



METEOROLOGICAL WARNINGS STUDY GROUP (METWSG)

FOURTH MEETING

Montréal, 15 to 18 May 2012

SUMMARY OF DISCUSSIONS

1. HISTORICAL

1.1 The fourth meeting of the Meteorological Warnings Study Group (METWSG/4) was held at the International Civil Aviation Organization (ICAO) Headquarters in Montréal, Canada, 15 to 18 May 2012. The meeting was partly hosted by the International Air Transport Association (IATA) at their Headquarters, also in Montréal, Canada.

1.2 The names and addresses of the participants are listed in Appendix A. Bill Maynard was elected Chairman of the meeting. The meeting was opened by Greg Brock, Chief of the Meteorology Section of the Air Navigation Bureau (ANB) of ICAO. In opening the meeting Greg reminded the group that the focus of the work of the meeting should be to prepare proposals for the proposed Meteorology (MET) Divisional Meeting that was tentatively scheduled for July 2014. Greg also highlighted the important issues expected to be dealt with including the improvement of SIGMET implementation, wind shear alert phraseology and tsunami warning guidance. He also noted the considerable efforts and resources put into the SIGMET advisory trial by the host States China, France and South Africa, without which the trials would not have been possible. The Secretary for the meeting was Neil Halsey, Technical Officer, Meteorology Section, Air Navigation Bureau, ICAO.

1.3 The meeting considered the following agenda items:

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| Agenda Item 1: | Opening of the meeting |
| Agenda Item 2: | Election of Chairman |
| Agenda Item 3: | Adoption of working arrangements |
| Agenda Item 4: | Adoption of the agenda |

Agenda Item 5: SIGMET/AIRMET

5.1 SIGMET implementation issues

5.2 SIGMET/AIRMET requirements

Agenda Item 6: Wind shear, turbulence and tsunami warnings**Agenda Item 7: Future work programme – deliverables****Agenda Item 8: Any other business****Agenda Item 9: Closure of the meeting**

1.4 A list of study notes and information papers issued for the meeting is given in Appendix B.

2. AGENDA ITEMS 1 TO 4: OPENING OF THE MEETING; ELECTION OF CHAIRMAN; ADOPTION OF WORKING ARRANGEMENTS; ADOPTION OF THE AGENDA

2.1 These items are covered under Section 1: Historical

3. AGENDA ITEM 5: SIGMET/AIRMET**3.1 SIGMET implementation issues*****Feasibility study into the issuance of SIGMET advisory information from selected regional centre(s) (Deliverable 1)***

3.1.1 At the first meeting of the Meteorological Warnings Study Group (METWSG/1), it had been identified that there continued to be longstanding issues relating to the issuance of SIGMET in some States. These included: a) issuance; b) dissemination; and c) formatting of SIGMET for all of the phenomena concerned. The meeting had formulated Agreed Action 1/2 where an ad hoc working group was tasked to undertake a feasibility study to consider the rationalization and consolidation of the issuance of SIGMET to selected regional centres. The ad hoc group had provided two differing views regarding the most appropriate way forward. Fundamentally, questions had been raised concerning the likely benefits of continuing efforts to assist States in the provision of SIGMET rather than simply paving the way towards the selection of regional centres for the issuance of SIGMET themselves.

3.1.2 At the METWSG/2 meeting, it had been agreed that a feasibility study be conducted to establish the viability of providing assistance to States through the introduction of SIGMET advisory information issued by selected regional centres similar to that produced by the Volcanic Ash Advisory Centres (VAACs) and Tropical Cyclone Advisory Centres (TCACs). The meeting had formulated Agreed Action 2/1 where an ad hoc group was to oversee the planning for, and conduct of, a feasibility study into the issuance of SIGMET advisory information from selected regional centres. The group presented the findings and recommendations at the METWSG/3 meeting.

3.1.3 METWSG/3 had agreed to continue the feasibility study into the issuance of SIGMET advisory information from selected regional centres. The meeting had formulated Agreed Action 3/1 where an ad hoc group was to continue to oversee the planning for, and conduct of, a feasibility study into the issuance of SIGMET advisories from selected regional centres. METWSG/3 had also agreed that a global SIGMET monitoring system be established and that the appropriate regional OPMET databanks should be invited to assist, as necessary. Furthermore METWSG/3 had formulated Agreed Action 3/3 that sought the provision of turbulence forecast products from the World Area Forecast Centre (WAFC) Provider States to the host States for the SIGMET advisory trial.

3.1.4 The trial had been conducted generally in accordance with the plan as agreed at METWSG/3. In that meeting, the SIGMET advisory format, dissemination method and the host States had been identified. The host States were identified as China (for the Asia trial), France (for northern Africa trial) and South Africa (for southern Africa trial). Before the trial, a World Meteorological Organization (WMO) header for the SIGMET advisory had been provided by WMO. The SIGMET advisory trial had been conducted as follows: 4 May to 31 July 2011 for Asia and 4 April to 30 June 2011 for Africa. An example of the advisory format is given below:

DTG: 20110408/2145Z
SAC: AFI-S
VALID: 082200/090300
FIR: FIMM/FMMM
PHENOMENON: EMBD TS
OBS
LOCATION: WI S2555 E04651 - S2305 E04653 - S1959 E04533 -
S1858 E04441 - S1645 E04337 - S1448 E04457 -
S1618 E04705 - S1827 E04728 - S2019 E04816 -
S1934 E05125 - S2227 E05253 - S2352 E05622 -
S2916 E05703 - S2938 E04952 - S2725 E04810
LEVEL: TOP FL480
MOVEMENT: STNR
INTENSITY: INTSF
RMK: NIL
NXT ADVISORY: 20110409/0230Z

3.1.5 In Asia, 18 meteorological watch offices (MWOs) had participated in the trial, and they had joined the WMO Voluntary Cooperation Programme (VCP) course of WMO as arranged in China beforehand. In the northern and southern parts of Africa, there had been 19 and 12 MWOs participating in the trial, respectively. The meteorological watch offices (MWOs) Rwanda, Burundi, Swaziland and Lesotho did not take part in the trial as they fall within the flight information regions (FIRs) covered by other MWOs, i.e. Dar es Salaam and South Africa.

3.1.6 Both the Regional SIGMET Advisory Centres (RSACs) responsible for northern Africa and southern Africa had employed measures to increase the level of participation in the trial by MWOs. These measures had included contacting the MWOs by phone, developing standard operating procedures (SOPs) and sending letters by e-mail and the aeronautical fixed telecommunication network (AFTN). Further, ICAO Regional Offices (Eastern and Southern African Office, Nairobi (ESAF) and Western and Central African Office, Dakar (WACAF)) had been brought in to assist and they too sent letters to MWOs inviting them to take part. Despite these efforts, some MWOs (Angola, Democratic Republic of the Congo (DRC), Mozambique and Zambia), especially in southern Africa, did not participate. In northern Africa region 12 MWOs formally had confirmed their participation in the trial. The other seven (Roberts, Tripoli, Khartoum, Asmara, Addis Ababa, Ntebbe and Mogadushu) did not participate in the trial despite the issuance of advisories and their publication on the website.

3.1.7 The reasons for non participation was identified to be mostly associated with the lack of communication infrastructure and training. In southern Africa, Angola had cited communication challenges and both DRC and Zambia pointed to lack of training for their staff. Malawi had joined the trial late and all their SIGMETs were disseminated via e-mail as their AFTN line was not working. No reasons could be identified for non participation from both Zambia and Mozambique. In northern Africa, the main reason for non participation was the impossibility to establish a contact with the MWOs. France had sent several AFTN messages prior to the trial asking the MWOs to confirm their participation and systematically tried to contact them by email, when possible, and by telephone, but without success since the phone number of some MWOs could not be reached from abroad.

3.1.8 In accordance with the request from the group at the METWSG/3 Meeting, the results of the trial were assessed through a number of performance indicators, including the percentage of SIGMETs issued by MWOs after receiving SIGMET advisory messages (compliance index of issuance), timeliness of SIGMETs issued by MWOs, format of SIGMET issued by MWO (percentage of SIGMETs with correct format) and user satisfaction. The outcome of computed compliance indexes are summarized in the table below.

Results of the SIGMET advisory trial in 2011

3.1.9 A summary of the performance indicators for all regions:

Performance indicator	Asia	Northern Africa	Southern Africa
Compliance index (issuance)	65.4 per cent	46.1 per cent	20 per cent
Timeliness	Mostly within one hour from the advisory	Mostly within one hour from the advisory	One hour or longer
Percentage of SIGMETs with correct format	99.7 per cent	99.8 per cent	28 per cent
User satisfaction	All satisfied “definitely” or “probably”	All satisfied “definitely” or “probably”	All satisfied “definitely” or “probably”

Summary of the results for ASIA

3.1.10 For Asia, the issuance of SIGMET messages in response to the SIGMET advisory messages received had been considered to be generally satisfactory during the trial, with a relatively high compliance index of issuance and a very low percentage of SIGMETs with an incorrect format. During the trial, two MWOs with MET deficiencies identified by ICAO, namely Lao DPR and PDR Korea, had issued some SIGMETs in response to the SIGMET advisories, which had been a sign of encouragement. Nepal and Myanmar did not issue SIGMET and had indicated that they cannot do so.

3.1.11 The MWOs and the users generally had considered that the SIGMET advisories had helped improve the issuance of SIGMETs in the trial, and they all had supported the permanent establishment of SIGMET advisory centres. In particular, the SIGMET advisories on severe thunderstorms (notwithstanding the sub-categories) were considered to be useful by the MWOs, followed by severe turbulence and severe icing. There were some comments to enhance the SIGMET advisories further, e.g. giving more details about the location and evolution of the significant weather. The timeliness, frequency and accuracy of the SIGMET advisories were also considered to be important.

Summary of the results for northern and southern Africa

3.1.12 In general, the outcome of the results during the trial had been satisfactory, especially in northern Africa. There were, however, still some areas of concern, particularly in southern Africa where a significantly low level of participation and SIGMET issuance had been recorded. The feedback from users had considered the availability of SIGMET advisory information helpful to their ability to issue SIGMET in a correct format and timely manner.

3.1.13 In northern Africa, the level of SIGMET issuance was at 46 per cent with the majority from MWOs located in the western parts of northern Africa and those belonging to the Agency for Air Navigation Safety in Africa and Madagascar (ASECNA). The MWOs situated in the eastern parts of northern Africa had not been very responsive to the SIGMET advisories. The formatting of most SIGMETs received from northern Africa had been compliant with ICAO Annex 3 — *Meteorological Service for International Air Navigation* provisions (99.8 per cent).

3.1.14 In southern Africa, the situation was rather different compared to northern Africa in terms of level of SIGMET issuance, (20 per cent) and correct formatting (28 per cent). The timely response to the advisories was also considered unsatisfactory with most MWOs reacting an hour or more after receiving the advisory. During the course of the trial, the level of participation by MWOs in southern Africa had improved as a result of the efforts explained above. These efforts had led to MWOs (Botswana and Tanzania) issuing SIGMETs for the first time. The level of SIGMET issuance for the majority of MWOs was below 50 per cent. Antananarivo (Madagascar) had been the only MWO which had a high SIGMET issuance rate (96 per cent). The level of compliance with regard to formatting was also low in southern Africa (28 per cent).

3.1.15 The following errors in SIGMET formatting had been identified:

- a) no hyphen after the WMO header;
- b) no equals sign at the end of message;
- c) incorrect weather phenomenon (SCT CB) included in the SIGMET; and
- d) foreign characters (e.g. full stop) placed in the body of the SIGMET.

3.1.16 Still in southern Africa, it was a concern that Angola and the Democratic Republic of Congo (DRC) had never issued SIGMETs despite receiving the highest number of SIGMET advisories. Angola had cited that they had challenges with their AFTN and had been working on it. DRC had indicated that they had had no training in SIGMETs hence had not able to participate in the trial. Further, Malawi, Mozambique and Zambia had both been contacted and had since promised to participate, but never did. The time comparison for southern Africa also showed that MWOs in this area had not instantaneously responded to advisories, and this could be because most, if not all, of the MWOs which participated in the trial did not operate 24/7. Lack of resources to monitor advisories in real time could also be the contributing factor.

3.1.17 The accessibility of an RSAC had proved to be very useful for MWOs, especially in the southern Africa as communication between the two resulted in some challenges being resolved. Botswana in particular was one such example whereby they had challenges with dissemination of their SIGMETs as a result of an incorrect WMO header in their messages. In addition, the RSAC could, through interaction with MWOs, identify other challenges facing the MWOs, such as a lack of training, staff shortages to carry out 24/7 duties, and insufficient/defective communication infrastructure including the AFTN network.

Training

3.1.18 As indicated above, the RSACs had been accessible to MWOs at all times, which had helped resolve long-standing issues regarding SIGMET issuance. ICAO/WMO training seminars had been often too far apart and inaccessible to most MWOs due to financial constraints. Therefore, establishing RSACs could help overcome some of these challenges. The RSMCs, if established, could also provide training and assist in the development of training courses as part of their responsibilities.

3.1.19 The VCP course of WMO which had been arranged in Beijing from 11 to 15 April 2012 for States involved in the SIGMET advisory trial was a perfect example. The course proved to be very useful for some States to develop the knowledge in the issuance of SIGMETs (e.g. the formatting of the SIGMET messages) and in application of the SIGMET advisory information.

Way forward

3.1.20 Bilateral agreements between States for the provision of SIGMETs could be a way to resolve deficiencies in some areas. A proven example of this had been the one set up between China and Cambodia (where China were providing the SIGMET service on behalf of Cambodia) which turned out to be effective.

3.1.21 Training to the MWOs was also considered to be important in addressing the SIGMET deficiencies. The RSACs may also wish to assist with the necessary training to the MWOs in the use of the SIGMET advisory messages and in the issuance of the SIGMETs based on the advisories.

3.1.22 The results of the trial in the northern Africa region showed that the regional advisories can improve the issuance of SIGMET information for MWOs issuing at least some SIGMETs on a routine basis. However, the provision of SIGMET advisories did not trigger the issuance of SIGMETs for FIRs where SIGMETs were never produced. For these States, the bilateral agreement as outlined above, could be a way to resolve the issue.

3.1.23 For FIRs of the northern Africa region in which there was no identified deficiency in the SIGMET issuance, the comparison between the SIGMETs and the SIGMET advisories, as well as the feedback of the MWOs, results in two conclusions: the timeliness and the accuracy of the SIGMET are generally better compared to the advisories; however, the SIGMET advisories are still considered to be relevant by the MWO forecasters. It can therefore be considered that regional SIGMET advisory provisions may constitute a fall-back solution for States with major SIGMET deficiencies.

3.1.24 The feedback of the forecasters in the Toulouse Regional SIGMET Advisory Centre indicated that the level of performance of the numerical weather prediction (NWP) models in the northern Africa region was not (yet) sufficient to use them as the main information source. Additional human expertise, mostly based on satellite observation, was necessary to issue SIGMET advisories. The area for which France was responsible during the trial was regarded as the maximum area that could be handled by a single forecaster.

Conclusion

3.1.25 Action 3/1 had tasked the ad hoc group to report to METWSG about the results of the trial of regional SIGMET advisory centres in mid 2011. The trial showed that SIGMET advisories helped improve the issuance of SIGMETs by MWOs. They encouraged some MWOs identified by ICAO as having SIGMET deficiencies to issue SIGMETs. For those MWOs that had already issued SIGMETs historically, the advisories appeared to help improve the timeliness and accuracy of the SIGMETs. From the feedback of users, it was generally supported to permanently establish regional SIGMET advisory centres. Moreover, bilateral agreements between MWOs and the availability of more training opportunities were considered to be some other possible ways to address SIGMET deficiencies.

3.1.26 SIGMET advisories were demonstrably improving the situation where a minimum of resources were available to the service provider (in terms of infrastructure, human resources, qualifications and competencies). Where the scarcity of resources was excessive, the benefit of advisories on SIGMET issuance would likely remain limited until the root causes of the deficiencies (such as infrastructure, staff competency, governance and oversight, management responsibility and QMS) were addressed by the relevant authorities of the State service providers. While these issues should be addressed as a matter of urgency, interim solutions such as a temporary transfer of responsibility to another service provider (e.g. the regional advisory center for issuance of SIGMET advisories, or a neighbouring country through bilateral agreement) should be explored with the assistance of ICAO and WMO.

3.1.27 The role of regional SIGMET workshops (Beijing, Dakar, Guatemala City and Seoul) jointly organized by ICAO and WMO during the last few years had shown a positive impact on the issuance of SIGMET by MWOs and should continue within the available resources. New WMO regional training centres in Lima, Peru and Qatar were planning a refreshed course in aviation meteorology with a strong focus on SIGMET issuance in early 2012, and the WMO Secretariat was making great strides to ensure participation by the States most in need.

3.1.28 The meeting noted that as part of the WMO Quality Management Framework, establishment of Standards for ground-based in-situ and remote sensing observing systems, which would assist forecasters in SIGMET production, were being pursued as a matter of priority by the relevant WMO Technical Commissions, addressing a concern voiced in the SIGMET advisory report about calibration and standards.

3.1.29 A high rate of satisfaction by users regarding the SIGMET advisory trial had been very encouraging, however remaining issues deserving attention, include:

- a) preference of graphics over text. All user feedback pointed to the inability of language to express the often very complex situations of high-impact weather for aviation;
- b) need for more detail, in particular for lower levels, as the role of an advisory for a very large area will necessarily limit the potential for fine detail. Once the principle of the "large-scale guidance" by the advisory is optimally used by the MWOs served by them, they were expected to add value to the advisories by adding the amount of detail that only availability of local and national observing systems, experience and local competence together with the "zoom effect" of concentrating on a smaller area would enable; and
- c) noticeably lower evaluation scores for mountain wave (MTW) SIGMET advisories revealed a fundamental weakness of SIGMET advisories for this particular phenomenon. Severe MTW turbulence (mostly due to incipient wave breaking) was typically limited to extremely small (sub-gridscale) areas, was not reliably predictable by a global-scale NWP, and required a very high degree of theoretical knowledge paired with strong local and regional experience, building on available aircraft reports and post-flight reports. Few of these conditions would be met in the developing world, and no immediate remedy for this issue could be offered.

3.1.30 The predictability of location and intensity of tropical convective cells had been shown to remain at 4 hours at best, and the use of global NWP would probably remain limited to flight planning (strategic) decision support for the foreseeable future.

3.1.31 Three principal actions were proposed that would be put for consideration of the MET Divisional Meeting, all of which were intended to improve the level of implementation of SIGMET provisions. These principle actions were:

- a) establishment of regional advisory centres on a multi-regional or global basis;
- b) establishment of further bilateral agreements between States for the provision of SIGMET; and
- c) continuation and enhancement of training efforts.

The group agreed that the above actions would undoubtedly serve to improve the level of implementation of SIGMETs but that in order to provide the Divisional Meeting with sufficient guidance, it was considered necessary to develop a concept of operations for the development of an advisory system to improve the issuance of SIGMETs that could be endorsed by the Divisional Meeting.

Note. — A tentative schedule for the development of a concept of operations for an advisory system can be found at Appendix C.

3.1.32 The group agreed that whereas the importance of continued efforts to establish bilateral agreements and the provision of enhanced training was essential, there were a number of cases around the world where both the capacity to provide a SIGMET service and the political willingness to enter into bilateral agreements were unfortunately absent. This places a high level of importance on the issuance of

advisory information where it could be expected to be the only information available on hazardous meteorological conditions in the States concerned.

3.1.33 The group also considered the long-term appropriateness of SIGMET as a product when looking towards to a data-oriented rather than a product-oriented future. Many of the difficulties noted by users over past years stem from the complexities involved when trying to interpret SIGMET information from multiple flight information regions (FIRs) for the same phenomenon. The level of coordination needed for MWOs can be extremely demanding, particularly where many small FIRs were involved for widespread phenomena such as for tropical thunderstorms. To this end, the group noted that a number of States including Australia, Canada and the United States provided phenomena-based information for multiple FIRs within their respective areas of responsibility in recognition that a single FIR-based SIGMET did not provide the most practicable means to issue and receive the information. One solution could be to consider a global system which was effectively the reverse of the current thinking. In other words, the MWO would be responsible for notifying a regional advisory centre of the details of any hazardous phenomena within its area of responsibility, and the regional centre role would be to combine and issue SIGMET information making use of the detailed information provided by the MWO concerned, together with its own observing and forecasting capabilities making it effectively a phenomenon based approach rather than an FIR based approach. As a future way of thinking, such a broad concept may provide one of the solutions in the longer term without threatening the sovereignty issues that provide a major challenge in this case. However, the group noted that the precise nature of any future phenomena-based system remains open for discussion. The group considered what guidance could be provided to the Divisional Meeting in this respect, either by making direct proposals or suggesting further study into the most appropriate long-term solution.

3.1.34 The group spent considerable time discussing the potential future systems and agreed that in the long term an ideal provision of information on hazardous meteorological conditions would consist of a continually updated digital databank that could be fed by multiple authorized sources (e.g. MWOs providing detailed local information combined with regional centres providing general outlook information covering those areas where no local information was available). It was further agreed that ideally, for the medium term it would be preferable to foresee a use of phenomenon-based information rather than FIR based information such as the current SIGMET. The short-term goal was also agreed as resolving the problem of missing information where SIGMET were routinely not produced.

3.1.35 The group agreed the following action:

Action Agreed 4/1 — Development of final proposal to the MET Divisional Meeting on SIGMET implementation

That an ad hoc group (A) consisting of **Albert, Bill, Colin, Herbert, Jun, Keith, Patrick (co-rapporteur), PW (co-rapporteur), Steve and Zhang** develop a proposal for endorsement by the MET Divisional Meeting for consideration by the group by 15 March 2013, that includes the:

- a) development of a concept of operations, considering the milestones in Appendix C, for a global or multi-regional advisory system and criteria for the selection of regional advisory centres by the respective planning and implementation regional group (PIRG)s;

- b) development of a revised format for the advisory information;
- c) development of an amendment proposal to Annex 3 to introduce an advisory system based on the concept of operations, in coordination with the Secretary, and
- d) development of a proposal for further study into a phenomenon-based notification system rather than a FIR-based system for hazardous meteorological conditions.

Note. — The concept of operations in a) above should include an agreed name for the advisory product and the associated production centres as well as consideration of bilateral agreements, cost recovery, quality management system implications and recommendations for required competencies and training.

Evaluation of future turbulence products for use as guidance to Meteorological Watch Offices (MWO) (Deliverable 4)

3.1.36 The group recalled that through Agreed Action 3/4, a request had been made for members of the group to provide information on the development of turbulence forecasting products that could be of use to MWOs in the production of SIGMETs. In response, the group was pleased to note information concerning ongoing research in the United Kingdom and the United States, and further noted that trial CB, icing and turbulence products provided by the world area forecast centres (WAFCs) had the potential of being used as guidance for MWOs that wish to do so subject to the results of verification data that was expected to be provided at seventh meeting of the World Area Forecast System Operations Group (WAFSOPSG) to be held in Lima, Peru from 17 to 21 September 2012.

3.1.37 It appeared likely that additional information/guidance could be expected for use by MWOs in the future, but, the group agreed that no such additional information could be expected to be mature enough for consideration by the MET Divisional Meeting and applicability in 2016. It was noted that once any future information becomes mature then appropriate proposals could be brought forward for further consideration.

Status of SIGMET

3.1.38 The group noted that the status of SIGMET had been raised as an issue to the Secretariat during the third meeting of the International Volcanic Ash Task Force (IVATF/3) that had been held in Montréal from 15 to 17 February 2012. It had been noted that ICAO documentation and, most notably Annex 3, did not refer to SIGMET as a “warning” (instead, denoting SIGMET as “information”) whereas the World Meteorological Organization (WMO) allocated “warning” headers such as WS, WT and WV. Following these points being made, it had been necessary to investigate the reasons for this with a view to providing a consistent approach for the future.

3.1.39 The group recalled that SIGMET was defined in Annex 3 in the following way:

“SIGMET information. Information issued by a meteorological watch office concerning the occurrence or expected occurrence of specified en-route weather phenomena which may affect the safety of aircraft operations.”

This definition had been slightly modified since its original creation, but the fact that it was referred to as SIGMET information rather than a warning had remained unchanged. The original definition had been developed by the Third Air Navigation Conference which had been held in Montréal from 18 September to 23 October 1956. Little information existed relating to the discussions at that meeting, although the following text came from the final report:

“12.18 It was decided to use the word “SIGMET” to indicate the important meteorological phenomena that constituted specified hazardous conditions and to avoid the use of such words as “warnings” ...”

3.1.40 It was difficult to know for certain what the reasons had been for the Air Navigation Conference to go out of its way to avoid the use of the word “warnings” in this context. However, it was suspected by the Secretariat that this would have been considered appropriate in the context of the Annex 3 provisions given below which relate to aerodrome observations and forecasts respectively:

“4.1.9 Owing to the variability of meteorological elements in space and time, to limitations of observing techniques and to limitations caused by the definitions of some of the elements, the specific value of any of the elements given in a report shall be understood by the recipient to be the best approximation to the actual conditions at the time of observation.”

“6.1.1 Owing to the variability of meteorological elements in space and time, to limitations of forecasting techniques and to limitations caused by the definitions of some of the elements, the specific value of any of the elements given in a forecast shall be understood by the recipient to be the most probable value which the element is likely to assume during the period of the forecast. Similarly, when the time of occurrence or change of an element is given in a forecast, this time shall be understood to be the most probable time.”

In view of the above Annex 3 provisions, the group agreed that if there was a continued need for such provisions in relation to aerodrome observations and forecasts, and that similar provisions should be applicable to the provision of all aeronautical meteorological information (noting that for the above provisions there existed desirable levels of accuracy in Annex 3, Attachments A and B respectively). One solution could be to develop similar provisions for each chapter of Annex 3 relating to observed or forecast information, but the group agreed that a more generic statement could be developed to be included in Chapter 2 of Annex 3 relating to all aeronautical meteorological information and to delete the provisions listed above. In this regard the group agreed the following action:

Action Agreed 4/2 — Development of a generic provision in Annex 3 relating to the uncertainties in the provision of meteorological information

That the Secretary develop an amendment proposal to Annex 3 relating to the uncertainties in the provision of meteorological information to be placed in Chapter 2 in place of Annex 3, 4.1.9 and 6.1.1 for consideration by the group at the METWSG/5 Meeting.

3.1.41 The group considered the identified differences between the ICAO and WMO positions outlined above but it was noted that, whereas the word “warning” was avoided in the definition of SIGMET provided by ICAO, it could be argued that this explicit reference was not needed, as a commonly understood definition of a warning relates to the provision of information concerning hazards. Furthermore, the group noted that the definition of SIGMET had been in use for more than fifty years with no operational difficulties being reported by users. Additionally, it was recognized by the group that to change the WMO headers would be a costly exercise involving software changes globally and that changing ICAO definitions would be a challenge. As a result the group agreed that no further action was necessary.

Guidance on the issuance of SIGMET and Annex 3, Table A6-1

3.1.42 The group was provided with a detailed report on a study of two ICAO regional SIGMET guides, namely those for the European region and Asia/Pacific regions. Several inconsistencies were noted by the report with clearly somewhat different interpretations being provided for various aspects of the provisions.

3.1.43 The group agreed that a comprehensive review of all regional SIGMET guides should be carried out noting that these guides generally contained generic information (which would not vary regionally) and specific information pertaining to the communications and other needs of each region. The review was to consider only the former section containing the general implementation issues and interpretation of the requirements in Annex 3. It was also noted that some problems existed owing to the combination of SIGMET, AIRMET and special air-report in Table A6-1. The group agreed that the study should include looking into the possibility of splitting Table A6-1 accordingly in order to clarify the requirements. Some clarifications were provided regarding the use of “=” as the end of message identifier and other issues. The group noted that it was a WMO requirement to ensure that a header and an “=” for a footer are included for each message. This allows easier dissemination, bulletin construction and assists with SIGMET testing.

3.1.44 A further report relating to the use of SIGMET test messages was provided to the group and it was noted that procedures for test messages existed in some regions for use in regional SIGMET tests which were regularly carried out. It was agreed that guidance on procedures for SIGMET tests should be considered as part of the study assuming that it would be appropriate to follow the same test procedures in each region. The group agreed the following action:

Action Agreed 4/3 — Regional SIGMET guidance and Table A6-1 of Annex 3

That an ad hoc group (B) consisting of **Albert, Atholl, Bill, Colin (Rapporteur), Juan, Patrick, Steve** and **Sue** with assistance from the **Secretary** to:

- a) develop generic guidance on the issuance of SIGMET for each ICAO Region to consider for use in their respective SIGMET guides to remove inconsistencies and
- b) investigate the possibility of splitting Annex 3, Table A6-1 into its component parts relating to SIGMET, AIRMET and special air reports.
- c) provide a report for consideration by the group by 15 March 2013.

Note. — The guidance should contain reference to SIGMET test procedures.

Map projections

3.1.45 The group considered a report describing some difficulties that had been encountered by States covering high latitudes where Mercator map projections do not describe lines that approach polar regions adequately. The current practice in Canada was to file a difference against Annex 3 provisions (e.g. Annex 3, Appendix 6 Table A6-1 Note 25 refers) that require the use of Mercator map projections for the description of lines in SIGMET. Instead, Canada uses a polar stereographic projection at the higher latitudes. It was considered by the group that Mercator projection, with its constant heading property, was appropriate for the vast majority of cases and that the complexity involved to cater for such differences by States that have territory in high latitudes could be most easily dealt with by filing differences against Annex 3. This conclusion was further aided by noting that the future introduction of Graphical Markup Language (GML) would, by design, carry information on the projections used in the required metadata.

Use of advisory messages

3.1.46 The group was asked to consider whether Annex 3, 7.1.4 relating to the use of advisory messages for tropical cyclones and volcanic ash by MWOs in the preparation of SIGMET should be upgraded from a Recommended Practice to a Standard since it was the only provision in Chapter 7 of Annex 3 that was not a Standard, and that it would follow the spirit of the importance of the advisory information.

3.1.47 The group considered that it would not be appropriate to upgrade a provision to a Standard that requires a product to be “based on” an advisory, and this term would make compliance difficult to prove. Furthermore, a more rigid provision as a Standard would not permit any added-value information which would also not be acceptable to States that maintain MWOs. As a result, the group agreed not to pursue this suggestion and that no further action was necessary.

Implementation of a centralized MWO in France and SIGMET coordination procedures in Europe

3.1.48 The group noted that the MWO functionality had been centralized in France with a single MWO providing SIGMETs for five FIRs since September 2011. It was recognized that a part of this decision was related to the reduction of the necessary coordination when phenomena covered multiple FIRs serviced by multiple MWOs.

3.1.49 The group noted the ongoing project as part of the MET ALLIANCE framework to improve SIGMET coordination with bilateral or multilateral operational coordination procedures already in place between Austria, Belgium, France, Germany, the Netherlands and Switzerland.

3.2 SIGMET/AIRMET requirements (Deliverable 2)

Intensity criteria for icing

3.2.1 The group recalled that Action Agreed 3/7 had requested members of the group to inform of any ongoing work in the area of developing intensity criteria for icing that could be used in the issuance and interpretation of SIGMET. The group noted that no such information had been made available and agreed that no further action on this topic was to be undertaken, as it was not foreseen to produce any mature results for consideration by the MET Divisional Meeting.

SIGMET categories for thunderstorms

3.2.2 The group recalled that Action Agreed 3/8 had requested that a user view be developed regarding the need for each of the SIGMET issuance categories of thunderstorm as given in Annex 3, Appendix 6, para 1.1.4. The group was invited to note a detailed response provided jointly by the International Air Transport Association (IATA) and International Federation of Air Line Pilots' Associations (IFALPA).

3.2.3 The group noted that the principal response given by users was that the current thunderstorm categories, as provided for the issuance of SIGMETs, were all of some operational use. However, it was also noted that, from the IATA perspective, the same operational decision was made regardless of the particular category of thunderstorm that was included in a SIGMET. Following a brief discussion, the group agreed to allow further time for users, including IATA, to obtain a further assessment of the need for the various categories for consideration by the group. The group agreed to the following action:

Action Agreed 4/4 — SIGMET categories for thunderstorms

That **Atholl** provide further user clarification on the need for each of the SIGMET issuance categories for thunderstorm as given in Annex 3, Appendix 6, 1.1.4 by way of a report for consideration of the group by 15 March 2013.

Ice particles

3.2.5 The group recalled that Action Agreed 3/17 had requested that information should be provided on research into the effects of ice particles on aircraft engines. To this end, the group noted work carried out in the United Kingdom and the United States which had shown that a small but significant number of incidents had occurred relating to the ingestion of ice particles by aircraft engines, and that research was being intensified in a number of States.

3.2.6 In summary, it appeared likely that useful information could be expected in the future, but the group agreed that no such information could be expected to be mature enough for consideration by the MET Divisional Meeting and applicability in 2016. It was noted that once any future information became mature, then appropriate proposals could be brought forward, as appropriate.

Radioactive SIGMET

3.2.7 The group was informed of ongoing work carried out by the International Airways Volcano Watch Operations Group (IAVWOPSG) into the issuance of SIGMETs relating to radioactive material. It was noted by the group that an ad hoc group of the IAVWOPSG was studying the potential to use information issued by experts at the WMO Regional Specialized Meteorological Centres (RSMC) and to therefore remove the requirement for SIGMET for this phenomenon. There were also other States (i.e. States without RSMC responsibility) which made radioactivity measurements that were used in the issuance of SIGMET. Members of the group were encouraged to provide their input to **Steve** who was a member of the ad hoc group of the IAVWOPSG. The group was reminded that any proposal to remove the requirement for SIGMETs for radioactive cloud would be passed to the METWSG for their consideration.

Transition to the use of XML/GML for the exchange of SIGMET

3.2.8 The group noted that a Meteorological Aeronautical Requirements and Information Exchange Project Team (MARIE-PT) had now been established, and that one of its primary roles was to oversee the transition to the use of XML/GML for aeronautical meteorological information. This responsibility included the transition of the exchange of SIGMET information to XML/GML which effectively removed this topic from the work programme of the METWSG.

SIGMET formats

3.2.9 The group noted some difficulties experienced in France relating to the description of the horizontal extent of phenomena in SIGMET and, in particular a request to use lines described by more than two points (i.e. multi-segment lines) and the description of areas between two lines. It was noted by the group that these two options allowed simplifications to be made in FIRs with complex boundaries in particular, which was in line with the intent to simplify the descriptors. Therefore, the group agreed the following action:

Action agreed 4/5 — Draft amendment proposal to the geographic descriptors for phenomena in SIGMET

That the **Secretary** develop a draft amendment proposal to Annex 3 to allow the use of multi-segment lines and areas between two lines in the horizontal extent of phenomena in SIGMET for consideration by the group at the METWSG/5 Meeting.

Definition of AIRMET

3.2.10 The group noted that the European Air Navigation Planning Group (EANPG) at its fiftieth Meeting held in Paris, France, from 8 to 11 December 2008 had formulated its Conclusion 50/36 which is reproduced below:

Conclusion 50/36 — Definition of AIRMET in Annex 3

That ICAO be invited to consider, if appropriate, amending the definition in Annex 3 by deleting the text “and which was not already included in the forecast issued for low-level flights in the flight information region concerned or sub-area thereof”, and aligning the relevant provisions related to AIRMET in Annex 3 accordingly.

3.2.11 It was noted that EANPG had felt that the definition was inconsistent with that of SIGMET and that, by making the definition of AIRMET conditional on the content of routine forecasts, there was a risk of some safety-related information not being available to some users. However, it had also been pointed out by EANPG that ICAO should consider the increased workload that would arise should the definition (requirements) be updated in this way.

3.2.12 The group noted the perceived inconsistency pointed out by the EANPG but agreed that the potential increase in workload would not be acceptable. It was further noted that Annex 3, 9.3.2 requires best efforts to be made to ensure that updated information is provided to users wherever possible and that the associated risks involved by such an increase in workload would outweigh the possible risks of not including those elements in AIRMET. Finally, the group noted that AIRMET is only formally required in one ICAO region (namely the European Region) and is not required elsewhere. As a result, the group agreed that no further action was necessary.

Low cloud and visibility in AIRMET

3.2.13 The group recalled that Action Agreed 3/13 had requested that the Secretary investigate the practices carried out in States that issue AIRMETs in situations where both the height of cloud base and visibility were reduced leading to the introduction of instrument flight rules (IFR) at an aerodrome, and of any need for including vertical visibility in AIRMET.

3.2.14 The group noted that approximately twenty States issue AIRMETs in accordance with ICAO provisions and that a number of those States in the European region had been contacted by the ICAO Regional Office regarding the questions posed. A limited number of responses had been received (less than half of the States involved) and, of those, all of them had followed the Annex 3 provisions in that they provided separate AIRMETs for each phenomenon, even in cases where the phenomena in question had been the height of cloud base and visibility, and thus related in terms of IFR conditions. Similarly, none of the States that responded had identified any need for including vertical visibility in AIRMET.

3.2.15 It was noted by the group that Canada and the United States did provide AIRMETs which combined low cloud and visibility. However, the group agreed that there was no need to pursue this topic in light of the responses received.

Mountain obscuration

3.2.16 It was suggested to the group that the requirement for providing mountain obscuration information in AIRMETs was redundant since it was not universally understood nor implemented and it was only in the provision of cloud height and top information that users could make operational decisions. However, it was pointed out that mountain obscuration AIRMETs were issued in some States routinely and that to remove this requirement in Annex 3 would cause some difficulties in those States. The group agreed to take no further action.

Spatial descriptors in Annex 3 Model SN and elsewhere

3.2.17 The group was asked to consider perceived inconsistencies relating to the spatial descriptors used in Model SN and elsewhere, namely FEW, SCT, BKN, OVC for all clouds other than cumulonimbus and ISOL, OCNL and FRQ for cumulonimbus clouds. It was specifically noted that, in accordance with Annex 3, Appendix 6, 4.2.1 ISOL related to up to 50 per cent coverage of CB which intuitively seems excessive for the use of the term “isolated”. Following some discussion, it was noted that the thresholds represented the operational requirements (i.e. 50 per cent, 50-75 per cent and >75 per cent respectively) and that the terms ISOL, OCNL and FRQ were understood by the user community. The group therefore agreed that no further action was required.

4. AGENDA ITEM 6: WIND SHEAR, TURBULENCE AND TSUNAMI WARNINGS

4.1 User assessment of wind shear provisions in Annex 3 and PANS ATM (Doc 4444) (Deliverable 3)

4.1.1 The group recalled that Action Agreed 3/14 had requested an ad hoc group to look into a user assessment of wind shear provisions in Annex 3 and the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444). The task in hand had been to consider the proposal made to provide an option in the wind shear alert to add either “REPORTED” or “EXPECTED”. The intention of these additions to the phraseologies to be included in Doc 4444 had been to provide additional information to the issuance of a wind shear alert.

4.1.2 The group noted that divergent views had been expressed by the ad hoc group with views both for and against the additions to the phraseologies in Doc 4444. These divergent views are outlined in the following table for ease of reference:

Arguments for not including the new phraseologies (SN/7)	Arguments for including the phraseologies (SN/9)
It is distracting to the controller to have to match air reports with corresponding wind shear alerts where air reports are not routinely passed to pilots.	It is common practice at many ATS units to relay all air reports to pilots. Adding “REPORTED” to a wind shear alert would simplify the process by removing the need to relay the air report in addition to the alert.
It is distracting to the controller to be tasked with monitoring automatic wind shear alerts, particularly in adverse meteorological conditions.	Similar to the above, the workload is reduced in cases where air reports are routinely passed to pilots in that the alert does the work.
Human error can be introduced which could reduce confidence in the product.	Added confidence could be provided as additional information supports the alert.
If “REPORTED” was used inconsistently around the world, confidence in the alerts could be reduced.	Given the high POD and low FAR of the alerts additional confidence could be provided locally.
Uncertainty of timing with the use of “EXPECTED” could desensitize pilots to the hazard.	Given that the information is passed on final approach the information is always current.
Increased variability in phraseologies used is distracting to pilots.	The optional use of these phraseologies would be documented in the Aeronautical Information Publication (AIP).

4.1.3 The group was asked to consider the views presented with a view to either proceeding with an amendment proposal to Doc 4444 or to reject the proposal and take no further action. To this end it was agreed that a user perspective was essential which led to the following statement provided by IATA:

“The IATA Flight Operations Group (FOG) held their most recent meeting in Hong Kong on the 27th/28th March 2012.

At the request of the Meteorology Task Force (METTF), amongst the topics to be discussed was the issue of wind shear and proposed changes to phraseology. An outline of the issue was given by IATA and a better, fuller explanation presented by the DragonAir FOG representative giving the background and purpose to the Hong Kong proposal. As the meeting was being held in Hong Kong, the opportunity was also taken to meet with a Cathay Pacific representative earlier for their views on the subject. During the discussion, all attendees had the benefit of both airlines comments.

The meeting, when taking into account related human and operational factors and the potential for confusion the proposed new phraseology could present, concluded that there was no reason to seek any changes to Doc 4444 preferring to remain with the current phraseology; it was determined that IATA should present this conclusion to both the upcoming IATA METTF and the ICAO METWSG meetings.”

4.1.4 The group agreed that the principal behind the divergent views outlined in 4.1.2 is the ability of the user to interpret and have confidence in the wind shear alert given the provision of the additional information as proposed. This would be the crux of any safety risk assessment for the use of such products which would rely heavily on user input. It was noted that IFALPA was not present at the meeting to provide their opinion on this issue. As a result of the statement by IATA reproduced above, the group agreed that no further action on this topic was necessary.

4.2 Application of ground based F-factor in wind shear alerting

4.2.1 The group was pleased to note the ongoing research being carried out in Hong Kong, China, relating to the use of LIDAR based F-factor for use in wind shear alerting. Many challenges were noted, particularly for departing aircraft, and it was further noted that efforts were to be made in relating any future system to aircraft type.

4.3 Guidance on manual observation and reporting of turbulence

4.3.1 The group recalled that Action Agreed 3/15 had requested that information be provided regarding any information available to users in support of reporting the severity of icing and turbulence.

4.3.2 The group noted that Doc *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444) , Appendix 1 did provide some guidance in relation to the reporting of turbulence, which is reproduced below for information:

Moderate — *Conditions in which moderate changes in aircraft attitude and/or altitude may occur but the aircraft remains in positive control at all times. Usually, small variations in airspeed. Changes in accelerometer readings of 0.5 g to 1.0 g at the aircraft’s centre of gravity. Difficulty in walking, Occupants feel strain against seat belts. Loose objects move about.*

Severe — *Conditions in which abrupt changes in aircraft attitude and/or altitude occur; aircraft may be out of control for short periods. Usually, large variations in airspeed. Changes in accelerometer readings greater than 1.0 g at the aircraft’s centre of gravity. Occupants are forced violently against seat belts. Loose objects are tossed about.*

It was recalled that it had been brought to the attention of the group at the METWSG/3 Meeting that it had become a practice in some parts of the world to report “moderate to severe” turbulence as an intermediary category. This had since been investigated by IFALPA which had identified some uncertainty with the guidance given above to the extent that a need had been identified to use an additional category (moderate to severe). To this end, IFALPA had agreed at their most recent global meeting that they did require the addition of a moderate to severe category for the reporting of turbulence. The group agreed that there seemed to be little operational benefit from the meteorological service provider perspective in having an additional category, as its use would most likely trigger the issuance of SIGMET in the same way that a severe turbulence encounter would. However, given the concerns expressed by IFALPA, two options appeared to exist, to:

- a) amend the Annex 3 and Doc 4444 provisions to allow for the use of the new category “moderate to severe” with appropriate provisions and guidance concerning the issuance of SIGMETs and AIRMETs, as well as the reporting of turbulence as given in Doc 4444, Appendix 1, or
- b) leave the reporting categories as they are and provide additional guidance in Doc 4444, Appendix 1.

4.3.3 The group noted that similar guidance was provided for the reporting of icing in Doc 4444, Appendix 1, which is reproduced below:

Moderate — *Conditions in which change of heading and/or altitude may be considered desirable.*

Severe — *Conditions in which immediate change of heading and/or altitude is considered essential.*

The group agreed that the guidance provided did little to assist pilots in their decision making process.

4.3.4 Following some discussion, the group noted that should a new intermediate category for the reporting of turbulence be introduced, then considerable care would be needed to provide adequate guidance into the reporting of the various categories, bearing in mind the aircraft type dependence and the level of subjectivity provided in the current guidance. It was agreed that no changes could be made to the provisions without appropriate guidance being developed, and that such guidance would be beyond the expertise of the METWSG. Further thought would be needed in order to determine the appropriate guidance relating to the provision of SIGMETs given the new category (i.e. should a SIGMET be considered where moderate to severe is reported?). It was not clear to the group, in the absence of a representative from IFALPA, whether the statement of requirement made by the organization was made in the knowledge of the potential changes to the decisions that would need to be considered. Therefore, the group agreed the following action:

4.3.5 The group may wish to agree the following draft action:

Action Agreed 4/6 — Air reports for turbulence and icing

That the **Secretary** seek confirmation from IFALPA that the requirement identified by IFALPA with regard to an additional reporting category (moderate to severe) was developed in the knowledge of the potential consequential implications to the issuance of SIGMET and report back to the group at the METWSG/5 Meeting.

4.4 Guidance on issuance of tsunami warnings (Deliverable 6)

4.4.1 The group recalled that Agreed Action 3/16 had tasked an ad hoc group with developing guidance for the provision of aerodrome warnings for tsunami with consideration of the practices adopted in those States potentially affected. The group noted a report from the associated ad hoc group.

4.4.2 The main thrust of the report was to suggest that the aerodrome warning for tsunami be replaced by either an element of a national system or by information stemming from an international warning centre whose area of responsibility covers the State concerned. The group agreed that it would be difficult to place requirements in ICAO provisions for national public safety systems or indeed for the International Tsunami Warning Centres. However, the group agreed that in cases where a national public safety plan was in place concerning the incidence of tsunami, and that the aerodrome in consideration was a full and active part of that plan, then the issuance of a separate aviation-related tsunami warning would be redundant and could even cause confusion. As a result the group agreed the following action:

Action Agreed 4/7 — Tsunami warnings where national public safety plans incorporating the aerodrome exist

That the **Secretary** develop a draft amendment proposal to Annex 3, Appendix 6, 5.1.3 to add a note stating that tsunami warnings are not required in cases where a national public safety plan for tsunami was fully integrated with the “at risk” aerodrome concerned.

4.5 Future dissemination and display of information on hazardous meteorological conditions (Deliverable 5)

4.5.1 The group recalled that Action Agreed 3/18 had requested that members of the group provide reports on any progress made in the dissemination and display of information concerning hazardous meteorological conditions, including the use of object based techniques.

4.5.2 The group noted that no such information had been received by the Secretary and agreed that no further action was necessary at that stage. Furthermore, the group noted that the MARIE-PT had, as one of its primary tasks, to identify and develop provisions for future air traffic management (ATM) requirements for meteorological information and, as such, any developments in this topic could be expected to fall under the remit of the MARIE-PT in coordination with the Air Traffic Management and Performance Panel (ATMRPP).

5. **AGENDA ITEM 7: FUTURE WORK PROGRAMME – DELIVERABLES**

5.1 The group was informed that the expected deliverables of the group would be updated based on the foregoing and placed on the group's website.

6. **ANY OTHER BUSINESS**

6.1 The group was informed of a pending request for clarification that was expected to be made to the Satellite Distribution System Operations Group (SADISOPSG) at its seventeenth meeting to be held in Cairo, Egypt, from 29 to 31 May 2012 concerning the inclusion of special air reports on the SADIS broadcast. It was explained to the group that any decision relating to what information should be included on the SADIS broadcast rests solely with the SADISOPSG and that the upcoming meeting would be in a position to resolve the issue. Further points were raised concerning the lack of implementation of air reports in general and the incorrect use of WMO headers for the dissemination of air reports. To this end the group agreed the following action:

Action Agreed 4/8 — Implementation of air reports

That the **Secretary** draws the attention of the ICAO Regional Offices to the implementation of air reports and to the correct use of WMO headers for the dissemination of air reports so that appropriate action may be taken.

6.2 The group agreed that a further meeting would be required in order to finalize outstanding issues ahead of the MET Divisional Meeting, and that the meeting should tentatively be held in Montréal over two days during the week of 17 to 21 June 2013. It was understood that this meeting would tentatively be held during the same week as the Aerodrome Meteorological Observation and Forecast Study Group (AMOFSG), subject to the agreement of the members of that group.

APPENDIX A

LIST OF PARTICIPANTS

NOMINATED BY	CONTACT NAME	BUSINESS PHONE	E-MAIL ADDRESS
Australia	Sue O'Rourke	+61 3 9669 4662	s.o'rourke@bom.gov.au
Canada	Bill Maynard	+1 613 991-4946	william.maynard@tc.gc.ca
Canada	Michael Masek	+1 613 563 5955	masekm@navcanada.ca
Canada	Brian Grechuk	+1 613 563-5777	brian.grechuk@navcanada.ca
Canada	Gilles Ratte	+1 514 283 6777	gilles.ratte@ec.gc.ca
China (Hong Kong)	Pak-wai Chan	+852 2926 8435	pwchan@hko.gov.hk
China (PDR)	Zhongfeng Zhang	+86 10 87922083	mazzf@vip.sina.com
Cuba	Juan Ayon Alfonso	+537 838 1146	Juan.ayon@iacc.avianet.cu
France	Patrick Josse	+33 5 61 07 82 37	patrick.josse@meteo.fr
Japan	Jun Ryuzaki	+81 3 3212 8341 x2298	jryuzaki@met.kishou.go.jp
South Africa	Albert Moloto	+27 11 390 9333	albert.moloto@weathersa.co.za
United Kingdom	Nigel Gait	+44 1392 886268	nigel.gait@metoffice.gov.uk
United Kingdom	Chris Tyson	+44 1392 885406	chris.tyson@metoffice.gov.uk
United States	Steven Albersheim	+1 202 385-7185	steven.albersheim@faa.gov
United States	Cyndie Ableman	+1 301 713 1726 x140	Cyndie.Abelman@noaa.gov
United States	Larry Burch	+1 816-582-1904	burch@avmet.com
United States	Matt Strahan	+1 816 308 9624	matt.strahan@noaa.gov
United States	Linda Smith	+1 405 954 0676	linda.g-ctr.smith@faa.gov

INTERNATIONAL ORGANIZATIONS

IATA	Atholl Buchan	+1 514 874 0202 x3407	buchana@iata.org
WMO	Herbert Puempel	+41 22 730-8283	hpuempel@wmo.int

APPENDIX B

LIST OF DOCUMENTATION

SN no.	Title	Presented by	Agenda item
1	Provisional agenda	Secretary	4
2	Progress report on SIGMET and AIRMET issues	Secretary	5
3	Progress report on wind shear, turbulence and tsunami warnings	Secretary	6
4	Work programme of the group	Secretary	7
5	SIGMET categories for thunderstorms	Atholl Buchan and Carole Couchman	5.2
6	Tsunami information	Steven Albersheim, co-rapporteur of ad hoc group C	6
7	Wind shear information	Steve Albersheim, co-rapporteur of ad hoc group B	6
8	SIGMET advisory	Patrick Josse and P.W. Chan, co-rapporteurs of ad hoc group A and Albert Moloto	5.1
9	Wind shear information	P.W. Chan, co-rapporteur of ad hoc group B	6
10	Improving guidance and inter-region consistency regarding the construction of SIGMET	Colin Hord	5.1
11	Distribution of special air reports	Colin Hord	8
12	Proposal for improvements of the geographical descriptions in SIGMET format	Patrick Josse	5.2
13	MAP projections	Bill Maynard	5.1
14	Use of advisory messages	Bill Maynard	5.1
15	AIRMET for mountain obscuration	Bill Maynard	5.2
16	Test messages	Bill Maynard	5.2
17	Spatial descriptors in warnings	Bill Maynard	5.2

LIST OF INFORMATION PAPERS

IP no.	Title	Presented by	Agenda item
1	Arrangements for the meeting	Secretary	3
2	Ice particle effect on engines - research by the United States	Steve Albersheim	5.2
3	Developments in turbulence forecasting	Colin Hord	5.1
4	Research into the effects of ice particles on aircraft engines	Colin Hord	5.2
5	Provision of meteorological information for radioactive clouds	Steve Albersheim	5.1
6	Application of ground-based F-factor in wind shear alerting	P.W. Chan	6
7	Review and evaluation of SIGMET advisory trial in Asia	Zhang Zhongfeng	5.1
8	Introduction of the system for the preparation, issuance and dissemination of SIGMET advisory in As	Zhang Zhongfeng	5.1
9	Review of a regional seminar on Asian aeronautical meteorology services	Zhang Zhongfeng	5.1
10	The issuance of SIGMET for the PHNOM PHNH FIR by the MWOs of CAAC on behalf of PHNOM PENH WMO	Zhang Zhongfeng	5.1
11	Implementation of a centralized MWO in France and SIGMET coordination procedures in Europe	Patrick Josse	5.1
12	Developments in turbulence forecasting	Steve Albersheim	5.1

**LIST OF PAPERS
IN ORDER OF AGENDA ITEM**

(INFORMATION PAPERS IN BRACKETS)

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4	1
5	2
5.1	10, 13, 14, (3), (5), (7), (8), (9), (10), (11), (12)
5.2	5, 12, 15, 16, 17, (2)
6	3, 6, 7, 9, (6), (13)
7	4
8	11

APPENDIX C

**PROPOSED SCHEDULE FOR THE DEVELOPMENT OF A CONCEPT OF OPERATIONS
FOR A GLOBAL OR MULTI-REGIONAL SYSTEM FOR INFORMATION ON HAZARDOUS
METEOROLOGICAL CONDITIONS**

- 15 Sep 2012 Develop an initial draft of the concept of operations that outlines what is needed in services (to make that date there will be a need for several internal iterations within the ad hoc group).
- 15 Oct 2012 Develop the functional and performance requirements for inclusion in the concept of operations.
- 1 Dec 2012 Update the concept of operations for a 2nd version for distribution and coordinaton with functional and performance requirements.
- 28 Feb 2013 Finalize the concept of operations with functional performance requirements for initial capability for implementation by 2016.
- 15 Mar 2013 Complete a working paper (WP) for coordination with Secretary for consideration by METWSG as Roadmap for implementation of regional centres. The WP should also propose perspective criteria for the selection of States that may wish to be a regional centre.

Note. — The concept of operations should define what is required in terms of resources to provide the services and also have a proposed end state capability for performance.

— END —