AERODROME METEOROLOGICAL OBSERVATION AND FORECAST STUDY GROUP (AMOFSG)

NINTH MEETING

Montréal, 26 to 30 September 2011

Agenda Item 5: Observing and forecasting at the aerodrome and in the terminal area

REPORT FROM THE AD HOC WORKING GROUP ON PROPOSED NEW STANDARDS

(Presented by Bill Maynard, Rapporteur of AMOFSG/8 WG/2)

SUMMARY

This study note presents the final report of an ad hoc working group formed by the eighth meeting of the AMOFSG. Its purpose was to review options for the development of new standards in Annex 3. In particular, whether new standards referencing WMO Manuals and Guides or which address requirements for “representative” could be developed.

1. INTRODUCTION

1.1 At its eighth meeting, the International Civil Aviation Organization (ICAO) Aerodrome Meteorological Observation and Forecast Study Group (AMOFSG) created ad hoc groups to progress work in preparation for its ninth meeting to be held in Montréal in September 2011.

1.2 The AMOFSG created an AMOF Ad hoc Working Group (AAWG) 8-2 (for 8th AMOF meeting, 2nd ad hoc group), or ‘AWG82’, with tasks that included:

   a) the review of a proposal to upgrade the current recommendation to use World Meteorological Organization (WMO) Manuals [and Guides] in paragraph 1.2 of Appendix 3 of Annex 3 — Meteorological Service for International Air Navigation to a standard;
b) the review of the specification of the word “representative” as used in ICAO Annex 3 and paragraph 1.1 of Appendix 3 of the Annex, in particular; and

c) a proposal for new SPECI standards for visibility and Runway Visual Range (RVR).

1.3 The AWG82 worked by electronic correspondence to review these topics, considered a range of proposals and formulated related conclusions. The details regarding the participants and their contact information can be found on the AMOFSG web site in the summary of discussion of the eighth meeting at:

http://www2.icao.int/en/anb/met-aim/met/amofsg/Pages/default.aspx

1.4 At the conclusion of the process, no consensus could be achieved regarding any possible new standards on these topics. The status quo was determined to be the option most supported by AWG82 participants, for all matters of discussion. However, there was general agreement regarding what the next steps should be: in particular, that the WMO should be invited to develop Manuals and Guides that are suitable for reference from any prospective new standards.

2. DISCUSSION

2.1 It is important to consider the relationship between ICAO and WMO. In particular, ICAO Document 7475 – *Working Arrangements Between the International Civil Aviation Organization and the World Meteorological Organization* - includes the following relevant text for consideration (in part, with emphasis added):

  b) Matters (i) which relate to the basic meteorological facilities required by the Meteorological Authorities to provide service to international air navigation, (ii) which relate to the meteorological techniques and practices employed in providing such service or (iii) which, for their successful resolution, require close coordination with the procedures and facilities employed in other (non-aeronautical) applications of meteorology should be regarded as lying primarily within the field of responsibility of WMO. [Preamble refers]

  2.2.2 This development [of Specifications of Aeronautical Meteorological Requirements and Methods of Satisfying them] will entail a separation of the material into two parts, the first of which will comprise a specification of the needs of international civil aviation in regard to meteorological service, suitable for ultimate adoption as International Standards and Recommended Practices (Annex to the Convention on International Civil Aviation). The second part will comprise supplementary material regarding the manner in which the required meteorological service, as indicated in the specification of the needs of international civil aviation, is to be provided.
WMO Manuals and Guides

2.2 The current wording of the subject recommendation is (Annex 3, Appendix 3, paragraph 1.2 refers):

**Recommendation.**— Meteorological instruments at aeronautical meteorological stations should be exposed, operated and maintained in accordance with the practices, procedures and specifications promulgated by the World Meteorological Organization.

2.3 It was assumed that the information required to meet the intent of this recommendation is primarily included in WMO Manual No. 8 – *Guide to Meteorological Instruments and Methods of Observation*. However, it was also notable that the WMO has other relevant Manuals or Guides, such as WMO No. 731 – *Guide on Meteorological Observation and Information Distribution Systems at Aerodromes* - and is also developing a new siting classification for land stations.

2.4 It was recalled that this recommendation was previously discussed by each of 2 predecessor ad hoc groups. Notably, there was general agreement in principle that this provision should be upgraded, subject to suitable understandings regarding the text and its application.

2.5 There were three options considered by the AWG82 group for the future of the subject recommendation. Based upon preliminary discussions, during the eighth AMOFSG meeting, the first two options were to be considered as favoured and were the primary focus of the group;

a) no change;

b) upgrade to a standard using the current text except to replace the current ‘should’ with a ‘shall’; or

c) revise the wording to achieve a new standard related to the underlying intent.

2.6 The inclusion of an explanatory note, as a sub-option to each of the above, was also considered.

2.7 It is problematic to have a standard refer to Manuals and Guides that, for the most part, consist of recommendations, guidance material and descriptive information. Therefore the group explored whether the WMO Manuals and Guides may be useable for the more limited purpose of the evaluation of State Manuals. It is notable that the preface of WMO No. 8 states (in part, emphasis added) that:

… the Guide is not intended to be a detailed instruction manual for use by observers and technicians, but rather, it is intended to provide the basis for the preparation of Manuals by National Meteorological and Hydrological Services (NMHSs) or other interested users operating observing systems, to meet their specific needs.

2.8 It was, therefore, proposed that the current recommendation be upgraded to a standard with the addition of a note that clarifies that the intent is not to use it as an operations manual. Rather the intent would be to use them as benchmarks for the assessment of State Manuals. Further, this note would
have specified that the primary manual or guide being referred to would have been WMO No. 8. The suggested revised wording was:

1.2 **Recommendation.** Meteorological instruments at aeronautical meteorological stations shall be exposed, operated and maintained in accordance with the practices, procedures and specifications promulgated by the World Meteorological Organization.

*Note – This information is contained in WMO No. 8 – Guide to Meteorological Instruments and Methods of Observation – which is not intended to be a detailed instruction manual but rather is intended to provide the basis for the evaluation of the adequacy of documented practices, procedures and specifications as prepared by each State.*

2.9 In other words, are the WMO Manuals and Guides sufficiently mature to use them as references for the limited purpose of the evaluation of State Manuals?

2.10 In related discussion, some factors that were listed as being in favour of upgrading this recommendation to a standard included:

- it would be consistent with intent of Doc 7475 that WMO take the lead on this matter (note excerpts in paragraph 2.1, above),
- the pending quality management requirements to take effect in November 2012 will require States to have related Manuals. If the current WMO Manuals and Guides are not being used as the basis for developing State Manuals, what is being used? And how is global consistency to be achieved?
- it is consistent with the main goal of WMO No. 8 as defined in its preface,
- there is a safety case that pilots must be made aware of significant deficiencies in weather observing practices and this is much more likely to happen if State Differences must be filed for major deviations from the WMO Manuals and Guides,
- it would be consistent with the intent of establishing the continuous improvement of State processes;
- it may provide additional incentive to WMO teams to give a priority to aeronautical matters, and
- it may provide greater certainty for manufacturers to reference in the development of new technology.

2.11 Arguments that were raised against the upgrading of this provision include:

- the majority of WMO provisions are written as general guidance and not as binding material making it unsuitable as a standard [with notable exceptions, such as WMO No. 306, which are written as standards].
— the WMO Manuals and Guides may not be updated in a regular or timely manner,

— the current WMO Manuals and Guides are likely already out-of-date concerning new and emerging technology,

— the new standard may be difficult to understand and apply,

— even with the inclusion of the note the preferred intent may not be clear with the current text of the subject paragraph, and

— the deliberations of the full AMOFSG, at its eighth meeting, indicated that the Status Quo remained a viable option for the time being so there is no urgency to expedite a new standard – we can wait to develop consensus first.

2.12 In summary, it was agreed in principle that it is highly desirable to develop a future standard based upon some underlying elements of this paragraph. However, the current WMO Manuals and Guides are not sufficiently mature to allow them to be used as standards, even with the inclusion of a note that limits their application. Furthermore, it was noted that new Manuals and Guides are in development. It may be reasonable to defer this matter until this new material can be reviewed. Alternatively, a completely new standard or significant revision to the current text in the subject paragraph could be considered, but there was insufficient time for the AWG82 to pursue this option.

2.13 Comments received from group participants on this topic are shown in the Appendix.

“Representative”

2.14 The word “representative” is used 25 times in recommendations, 6 times in standards, and once each in an example and in the record of amendments to Annex 3 – a total of 33 times.

2.15 The predecessor ad hoc group had concluded that, “the best option for upgrading several recommendations to standards was by the introduction of a definition of ‘representative’, in Chapter 1 of Annex 3”. However, a review of this conclusion by the full AMOFSG, at its eighth meeting, determined that a new definition may result in prolonged debates leading to unknown results. An alternative suggestion was to find some means of including an appropriate specification of “representative” in a standard elsewhere within the text of the Annex. The AWG82 was asked to further explore this possibility.

2.16 The main intent of “representative”, based upon the current text of Annex 3, is achieved primarily through appropriate siting of instruments. For example, from Appendix 3 of the Annex the phrase “representative should be obtained by sensors appropriately sited” appears in 4 separate recommendations. (4.1.1.2, 4.2.1.2, 4.4.1 and 4.5.1 refer) and is consistent with the general requirement, as follows:

1.1 **Recommendation**.— *The meteorological instruments used at an aerodrome should be situated in such a way as to supply data which are representative of the area for which the measurements are required.*
2.17 It is notable that there are no specific recommendations in the Annex regarding the siting of temperature and humidity sensors (4.6.1.2 refers). Furthermore, for the observation of atmospheric pressure, there is neither a siting recommendation nor a recommendation to be “representative”.

2.18 The main intent of appropriate siting is to minimize a major component of systematic error. There are three primary components of systematic error, as addressed in WMO No. 8, that relate to “representative” (i.e. non-instrumental errors). First, there is error related to inappropriate siting and / or exposure. Second, there are errors due to inappropriate averaging periods and reporting frequencies that do not match the user requirements. Thirdly, there are a several ‘external’ factors that may result in error (Part III, Chapter 1, section 1.6 refers).

2.19 Averaging periods and update frequencies are already in the Annex as considerations for achieving “representative”. In one case, a standard requires that “…output shall be updated at least every 60 seconds to permit the provision of current, representative values…” (in part, Appendix 3, 4.3.4 pertaining to RVR, refers). The required update frequency is directly proportional to the probability that a subsequent report of a given variable could result in a different decision by operators.

2.20 Although qualitative guidance exists regarding how to achieve “representative”, there is limited quantitative information. Note, for example, the following excerpt from the “WebMet.com” MET Monitoring Guide that can be found at:

http://www.webmet.com/met_monitoring/toc.html

Section 3.1 (in part, emphasis added) …a meteorological observation, data base, or monitoring site, either is, or is not representative within the context of whatever criteria are prescribed. It follows that, a quantitative method does not exist for determining representativeness absolutely. Given the above, it should not be surprising that there are no generally accepted analytical or statistical techniques to determine representativeness of meteorological data or monitoring sites.

2.21 Although we cannot provide a clear specification of “representative” it may be possible to expect that a number of related factors be appropriately identified and addressed. There are subcomponents of achieving “representative” that can be reasonably managed and which should be appropriately addressed within documented State Manuals. It may be impossible to be objectively “representative”. However, it is possible to be “more” representative or sufficiently representative to meet a defined user requirement.

2.22 In consideration of the above, the group considered the following as a possible new standard, with associated note, for inclusion in the Annex, to replace the current text in Appendix 3, 1.1:

1.1 Representative observations shall be achieved by: specifications and practices for; siting and exposure, averaging period and update frequency, and the control of external factors and identifiable sources of systematic error; as needed to meet operational requirements.

Note. — The identifiable sources of error may include: proximity to obstructions, buildings, local terrain, sources of water, snow pack and vegetation; local climate; aeronautical factors (e.g. obstacle restriction provisions); long runways; aircraft parking and maneuvering areas. External
factors may include dust, sand, pollution, salt, large ambient temperature extremes and vandalism. Where additional local factors occur, multiple instrument sites should be considered.

2.23 Following careful consideration of the above, the most supported viewpoint of the group was that the Status Quo remained the best option. Clearly, there is a significant problem with any form of “representative shall” given that the term “representative” is not quantitatively defined and it may, in fact, be indefinable in objective terms. An alternative standard that relates to “representative” but does not directly mandate its achievement needs to be considered. However, the AWG82 did not have sufficient time to pursue this further.

2.24 Comments received from group participants on this topic are shown in the Appendix.

New SPECI for visibility and RVR

2.25 The group was asked to consider the upgrading to a standard of the current recommendations regarding SPECI criteria for visibility and runway visual range (RVR). The following recommendations, from Appendix 3, of the Annex would be affected (in part):

Appendix 3, 2.3.2 Recommendation.— SPECI should be issued whenever changes in accordance with the following criteria occur:

...e) when the visibility is improving and changes to or passes through one or more of the following values, or when the visibility is deteriorating and passes through one or more of the following values:

1) 800, 1 500 or 3 000 m; and

2) 5 000 m, in cases where significant numbers of flights are operated in accordance with the visual flight rules;...

...f) when the runway visual range is improving and changes to or passes through one or more of the following values, or when the runway visual range is deteriorating and passes through one or more of the following values: 150, 350, 600 or 800 m;...

2.26 It was recalled that a previous ad hoc group could not achieve consensus regarding a proposal to upgrade the recommendation that RVR be assessed for all CAT I / high intensity lighting runways (Annex 3, 4.6.3.2 refers). This may have the effect of limiting the application of any related SPECI standard to only CAT II/III runways.

2.27 It was further noted that there are significant deviations in State practices for the reporting of RVR, in particular, and visibility, and little evidence of consistency for related SPECI (see State Differences for reference). In fact, several States do not include RVR in the METAR / SPECI, a few do not take RVR observations at all (or only at CAT II/III aerodromes) or only for selected runways regardless of the operational or favoured runway, while many others use varying averaging periods, do not include trends, or are inconsistent regarding how to address runway lighting in reports (i.e. do we want SPECI whenever the light setting for a runway is changed?)
2.28 The current provisions of Annex 3 already enable SPECI for these elements, should any State have immediate need to implement them (4.4.1 and appendix 3, 2.3.2 e) and f) refer). Therefore deferring standards in this regard will not inhibit implementation, where necessary for local reasons.

2.29 There is not presently, nor is there likely to be in the short term, any consensus regarding what the related SPECI criteria should be. The current thresholds would have to be revalidated before becoming standards.

2.30 The group concluded that the development of mature proposals for new standards related to SPECI criteria for RVR and visibility were not feasible within the time and resources available to the group. Moreover, it was determined that there were other recommendations that must be addressed as a prerequisite before this goal could become realistically achievable.

2.31 Comments received from group participants on this topic are shown in the appendix.

3. CONCLUSIONS

3.1 The group agreed, in principle, with the long term objective of identifying new standards based upon the current recommendations in paragraphs 1.1 and 1.2 of Appendix 3 of Annex 3. However, for the time being, the most favoured option by the group participants was to maintain the status quo.

3.2 There was agreement that the applicable ICAO Documents should be reviewed to update and improve their inclusion of essential content found in WMO Manuals and Guides.

3.3 There was agreement that the next appropriate step would be to invite the WMO to develop improved Manuals and Guides suitable for reference from future standards on these matters.

3.4 The Secretary should be invited to consider whether paragraphs 1.1 and 1.2 of Appendix 3 should be moved to Chapter 4 of the Annex.

3.5 The AMOFSG/9 may wish to consider if a successor ad hoc group should be assigned with reviewing any new WMO Manuals or guidance material that may support upgrading paragraphs 1.1 and 1.2 of Appendix 3 to Annex 3 to standards and / or to consider additional options by which potential new standards may be able to address some of the key underlying intents of these provisions.

3.6 There was no support for new SPECI standards for changes in visibility or RVR.

4. ACTION BY AMOFSG

4.1 The AMOFSG is invited to:

   a) comment on whether any decisions should be drafted based upon the conclusions of the group and, in particular, the invitation to the WMO to develop revised Manuals and Guides suitable as standards references.

   b) consider whether there should be a successor group and what, if any, tasks it should be assigned.
c) comment, in general, upon the paper and the conclusions of the group.
A. Some specific comments from participants on the topic of references to WMO Manuals and Guides follow, first from CM:

Can a standard refer to a non-‘standard’ document? - It seems not appropriate to do so. However, if this is not a standard, we would not have this problem and in fact, we need to retain the reference to the important documents of WMO.

There is one worry that once paragraph 1.2 become standards, States may have to file a difference, if they are not confident enough or have no concrete proof that they meet these standards (which is difficult to prove). Having considered that above, I am more inclined to think that there is no hurry to turn paragraph 1.2 into standards. Reference to the WMO documents should be retained.

Secondly, from Steve;

We reviewed the papers you provided us with regard to the issue of the use of the term "representative" and the other paper on changing the siting of meteorological stations to a standard. The findings based on consultation with others in the FAA [Federal Aviation Administration] and NWS [National Weather Service] is that we should not change the existing language in the Annex.

Specifically siting of instrumentation at the aerodrome is always done as best as practical to the guidance provided in WMO No 8, but there are circumstances that it is not always practical or the technology has advanced further along than the current WMO documentation. Even if everyone agreed to change the recommendation to a standard, the note you have provided allows States to deviate so there is nothing really achieved by making this change.

Thirdly, from Herbert

I shared [the discussion paper] with our Observations and Instruments chief in WMO, who is also quite happy, but would like "Manuals" replaced by Manuals and Guides" throughout the text.

B. Comments from participants on the topic of the usage of the word “representative” in the Annex, first from Herbert

When it comes to the systematic error, I would suggest an extra small paragraph as suggested below:

"For a meteorological observation to be considered representative of a four - dimensional volume of air space (such as a runway complex, touch-down zone or similar for a specified time interval, a clear definition of the phenomena to be covered by this observation will be necessary, reflecting
the typical length-and time scales of these phenomena. While an observation of a slowly varying parameter such as air pressure would easily be considered representative for an aerodrome, visibility in case of patchy fog would require a clear definition of the space scale covered, and when it comes to micro-scale phenomena such as microbursts, wake turbulence or hail swathes, the users need to be informed (via the meta-data for the observing station) which time and space scales would normally be covered by the observing systems." (e.g. if only 2 anemometers are installed, no reliable wind shear or wake turbulence information can be given, but in case of a combination of operational TDWR [Terminal Doppler Weather Radar] and Doppler Lidar, all of these could be well represented in the observation.

Further from Herbert (a few days later),

having followed the exchange on the issue of "representative" leads me to my original remarks about this issue, that whether a measurement could be representative for an 4-dimensional volume depended not only on the siting and nature of the instrument (e.g. a visibility/ceiling measurement based on backscatter will depend very much on the homogeneity of the moisture/droplet density), but also on the type of phenomenon (wind shear, turbulence, hail all are often connected to micro-scale convective processes). For these reasons a point measurement will never be able to guarantee a value or narrow range of values that can be considered "representative" for a larger 4-dimensional volume.

In this sense, Steven and CM Cheng may have a very valid point that any service provider would be extremely hard pressed to prove the "representative" character of individual observing systems for all relevant weather situations. If we are serious about requiring representative measurements, volume scanning systems, combinations with remote sensing and other techniques (or, heaven forbid, even properly trained human observers!!) would become "de rigeur", and this may have some very serious cost consequences.

From Colin,

Thanks for doing this, I agree that the representativeness work that is being conducted by the WMO is not complete nor sufficiently mature for inclusion.

In order that we do not lose any flexibility here, aviation issues must come first. We cannot have the situation where the meteorologists say the “ideal” location for the instrumentation is in the middle of a runway! We must retain the ability to have some common sense in these type of regulations – we have 58 stations that provide METAR – you no doubt have many more. I would imagine that some of the aerodromes you have instrument locations that are not ideal but then that is only place they can go!

From CM

Can we provide detailed and hopefully quantifiable definition of ‘representativeness”? - It appears not possible for the time being. We know that siting of MET instruments is very much a competition/compromise of MET requirements with other non-MET requirements. While we can say that the MET instruments shall be so siting as to minimize error of measurement, it is difficult, if at all possible, to draw a clear line between meeting the requirement or not. So from the perspective of USOAP [Universal Safety Oversight Audit Programme], it is difficult to demonstrate or prove that the standard of representativeness is met or not.
There is one worry that once paragraph 1.2 become standards, States may have to file a difference, if they are not confident enough or have no concrete proof that they meet these standards (which is difficult to prove). Having considered that above, I am more inclined to think that there is no hurry to turn paragraph 1.2 into standards. Reference to the WMO documents should be retained.

From Steve,

With regard to the issue of representativeness. We have discussed this several times and there is still very little support to make any changes to the existing language in the Annex. The proposal you have put forth I believe makes it much more complicated to interpret and understand. My position is the language as currently provided in the Annex meets our needs.

C. Some specific participant comments on the topic of proposed new standards for SPECI for changes in RVR and visibility follow. First from Herbert:

I am in full agreement with your proposal. RVR will be a prime candidate for SWIM, i.e. direct access to the data created, by nature of its rapid variation. The current SPECI, as you point out, are enabled and thus the need for an upgrade to an "intermediate" solution is not considered a priority.

Secondly, from Steve;

I support your approach to defer the tasking of the [AWG82]. Your reasoning is well stated, especially [paragraph 2.28 above], where States can implement for local reasons. This also begs the question, what is the real reason or push to upgrade the RVR in SPECI to a standard? With the likely significant cost to implement and become compliant, who benefits? With respect to your alternative position, i.e., raising Cat II/III to a Standard, I prefer keeping this as a Recommendation, as I don't see the requirement to upgrade.

— END —