09	
FVPS01	NZKL	170207	02:08:27	
FVXX02	LFPW	170202	02:02:41	
FVXX25	KNES	170200	02:02:01	

VA SIGMET (WV)

TTAAii	*CCCC*	*YYGGgg*	*MWO*	*FIR*	*Received Time(UTC)*	*Comments/Remarks*
WVAK01	PAWU	170200	PAWU	PAZA	02:00:11	
WVAU01	ADRM	170201	YDRM	YBBB	02:02:04	
WVCI31	RCTP	170205	RCTP	RCAA	02:04:58	
WVCI33	ZBAA	170205	ZBAA	ZBPE	02:05:26	
WVCI34	ZSSS	170205	ZSSS	ZSHA	02:02:34	
WVCI35	ZJHK	170201	ZJHK	ZJSA	02:03:34	
WVCI36	ZUUU	170205	ZUUU	ZPKM	02:11:04	
WVCI37	ZLXY	170205	ZLXY	ZLHW	02:07:44	
WVCI38	ZYTX	170205	ZYTX	ZYSH	02:01:50	
WVCI39	ZWWW	170202	ZWWW	ZWUQ	02:02:40	
WVCI45	ZHHH	170204	ZHHH	ZHWH	02:08:52	
WVFJ01	NFFN	170000	NFFN	NFFF	02:15:46	
WVIN31	VOMM	170201	VOMM	VOMF	02:09:57	
WVJP31	RJTD	170205	RJTD	RJJJ	02:06:24	
WVKP31	ZUUU	170206	ZUUU	VDPP	02:12:23	
WVLA31	VLVT	170200	VLVT	VLVT	02:01:03	
WVMS31	WMKK	170205	WMKK	WBFC	02:04:28	
WVPA01	PHFO	170201	PHFO	KZAK	02:02:09	
WVPH31	RPLL	170210	RPLL	RPHI	02:08:43	
WVPN01	KKCI	170200	KKCI	KZAK	02:00:11	
WVRA31	RUCH	170205	RUCH	UIAA	02:08:01	
WVRA31	RUHB	170206	RUHB	UHHH	02:07:57	
WVRA31	RUMG	170205	RUMG	UHMM	02:08:59	
WVRA31	RUPV	170200	RUPV	UHMP	02:09:13	
WVRA31	RUSH	170205	RUSH	UHSS	02:04:22	

WVRA31	RUVV	170202	RUVV	UHWW	02:03:13
WVRA32	RUPV	170200	RUPV	UHMA	02:06:01
WVRA32	RUYK	170207	RUYK	UELL	02:07:28
WVRA33	RUHB	170202	RUHB	UHBB	02:02:49
WVSR20	WSSS	170205	WSSS	WSJC	02:05:38
WVSS20	VHHH	170202	VHHH	VHHK	02:03:05
WVTH31	VTBS	170211	VTBS	VTBB	02:13:53
WVVS31	VVGL	170200	VVGL	VVNB	02:05:06
WVVS31	VVGL	170208	VVGL	VVTS	02:14:38

— END —