INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

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

SUMMARY OF DISCUSSIONS

24 – 26 January 2011
Fukuoka, Japan

Seminar Objective and Attributes **Page**

Summary of Discussions

Attachments

Acronyms

Please note, many acronyms here within pertain to the material in this Report.

A

ACC	Area Control Centre
AIGCW	Aviation Impact Guidance for Convective Weather
AIM	Aeronautical Information Management
AIR	Airworthiness
AIREP	Aircraft report
AIRMET	Information concerning en-route weather phenomenon which may affect the safety of low-level aircraft operations
AIS	Aeronautical Information Service
AMAN	Arrival Manager System (Hong Kong China)
AMDAR	Aircraft Meteorological Data Relay
AMOFSG	Aerodrome Meteorological Observation and Forecast Study Group
ANS	Air Navigation Service
APAC	Asia and Pacific
ASHTAM	special series NOTAM notifying, by means of a specific format, change in activity of a volcano, a volcanic eruption and/or volcanic ash cloud that is of significance to aircraft operations
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATMC	Air Traffic Management Centre (Japan)
ATMetC	Air Traffic Meteorology Centre (Japan)
ATMRPP	Air Traffic Management Requirements and Performance Panel
ATNS	Aviation Thunderstorm Nowcasting System
ATS	Air Traffic Service

B

C

CAD	Civil Aviation Department (Hong Kong China)
CAeM	Commission for Aeronautical Meteorology (of WMO)
CARATS	Collaborative Actions for Renovation of Air Traffic Systems
CAAS	Civil Aviation Authority of Singapore
CB	Cumulonimbus
CCFP	Collaborated Convective Forecast Product
CNS	Communications, Navigation and Surveillance
CDO	Continuous Descent Operations
CDR	Coded Departure Route
CI	Cost Index
CIS	Commonwealth of Independent States
CIWS	Corridor Integrated Weather System (FAA)
CWSU	Center Weather Service Unit

D

DARP	Dynamic Airborne Re-route Procedure
DGCA	Director General Civil Aviation
DSS	Decision Support System
DST	Decision Support Tool
D-VOLMET	Data link VOLMET

E

ECFP Extended Convective Forecast Product
ECMWF European Centre for Medium – Range Weather Forecasts
EDR Eddy Dissipation Rate

F

FAA Federal Aviation Administration
FASID Facilities and Services Implementation Document
FF-ICE Flight and Flow Information for a Collaborative Environment
FIR Flight Information Region
FMC Flight Management Computer
FMS Flight Management System

G

H

HF High Frequency

I

IATA International Air Transport Association
IAVW International Airways Volcano Watch
ICAO International Civil Aviation Organization
IFALPA International Federation of Airline Pilots' Associations
IFATCA International Federation of Air Traffic Controllers' Associations
IP Information Paper
IPACG Informal Pacific ATC Coordinating Group
ITCZ Inter Tropical Convergence Zone
ITWS Integrated Terminal Weather System
IVATF International Volcano Ash Task Force
IVGG REDRAS Institute of Volcanic Geology and Geochemistry of FED Russian Academy of Sciences

J

JMA Japan Meteorological Agency
JCAB Japan Civil Aviation Bureau

K

KAMA Korea Aviation Meteorology Agency
KVERT Kamchatka Volcanic Eruption Response Team

L

LCH Lamp (Localized Aviation Model Output Statistics Program)/CCFP Hybrid
LIDAR Light Detection and Ranging
LOA Letter of Agreement

M

MET Meteorology
METAR Aerodrome routine meteorological report
METWARN Meteorology Warnings
MSTA Meteorological Services in the Terminal Area
MWO Meteorological Watch Office

N

NMHS	National Meteorological and Hydrological Services
NOPAC	Northern Pacific
NOTAM	Notice to Airmen
NWM	Numerical Weather Model
NWS	National Weather Service

O

OPMET	Operational meteorological (information)

P

PACOTS	Pacific Organized Track System
PANS	Procedures for air navigation services
PBN	Performance Based Navigation

Q

QMS	Quality Management System

R

RAPT	Route Availability Planning Tool
RODB	Regional OPMET Data Bank

S

SAR	Search and Rescue
SARP	Standards and Recommended Practices
SAS	Single Authoritative Source
SCI	Science
SDS WAS	Sand and Dust Storm Warning Advisory Assessment System
SG	Sub group
SIGMET	Information concerning en-route weather phenomenon which may affect the safety of aircraft operations
SIGWX	contraction of Significant and Weather
SPC	Storm Prediction Center (US)
SPECI	Aerodrome special meteorological report (in meteorological code)
SREF	Short Range Ensemble Forecast
SVERT	Sakhalin Volcanic Eruption Response Team
SWAP	Severe Weather Avoidance Plan

T

TAF	aerodrome forecast
TB	turbulence
TBO	Trajectory Based Operations
TCAC	Tropical Cyclone Advisory Centre
TCWF	Terminal Convective Weather Forecast
TDWR	Terminal Doppler Weather Radar
TF	task force
TFM	Traffic Flow Management
TMA	Terminal Maneuvering Areas (FAA); terminal control area (ICAO)
TMI	Traffic Management Initiatives

U

UPR	User Preferred Route

V

VAAC	Volcanic Ash Advisory Centre
VCP	Voluntary Cooperation Programme
VHF	Very high frequency
VOLMET	Meteorological information for aircraft in flight

W

WAFS	World Area Forecast System
WITI	Weather Impact Traffic Index
WMO	World Meteorological Organization
WXXM	Weather Information Exchange Model

X

XML	Extensible Markup Language

Y//Z

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1. Objective

1.1 The ICAO/WMO APAC MET/ATM Seminar was conducted under the prerogative of APANPIRG/19 Conclusion 19/53 which called for a MET-ATM Seminar in 2010. The delay of twelve weeks was due to a conflict in scheduling and worked to APANPIRGs advantage in that APANPIRG/20 Conclusion 21/50 called for ICAO to invite the World Meteorological Organization (WMO) to conduct the seminar conjointly to take advantage of experts that contribute to ICAO and the WMO Expert Team on Meteorological Services in the Terminal Area (MSTA). The host State, Japan, agreed to the arrangement and Seminar rescheduled to 24-26 January 2011. The objective of the Seminar is to exchange knowledge of MET support to ATM and to learn regional needs by ATM. The outcomes of the Seminar may be used by the Second Meeting of the MET/ATM Task Force (MET/ATM TF/2) to develop action items necessary in meeting regional MET requirements for ATM. As there are currently no ATM requirements in Annex 3, the outcomes of the Seminar may also feed into the MET/ATM TF/2 meeting in developing requirements at the global level via actions for member States present that are also members of the Aerodrome Meteorological Observing and Forecasting Study Group (AMOFSG) which would provide regional outcomes for global consideration in developing Standards and Recommended Practices related to MET products for ATM.

2. Attendance

2.1 The Seminar was attended by 76 experts from 14 States, 2 Special Administrative Regions, IATA, IFALPA, IFATCA, WMO and ICAO. The List of Participants is provided in **Attachment 1** to this Report.

3. Opening of the Seminar

3.1 Mr. Shogo Tanaka, Director of Technology of the Fukuoka District Meteorological Observatory opened the meeting and welcomed all the participants to Fukuoka, Japan and emphasized the importance of exchanging information on MET products and services for ATM in the Region. Mr. Ikuo Miura, Head Air Traffic Meteorology Center was the special guest speaker further emphasized coordination of MET and ATM due to the sensitivity of air traffic management to weather hazards such as clear air turbulence, thunderstorms, mountain waves, typhoons and volcanic ash. He noted the ATMetC provides briefings, MET products tailored for ATM and general coordination.

3.2 Mr. Keohan thanked the host State, Japan, for providing facilities for this special event and thanked all the participants for their excellent response in providing papers and presentations.

4. Facilitators of the Seminar

4.1 Mr. Peter Dunda and Mr. Christopher Keohan, Regional Officer, MET acted as facilitators of the seminar.

5. Organization and language of the Seminar

5.1 The seminar met as a single body. Working language was English including all presentations and this report. The seminar considered 21 presentations, 17 working papers (some papers overlap with presentations), and 3 IPs. List of presentations and papers are provided at **Attachment 2** to this Report.

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Seminar Programme

1.1 The Seminar Programme is as follows:

Discussion Topic 1: Brief review of the organization of Air Traffic Management (ATM) and Meteorological (MET) Services by the States:

1) Authorities and Providers

2) Current and proposed organizational frameworks and consultative mechanisms (e.g. process of developing new MET unit to provide services for ATM)

3) ICAO provisions and guidance materials relating to MET and ATM coordination arrangements (i.e. Doc 9377, sample LOA)

Discussion Topic 2: Meteorological impacts on ATM and MET information required for Air Traffic Flow Management

1) En-route – Large scale weather deviations, volcanic ash, etc.

2) Terminal Area – weather impact on capacity

Discussion Topic 3: Use of meteorological information by ATM

1) ATM operational needs

2) ATM responses to

a. MET services available (including new information under trial)
b. MET services shortfalls and uncertainties

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

1) ATM developments requiring additional/new MET information

2) ATM-tailored MET products

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

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Discussion Topic 1: Brief review of organization of Air Traffic Management (ATM) and Meteorological (MET) Services by the States

Introduction

1.1 The seminar noted in the introduction presentation that current Annex 3 provisions meet some user needs, but not all. Observations and reports (METAR/SPECI), forecasts (TAF, trend, route, area) and warnings (SIGMET, AIRMET, aerodrome warnings and wind shear warnings), services for operators and flight crew members (briefing, consultation, flight documentation, VOLMET), information for Air Traffic Service (ATS), Search and Rescue (SAR) and Aeronautical Information Service (AIS) and off-line services (climatological information, archived information for investigations) are provisions in Annex 3 provided by contracting States. Furthermore, World Area Forecast System (WAFS) (global forecasts of upper wind, temperature as well as cumulonimbus-CB, turbulence and icing via internet for trial purposes and en-route SIGWX, volcanic ash advisories by Volcanic Ash Advisory Centres (VAACs), tropical cyclone advisories by Tropical Cyclone Advisory Centres (TCAC), Regional OPMET Data Banks (RODB) and VOLMET (HF, VHF, D-VOLMET) are provided by Provider States and subject to a regional air navigation agreement.

1.2 The above information has operational purpose in terms of safety and efficiency; however, today's demands have evolved to have very timely, accurate weather information used to optimize flight paths in the pre-flight stages and in-flight that could involve common and universal access to MET information by users (network enabled environment) as well as past, current and future state of the atmosphere that would be integrated into Decision Support Tools (DSTs). As a result, global developments of MET services for ATM are being conducted by the AMOFSG in coordination with the WMO. The user feedback is conducted through the Air Traffic Management Requirements and Performance Panel (ATMRPP). Though MET requirements for ATM have not fully matured and therefore implementation by the Task Force not yet urgent, the seminar provided States with a forum to exchange the latest information on global developments of requirements and provided States the opportunity to exchange their latest advancements in providing MET services for ATM.

1.3 As noted by the seminar, outcomes of the seminar that may assist the AMOFSG in developing requirements may be tabled as an action in the Second Meeting of the MET/ATM Task Force (MET/ATM TF/2) by one or more of the member States present at both the AMOFSG and APAC MET/ATM TF (Australia, China and Japan). Outcomes of the Seminar will also be reported to the ATM/AIS/SAR/SG/21 and CNS/MET SG/15 meetings held in June and July 2011.

1.4 The seminar noted that the timing of future MET/ATM events should take into consideration MET requirements for ATM introduced in Annex 3 (Amendment 76 in 2013 and Amendment 77 in 2016) as well as outcomes of the conjoint ICAO MET/AIM Divisional Meeting / WMO CAeM XV Session in 2014 and possible changes to PANS-ATM. Other important milestones were noted by the seminar such as the Twelfth Air Navigation Conference where concepts of MET services for ATM are expected to be tabled.

1.5 In addition to the formulating MET services requirements for ATM, the seminar noted that the delivery of information as alphanumeric code will be replaced by the Extensible Markup Language (XML) (enabled in 2013 for bi-lateral exchange and mandatory in 2016/2019).

1.6 The seminar then noted the overall ICAO vision of the Global ATM Operational Concept that meets agreed levels of safety and provides optimum economic operations and national security requirements and is environmentally sustainable. In this light, MET is a crucial element in ATM capabilities such as:

- Optimum climb speed modes for economy operation;

- Cost index (CI) flight operations, which allow the Flight Management System (FMS) to calculate the speed of most desired efficiency;

- Dynamic Airborne Re-route Procedure (DARP) flexible tracking; and

- Continuous Descent Operations (CDO).

As the seminar noted, the global initiatives are mirrored in the Asia/Pacific Region in various forums (DGCA Action Item 46/1 – Seamless Sky ATM, APANPIRG C21/8 – ICAO Asia/Pacific Seamless ATM Workshop, APANPIRG C21/12 – convening of the Seamless ATM ad-hoc Meeting, which will take place in Tokyo Japan in April 2011). With reference to the Seamless ATM ad-hoc Meeting, the seminar was informed that coordination with MET is expected in such events.

State arrangements between MET and ATM

1.7 Many States described the arrangements of MET services for ATM. For example, the Japan Meteorological Agency (JMA) established the Air Traffic Meteorology Centre (ATMetC) and began its operations in October 2005 for the purpose of supporting the Air Traffic Management Centre (ATMC) of the Japan Civil Aviation Bureau (JCAB). Preparation steps of developing such a MET Centre for ATM were provided in WP/7 for consideration by other States who do not have such services. These steps included: 1) visiting an operational centre; 2) MET and ATM coordination for services to be provided based on past weather delays; 3) ATMC requirements such as weather severity and forecast time; 4) human factor considerations in displaying of information (design in similar fashion as other ATM systems in place); 5) service flexibility (briefings on short demand); and 6) training MET about ATM rules to better understand needs and improvements to their services as well as training ATM about MET to maximize effectiveness of product use.

1.8 Coordination arrangements were discussed and included information on ATM such as air traffic info and delay info for further analysis. Conversely, information on MET products such as 1-hourly update of Categorized Forecast, 3-hourly update of weather Summary, and technical meetings that may result in operational changes and meetings on discussing ATM operational policy. The importance of MET for ATM has been proven in Japan and reflected in the inclusion of MET in the future air traffic system (CARATS – Collaborative Actions for Renovation of Air Traffic Systems).

1.9 The seminar was made aware of the arrangement between MET and ATM in the Republic of Korea. That is, the Korea Aviation Meteorology Agency (KAMA) arrangement with the Civil Aviation Authority of the Republic of Korea is for meteorologists to visit the Area Control Centre (ACC) to provide four weather briefings related to ATM before each shift each day. This is in response to ATM needs and limited human resources at KAMA which does not currently have a MET unit in the ACC. Information provided includes present weather, warnings, and cloud tops as well as turbulence, icing and CB for 10-25 kft, WINTEM for 18-38 kft, and SIGWX for 25-45 kft. Controllers request aircraft reports and receive 20-40 per day which helps verify forecasts (such as the Area Hazardous WX Prediction System) for elements such as icing and turbulence.

1.10 The Russian Federation provided the Seminar of working group information into the Inter State Council for Hydrometeorology. Meteorological Services for Civil Aviation in the airspace of the Commonwealth of Independent States (CIS) (12 States from former USSR) coordinates improvements of meteorological services for civil aviation through representatives of the National Meteorological and Hydrological Services (NMHS) through a working group. Goals include reducing the differences between national practices and ICAO standards, sharing of information (IP/3) to improve forecasting for aviation, implementing cost recovery, upgrading equipment, utilizing AMDAR, utilizing WAFS products, implementing QMS (expected by 2012), staff training, and increase interaction with users.

Discussion Topic 2: Meteorological impacts on ATM and MET information required for Air Traffic Flow Management

2.1 En-route

Volcanic Ash

2.1.1 The seminar noted the impact to air travel caused by volcano eruptions in the Russian Federation, Japan and Indonesia. Aerodromes close to an eruption that had ash fall out concerns included Jogjakarta in Indonesia and those around Mt. Sakurajima. Each State continues to improve volcanic ash information from volcano observatories and volcanic ash advisories (Japan) as described in the paragraphs below.

Northern Pacific (NOPAC)

2.1.2 As described to the seminar, the Mt. Sarychev eruption in the Russian Federation on June 12, 2009 impacted significantly the northern pacific (NOPAC) airspace such that all five ATS routes between Anchorage and Japan overlapped with the volcanic ash cloud. Five aircraft did not have sufficient information on the volcanic ash cloud that impacted to these routes before beginning their flight, and thus returned to Japan as they were not cleared to use these routes. To avoid future instances of operators not having sufficient information in the flight planning stage, JCAB distributes volcanic ash related information (route closures) to the operator. Likewise, the operator should recommend routes before airborne.

2.1.3 Operational responses to the volcanic ash cloud include the use of Pacific Organized Track System (PACOTS) near the volcanic ash cloud and utilizing Russian airways. To explain the former, PACOTS is used typically to adjust flight trajectories to take advantage of the jet-stream. That is, two eastbound tracks are formulated to take advantage of a strong tail wind and two westbound tracks are formulated to minimize the headwind. This is coordinated each day between Japan and the U.S. The location of the PACOTS is south of the volcanic activity most of the year and therefore is a possible route to consider. There are limitations to PACOTS in that they are flexible only to a day.

2.1.4 Japan explained the coordination process which takes place before the actual activation of the PACOTS tracks between the ATMC of Japan and Oakland ARTCC of the United States. The coordination between the ATMC and Oakland ARTCC starts almost half a day in advance of the actual implementation. Due to this lengthy coordination process, a change in situation cannot be fully reflected in the definition of the PACOTS tracks, and the city-pair restriction cannot be removed flexibly. In light of this, Japan advised operators of the telephone number in the PACOTS track NOTAM and the operators were expected to coordinate with the ATMC of Japan for the removal of the restrictions on an individual case basis. Japan would consider the removal of the city-pair restriction in future. Note that the use of User Preferred Routes and DARP are most desirable, the latter being most flexible given that the changes to a flight path can be performed in flight.

2.1.5 Given the above, the following measures are being examined (Informal Pacific ATC Coordination Group - IPACG) to improve capacity during volcanic ash events:

- Relaxing city pair restrictions
- Coordination between the Russian Federation and Japan in terms of alternate routes
- Establishing coordination procedure regarding traffic flow under contingency between JCAB and State ATM Cooporaton (through a Letter of Agreement)

- Make warning message content consistent from FIR to FIR

- Assessment of coordination between the State volcano observatory of the Russian Federation, VAACs Tokyo, Anchorage and Washington on dissemination of volcanic ash information for ATM.

2.1.6 The seminar noted actions taken by the Russian Federation in designating the Institute of Volcanic Geology and Geochemistry of FED Russian Academy of Sciences (IVGG FED RAS) as the State Volcano Observatory to monitor active volcanoes in the far east of the Russian Federation that includes Sakhalin and Kuril Islands. An agreement between Rosaviatsiya, Roshydromet and RAS was signed to stipulate coordinating and operational procedures for the 24/7 monitoring of volcanic eruptions and volcanic ash clouds in the Far East as well as the dissemination of information to ACCs, Meteorological Watch Offices (MWO) and VAACs. These efforts were noted with appreciation by WMO in that volcanic ash is difficult to observe by satellite given the persistent overcast skies in that region.

Indonesia

2.1.7 The seminar noted the impact to air travel in Indonesia as a result of a volcano eruption of Mount Merapi on Java Island that began on October 26, 2010. In particular, 400 flights were cancelled from 7-20 November 2010 in response to the closure of Jogjakarta Airport. An additional 65 flights were cancelled from 1-6 November 2010 in response to volcanic ash information. Needless to say, thousands of passengers were unable to travel and due to the longer routes to avoid volcanic ash clouds, greater fuel was expended by the airlines and thus revenue loss was incurred by them. There was also one air traffic incident as a possible result of contingency measures near the FIR boundary of Jakarta Ujang Pandang which is currently being investigated.

2.1.8 The significant impact to air travel was largely due to the proximity of the volcano to busy air routes and aerodromes in the vicinity of the capital, Jakarta. The impact was likely reduced due to the ATS contingency plan in place (established 2007) that involves collaboration between civil aviation authority, MET authority, air navigation service provider, and the military. Using current and forecasted volcanic ash cloud information provided by VAAC Darwin and the MET office, the proper contingency routes were applied and when necessary, coordination with the military. Further activities by the CAA of Indonesia include requesting pilot reports of volcanic ash which in turn improves real time observations and proper rerouting. Indonesia expressed its desire for contamination levels by the VAAC and/or State to minimize the impact to air travel while maintaining safety. The seminar noted this global issue of thresholding volcanic ash for concentration levels is being addressed by the International Volcano Ash Task Force (IVATF).

2.1.9 With reference to observing volcanic ash more accurately (for an improved VAAC forecast), WMO suggested that the region may need at least 2 research aircraft to measure the volcanic ash by using drop sondes due to the persistent clouds and rain in Indonesia. Studies of using this for measurements at the source are ongoing, but results expected in the next year.

VAAC Anchorage and Washington considerations

2.1.10 A presentation on improvements to a national volcanic ash programme with multiregional implications was presented by the United States, which contains two VAACs: Anchorage and Washington, whose regions overlap the Pacific of the APAC region. Improvements are based on gaps identified in the infamous Icelandic eruption in April 2010 that disrupted air travel and commerce around the globe. Stakeholders that included 6 major air carriers weighed in on necessary improvements on volcanic ash information through an FAA public meeting and requested the following:

- Disseminate **information sooner** even with less certainty
  - Including **timely information on eruptions** and **more frequent updates**

- **Improved vertical resolution**

- **More detailed SIGMET graphic** (note confidence in SIGMET text is low)

- Use of severity or **intensity index** (e.g. light/moderate/severe)

- Use of **level of confidence** easy to understand

- **Ingest** information in Flight Management Computer (FMC)

- **Operator decision making**

2.1.11 The above information is expected to be addressed. In the short term, improvements to the volcanic ash cloud information is being sought through operational testing of an upgraded model (U.S. Hy-Split) that takes into account dynamic emissions and improved removal mechanisms. In addition, initializing the transport model with satellite data is being investigated

Global mechanism to improve volcanic ash information for stakeholders

2.1.12 The eruption of Mount Eyjafjallajökull in Iceland in April 2010 exposed the need for improved science, regionally coordinated contingency plans and engine certification standards for safe ash concentrations. These issues are being addressed by the IVATF formed to develop a global safety risk management framework that will make it possible to determine the safe levels of operation in airspace contaminated by volcanic ash (SP/6). Many deliverables are expected in 2011 (noting that some will take longer) which are tasked to 4 subgroups: Air Traffic Management (ATM to assess contingency plans and notification and warning procedures), Airworthiness (AIR to identify acceptable levels of ash concentration for operations in contaminated airspace and assess regulatory procedures), Science (SCI to assess detection capabilities and eruption source parameters) and the International Volcanic Ash Watch Subgroup (IAVW to assess framework of transport and dispersion models used by the VAACs and evaluate framework to assess eruption source parameters).

2.1.13 One member of the IVATF, IFALPA, reiterated its position with reference to the above developments (SP/15) and in particular that pilots are the final decision makers in determining the safety of flight and that operators should refrain from any disciplinary actions when flight crews exercise their flight safety responsibility not to fly in ash. In order to make the most informed decision, IFALPA supported the above developments and emphasized the need for thorough research on the effect of ash on aircraft, engines and occupants in determining risks associated with ash concentration levels.

2.1.14 The seminar noted that outcomes of the IVATF have regional implications, and in particular to the MET/ATM and METWARN/I TF of the CNS/MET SG, in developing regional contingency plans.

Regional contingency plans

2.1.15 The seminar noted that one member attended the Atlantic Conference on Eyjafjallajökull and Aviation in Iceland from 15-16 September 2010 and provided outcomes of this meeting such as the use of volcanic ash concentration thresholds as they relate to a no fly zone, time limited zone and enhanced procedures zone. Most relevant to the APAC Region is need for regional contingency plans and possible contributions to the IVATF ATM sub-group in reviewing current plans, assist States in establishing plans, review flight planning information dissemination and enhance operational information exchange mechanism. The first suggested step is to develop interim coordination arrangements. This step is supported by APANPIRG/21 Decision 21/9 which called for updated contact information from States with reference to operations during volcanic ash events.

2.1.16 The seminar noted that 13 States responded to the State letter (19 October 2010) requesting contingency contacts for operation purposes in a volcanic ash event and encouraged other States to contribute in providing contact information. The seminar agreed that this updated list can be used in coordination amongst Air Navigation Service (ANS) Providers to ensure minimum impact to flight operations during a volcanic ash event and keeping each other informed of the local situation. Coordination may include:

- Identifying affected areas based on information available
- Circumnavigate around ash contaminated areas
- Deviation procedures from established routes
- Establishment of temporary routes

The meeting noted that this coordination is necessary in a Crisis Management Procedure. In addition to coordination, the other two important elements in dealing with a crisis include information management and technical.

2.1.17 The seminar noted that the Civil Aviation Authority of Singapore (CAAS) volcanic ash incident reporting includes:

- Updates on observation and forecast from VAAC Darwin
- Latest NOTAM and ASHTAM
- Updates from local MET Services
- Highlight flights and airways affected by forecasted plumes
- Updates from Singapore Air Traffic Control Centre on situation in the air

which could also be considered for inclusion in the regional contingency plans. The use of a no fly zone or black zone was discussed and suggested that requirements of restricted airspace near the volcano should be determined by the CAA. The use of SIGMET on volcanic ash represents a no fly zone in many States and this also needs to be considered.

2.1.18 The seminar reviewed a request by the Secretariat to fill out points of contact information for ACCs, MWOs, VAACs, and TCACs for (1) their States use and for (2) input into a regional contingency plan for various weather phenomenons that includes volcanic ash, tropical cyclone, Tsunami and radioactive cloud (CNS/MET SG/14 D14/30 refers). One member expressed some concern with having too many points of contact lists and the difficulty associated with keeping these documents up to date. The seminar noted that the MET/ATM TF meeting can keep the relevant POCs up to date. Another related suggestion was to consolidate the MWO point of contact information to one per State and have that one MWO coordinate with other MWOs within that State if necessary. Therefore, the Seminar did not object to the consolidation of contact information, but to keep it simple and to keep it up to date in the various ICAO meetings.

2.2 Terminal Area

Tropical Cyclone

2.2.1 As noted above, the volcanic ash events discussed had a significant impact to en-route travel (e.g. NOPAC). Large scale events can also have an impact on aerodrome capacity as described with a tropical cyclone event by Japan. Specifically, airport capacity adjustments were anticipated several hours in advance of winds expected at the Tokyo International Airport that would result in limiting capacity. This was done based on ATMetC briefings on wind impacts for Tokyo associated with a typhoon on 7 and 8 October 2010. Reduced airport capacity lasted 3.5 hours and the forecast capacity and actual capacity were not very different showing the success of MET/ATM coordination in this event. Anticipation of CAT II and CAT III operations also assisted in capacity reduction forecasts due to the increased spacing required. This assisted in reducing excessive radar vectoring associated with holds and limited the number of ground stops. Moreover, delays were reduced as a result of an accurate estimate in time that the airport capacity would return to normal.

2.2.2 The seminar also noted that cost savings to airlines is realized when in air holding is minimized and departure holds are done before boarding. Since various weather systems have various consequences to air capacity, the following MET information should be provided to ATM: weather phenomenon, range of affected area, time of occurrence, and time of recovery. In addition, the seminar noted that post analysis on how the weather elements impact airport capacity should be performed to assist in future events and ideally, automated formulas developed to anticipate airport capacity based on the weather elements forecasted.

Inter Tropical Convergence Zone

2.2.3 The Inter Tropical Convergence Zone (ITCZ) impacts air traffic flow in many FIRs for several months from Southeast Asia to Australia. Specifically, Hong Kong China shared with the seminar its ATM needs for accurate probabilistic convective forecasts in graphic and tabular form for air traffic points of interest such as holding areas. ATM utilizes holding areas for large scale weather deviations (particularly if the AAR is less than 32 at the Hong Kong International Airport) and if such holding areas are also impacted or expected to be impacted, ATFM may have to utilize other plans such as delays from as far away as Singapore (which is only a 3.5 hour flight). Furthermore, to assure flight safety for large scale weather deviations, ATM utilizes different flight levels to avoid aircraft conflicts. The Significant Convection Monitoring Forecast provides probability of convection for a 3-hour time block at selected ATM points of interest out to 12 hours of an area out to 256 km (various range depictions available). This product is derived from numerical models and modified by forecasters based on observations which add to the accuracy of the product. Coordination through briefings between MET and ATM is found to be very useful and two briefings a day during the convective season expected. Further collaboration through conference calls (ATC and the Hong Kong Observatory) and workshops are to enhance the benefits of the MET products for ATM and continued improvement. Inclusion of the operator assists in collaborative decision making for ultra-long haul flights in making an informed decision as to whether or not the flight can continue to Hong Kong China or if the priority of these flights to continue their approach can be granted.

Dust Storm

2.2.4 Australia showed the affects from a major dust storm that impacted a large portion of eastern Australia from 21-27 September 2009 that resulted in significant airport capacity reductions at Sydney and Canberra. Aviation impacts included hundreds of flight diversions, numerous flight cancellations and air traffic management problems. Visibility lowered to between 1000 and 400 metres for at least 3 hours on the morning of 23 September 2009 within the period of 9 hours that dust was reported that day. Visibility forecasts 12 hours from the event did not indicate a reduction in visibility that would have changed ATM planning. The information provided 12-15 hours before this event would have translated to an Airport Acceptance Rae (AAR) of 34/hour with a reduction to 24/hour due to the winds. The actual arrival rate during the dust storm was 14-18/hour. Had the visibility forecast of 800 m or below been provided in advance, the planned AAR would have been 12-16/hour. This information would have allowed for a re-calculation of AAR and a re-run of the ground delay programme that would have prevented many diversions resulting in less ATM workload and cost savings to the airlines. The onset of and cessation of reduced visibility as well as the minimum visibility value well in advance of an event would allow for more accurate planning by ATM. Furthermore, operators could have reduced the risk of not having an available alternate given many aerodromes in the region were affected by the reduced visibility. Dust storm observing and forecasting improvements may be realized with clarification on criteria and reporting being developed by WMO SDS (Sand and Dust Storm) Warning Advisory Assessment System (WAS) in conjunction with ICAO (AMOFSG and METWSG) as well as training and improved forecasting documentation guidance such as the Bureau of Meteorology's Aeronautical Forecasters Handbook. The seminar also noted that dust and sand storms should be considered as a future product in the MSTA.

MET systems for ATM in the terminal area

2.2.5 Weather impacts in the terminal area and capacity reduction were addressed by several presentations. To minimize the impact of weather on capacity, States provide various MET products for ATM.

2.2.6 One such system in Japan called ATMet Information Sharing allows ATM to obtain real time weather information such as weather radar, satellite images, and METAR/SPECI for 14 domestic airports. Visibility values in the observations are noted to be very valuable to ATM due to the impact on capacity. Other products include cloud top on air routes and heavy precipitation near the aerodrome. Other maps are also available such as SIGMET and lightning information. Wind shear and wind shift information are derived from wind shear detection systems such as Terminal Doppler Weather Radar (TDWR) and Light Detection and Ranging (LIDAR). The seminar noted that this system could have value to other States, but in its current form it is not portable. With reference to the wind shear information, the seminar noted that wind shear systems should be acquired based on the need which depends on the wind shear type(s) at the aerodrome as noted in the ICAO APAC Workshop on Wind Shear Systems Acquisition held in Bangkok from 1-3 December 2010.

Flow Control Centres

2.2.7 The seminar noted that some States have a significant number of flights per day that warrants a command centre to minimize delays while maintaining safety. One such case was provided by the United States in that weather (convections, winds, ceiling and visibility, snow and tropical cyclones) related delays accounted for 70% of all delays within the States' FIR. To mitigate these delays, Traffic Management Initiatives (TMI) such as Ground Delay Programmes, Ground Stops, and Air Space Flow Programmes are employed. To expand on the latter, a formalized programme called Severe Weather Avoidance Plan (SWAP) is used in areas susceptible to severe weather. Coded Departure Routes (CDRs) are often used with SWAP that provides a 3 letter code of action/consideration by the operator such as
RQD-Required-stakeholders must take action to comply; RMD-recommended-stakeholders should consider TMI in advisory; PLN-plan-TMI may be implemented; FYI-advisories requiring no action; UPT-user preferred trajectory where the route user requests are based on existing conditions. Coordination in implementing a TMI from the command centre is performed with the stakeholders (industry, en-route centres and terminal) promoting the collaborative decision making process and realizing a common goal: minimize delays while maintaining safety. The seminar noted that CDM in the U.S. is under the Airport Transportation Association and the output is provided to the FAA.

Terminal and En-route Systems

2.2.8 To support such national centres, accurate, timely weather forecasts, particularly of convection, is necessary. The seminar noted the current and prototype MET support to national airspace system of the United States. Improvements to the MET unit (Central Weather Service Unit –CWSU) at the en-route centres include standardized forecasts (e.g. convection) for the terminal area to satisfy requirements and round the clock coverage. To continue improving MET support to the national airspace system, a joint FAA and NWS team set out to develop functional and performance requirements for Traffic Flow Management (TFM) with implementation of several CDM oriented products by the end of 2011 expected.

2.2.9 These products which are mostly focused on convection include Collaborated Convective Forecast Product (CCFP) that provides a convective forecast with associated confidence out to 6 hours with 2 hour increments and is a rudimentary form of Single Authoritative Source (SAS). The seminar noted that the CCFP does include forecasters in the loop. Other products include LCH (Lamp/Localized Aviation Model Output Statistics Program/CCFP Hybrid) of probabilistic forecast of convection out to 25 hours updated every hour. Expansion to use CoSPA (contains precipitation intensity) echo tops to 8 hours updated every 15 minutes derived from NWM and CIWS (Corridor Integrated Weather System) storm extrapolation, which is gridded for DST. Another product, Extended Convective Forecast Product (ECFP) utilize probabilistic forecast of convection valid for 24-30 hours. Aviation Impact Guidance for Convective Wx (AIGCW) is a convective product that overlays Storm Prediction Center (SPC) SREF forecast with historic air traffic data of 5 hours at one hour intervals to produce the percent of time aircraft is in convection to assist TFM.

2.2.10 Noting that wind has a significant impact on TFM, wind speed outlook at various altitudes is translated to airspace compression using a flight path shear product by MIT/Lincoln Laboratory. A forecast component is also being investigated.

2.2.11 Various Decision Support Tools (DST) using weather information include Weather Avoidance Fields, Route Availability Planning Tool (RAPT) (out to 30 minutes) and Weather Impact Traffic Index (WITI) which results in capacity impact forecasts and en-route impacts (RAPT) and a combination of airport/terminal/en-route impacts (WITI), which can be used to predict required level of adjustment (how many flights should be cancelled to reduce delays to an acceptable level). These various systems are categorized from Strategic Planning 4 hours ahead (LCH) to Operational Bridging 2 hours ahead (CCFP, CoSPA, CIWS) to Tactical 20 minutes ahead (ITWS). Details of SAS and DST not verifying remain an issue. The seminar noted that operational bridging entails adjusting strategic planning using updated information (decision support tools) and making decisions that optimizes the capacity and flow of air traffic in a given situation. This phase was considered challenging by the seminar. To help realize the benefits of these systems, MET is educated on ATM at the aviation weather centre, whereas the ATM typically learns of weather systems on the job.

2.2.12 The CDM tools mentioned in the previous paragraphs can be accessed at the following website: www.flycdm.com. The seminar noted that further consideration of utilizing these tools in the APAC Region will be conducted the by the MET/ATM TF.

Discussion Topic 3: Use of meteorological information by ATM

3.1 The seminar noted the 1,000 feet vertical spacing where Reduced Vertical Minimum Spacing (RVSM) is utilized is increased to 2, 000 feet vertical spacing when severe turbulence is reported as per the RVSM Manual. The seminar noted that this is a reaction to a condition, but a State may choose to relax the required spacing if forecast of turbulence. Furthermore, WMO noted that altimeter readings are based on static conditions and are associated with an error when vertical accelerations are present in such cases as turbulence or laminar gravity waves of approximately 10-15 km in length. In the later case, speed increases occur with positive vertical motion and likewise decreases with negative vertical motion, both impacting possible spacing constraints. The APAC Region was informed of new spacing requirements related to super large aircraft. Specifically, spacing has increased to 10 nm behind B747-8 if the following aircraft is light. Furthermore, ICAO is investigating separation standards behind other super large aircraft such as the A-380.

3.2 The seminar noted that ATC has tactical perspectives (versus ATM planning) and needs that should be considered in developing MET requirements since contributions could contribute to harmonization of Annex 3 requirements with PANS-ATM or any guidance material. IFATCA further noted previous inconsistencies in visibility reporting (touchdown zone versus direction of approach/landing) between these two documents and the need for harmonization through the global groups such as AMOFSG. ICAO invited IFATCA to request membership of the global groups noting their perspective. This perspective could assist in the definition of aerodrome in the formation of TAF, which is currently 8 nm from the aerodrome centre, which does not cover the entire aerodrome in some cases. In addition, the IFATCA member desired graphics as the most useful way to interpret weather information that may impact their operations. The seminar noted the importance of graphics and further noted that a process of obtaining the most useful graphic involves extensive consultation with the users and training.

3.3 The group noted Japan developed the Air Traffic Meteorological category forecast which utilizes weather information and determines through a series of operational logic based on past weather events, service rules of airlines, flight operations manuals and ATM offices whether or not air capacity change is warranted. Details of these rules can be found in WP/9. Consequently, the air traffic flow is adjusted accordingly. This 6-hour forecast updated every hour provides four probabilities of significant weather impacts such as CB and TB for the sector; wind, visibility, snowfall rate for major airports in table, tabular and map-type format depending on the specific user need. Currently, human intervention to the forecast is at times necessary. Further improvements are needed to remove the human from the loop.

3.4 CDM was described as operational in the United States and Japan. Japan includes ATMC, ATMetC and the Ministry of Defense and utilizes the ATMet Informaton Sharing System. CDM includes video conferencing twice a day which assists in operations plan. CDM also utilizes the Air Traffic Meteorological category forecast as well as SIGWX briefing sheet (the latter is more detailed than the former).

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

4.1 ATM developments requiring additional/new MET information

Global efforts of determining new requirements

4.1.1 The group noted the current goal of the AMOFSG Ad-hoc Working Group which is to provide guidance to AMOFSG and the secretary on the operational requirements for the provision of meteorological information services, based on the concept provided by the ICAO Air Traffic Management Requirements Performance Panel (ATMRPP) to improve the efficiency of traffic flow with Performance-Based Navigation (PBN) (SP/5). The associated tasks are assigned to the Ad-hoc Working Group and include the following:

- Develop an outline for the meteorological services required to support the ICAO concept of performance-based flight operations reflecting the needs of aircraft operators and ATM

- Identify an initial set of performance metrics for the meteorological elements that are required for performance-based flight operations

- Develop an initial set of Meteorological Information Services, based on performance-based flight operations principles, with a focus on high density Terminal Maneuvering Areas (TMA's) and Airports

- Develop recommendation for the level of supplemental information required for newly developed requirements for meteorological information for performance-based flight operations; i.e. providing clear recommendations and rationale for the required provisions:

  - Standards and Recommended Practices (SARPs)
  - Procedures
  - Manuals
  - Other Guidance material

4.1.2 The seminar noted that MET services for ATM that exceed Annex 3 provisions from several States (e.g. Hong Kong China, Australia and the United States) include some common characteristics (**graphical, mostly digital, at least partially automated and none integrate into ATM**). In developing requirements, it is envisioned that Annex 3 will enable MET Services for ATM where the details are housed in more dynamic document such as a Manual developed by ICAO and WMO. This scenario would allow succinct stable high level requirements to be in Annex 3 while the "how to do it" portion would reside in a manual. Cost recovery of services would be enabled in this scenario as well. The meeting noted that cost recovery is linked through regional requirements in Facilities and Services Implementation Document (FASID) Tables MET to the *Manual on Air Navigation Services Economics* (Doc 9161). Therefore, any regional requirements could be placed in a FASID Table.

4.1.3 In supporting PBN, determining probabilistic and deterministic weather information in an integrated form for certain categories of airspace (En-route-High Density, TMA – High Density, En-route – Low Density and TMA – Low Density) in a common code form could be reflected in a new Manual. The seminar noted that the associated needs and the definition of these categories of airspace are still in the concept phase.

WAFS and PBN

4.1.4 In order to improve the efficiency of traffic flow with PBN, the new concept document, "Flight and Flow Information for a Collaborative Environment (FF-ICE) has been introduced by the ATMRPP, which includes the reference to weather in general terms. How weather will contribute to PBN and the Global ATM concept was discussed by the seminar.

4.1.5 Specifically, in the United States the Next Generation Air Transport System (NextGen), 4-D weather information from a single authoritative source will be integrated into Flight Management Systems (FMS) as well as transportation systems and decision support systems (DSS) to support safe and more efficient flight by providing ATM with best choice options. This concept enables trajectory-based operations (TBO) and high-density operations allowing weather information to be transparent to the end user. Probabilistic forecasts are considered in developing best choices. The seminar noted that best choices given these probabilistic forecasts should be related to a known cost of making a decision.

4.1.6 With relation to WAFC, use of a blended output of elements such as turbulence derived from different sources by the two WAFCs illustrates the efforts towards global harmonization of a product in support of flight planning. As delivered by the WAFC Provider State, to meet PBN needs, WAFCs products would need to have higher temporal, spatial and update resolutions.

4.1.7 One member provided a response to the previous paragraph that included the need for the State to determine who provides the information to ATM and that easy to interpret products are still needed, such as graphical products. Furthermore, gridded data for the terminal area may be considered once the concept of providing information in decision support tools has been proven. WMO stated that the 4-D data cube of gridded data is only one component of services to be provided to ATM.

4.2 ATM-tailored MET products

4.2.1 The group noted that MET requirements for ATM at the Hong Kong Civil Aviation Department (CAD) were developed by way of a working group consisting of members of CAD and the Hong Kong Observatory. MET services developed to meet these requirements include:

- Utilization of high resolution upper wind (from the European Centre for Medium-Range Weather Forecasts - ECMWF) to an arrival metering and sequencing system (known as Arrival MANager System – AMAN) which has improved landing time estimates.

- Significant Convection Forecast provides a low, medium, high probability of significant convection over specified areas in the Hong Kong FIR which allows manual adjustments in the first few hours has assisted in ATC planning at arrival gates and utilization of holds. In addition, this has supported briefings.

- Aviation Thunderstorm Nowcasting System (ATNS) provides convective movement to 60 minutes at 6 minute intervals and provides ATC severity alerts used for shorter term planning. Expansion of this product in time and coverage (arrival and departure corridors) will be explored as well as the impact of weather elements on delays to improve the forecast services.

ATC user feedback and meteorological verification is used to provide future improvements. In addition to model improvements, extra briefings are provided during the rainy season at the request of the users.

4.2.2 Future developments of forecast products include gridded turbulence index and low visibility derived from the Atmospheric Integrated Rapid-cycle (AIR) forecast model system. The former is verified using eddy dissipation rate (EDR) calculated from the wind data of commercial jets and the latter uses an empirical formula of vertically liquid water in the lowest kilometer based on several low-visibility cases.

<u>Future data delivery</u>

4.2.3 The group agreed that not only are new MET requirements of products and services for ATM necessary to keep up with the current and future air traffic demands and realize the potentials of PBN, but the method of delivery also has to adapt and in particular to accommodate automatic data ingest systems used for decision support tools. In this light, the seminar noted that the future exchange of weather information by way of Extensible Markup Language (XML) is expected to be endorsed by the conjoint ICAO MET/AIM Divisional Meeting / WMO CAeM XV Session in 2014. Efforts are being made by the FAA and Eurocontrol as well as States in the APAC Region in conjunction with WMO to develop XML exchange format for ICAO and non-ICAO weather products. The weather information exchange model (WXXM) is one of 5 data interchange components associated with NextGen and SESAR. Advantages of this model are that the data is to mitigate current issues: difficult to ingest in automation, prone to coding errors, difficult to quality control. Furthermore, more flexibility is associated with WXXM such as the introduction of extra elements and raw text. Version 1.1 (based on version 1.0.1 of WXCM/WXXM/WXXS developed by Eurocontrol) available in 2010 has additional products such as PIREP, AIREP, Volcanic Ash Advisory, Graphical AIRMET (U.S.), gust fronts and microbursts. Version 2.0 is expected in 2011 with further improvements (e.g. additional products and documentation improvements).

4.2.4 The seminar expressed concerns over the logistics associated with data exchanged via WXXM and in particular with maintaining the data exchange and how the user will obtain the information without appropriate decoding (or server adaptors). Internally, a State may work out these logistics; however, the need for coordinating State to State has been identified, but not resolved at this time. It was agreed that ICAO and WMO involvement is necessary for a transition to new data exchange systems.

4.3 Meteorological Services in the Terminal Area

4.3.1 The group noted developments with the new Meteorological Services in the Terminal Area (MSTA) initiative being developed by the WMO in collaboration with ICAO. The prototype MSTA is expected to assist ICAO in developing requirements on MET products and services for a wider terminal area that are not currently part of Annex 3 provisions, which would be produced and delivered by meteorological offices from the State. Busy terminal areas are expected to be the beneficiaries of the MSTA in assisting ATM since impacts such as convection to arrival gates are not covered under the current TAF. To keep pace with the operators demands, MSTA prototype currently offer forecasts and probabilities of convection, winds, low ceiling/visibility and winter weather. These new MET services will be considered for endorsement by the next Conjoint ICAO MET/AIM Divisional Meeting/WMO CAeM Session scheduled for 2014.

4.3.2 The group noted that MSTA development is to assist ATM in minimizing delays while maintaining safety and for terminals to use a common set of products that are of a fine resolution in time and space to meet the user's needs. Produced in a digital, gridded or object oriented format for ingestion by DST, the MSTA will also be available as a web-based colour graphic with alerting criteria. In support of CDM, the MSTA will provide common situational awareness to the various users. Due to bandwidth restrictions, textual descriptions may initially be used to be uplinked to pilots. The seminar noted that MSTA is not out to define the data base, but how to effectively use the data available for ATM purposes and in particular, focus on elements that impact capacity and operations.

4.3.3 Currently, three forecast time frames of convection are proposed by the expert team. That is, the nowcast (up to one-hour with rapid updating), short-term forecast (1-6 hour for greater distance around the aerodrome) and outlook (6 hours to 2 days). Other weather elements such as icing, turbulence and low-level wind shear in the terminal area are under development. Potential users are encouraged to utilize the MSTA prototype products at the following web address: http://www.msta.weather.gov.hk).

4.3.4 The MSTA Task Team on User Needs was established by the WMO CAeM to promote feedback and needs from the aviation community. This group liaises with the AMOFSG ATMRPP in formulating requirements in preparation for endorsement of MSTA products by the Conjoint ICAO MET/AIM Divisional Meeting/WMO CAeM Session in 2014 and reflected in the requirements. A summary of user feedback thus far is provided in Attachment A to WP/13 and obtained by various aviation forums in 2009 and 2010. The following questions raised in these forums were discussed by the group:

- In what form and for which uses (ATS, ATM, ATFM) should probabilistic information be included in forecasts of MET elements?

- What verification metrics and user oriented performance metrics are to be included in the validation and verification process (e.g. derived from operationally desirable accuracy of forecasts)?

- How should MET products from MSTA be translated to user impacts (such as capacity changes) in a collaborative set of high-level business rules? (consider more than one parameter scenarios)

- How should future requirements related to MSTA be packaged (SARPs referring to guidance such as Manuals/Guides)?

4.3.5 The seminar responded briefly to the above questions, but realized more time and thought is needed in providing a consensus. Therefore, time will be spent at the MET/ATM TF/2 meeting seeking answers to the above questions. Note that with reference to the first question, the science behind probabilistic information needs to be addressed and careful consideration placed with ensemble outputs, where further development is being placed. With reference to the second question, the seminar noted that there are some tools that have their own verification tools for ATM to view in order to help decide how trustworthy the product is for that time.

State planning for MSTA

4.3.6 State planning for MSTA is already underway in China. That is, the Air Traffic Management Bureau (ATMB) of the Civil Aviation Authority of China (CAAC) launched its MSTA programme in 2010 with focus on China's 3 busiest airports: Beijing, Shanghai and Guangzhou. The meteorological office designated by the State Meteorological Authority will provide the new terminal products and services since many are derived from local Doppler weather radar and mesoscale numerical prediction models. Development to 2012 will focus on convection, wind and icing and distributed amongst regional meteorological centres within the State. That is, Beijing Regional Aviation Meteorological Center will develop icing forecast while the Guangzhou and Shanghai Regional Aviation Meteorological Centers will develop convection and wind products. Other attributes of MSTA for China developed by the work group in consultation with the Hong Kong Observatory is provided in the enclosed table.

Element of MSTA	**Content**
Geographical area	Actual coverage of local terminal area
Meteorological elements	Stage 1: Convection, wind and icing Later stages: cross wind, low ceiling and visibility, snow
Format	Graphical, tabular, text or coded format (depending on user)
Valid times	Up to 6 hours (convection) and up to 24 hours (other elements)
Accuracy required	Agreement MET Auth and users (based on provider accuracy attainable and acceptance to users)
Verification	Method to be developed with development of MSTA WMO guidance suggested on how to develop MSTA

A demo of the first set of products is expected to be delivered by 2012. Subsequent improvements based on user responses and experiences from other States as well as the research and development of other products listed in the later stages are expected beyond 2012.

4.3.7 China informed the seminar of the upcoming WMO VCP Programme Seminar on Aeronautical Meteorology Service to be held in Beijing, China in April 2011 to coordinate with 9 States in the APAC Region on participating in the SIGMET advisory trial this spring/summer 2011. This is in support of the global initiative to investigate ways to improve the issuance of SIGMET.

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ICAO/WMO
ASIA/PAC Meteorology/Air Traffic Management (MET/ATM) Seminar
(24 – 26 January 2011)

Second Meeting of the
Asia/Pacific Meteorology/Air Traffic Management Task Force
(MET/ATM TF/2)

27 – 28 January 2011
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International Civil Aviation Organization

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

Fukuoka, Japan, 24 – 26 January 2011

LIST OF WORKING/INFORMATION PAPERS AND PRESENTATIONS

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3	2 (1)	Contingency Points of Contact for Volcanic Ash Events	ICAO
4	2 (1)	Support to METWARN/1 TF in Developing Contingency Plan	ICAO
5	2 (1)	Impact of the Mount Merapi Eruption to the Civil Aviation	Indonesia
6	2	Impact of the Volcanic Ash on Air Traffic Management	Japan
7	1	Organization of MET Support for ATM in Japan	Japan
8	2	Meteorological Elements that Affect Air Traffic Management	Japan
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12	4 (2)	Development of MET Products and Services for ATM and ATFM	Hong Kong, China
13	4 (2)	New Meteorological Services Supporting Air Traffic Management	WMO
14	4 (1)	Information on Perspective Future Function of the World Area Forecast System	USA
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17	2 (1)	Aviation Meteorological Products and Services	Hong Kong, China

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1	-	Meeting Bulletin	ICAO
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PRESENTATIONS

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1	1	Introduction to MET/ATM Seminar	ICAO
2	1	What is ATM?	ICAO
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4	3 (1)	Reduced Vertical Separation Minimum (RVSM)	ICAO
5	4 (1)	Report on MET in Support of ATM ad hoc WG from AMOFSG	USA
6	2 (1)	U.S. Volcanic Ash Programme in Support of IVATF	USA
7	4	Weather Exchange Model	USA
8	2 (2)	Traffic Flow Management Requirement and CDM	USA
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10	2 (1)	Regional Contingency Arrangements for Volcanic Ash Incidents	Singapore
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15	2 (1)	A Pilot Perspective on Volcanic Ash	IFALPA
16	2 (2)	Impact of the 23 September 2009 Sydney Dust Storm	Australia
17		How is my driving? (ATM Operational Needs)	IFATCA
18	2 (1)	Impact of the Mount Merapi Eruption to the Civil Aviation	Indonesia
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20	2 (1)	Development of MET Products and Services for ATM and ATMFM	Hong Kong , China
21	4 (3)	New Meteorological Services Supporting ATM – MSTA	WMO

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