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WORKING PAPER

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Third NAM/CAR Air Navigation Implementation Working Group Meeting (ANI/WG/3)
Mexico City, Mexico, 4 to 6 April 2016

- Agenda Item 4: Follow-up, Performance Evaluation and Monitoring of the NAM/CAR Regional Performance Based Air Navigation Implementation Plan (NAM/CAR RPBANIP) Targets**
- 4.1 Progress Reports of the Task Forces and the ANI/WG**

METEOROLOGICAL INFORMATION EXCHANGE

(Presented by the Secretariat)

EXECUTIVE SUMMARY	
This paper presents the requirement for the exchange of aeronautical meteorological information in a digital form and invites the Meeting to participating in the Air Traffic Service (ATS) Messages Handling Systems (AMHS) testing - for Extensible Markup Language (XML) MET exchange, to seek the full operational use of the AMHS capability	
Action:	The suggested actions are presented in Section 3
Strategic Objectives:	<ul style="list-style-type: none">• Safety• Air Navigation Capacity and Efficiency
References:	<ul style="list-style-type: none">• MET Divisional Meeting, 7 to 18 July 2014• Doc 10003 <i>Manual on the Digital Exchange of Aeronautical Meteorological Information</i>• GREPECAS PPRC/3 Meeting Decision 3/6• ICAO Amendment Proposal for Annex 10, Volume II, ref AN 7/1.3.104-15/31 (April 24, 2015)

1. Introduction

1.1 The first edition of the *Manual on the Digital Exchange of Aeronautical Meteorological Information* — Doc 10003 was published in response to the introduction of the exchange of aeronautical meteorological information in a digital form as part of Amendment 76 to Annex 3 — *Meteorological Service for International Air Navigation*, applicable 14 November 2013.

1.2 The MET Divisional Meeting 7 to 18 July 2014, and its Recommendation 2/3 c) which states: To undertake, as a matter of urgency, formal testing of the exchange of global OPMET information and world area forecast system (WAFS) forecasts on the ATS message handling system

(AMHS) with a view to determining the capability and minimum specifications required to distribute such data to States/users in the future.

1.3 Amendment 76 to Annex 3, include the requirement for Aviation Routine Weather Report (METAR) and Aviation Selected Special Weather Report (SPECI) if disseminated in digital form shall be formatted in accordance with a globally interoperable information exchange model and shall use XML/Geography Markup Language (GML).

1.4 During the CAR/SAM Planning and Implementation Regional Group (GREPECAS) Third Meeting of the Programmes and Projects Review Committee (PPRC/3) Meeting, when analysing the implementation of AMHS systems and their interconnection in the CAR and SAM Regions, it was observed that AMHS application has not been exploited in its full potential, and that it operates in the same way as Aeronautical Fixed Telecommunication Network (AFTN), only with alphanumeric characters and does not use the messages annex delivery, annexes that could contain various information such as tables and graphs; convening that States should take advantage of AMHS, as well as the establishment of greater capacity and speed communication networks, sending messages with annexes attached, previously coordinated among units, where messages are exchanged, in order to increase the information required by these units, and achieve a better situational awareness. When a thorough use of AMHS is made, the use of AFTN will decrease through Gateway, and therefore the AMHS interconnection will increase in the regional and interregional levels. A working group was decided to be formed to start a strategy development and implementation to obtain an effective AMHS use. The working group would be integrated by Brazil, Dominican Republic, United States and the programmes D coordinators of the CAR/SAM Regions, the Meeting and formulated the next decision:

DRAFT

DECISION 3/6 ESTABLISHMENT OF A WORKING GROUP TO OBTAIN BETTER AMHS OPERATIONAL USE

That, in order to exploit AMHS potentialities and take advantage of its operational use:

- a) *a working group is formed by Brazil, Dominican Republic, United States and D Programme coordinators in the CAR and SAM Regions for ground- ground and air-ground communications infrastructure;*
- b) *the working group will work through virtual meetings and will prepare a strategy to ensure AMHS operational use, providing it to the Region disposal as soon as practicable.*

2. Discussion

2.1 According with the Annex 3, Appendix 3, 2.1.3 and 2.1.4; Appendix 5, 1.1.2, 1.1.3, and 1.1.4; Appendix 6, 1.1.6, 1.1.7 and 1.1.8 and Doc 10003 - *Manual on the Digital Exchange of Aeronautical Meteorological Information*; Amendment 76 to Annex 3 applicable November 2013 enabled the exchange of OPMET data in digital form under bilateral agreements between States in a position to do so for METAR and SPECI, Terminal Area Forecast (TAF) and Information Concerning En-Route Weather Phenomena Which May Affect The Safety Of Aircraft Operations (SIGMET).

2.2 Where States are in a position to exchange METAR, SPECI, TAF and SIGMET in a digital form, Annex 3 requires that the information be formatted in accordance with a globally interoperable information exchange model, use extensible markup language (XML)/geography markup language (GML), and be accompanied by the appropriate metadata.

2.3 The exchange of METAR and SPECI, TAF and SIGMET in digital form will become a recommendation (requirement) in Amendment 77 (78) applicable November 2016 (2018). Other MET elements such as volcanic ash advisories (Recommendation Amendment 77) will be exchanged in digital form in due time.

2.4 The Secretary of Communications Panel invites the States to participating in AMHS testing – for XML MET exchange, (see **APPENDIX A: Project Test Plan Template**) consisting in two phases:

- Phase 1 – a compatibility test, to see if AMHS can accept the new XML message formats
- Phase 2 – to test the ability of the AMHS to accept realistic messages and volumes

2.5 The ANI/WG AMHS TF has been notified of this invitation and looks for this TF planning and actions as needed. The GREPECAS D Project Coordinator is formed by the same members of the AMHS TF lead by United States, Ms. Dulce Roses.

3. Suggested Actions

3.1 The Meeting is invited to:

- a) Provide any comments and considerations related with the actual capacity and inter-regional connectivity required for the AMHS testing - for XML MET exchange;
- b) The AMHS TF to review this information and conduct draft a proposal of the strategy requested by Decision 3/6 of PPRC/3 Meeting based on this MET Exchange requirement; and
- c) States to consider the participation of the States in the AMHS testing - for XML MET exchange- establishing dates and PoC.

IWXXM Bi-Lateral Testing

Project Test Plan Template

Version: 0.0

Program Manager

Date

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1.0 INTRODUCTION

1.1 Purpose

This Project Test Plan provides the strategy for evaluating the readiness of the system components required for the exchange and application of International Civil Aviation Organization (ICAO) Operational Meteorological (OPMET) information encoded in eXtensible Markup Language (XML) format. This plan documents the project scope, responsibilities, tasks, schedules and deliverables required in testing the bi-lateral exchange of ICAO XML OPMET information using the ICAO Weather Information Exchange Model (IWXXM).

1.2 Project Background

In November of 2013, amendments to ICAO Annex 3 – *Meteorological Service for International Air Navigation* and WMO Document No. 49 were made allowing the bi-lateral exchange of four OPMET products (i.e., METAR, SPECI, TAF, and SIGMET)¹ in XML between states in a position to do so. Concurrently the IWXXM 1.0 was released, which is an XML representation of those OPMET products. The current plan for implementing the exchange of XML products is based on the ICAO three year amendment cycle:

November 2016 - ICAO Annex 3 amended to make the exchange of XML products a recommended practice. Additionally, more ICAO Annex 3 products will be allowed to be exchanged in XML

November 2019 - ICAO Annex 3 amended to make the exchange of XML products a mandatory practice. Additionally, the remaining ICAO Annex 3 products will be allowed to be exchanged in XML

IWXXM has not been tested for operational readiness in a bi-lateral fashion. As part of the activities under the MIE a suite of tests should be developed to discover operational issues prior to 2016 when IWXXM exchange becomes a recommended practice.

In support, a Concept of Operations for the Transition of OPMET Data Exchange using IWXXM to enable System-Wide Information Management (SWIM) has been developed by the European Data Management Group (DMG) [Ref A]. The proposed bi-lateral testing will verify the feasibility of the DMG concepts and help identify implementation issues for consideration.

Currently ICAO OPMET data is exchanged in TAC format using AFTN/CIDIN or AMHS (basic service). The format of the OPMET data is limited to fit within traditional AFTN messaging limitations. Whilst this has met the needs of the Aviation community it is not possible to exchange more Modern XML format messaging.

1.3 Test Scope

The goal of the bi-lateral testing activity is to implement an operational prototype environment that would be used to:

- identify any limitations in the IWXXM model that can be discovered through pseudo-operational bi-lateral exchanges
- track and feed discovered limitations back to the responsible groups for resolution (such as the IWXXM developer group)

¹ Per ICAO Doc 8400 – *Procedures for Air Navigation Services, ICAO Abbreviation and Codes*: METAR = Aerodrome routine meteorological report. SPECI = Aerodrome special meteorological report. TAF = Aerodrome forecast. SIGMET = Information concerning en-route weather phenomena which may affect the safety of aircraft operations

- serve as a basis for evaluating the concepts and procedures of the operational environment that will eventually be implemented
- engage with OPMET organizations to increase communication and awareness regarding upcoming changes
- Provide validated answers to some of the questions raised in the CONOPS

The prototype environment is needed for initial testing for the 2016 rollout. In addition, it may also be useful in future phases of IWXXM testing as updates are made to the IWXXM model.

The testing environment should be as close to the operational environment as practical:

- involving the operational organizations who will be responsible for IWXXM; or those who are responsible for producing and consuming OPMET information which is currently encoded in the Traditional Alphanumeric Code (TAC)
- using protocols and methods (such as network infrastructure) as similar as possible to that envisioned for future XML exchanges

1.4 Approach

The message exchange testing with international and national partners should proceed in phases. Any technical issues that are identified in each phase should be resolved before proceeding to the next phase. The objectives of each phase are outlined in Section 1.4.1. The details for each test phase are contained the Annexes A-D.

1.4.1 Test Phase Objectives

1.4.1.1 Phase I – Communications Capability Verification

Phase 1 will test whether the AFS network infrastructure is capable of passing XML/IWXXM messages. Testing network infrastructure is not the primary focus of testing, but it is an important prerequisite for IWXXM testing. Static (not real time) IWXXM messages for each product would be exchanged across the circuits in the most simple manner. Messages would be passed over the network in World Meteorological Organization (WMO) Collections as defined in the IWXXM 1.0, similar to WMO bulletins today with the Traditional Alphanumeric Code (TAC) messages.

The required AMHS infrastructure required is an AMHS UA connected to an MTA in one state, and a UA connected to an MTA in another state. The 2 MTA's should be interconnected. It is desirable that the MTA's are in a non operational environment, but with correct addressing this could be achieved over an operational network.

Messages would initially be passed in an uncompressed XML form these do not necessarily need to be IWXXM messages. This will demonstrate AMHS's capability to exchange the full XML character set..

Once this is successful they would be transmitted in a compressed form using GZIP² and Efficient XML Interchange (EXI) compression or whatever format is prescribed by ICAO. The compressed XML data will be exchanged in an AMHS FTBP. Messages will be transmitted both directions.

1.4.1.2 Phase II – IWXXM Encoding and Exchange Verification

Phase II expands Phase 1 to include real-time data and traffic volumes. It should also test file extensions, traffic flooding, compression techniques etc. Initially only OPMET products, METAR, SPECI, TAF, SIGMET will be exchanged bi-laterally encoded as XML. This phase would verify that real data can be exchanged in real-time with

² GZIP is a file format and a software application used for file compression and decompression

all the variances and corner cases of the true operational environments, as well as identify and correct any system errors (IWXXM and/or TAC converters) prior to operational use.

Creation and Use (Host state -> International Partner):

Information is created as normal TAC messages by the Host State. They are converted to IWXXM for international distribution, which is placed onto international circuits by the Host State. The messages are then received by International Partner.

Creation and Use (International Partner -> Host State):

Messages are passed to the Host State as IWXXM messages across international circuits (AHMS) as FTBP. These messages are integrated into Host State systems and operational consumers review the information and assess its correctness and utility.

1.4.2 Project Test System

Insert description and diagram of test system

1.5 Reference Materials

- A. *Concept of Operations for the Transition of OPMET Data Exchange using IWXXM to enable SWIM, Version V2.2, 15 July 2014, ICAO Meteorological Group in Europe (METG), European Data Management Group (DMG).*
- B.

2. PROJECT MANAGEMENT AND OVERVIEW

2.1 Project Management

Add description of Project Management needs for testing.

2.2 Project Stakeholders

The key stakeholders in this project are listed below: insert key participants as they are identified.

Organization	Individual	Position	Contact Information

2.3 Responsibilities

The key agency responsibilities are listed below: Expand and ID agency office/program

- Manage the Project Test Plan development and execution (
- Establish the prototype test system
- Test Partner Selections – International and National
- Evaluate test results and determine necessary corrective actions

2.4 Major Milestones and Schedule

Build/Extract from Annex A-D – Keep at Major Level

Task	Description	Schedule	Remarks
Project Test Plan Published	First Draft		
	Initial Stakeholder Review		
	Final Plan		
Prototype Test Site Established	Communications Links		
	IWXXM/TAC Conversion if available		
Test Partners Identified	International		
	National		
Execute Test Plan	Phase I		
	Phase II		

2.5 Project Deliverables

Extract from Annex A-D

2.6 Interdependencies

The following key interdependencies are identified:

- Identify-??

ANNEX A: PHASE 1 – COMMUNICATIONS CAPABILITY VERIFICATION

Phase 1 will test whether the network infrastructure is capable of passing XML/IWXXM messages. Testing network infrastructure is not the primary focus of testing, but it is an important prerequisite for IWXXM testing. Static (not real time) XML messages would be exchanged across the circuits in the most simple manner demonstrating the FTBP capability in AMHS.

Messages would initially be passed in an uncompressed XML form. Once this is successful they would be transmitted in a compressed form using the defined compression method possibly GZIP and EXI compression. Messages will be transmitted both directions.

Schedule

- Create static example of an XML message (preferably a METAR/TAF or SIGMET).
For additional testing these could be in XML, GZIP compressed XML, and EXI compressed XML, embedded in a WMO XML Collection.
- Create test circuit with International Partners via AMHS
- Exchange and verify correct message structure of static example messages in XML
- Exchange, decompress, and verify GZIP-compressed static messages
- Exchange, decompress, and verify EXI-compressed static messages
- Create white paper describing the capabilities of AFTN and AMHS to distribute compressed and uncompressed XML messages.
- Create white paper describing implications of observed XML data volumes for global operational dissemination
-

Test Criteria/Metrics:

Note: In-depth network or detailed protocol tests are out of scope. Phase I is included as a way to identify network issues separately from other issues. The primary purpose of the overall bi-lateral testing is to demonstrate AMHS's capability to meet the requirements to be able to exchange IWXXM product into the future..

Issues/Risks:

Deliverables:

ANNEX B: PHASE II – IWXXM ENCODING AND EXCHANGE VERIFICATION

Phase II will expand Phase I to include real-time data. All four IWXXM products (METAR, SPECI, TAF, SIGMET) would be exchanged bi-laterally with data encoded as XML. This phase would verify that real data can be exchanged in real-time with all the variances and corner cases of the true operational environments.

Creation and Use (Host State-> International Partner):

METAR/SPECI, TAF and SIGMET as provided in TAC are converted to IWXXM for international distribution, which is placed onto the test international circuits, to demonstrate AMHS capability to meet the traffic volumes required, message flood scenarios should be introduced.

Creation and Use (International Partner -> Host State):

Messages are passed to the participant as IWXXM via AMHS and are integrated into systems User Agents to look at the information and assess its correctness and utility.

Schedule

- Set up computing hosts, infrastructure.
- Create and test AMHS interconnection for bi-directional communications of XML messages
- Get real time IWXXM data (METAR, SPECI, TAF, SIGMET) data feeds running.
- Validate network and protocol capability to exchange high volumes of data this will look at virus checking, security, timeliness etc.

Test Criteria/Metrics:

Issues/Risks:

Deliverables: