



*International Civil Aviation Organization*

**ICAO/WMO ASIA/PACIFIC METEOROLOGY/AIR TRAFFIC  
MANAGEMENT (MET/ATM) SEMINAR**

Fukuoka, Japan, 24 – 26 January 2011

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**Discussion Topic 4: Thorough review of future requirements – MET component of the  
CNS/ATM systems:**

**3) Presentation of new MET services under development  
(Meteorological Services in the Terminal Area)**

**NEW METEOROLOGICAL SERVICES  
SUPPORTING AIR TRAFFIC MANAGEMENT**

(Presented by the WMO)

**SUMMARY**

The new Meteorological Services in the Terminal Area (MSTA) initiative, currently being undertaken by the World Meteorological Organization (WMO) in close collaboration with ICAO, aims at providing enhanced meteorological services for the wider terminal area, which is currently not covered by the standard MET services stipulated by ICAO, especially for busy airports, to support Air Traffic Management (ATM). The plan is to obtain endorsement for these new MET services by the next Conjoint ICAO MET/AIM Divisional Meeting/WMO CAeM Session (currently scheduled for 2014) and reflected in ICAO Annex 3.

This paper aims at updating the ICAO APAC MET/ATM TF 2<sup>nd</sup> meeting on the latest progress of this development and at requesting MET authorities and aviation user communities to contribute actively to this work, through provision of feedback and suggestions.

**1. BACKGROUND**

1.1 The international air navigation service is presently undergoing a paradigm shift: one that is moving it away from past Air Traffic Control (ATC) environments to the more integrated and collaborative Air Traffic Management (ATM) now needed to meet aviation's needs in the 21<sup>st</sup> century.

1.2 These requirements have stemmed from the risk, more pressing than ever, that because of the more or less continuous growth in aviation, the capacity of regional air navigation systems may soon be exceeded by operator demand. This issue is presently of particular importance in the European (EUR) and in North American (NAT) Regions, but it has also become an increasingly urgent priority in the Asia/Pacific (APAC) Region, where the aviation market is today one of the world's largest .

1.3 The goal of the changes now under development is to ensure that a safe, secure, efficient and environmentally sustainable air transportation system will continue to be available to all aviation stakeholders at the global, regional and national levels. The implementation of a new ATM system that will make maximum use of the enhanced capabilities provided by advances in science and technology, as well as allowing for the effective sharing of available information on the basis of Collaborative Decision Making (CDM), is a mandatory component on the path to this objective. The Next Generation Air Transportation System (NextGen) and Single European Sky ATM Research (SESAR) initiatives are the corresponding programs now ongoing in the USA and Europe to meet this challenge. In the APAC Region, Japan has also recently drawn up its long-term ATM vision known as the Collaborative Actions for Renovation of Air Traffic Systems (CARATS), and some other states like China and Korea are also planning to establish their own future visions.

1.4 It is under this evolving environment that the concept of Meteorological Services in the Terminal Area (MSTA)<sup>1</sup> was conceived of by the Commission for Aeronautical Meteorology (CAeM) of the World Meteorological Organization (WMO) in its 13<sup>th</sup> Session in 2006, and re-affirmed and updated at the 14<sup>th</sup> Session in 2010. The aim is to ensure a harmonized and consistent approach to providing enhanced meteorological services for the wider terminal area. This paper aims at updating the ICAO ASIA-PAC MET/ATM TF 2<sup>nd</sup> meeting on the latest progress of this initiative

## 2. DISCUSSION

2.1 In recent years, with increasing air traffic leading to issues of airport and route capacity limits, as well as the advancement of meteorological sciences such as numerical weather prediction and ‘nowcasting’ techniques, different meteorological products tailored for supporting Air Traffic Management (ATM) have been developed. These developments have occurred in parallel across various regions in order to address the gap between the data products stipulated in ICAO existing provisions and the newer and evolving 21<sup>st</sup> century ATM user needs for meteorological information.

2.2 Currently, ICAO Annex 3 stipulates meteorological data products such as the Aerodrome Forecast (TAF), Trend-type Landing Forecast (TREND) and Aerodrome Warnings, which are presented to the users in highly-condensed codes in textual format. Primarily due to limitations of past and current legacy telecom systems, this coded aspect of weather data has since become a severe constraint for meteorologists as they seek to convey the specific details of available weather information to modern aircraft operators and other users of the ANS.

2.3 A case in point is how convective weather, which impacts busy approach areas, flight routes, corner posts and fixes over the wider terminal area<sup>2</sup>, is already causing significant impacts to ATM operations and capacity. Currently this important aspect cannot be addressed by the regulatory products which only provide information for a limited set of weather parameters for the aerodrome. Other products under development, in trial, or already in operational use at some airports in various regions of the world, include wind forecasts over approaches, crosswind probability forecasts for runways, strike probability for tropical cyclones, etc...

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1 The term ‘New Terminal Forecast (NTF)’ was initially used when the MSTA concept was first developed. It was subsequently renamed as Meteorological Services in the Terminal Area (MSTA). This was done to avoid possible misinterpretation that the new services were intended to replace the conventional ‘Aerodrome Forecast (TAF)’.

2 The terminal area is the portion of the airspace within the proximity of a controlled aerodrome, within which arriving and departing aircraft are managed to provide separation, assurance, appropriate arrival spacing, appropriate departure spacing and final approach sequencing.

In more advanced applications of these weather products, specific information of the weather impact on air traffic capacity is also generated and provided to ATM and airline users. One such example is the Air Traffic Meteorology Center (ATMetC) of Japan.

2.4 To address these new and evolving ATM user needs and to avoid the costly parallel development of similar weather products of varying and confusing data formats, an expert team has been set up by the WMO in order to work closely with ICAO to develop a formal MSTA proposal. This proposal would be based on similarities in products developed thus far and would also recognize current technological capabilities and limitations.

2.5 It is envisaged that this new MSTA data product would provide forecasts of weather elements critical to aviation in the wider terminal area, along with longer lead times and much finer resolution in space (both the horizontal and vertical domains) and time (especially in the first couple of hours of the forecast) compared to currently available aviation MET products. While MSTA is intended primarily for busier airports and terminal areas, it is also envisaged as a significant enhancement to aviation safety in general.

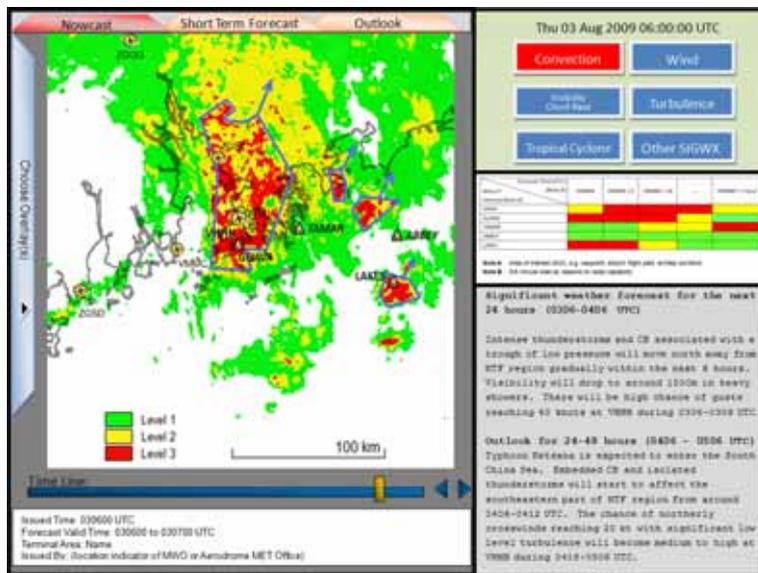
2.6 The new MSTA will be produced in a digital, gridded format, initially being available as a web-based colour graphic with alerting criteria. It will provide common situational awareness for data sharing by different user groups in support of CDM, and could be supplemented by textual descriptions as appropriate and simplified/condensed to facilitate uplinks to aircraft cockpits. This gridded data would be available for direct integration into users' decision-support systems.

2.7 At this early stage in its development, the MSTA product will focus on forecasts of convection, winds, low ceiling/visibility and winter weather. In addition, probability attributes of the various weather elements will be included as possible inputs for user decision-support systems. A number of core experts from various regions are working together on MSTA development, including several from the APAC Region (Australia, Hong Kong/China and Japan).

2.8 Prototypes of convection and wind products have already been developed and were presented to the 14<sup>th</sup> Session of the CAeM held in Hong Kong, China in February 2010. To provide the forecast for both tactical and strategic traffic management, the expert team proposes using three timeframes for the convection. The Nowcast timeframe will cover the 0-1 hour forecast with rapid updating. The Short-term Forecast will provide information for the 1-6 hour timeframe with somewhat coarser resolution and for a greater distance around the aerodrome. The final time period will be the Outlook covering the time from 6 hour out to 2 days and will provide only a general outline of expected convection. Figure 1 shows a prototype MSTA convection product presented in an integrated display.

The team will continue to develop the other parameters according to its resources and capabilities, e.g. icing, turbulence and low level windshear in the terminal area. To facilitate further development of MSTA prototypes and input from the aviation community, a web site (<http://www.msta.weather.gov.hk/>) is currently being hosted by the Hong Kong Observatory, Hong Kong, China, with access available to WMO members and aviation users.

**Figure 1: A prototype MSTA convection product presented in an integrated display.**



2.9 In support of the WMO expert team’s activities, a new Task Team was also set up by the CAeM to strengthen engagement with aviation user communities, focusing on user needs and gathering feedback on the MSTA concept (MSTA Task Team on User Needs).

2.10 On the ICAO side, the Aerodrome Meteorological Observation and Forecast Study Group (AMOFSG) has established an ad hoc group to work closely with the WMO Task Team to coordinate inputs from the requirements perspective. Its work program also includes consultations with the ICAO Air Traffic Management Requirements and Performance Panel (ATMRPP).

2.11 The objective of these efforts is to develop a detailed MSTA proposal, supported by ICAO and the aviation user communities, ready for endorsement by the next Conjoint ICAO MET/AIM Divisional Meeting/WMO CAeM Session (currently scheduled for 2014) and reflected in ICAO Annex 3.

2.12 In order to give users detailed information on the MSTA proposal, a presentation of the MSTA initiative has been done at several meetings of the aviation user community in 2009 and 2010: IATA MET Task Force meetings, ICAO regional MET/ATM TF meetings, Global AIM Congress, ASIA/PAC DGCA Conference, Air and Space Academy meeting, etc... The team has received positive feedback and support from user representatives, including IFALPA or IFATCA which represent users who face critical weather in the terminal area. Summary of user feedback is given in **Appendix A**.

2.13 In parallel with the development on other meteorological parameters, some relevant questions that were raised during these aviation community meetings have to be answered:

- a) a consensus seems to exist about the need for probabilistic forecasts in the MSTA proposal ; how should this probabilistic information be encompassed in the new service to be sure that it fulfils user needs ?

- b) the new MET service would have to be supported by a well documented and transparent validation and verification (V&V) process. This process would have to be defined and developed following the user perspectives: what relevant verification metrics to be used to include the user perspectives in the V&V process? Would it be advisable to follow the practice of first defining the operationally desirable accuracy of forecasts, from user's perspective and taking into account the current/potential technological advancements in the next decade, as currently stipulated in Attachment B of ICAO Annex 3? Or something more visionary is needed considering the new requirements and operational environment of CDM/SWIM ?
- c) to avoid different or mis-interpretation of weather forecast, the MSTA proposal would have to use or integrate the impact of weather on operations. There is a need to transform MET information to impact from user perspectives: how should the MSTA concept do the bridging of the gap between MET information (e.g. basic NWP parameters) and user impact (e.g TMA capacity)? As a first step, would it be useful that the user community agrees with the MSTA teams on the MET parameters (cf. "element to be forecast" of Attachment B of ICAO Annex 3) to be provided so that the users can derived impact-related information and make decisions?
- d) in the MSTA proposal to be considered by the ICAO/WMO Conjoint Meeting, what should be included as Core SARPs (i.e. Standards and/or Recommended Practices), Appendices (e.g Model Charts and Forms), Attachments (e.g. desirable accuracy of forecasts) and/or guidance material (i.e. Manuals/Guides) respectively?

2.14 The WMO MSTA teams, especially the Task Team on User Needs, will continue to strengthen engagement with aviation user community through intensive consultation based on the set of questions above, as well as to collect user feedback and suggestions through the MSTA website.

### **3. ACTION BY THE MEETING**

3.1 The meeting is invited to:

- a) note that the proposal for the Meteorological Services in the Terminal Area (MSTA) to support Air Traffic Management (ATM) for wider terminal areas is being developed by the World Meteorological Organization (WMO) in close collaboration with ICAO, and is planned to be considered for endorsement at the next Conjoint ICAO MET/AIM Divisional Meeting/WMO CAeM Session in 2014; and
- b) request States to encourage their MET and ATM Authorities to keep in view of the MSTA development and to contribute actively to the work of the respective ICAO and WMO teams, through provision of feedback and suggestions, especially on relevant questions presented above in discussion item 2.13.

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**APPENDIX A**

**Summary of user feedback collected so far**

<b>Items</b>	<b>Sub-items</b>	<b>feedback</b>	<b>From whom</b>	<b>meeting</b>
Weather Element		<ul style="list-style-type: none"> <li>- Winter weather, e.g. icing,</li> <li>- Low cloud ceilings and visibility</li> <li>- Turbulence and windshear (Note 1)</li> <li>- Runway condition, e.g. snow, water (Note 2)</li> <li>- Snow, winter storm, volcano</li> </ul>		A, I, H J, K
		Encourage ET to keep its work plan on further service elements under review in response to user requirements.		B
Terminal Area		Coverage : <ul style="list-style-type: none"> <li>- 100km/300km radius/TMA/approach/final approach: IATA definition not concrete enough for users;</li> <li>- allow flexibility for MET authority to agree on the terminal area size with the users.</li> </ul>		K I
Product format	Convection	<ul style="list-style-type: none"> <li>- “convective” definition: Rainfall intensity → how to translate to CB and intense convective clouds/funnel cloud/ MBA/WS/TURB/Icing?</li> <li>- Request 1-2 hr lead time for convection forecast</li> <li>- Colour : should relate to probabilistic percentage</li> </ul>	CAA of NZ,  IFATCA	A
		good, seems simple to understand		survey
		Some questions on colour but not much on resolution		E
	Nowcast	May better term “nowcast” as “very short forecast” to avoid confusion with “surveillance”	CAA of NZ	A
	Short term and outlook	<ul style="list-style-type: none"> <li>- Operational controller : forecast for next 8 hours</li> <li>- Supervisor : 12-24 hr forecast</li> <li>- ATFM :24-28</li> </ul>	IFATCA	A
	Wind	<ul style="list-style-type: none"> <li>- Vertical cross-section along flight path useful</li> </ul>	CAD	A
		slightly technical presentation		survey
		- Outcome should be a set of objectives, not a prescriptive set of standards, because there will be different needs and applications of format around the world	CAA of NZ	A
	User interface	- generally OK and simple		survey
	Impact	To avoid different or mis-interpretation of weather forecast, we have to use or integrate the impact of weather on operations, and MSTA should not just be another weather product.	IATA	
		- better to transform MET information to impact to air traffic flow/airport capacity (air traffic flow / airport capacity forecast)	IFALPA	H

		Need to transform MET information to impact from user perspectives, however, also recognizes: (a) large gap between MET information (e.g. only basic NWP parameters like 500 hPa GPH routinely verified) and user impact (airspace/airport/route capacity) needs to be bridged; (b) MET community yet to agree to certain parameters (e.g. EDR vs turbulence potential); (c) would it be a useful first step to agree with the user community on the MET parameters to be provided (e.g. radar reflectivity, echo top) so that the users can derive impact-related information and make decisions?	FAA	K
	Other comments	Initial focus: Product intended for aerodromes with high traffic density. Who to determine “high density airport” and how?		B E
		-Promote global standardization of information in support of common situational awareness and CDM and better coordinate increasing number of national or aerodrome-specific parallel developments of tailored MET services.		B
		confidence level would be useful to indicate uncertainty of MSTA	IFALPA	H
		Not necessary follow the model “first collect user requirements and then develop products” – iPhone is an excellent example of not following this.		K
		Human in the loop will continue to be required.	IFALPA	K
		Uplink of MET information being developed by Airbus	Airbus	K
		Need to consider the following questions in the future ATM operational environment: (a) How will the CDM community be involved in the content and governance of the future Single Authoritative Source (SAS)? (b) How will CDM execute “operational bridging” (e.g. how the human could add value, how to relate tactical and strategic information)?	FAA	K
Presentations	Probabilistic approach	Suggest to use % to represent probability instead of low/medium/high in textual description	IFATCA	A
		Polygons : whether they can keep up with weather cells forming or dissipating	CAA of NZ	A
	Graphics / text	- ICAO and IFALPA expressed concern about graphics, because textual information is their way of working. They requested standard text. (Note 3) - Detailed format (graphic, text) should be flexible enough for further consultation with user (Note 4)		E
Delivery	Onboard and ground	- Onboard uplink requires aircraft to be equipped with graphical display which will take time. - Suggest a “quick-win MSTA” e.g. alphanumeric product containing MSTA information, a kind of TAF for terminal area		J
Requirements		- Lack of ATM requirements for the product. - NTF is solution but problem was not yet defined		C
		Comments on FF-ICE (provided by ET/MSTA)		
Accuracy/ verification		- Require accurate and timely information	IFATCA	A,
		- verification and confidence information are useful		Survey
		- Well communicated validation and verification. - Transparent and well documented process,		B

		In order to ensure appropriate quality, it was recognized that there may need to be some forecaster involvement if required.		B
		Provide performance indicators like FAA drafted for NextGen		D
		Importance of verification/validation of MSTA products and on the use of probabilistic forecast for most cost-effective flight planning.	IATA	
Usefulness		Positive response regarding benefits to ATM.....		A-J
		Good to see enlarged coverage than TAF		A
		Useful, very important to ATC and ATFM		A
Customers/ consultations		<ul style="list-style-type: none"> <li>- Strengthen consultation with representatives of user groups including ATM, airlines, airports, and pilots concerning the conceptual design, as well as considering the evolving NextGen and SESAR user requirements</li> <li>- Based on feedback, develop service concept and the business case, in close consultation with AMOFSG with a view to its inclusion as an enabling clause in the Annex 3 at appropriate time.</li> <li>- Ensure all members (include developing countries) were kept informed about the progress.</li> </ul>		B
		<ul style="list-style-type: none"> <li>- Who are the users? ATC, ATM</li> <li>- IATA does not represent all airlines/operations, not only rely on IATA feedback.</li> </ul>		J
		Provide relevant user organizations, e.g. IATA, IFALPA with detail guidance on how to implement and utilize such products and what benefits they can provide		D
		IATA (Graham) : necessary to provide some opportunities to give users detail information about its prototype and to reflect users' view on it (e.g. EuroControl MET/ATM workshop, MET/ATM seminar in Japan)		D
		IFALPA, CANSO offered to be involved (Note 5)		G
Cost issue		Actual minimum requirement v.s. "gold-plated" service. Former is more important	CAA of NZ	A
		IATA's question: who pays for new MSTA products ?		
SMS/quality		Should undergo SMS process to ensure integrity and not inducing additional risk to safety, esp. those involve changes in ATC procedures or integration with ATC systems.	IFATCA	A
Manage user expectations		Limitation of new MET products has to be well communicated and fully explained to ATC users before implementation.	IFATCA	A

Note 1 : already included in ET/MSTA work plan

Note 2 : only can be done in collaboration between MET and Airport authority (rely on runway sensors)

Note 3 : Concern about graphics is mainly because users are not familiar with graphical product. There is a real need for training and transition, esp. pilots.

Note 4 : suggest not to dictate the format. Provide a default suggestion, but the format and priorities should be decided by user

Note 5 : coordinate by TT-UN

#### Notation of meetings/conferences

- A : 1<sup>st</sup> Asia/PAC MET/ATM TF meeting in Bangkok(Dec 2009)
- B : CAeM XIV in Hong Kong (Feb 2010)
- C : IATA MET Task Force (Oct 2009 )
- D : AMOFSG/8 in Melbourne (Feb 2010)
- E : IATA Meeting in Washington (Apr 2010)
- F : IATA MET TF Meeting in Boulder (Sep 2010)
- G : Global AIM Congress in Beijing (Jun 2010)
- H : DGCA Conference in Macau (Oct 2010)
- I : Working group on MSTA with CAAC (Aug 2010)
- J : French Commission for Commercial Aviation (Oct 2010)
- K : Air and Space Academy Meeting in Toulouse (Nov 2010)