



METEOROLOGY PANEL



**Summary Document -
Meteorology Panel
Working Group on Meteorological Information and Service Development
(METP WG-MISD/1)**

FIRST MEETING

Washington, D.C., United States of America, 16 to 19 November 2015

INTERNATIONAL CIVIL AVIATION ORGANIZATION

1.0 OPENING OF THE MEETING

The first meeting of the Working Group on Meteorological (MET) Information and Services Development (WG-MISD/1) was convened 16 to 19 November 2015, in Washington, DC, United States of America (USA), at the offices of RTCA, Inc.

Four of the five WG-MISD Work Streams were informed of progress on their respective work plans, with additional topics of interest raised by work stream members through working papers (WPs) and information papers (IPs).

Mr. Raul Romero, Technical Officer, Airspace Management and Optimization Section, ICAO Headquarters served as Secretary for the meeting.

Mr. Richard Heuwinkel, Manager, NextGen Aviation Weather Division, Advanced Concepts & Technology Development Office, Federal Aviation Administration (FAA), as well as Rapporteur of the WG-MISD, oversaw the meeting.

2.0 PARTICIPATION

Lists of attendees for each Work Stream meeting, including members' respective State and organizational affiliations, are contained in Appendix A of this report.

3.0 WG-MISD/1 REGIONAL HAZARDOUS WARNING ADVISORY CENTER (RHWAC) WORK STREAM SUMMARY AND ACTIONS

3.1 Introductory Information

The WG-MISD Regional Hazardous Weather Advisory Center (RHWAC) Work Stream met on Monday, 16 November 2015, in Washington, DC.

Following brief introductions, the role of the RHWAC Work Stream in supporting the WG-MISD Rapporteur's recommendations to the Meteorology Panel (METP) was reaffirmed.

Members and other attendees were informed on a number of topics relating to the RHWAC Work Stream work plan, as briefed during previous Work Stream teleconferences (30 June 2015 and 13 July 2015).

A primary expected outcome for the meeting was agreement on a schedule for completion of the Concept of Operations (ConOps) to facilitate finalizing performance requirements for the defined services and selection criteria for potential providers of regional hazardous weather advisory information.

The meeting followed a format, whereby agenda items were largely driven by topics raised through working papers (WPs). Topics for discussion included recent progress on the draft *Concept of Operations (ConOps) for Advisory Services for Hazardous Meteorological Conditions*, preliminary performance requirements, and selection criteria for regional centers.

Discussion was led by the Work Stream Coordinator, Sharon Lau Sum Yee of Hong Kong Observatory.

NOTE: Referenced papers are available on the ICAO METP secure website.

3.2 List of Attendees

Steve Albersheim, Dorothea Banse, Michael Berechree, Larry Burch, Vyacheslav Burov, Stephanie Desbios, Dirk Engelbart, Nigel Gait, Brian Grechuk, Dennis Hart, Thomas Helms, Richard Heuwinkel (Rapporteur), Colin Hord, Phillippe Husson, Yohko Igarashi, Dimitar Ivanov, Anna Ivanova, Thomas Kiley, Sharon Lau Sum Yee, Keith Mackersy, Yuliya Naryshkina, Larisa Nikitina, Sue O'Rourke, Mario Ouellet, Melissa Peterson, Graham Rennie, Raul Romero, Bob Rutledge, Jun Ryuzaki, CM Shun (Deputy Rapporteur), Thomas Steinkopff, Matt Strahan, Zhongfeng Zhang

NOTE: Work Stream Member affiliations are available in Appendix A, to this report.

3.3 List of Actions from the WG-MISD/1 RHWAC Work Stream Meeting

- 3.3.1 The Work Stream was informed (WG-MISD/1 WP03) of progress in the development of the RHWAC Work Stream work plan. The Work Stream agreed to amend the work plan to emphasize that the METP, as a technical panel, is not responsible for *implementing* a proposed RHWAC solution, and formulated the following Action:

WG-MISD/1/RHWAC Action 1/1: That the RHWAC Work Stream Coordinator will remove Activity 2.4 'Implementation of Regional Hazardous Weather Advisory Centers,' and revise the work plan to indicate that the implementation of RHWACs is not the responsibility of the METP.

- 3.3.2 The Work Stream reviewed progress on the RHWAC ConOps (WG-MISD/1 WP02) and discussed the advantages and disadvantages of direct dissemination of advisories to aviation decision-makers in Phase 1 (Reference: METDIV Report, Appendix D, 2.D-2). The Work Stream agreed that a more detailed analysis of the alternatives should be conducted and formulated the following Action:

WG-MISD/1/RHWAC Action 1/2: That the RHWAC Work Stream Coordinator will:

- 1. Separate the draft high-level information flow diagram in the ConOps into Phase 1 and Phase 2 (Reference: METDIV Report, Appendix D, 2.D-2).**
- 2. Conduct an analysis of the advantages and disadvantages of the following alternatives for further discussion by the full Work Stream.**
 - i. Alternative 1: RHWACs produce advisories for under-served FIRs covering only the parameters in SIGMETs and disseminate those advisories only to MWOs for production of SIGMETs.**
 - ii. Alternative 2: RHWACs produce advisories for under-served FIRs covering only the parameters in SIGMETs and the advisories and SIGMETs, where produced by the MWOs concerned, are disseminated to ATM for direct decision support.**
- 3. Insert language indicating that ATM decision-makers should receive consistent MET information, notwithstanding the possibility of adopting Alternative 2 above.**

4. Include more detailed comments on the responsibilities and functions in Appendix B of the RHWAC ConOps

At the conclusion of the Work Stream meeting, the Rapporteur noted that, based on the day's discussion, the trials are not necessary in the near-term; however, the issue could be discussed in the future.

- 3.3.3 The Work Stream discussed Phases 2 and 3 of the ConOps (WG-MISD/1 WP02) in the context of the scope of advisories and structure of service provision (e.g., will MWO's be the correct service provider if the service replaces SIGMETs with some broader information package that transcends FIRs). It was noted that there is an ongoing activity within the Work Stream to review the MET information service provision framework relative to the Global Air Navigation Plan (GANP) objectives which include, *inter alia*, the development of guiding principles for States to facilitate inclusive MET service provisions on local, sub-regional, regional, multi-regional, and global levels. Therefore, the Work Stream agreed that a long-term strategy for follow-on Phases was needed, for which a sub-team will draft a white paper, and formulated the following Action:

WG-MISD/1/RHWAC Action 1/3: That an ad hoc team, led by Mr. D. Hart, will develop an 'Aviation MET Service Delivery' white paper, detailing a holistic approach for the future provision of MET services for 30 November 2015 (Wellington, NZ).

- 3.3.4 Discussion surrounding the development of the RHWAC ConOps (WG-MISD/1 WP02) led to follow-on dialogue concerning the TAC or digital format of the advisory. There is currently no requirement for the advisory product to be included in the suite of products to be made available in digital format (i.e., XML and IWXXM) in Annex 3 – *Meteorological Service for International Air Navigation*.

However, Work Stream members also expressed concern over introducing a new product in TAC format only. Work Stream members agreed to consult the Meteorological Information Exchange Working Group (WG-MIE).

The Work Stream noted that not all MWOs are capable of interpreting digital information, so a non-digital option will need to be part of any solution (at least in the near term). The work stream formulated the following Action:

WG-MISD/1/RHWAC Action 1/4: That the RHWAC Work Stream Coordinator will request that WG-MIE support the provision of a regional advisory in XML (i.e., IWXXM) format, recognizing some States may continue to require traditional alpha-numeric code (TAC) format.

- 3.3.5 The Work Stream discussed RHWAC selection criteria (WG-MISD/1 WP07).

Draft selection criteria were circulated ahead of the meeting, and comment solicited. The Work Stream agreed that comments will be addressed, and that Appendices will be merged, formulating the following Action:

WG-MISD/1/RHWAC Action 1/5: That a sub-team (O'Rourke, Ryuzaki, Lau Sum Yee) will consolidate the different versions of the Guidance Document into a revised draft for Work Stream Members' consideration.

3.4 List of Decisions from the WG-MISD/1 RHWAC Work Stream Meeting

- 3.4.1 The Work Stream discussed the potential risk in beginning work on Phase 1 without a well-developed, long-term strategy for Phase 2. The group agreed that work can begin on Phase 1, provided a parallel effort begins examining the long-term approach.

The Work Stream formulated the following Decision:

WG-MISD/1/RHWAC Decision 1/1: That the RHWAC Work Stream will focus on completing Phase 1, with the main objective of mitigating deficiency in the provision of SIGMETs. The Work Stream will deliver an enabling provision for Amendment 78 to Annex 3 on the regionalization of phenomena-based information, to improve the provision of SIGMETs, possibly on a voluntary basis in the initial stage.

- 3.4.2 The Work Stream discussed method for ensuring that any work completed in Phase 1 does not hinder later work in Phases 2 and 3. The group acknowledged that work in Phase 2 must begin before Phase 1 is completed, but noted the importance of aligning the outcomes of different Phases.

The Work Stream agreed to consult the Meteorological Requirements and Integration Working Group (WG-MRI), and to request a paper describing future concept(s) for regional hazardous weather advisory information in the System Wide Information Management (SWIM) environment for use with Trajectory Based Operations (TBO).

The Work Stream formulated the following Decision:

WG-MISD/1/RHWAC Decision 1/2: That the RHWAC Work Stream will develop Phase 2 and Phase 3 of regional hazardous weather advisory service definition, taking into account the expected outcome of Phase 1, and any input from WG-MRI regarding the future of MET information provision, in order to ensure a smooth transition between phases.

- 3.4.3 The Work Stream also discussed whether to incorporate potential trial(s).

One suggestion was to initiate an operational trial that would transition into formal operations. Some Work Stream members indicated that the 2011 trial had already proved the concept of regional SIGMET advisories, and that no further trials are necessary. The need for a trial in connection with the voluntary provision of RHWAC service in the initial stage (See 3.4.1) will be reassessed after the ConOps is completed.

3.5 Additional Results of WG-MISD/RHWAC Deliberations (provide by the Work Stream Coordinator)

Discussion Point	Preference
Should RHWAC address single or multi-hazard?	Multi-Hazard.
Should sandstorm (SS) be included?	No.
Is there a need for an advisory in IWXXM format to MWOs, in the initial stage?	Yes, request support from WG-MIE working group, noting that the development of schema may not be completed in time to support the initial stage. (Note: Some States may continue to require TAC format.)
Should objective verification be included?	Yes.

4.0 WG-MISD/1 RELEASE OF RADIOLOGICAL MATERIAL (RRM) WORK STREAM SUMMARY AND ACTIONS

4.1 Introductory Information

The WG-MISD Release of Radioactive Material (RRM) Work Stream met on Tuesday, 17 November 2015, in Washington, DC.

Following brief introductions, the role of the RRM Work Stream in supporting the WG-MISD Rapporteur's recommendations to the Meteorology Panel (METP) was reaffirmed.

Members and other attendees were informed on a number of topics relating to the RRM Work Stream work plan, as briefed during previous Work Stream teleconferences (1 July 2015 and 25 September 2015).

A primary expected outcome for the meeting was agreement on a schedule for completion of the ConOps (including necessary steps), such that the process of finalizing the performance requirements for this service can be completed.

The meeting followed a format, whereby agenda items were largely driven by topics raised through information papers (IPs). Topics for discussion included recent progress on the ConOps and the development of preliminary performance requirements.

Discussion was led by the Work Stream Coordinator, Dirk Engelbart of the German Ministry of Transport and Digital Infrastructure.

NOTE: Referenced papers are available on the ICAO METP secure website.

4.2 List of Attendees

Steve Albersheim, Dorothea Banse, Michael Berechree, Larry Burch, Stephanie Desbios, Dirk Engelbart, Nigel Gait, Brian Grechuk, Dennis Hart, Thomas Helms, Richard Heuwinkel, Colin Hord, Phillippe Husson, Yohko Igarashi, Dimitar Ivanov, Anna Ivanova, Thomas Kiley, Sharon Lau Sum Yee, Keith Mackersy, Yuliya Naryshkina, Larisa Nikitina, Sue O'Rourke, Mario Ouellet, Melissa Peterson, Graham Rennie, Raul Romero, Bob Rutledge, Jun Ryuzaki, CM Shun, Klaus Sievers, Thomas Steinkopff, Matt Strahan, Barbara Stunder, Zhongfeng Zhang

NOTE: Work Stream Member affiliations are available in Appendix A, to this report.

4.3 List of Actions from the WG-MISD/1 RRM Work Stream Meeting

- 4.3.1 The Work Stream was informed of progress on the RRM ConOps via information in WG-MISD/1 IP15, IP16, IP19 and IP20. The group addressed outstanding issues related to the ConOps, and provided input on necessary

changes. A path forward for the ConOps was agreed-upon by the Work Stream, which formulated into the following Action:

WG-MISD/1/RRM Action 1/1: That the Work Stream Coordinator will revise version 0.9 of the ConOps to include comments from Work Stream members, by December 2015.

4.3.2 In addition to including comments from this meeting, Work Stream members will have an opportunity to comment on the updated ConOps when it is disseminated via the commenting tool. A path forward for the ConOps was formulated into the following Action:

WG-MISD/1/RRM Action 1/2: That the Work Stream Coordinator will proceed with the update to the RRM ConOps, through the following steps:

- 1. Disseminate new draft of the ConOps via the commenting tool by end of December 2015**
- 2. Record and adjudicate comments on the ConOps from Work Stream Members by 22 January 2016**
- 3. Update and revise ConOps, based on input from Work Stream members before the next WebEx Telcon. A timeline/schedule will be included in this draft by end of February 2016**

4.3.3 The Work Stream noted that the Urgent Protective Action Planning Zone (UPZ) has a radius of 15 km to 30 km, as recommended by IAEA requirements, and is the default. The feasibility of creating a ‘zero-tolerance’ model in which any airspace contaminated by radiation is closed was discussed. However, this zero-tolerance model was previously used in Volcanic Ash and proved unsustainable due to large areas of airspace being closed for long time periods. The decision on the dimensions of the warned airspace will require input from IAEA.

Uncertainty related to the location of radiation source(s) leads to an inability to model downstream location and concentration of radioactive material. Input from RSMCs will help determine how to substitute for source term in dispersion models.

Discussion turned to determining an acceptable amount of radiation. Input from outside sources will be necessary; particularly from IAEA and RSMCs.

There is also uncertainty regarding who will provide radiation-related advisories/SIGMETs—regional centres or MWOs.

The work stream formulated the following Actions:

WG-MISD/1/RRM Action 1/3: That Mr. Klaus Sievers will solicit input from IAEA regarding advisory dimensions, specifically a 16 vs. 60 nautical mile (30 km to 112 km) radius, and whether the radius needs to change with height.

WG-MISD/1/RRM Action 1/4: That the Work Stream will solicit input from RSMCs to assist in identifying which information

should be used to initialize dispersion modelling in the absence of a source term.

WG-MISD/1/RRM Action 1/5: That the Work Stream will solicit input from RSMCs to assist in identifying threshold levels that may be acceptable to aircrew and passengers, as well as aircraft systems.

- 4.3.4 The Work Stream discussed the ramifications of not receiving guidance from IAEA in a timely manner. The group acknowledged that it may be unable to wait for IAEA to draft the necessary information, and formulated the following Action:

WG-MISD/1/RRM Action 1/6: That the Work Stream will develop draft documentation* addressing the following, and make it available to European members of the WG-MISD for use in European Crisis Control Center (EACCC) Planning:

- 1. Develop contamination charts that reflect 3D contamination**
- 2. Develop guidance on the radioactive cloud SIGMET**
- 3. Develop context for the use of the products**

**Note: This will not be an approved METP document.*

- 4.3.5 In subsequent discussions amongst the Management Group on 20-21 November 2015, to explain the elements of Action 1/6 above, the following clarifying language was agreed to:

To support the European activities to overcome the identified shortcoming, the METP/WG-MISD concluded that the prepared 'Nuclear ConOps' and 'initial guidance' will be made available to European Members of the MET Panel for use in a European Aviation Crisis Coordination Cell (EACCC) context at the same moment in time as it will be made available to the MET Panel for final approval (October 2016). It should however be noted that this draft material still requires the approval of the MET Panel, ANC and other ICAO bodies before they can be considered formal ICAO provisions.

Of specific interest to the EACCC will be the elements of the draft provisions that:

1. Develop contamination charts and request the WMO ET-ERA to facilitate a pilot project on the provision 3D contamination and provide a report to the ICAO MET-P;
2. Provide guidance on Nuclear SIGMET, and;
3. Develop context for use by operational decision makers of the Contamination Charts and Nuclear SIGMETs including preliminary considerations on applicable thresholds for contamination (and potentially dosages). Note completion of thresholds and dosage information by October 2016 is dependent upon substantial and timely input, ideally from the IAEA.

5.0 WG-MISD/1 SPACE WEATHER INFORMATION (SPACE) WORK STREAM SUMMARY AND ACTIONS

5.1 Introductory Information

The WG-MISD Space Weather Information Work Stream convened on Wednesday, 18 November 2015, in Washington, DC.

Members and other attendees were informed on a number of topics relating to the Space Weather work stream work plan, as briefed during the previous Work Stream teleconferences (30 September 2015 and 5 November 2015).

Following brief introductions, the role of the Space Weather Work Stream in supporting the WG-MISD Rapporteur's recommendations to the Meteorology Panel (METP) was reaffirmed.

The meeting followed a format whereby the agenda items were driven by topics addressed in working papers (WPs) and information papers (IPs). Much of the discussion was related to the content of the final version of the Space Weather Concept of Operations (ConOps) document.

Discussion was led by the Work Stream Coordinator, Steven Albersheim of the Federal Aviation Administration's (FAA) Aviation Weather Division.

Note: Referenced papers are available on the ICAO METP secure website.

5.2 List of Attendees

Steve Albersheim, Dorothea Banse, Michael Berechree, Larry Burch, Vyacheslav Burov, Stephanie Desbios, Dirk Engelbart, Nigel Gait, Brian Grechuk, Dennis Hart, Thomas Helms, Richard Heuwinkel, Colin Hord, Phillippe Husson, Yohko Igarashi, Dimitar Ivanov, Anna Ivanova, Thomas Kiley, Sharon Lau Sum Yee, Keith Mackersy, Yuliya Naryshkina, Larisa Nikitina, Sue O'Rourke, Mario Ouellet, Melissa Peterson, Graham Rennie, Raul Romero, Bob Rutledge, Jun Ryuzaki, CM Shun, Klaus Sievers, Thomas Steinkopff, Matt Strahan, Larisa Trichtchenko, Zhongfeng Zhang

NOTE: Work Stream Member affiliations are available in Appendix A, to this report.

5.3 List of Actions from the WG-MISD/1 – Space Weather Work Stream Meeting

- 5.3.1 The meeting reviewed MISD/1 WP04, regarding the initial disposition of the comments received on version 3.0 of the *Concept of Operations for Space Weather Information in Support of International Air Navigation*. The resolution of several specific issues with the ConOps document will be accomplished the presentation of Information Papers. The Work Stream agreed that the ConOps needs to be revised to support the subsequent development of provisions for space weather information based on functional and performance requirements, and formulated the following action:

WG-MISD/1/SPACE Action 5/1: That the Work Stream Coordinator, in consultation with a small editorial team (to be selected), draft a revised version of the ConOps for review by the Work Stream no later than 1 February 2016.

- 5.3.2 The meeting reviewed WG-MISD/1 IP01, regarding the need to include a standard definition of space weather in the ConOps. Under the working arrangements between ICAO and the World Meteorological Organization (WMO), ICAO will strictly adhere to the WMO definition of space weather phenomena and the definition will be included in the Amendment to Annex 3 for the provision of space weather information. The Work Stream agreed that the ConOps must include the WMO definition of space weather phenomena and formulated the following decision:

WG-MISD/1/SPACE Decision 5/1: That the Work Stream Coordinator include in the final version of the Space Weather Concept of Operations (ConOps) a definition of space weather that is consistent with the WMO definition of space weather.

Note: A working definition of space weather phenomena that is more pertinent to the aviation user communities will be included in the Space Weather Manual that will be developed after the provisions for space weather information.

- 5.3.3 The meeting reviewed WG-MISD/1 IP02, which outlined the strengths and weaknesses of the United States National Oceanic and Atmospheric Administration (NOAA) Space Weather Scales (NOAA Scales). The Work Stream agreed that there is a need to review the appropriateness of the NOAA Space Weather Scales, as noted.

The following points were made during the discussion of WG-MISD/1 IP04:

The NOAA Scales provide an easy to use threshold and are utilized by many aviation decision-makers (e.g., airlines). However, not all space weather information providers forecast space weather events using the NOAA Scales due to the different characteristics of space weather events by geographic location (e.g., high latitude).

A forecast of radiation exposure cannot currently be provided based solely on the NOAA Scales. It might be possible to provide a better level of polar cap HF radio signal absorption if not constrained by the NOAA Scales. The Work Stream should not limit the ConOps to the NOAA Scales when it may be possible to provide better information. It may be better to focus on impact-based products and services.

The Work Stream agreed that while the NOAA Scales are widely used in aviation decisions, other scales are also used for forecasting space weather phenomena and, in some cases, may be of more utility than the NOAA Scales. The Work Stream further agreed that the process for developing functional and performance requirements should yield answers about the type of scales most need by aviation decision-makers, and formulated the following decision:

WG-MISD/1/SPACE Decision 5/2: That the Work Stream Coordinator will not include NOAA Space Weather Scales in the appendices of the final version of the Space Weather ConOps and ensure that the document includes the following:

- 1. A note that the NOAA Space Weather Scales are currently in widespread use; and,**

2. A general description of a science-based, aviation-specific space weather impact table(s).

- 5.3.4 The meeting was informed about the different aviation user groups affected by space weather events and the operational impacts on each group through WG-MISD/1 IP03.

During the discussion, it was noted that degradation of HF communications, GPS signal degradation, and radiation exposure of crew and passengers likely constitute a significant majority of the impacts of space weather events on aviation operations. In addition, currently there is some skill in forecasting the impacts in those areas. The NOAA Scales are good for forecasting the degradation of HF communications but fall short in forecasting the other two items.

The Work Stream agreed that the majority of the impacts of space weather events on aviation operations are in the areas of communications, navigation, and general radiation environment, and formulated the following action:

WG-MISD/1/SPACE Action 5/2: By March 2016, a sub-team (to be selected) will review and refine the draft functional and performance requirements and align the requirements with the following areas of impact identified by the meeting:

- 1. Communications (HF)**
- 2. Navigation (GNSS)**
- 3. General Radiation Environment (aircraft systems, aircrew, and passengers)**

The meeting noted that the only stated requirement for space weather information is from IATA in a letter dated November 2011. The only coordination with other ICAO panels is with the Navigation System Panel. The Performance Based Navigation (PBN) Panel, which is responsible for GNSS, has yet to state a requirement for space weather information.

The meeting further noted that in the report of the 12th Air Navigation Conference (AN-Conf/12-WP/162) it was agreed that the provision of space weather information should be included in Block 1 of the ASBU for meteorological information. The Work Stream agreed that the impact of space weather events is cross-cutting in nature and formulated the following action:

WG-MISD/1/SPACE Action 5/3: The Chair of the METP will correspond with relevant ICAO panels regarding the development of provisions for space weather information and services.

- 5.3.5 The meeting was informed about Equatorial Plasma Bubbles (EPBs) through WG-MISD/1 IP09, a solar radiation phenomenon that is not dependent on short-term solar activity (e.g., solar flares) but can impact aviation operations.

The Work Stream noted that EPBs are an example of a space weather phenomenon that can impact communications and navigation systems but is not addressed by the NOAA Space Weather Scales. The Work Stream agreed that, for both operators and regulators, it is likely more important to know the

impact of EPBs rather than observing or forecasting EPBs, and formulated the following decision:

WG-MISD/1/SPACE Decision 5/3: The Space Weather Work Stream Coordinator will consider how best to address the impacts of EPBs on aviation operations are addressed in the ConOps.

- 5.3.6 The meeting reviewed WG-MISD/1 IP11 outlining the reasons that sub-orbital flight should not be included in the scope of the final version of the Space Weather ConOps. The IP noted that a sub-orbital flight is defined as a space flight that reaches an altitude of 62 statute miles (100 km) above sea level without completing one orbital revolution of the Earth. The IP further noted that the altitudes of sub-orbital flights are considerably higher than typical international flights conducted by airline operators. In addition, none of Aviation User Needs Statements, functional requirements, or performance requirements in version 3.0 of the ConOps directly address sub-orbital flights.

Therefore, the Work Stream agreed that sub-orbital flight should be outside the scope of the ConOps and formulated the following decision:

WG-MISD/1/SPACE Decision 5/4: The Space Weather Work Stream Coordinator will ensure that sub-orbital flight is acknowledged in the final version of the ConOps but is specifically defined as being out of scope for the ConOps.

- 5.3.7 The meeting discussed WG-MISD/1 IP13 regarding comments received on version 3.0 of the ConOps pertaining to the approach in describing existing global space weather information capabilities and services.

It was noted that any references to State capabilities in ICAO manuals or guidance documents should only be include in an appendix. As a result, the Work Stream agreed that, to the greatest extent possible, the ConOps should not include references to specific State space weather information capabilities, and formulated the following decision:

WG-MISD/1/SPACE Decision 5/5: The Space Weather Work Stream Coordinator will include in the final version of the ConOps document generalized descriptions of space weather information, services, and capabilities, to the greatest extent possible.

- 5.3.8 The meeting reviewed WG-MISD/1 IP14 describing the reasons that degradation of VHF communications need not be included in the final version of the ConOps document. The Work Stream agreed that the low level of awareness of space weather induced VHF interference within the space weather community indicated that it is not a significant issue for aviation operations, and formulated the following decision:

WG-MISD/1/SPACE Decision 5/6: The Space Weather Work Stream Coordinator include in the final version of the ConOps a note indicating that, while the impact of space weather events on HF communications is of greatest concern, it is understood that

space weather events can interfere with UHF and VHF communications.

- 5.3.9 The meeting reviewed WG-MISD/1 WP11 which formally introduced to the meeting the functional and performance requirements for space weather information included in Appendix C of version 3.0 of the ConOps. The Work Stream will mature these requirements to support development of the provisions for space weather information for inclusion in Amendment 78 of Annex 3.

The Work Stream agreed that the functional and performance requirements included in Appendix C of version 3.0 of the ConOps need to be reviewed and revised to reflect both an emphasis on impact-based performance requirements and the information that can be provided by space weather centres with some skill. The Work Stream further agreed that an effort needs to be undertaken by subject matter experts to harmonize the scales used to forecast the impacts of space weather events, and formulated the following action:

WG-MISD/1/SPACE Action 5/4: The Space Weather Work Stream Coordinator, the METP Chair, and the ICAO Secretariat, will engage the appropriate WMO expert group (i.e., ICTSW or its successor) to validate the suitability of the NOAA Space Weather Scales to meet the proposed Space Weather SARPs by November 2017 (for inclusion in the Space Weather Manual).

6.0 WG-MISD/1 VOLCANIC ASH INFORMATION (VA) WORK STREAM SUMMARY AND ACTIONS

6.1 Introductory Information

The WG-MISD Volcanic Ash Information (VA) Work Stream convened on Thursday, 19 November 2015 in Washington, D.C.

Following brief introductions, the role of the VA Work Stream in supporting the WG-MISD Rapporteur's recommendations to the Meteorology Panel (METP) was reaffirmed.

Members and other attendees were informed on a number of topics relating to the VA Work Stream work plan, as briefed during previous Work Stream teleconferences (27 July 2015 and 29 October 2015).

The meeting followed a format, whereby agenda items were largely driven by topics raised through working papers and information papers.

Discussion was led by the Work Stream Coordinator, Steven Albersheim of the Federal Aviation Administration's (FAA) Aviation Weather Division.

NOTE: Referenced papers are available on the ICAO METP secure website.

6.2 List of Attendees

Steve Albersheim, Dorothea Banse, Larry Burch, Dirk Engelbart, John Fisher, Nigel Gait, Phillippe Husson, Yohko Igarashi, Dimitar Ivanov, Jaime Kibler, Thomas Kiley, Peter

Lechner, Sue O'Rourke, Mario Ouellet, Graham Rennie, Raul Romero, Bob Rutledge, Dave Schneider, Klaus Sievers, Zhongfeng Zhang

NOTE: Work Stream Member affiliations are available in Appendix A, to this report.

6.3 List of Actions from the WG-MISD/1 VA Work Stream Meeting

- 6.3.1 Work Stream members were informed (WG-MISD/1 WP09) of a new job card relating to sulphuric dioxide (SO₂), assigned to the WG-MISD after the METP Meeting in April 2015.

The job card was reviewed by members for both accuracy and scope.

As written, the job card calls for assessing impact(s) to human health not only for SO₂, but also for 'other hazardous volcanic gases.' The Work Stream agreed to amend the job card to ensure the focus is on SO₂, and formulated the following Action:

WG-MISD/1/VA Action 1/1: That an ad hoc team, led by the VA Work Stream Coordinator, will prepare draft language in the SO₂ Job Card to focus the priority on SO₂, but retain the eventual need for 'other hazardous volcanic gases,' thereby limiting the scope of the job card, for approval by the METP.

- 6.3.2 The Work Stream agreed that a separate work plan for SO₂ would be needed, and tasked the VA Work Stream Coordinator to lead an effort to produce a draft plan, and formulated the following Action:

WG-MISD/1/VA Action 1/2: That a sub-team (Albersheim, Fisher, Rennie, Sievers), led by the VA Work Stream Coordinator, will:

1. Identify the ICAO Panels relevant to the SO₂ issue, (Aviation Medicine, Flight Operations, Airworthiness, Meteorology, Air Traffic Management Requirements Performance, Information Management, etc.),
2. Draft a work plan detailing an approach in assessing the need for, and potential provision of, SO₂ information, and provide a synopsis of existing SO₂ science,
3. In time for delivery of (b) by end of January 2016.

Sample Framework: SO₂ gas from a volcano that pose a risk to aircraft occupants

Activity	Predecessor Activity	Due Date	Status
ConOps Include hazardous volcanic SO ₂ gas in the VA ConOps	None		
Coordination a. Identify other ICAO Panels relevant to the SO ₂ issue b. Collect information from relevant ICAO Panels			
Requirements a. Develop functional requirements for the information services	Obtain known hazardous thresholds for		

b. Develop performance requirements for the information	aircraft occupants		
Amendment Proposal(s) Prepare proposals for Amd 7x Annex 3, other related Annexes, and/or guidance documents			
Service Provision Deliver a recommended solution to the METP			

6.3.3 Work Stream members indicated a strong desire to consult appropriate expertise in drafting (and carrying-out) the work plan. It was agreed that the focus should be on meteorological aspects of addressing SO₂, with other domains (human health, aircraft certification, impact to equipment, etc.) left to other appropriate ICAO and World Meteorological Organization (WMO) subject-matter experts.

An information paper (WG-MISD/1 IP08) was presented demonstrating the unique capabilities of Himawari-8, particularly as they relate to the sensing of SO₂. It was noted by the Work Stream that, in some ways, the detection of SO₂ is easier than volcanic ash, and that exposure thresholds/dosages would pose a larger challenge, in addressing the job card.

Two additional information papers (WG-MISD/1 IP08 & IP12) presented VA and SO₂ considerations from a pilot's perspective, including a brief demonstration of the difficulties in identifying VA and SO₂ clouds from the cockpit (via sight and smell, respectively). The papers included a number of specific recommendations for addressing VA and SO₂, on behalf of the International Federation of Air Line Pilots Associations (IFALPA), as well as pointing out that pilots may not be able to observe and report ash due to various atmospheric conditions.

During follow-up conversation, it was suggested that the human health aspects of addressing SO₂ are likely the most sensitive (i.e., a constraining factor), and that this is the most appropriate place to start (versus impact to airframe or aircraft systems).

Additional information informed the discussion (WG-MISD/1 IP18), including recent VA-related proceedings convened under the auspices of WMO. Synopses and related outcomes from several of those meetings were included:

- WMO Volcanic Ash Advisory Centre (VAAC) 'Best Practice' Workshop 2015. 5 to 8 May, 2015. UK Met Office, Exeter, UK.
- International Workshop on Volcanic Ash (IWVA/7). 19 to 23 October, 2015. Anchorage, Alaska, USA.
- Meeting of the WMO/IUGG Volcanic Ash Scientific Advisory Group (VASAG/6). 23 to 24 October, 2015. Anchorage, Alaska, USA.

As a result of the above papers and related dialogue, the Work Stream formulated the following Actions:

WG-MISD/1/VA Action 1/3: That an ad hoc team, led by the VA Work Stream Coordinator, will poll appropriate subject matter experts on the current state of the science in their respective areas of expertise.

WG-MISD/1/VA Action 1/4: That an ad hoc team, led by the VA Work Stream Coordinator, will invite input from WMO (including the VASAG), the International Union of Geodesy and Geophysics (IUGG), and aircraft manufacturers on scientific issues related to SO₂.

- 6.3.4 Work Stream members were then informed of progress on updates to the *Roadmap for International Airways Volcano Watch (IAVW) in Support of International Air Navigation (IAVW Roadmap)* (WG-MISD/1 WP06) and draft *Concept of Operations for Volcanic Hazard Information for International Air Navigation in Support of the Global Air Navigation Plan and the Aviation System Block Upgrades (VA ConOps, v1.1)* (WG-MISD/1 WP05).

The Work Stream was briefed that the VA ConOps only addresses Blocks 1 and 2 timeframes of the Aviation System Block Upgrades (ASBUs), while the VA Roadmap encompasses all ASBU Blocks (i.e., 0 through 3). It was noted that subsequent review of these documents by the Work Stream will be facilitated via online comment and adjudication mechanisms.

The Work Stream formulated the following Actions:

WG-MISD/1/VA Action 1/5: That the VA Work Stream Coordinator will distribute an updated version of the VA ConOps for comment and feedback by the entire Work Stream, and provide a comment sheet for comments (comments to be received by 15 January 2016).

WG-MISD/1/VA Action 1/6: That the VA Work Stream Coordinator will distribute updated version of the VA Roadmap for comment and feedback by the entire Work Stream, and provide a comment sheet for comments (comments to be received by 15 January 2016).

NOTE: The Work Stream Coordinator will consider changes proposed by K. Sievers in WG-MISD/1 WP08.

- 6.3.5 A working paper (WG-MISD/1 WP08) was presented, addressing inconsistencies in the application of volcano color codes, and the resulting impact on airline operations. The Work Stream acknowledged the inconsistencies and noted that volcano observatories set the color codes and not the VAACs. The group acknowledged the complexity of the problem and agreed the topic warranted additional discussion.

The Work Stream formulated the following Action:

WG-MISD/1/VA Action 1/7: That a sub-team (Albersheim, Schneider, Rennie, Sievers), led by the VA Work Stream

Coordinator, will provide additional papers regarding volcano color codes, for consideration.

- 6.3.6 Similarly, an information paper (WG-MISD/1 IP05) was presented, addressing the need for quantitative volcanic ash modelling. The Work Stream again acknowledged the value of (and need for) this type of information, and suggested it be included in the next update to the IAVW Roadmap by formulating the following Action:

WG-MISD/1/VA Action 1/8: That the VA Work Stream Coordinator will consider the content of WG-MISD/1 IP05 (Quantitative Ash Measurement) in the update to the VA Roadmap.

- 6.3.7 Additional referred actions (not directly attributable to the VA Work Stream) were also captured. They are listed as referred actions below, so as not to be lost. These actions are not for the WG-MISD VA Work Stream itself, but for individuals to follow-up.

Referred Action 1: ‘No Ash.’ G. Rennie.

Mr. Rennie will invite a corresponding WG-MOG advisor(s) to present the ‘No Ash’ proposal (WG-MISD/1 IP10) at the next WG-MOG, for consideration.

NOTE: Reference Conclusion 7/29, IAVWOPSG/7 report.

Referred Action 2: ‘Re-suspended Ash’ (proposed changes to Annex 3). Y. Igarashi.

Ms. Igarashi will invite a corresponding WG-MOG advisor(s) to present the ‘Re-suspended Ash’ proposal (WG-MISD/1 IP07) at the next WG-MOG, for consideration.

NOTE: Ensure a draft revision of the SIGMET template is part of the proposal passed to WG-MOG.

Referred Action 3: ‘Review of VA Information Service Delivery Model.’ S. Albersheim, for G. Rennie.

A review of the VA information service delivery model of the IAVW was proposed (WG-MISD/1 IP06), to ensure optimum provision of services (to include consistency, seamlessness of VA products, etc.). Mr. Albersheim will ensure the proposal is passed to the appropriate MET-P WG, as discussion on this topic progresses.

The meeting concluded with a review of action items.

Note from the ICAO Secretariat: All future papers for METP Working Group or Work Stream meetings (henceforth to be referred to as ‘Study Notes,’ per the METP Management Group, 21 November 2015) should respect the same 30-day minimum for posting to the ICAO website typically reserved for WPs and IPs. This is to allow sufficient time for review by members, advisors, and States.

- END -

APPENDIX A

Listing of meeting attendees for WG-MISD/1 Regional Hazardous Warning Advisory Center Work Stream Meeting (16 November)

NAME	STATE AFFILIATION	ORGANIZATIONAL AFFILIATION
Albersheim, Steve	United States	FAA, Aviation Weather Division
Banse, Dorothea	Germany	Deutscher Wetterdienst (DWD)
Berechree, Michael	Australia	Australian Bureau of Meteorology, Weather & Ocean Services Branch
Burch, Larry	United States	FAA (CTR), Aviation Weather Division
Burov, Vyacheslav	Russian Federation	Institute of Applied Geophysics of Russian Federation, Analytical Department
Desbios, Stephanie	France	Météo-France, Meteorological Services for Aviation, Toulouse
Engelbart, Dirk	Germany	German Ministry of Transport and Digital Infrastructure, Meteorological Services
Gait, Nigel	United Kingdom	UK Met Office, International Aviation
Grechuk, Brian	Canada	NAV CANADA, Aviation Weather Services
Hart, Dennis	EUROCONTROL	EUROCONTROL
Helms, Jr., Tom	United States	FAA (CTR), Aviation Weather Division
Heuwinkel, Rick	United States	FAA, Aviation Weather Division
Hord, Colin	United Kingdom	UK Civil Aviation Authority
Husson, Phillipe	France	Météo-France, MET Services for Aviation - Volcanic Ash Advisory Centre (VAAC) Toulouse
Igarashi, Yohko	Japan	JMA, Volcanic Ash Advisory Center (VAAC) Tokyo
Ivanov, Dimitar	WMO	WMO
Ivanova, Anna	Russian Federation	FSBE "Hydrometeorology Research Centre of Russia," Aeronautical MET Department
Kiley, Tom	United States	FAA (CTR), Aviation Weather Division
Lau Sum Yee, Sharon	China (Hong Kong, China)	Hong Kong Observatory, Aviation Weather Services Branch
Mackersy, Keith	New Zealand	Civil Aviation Authority of New Zealand
Naryshkina, Yuliya	Russian Federation	FSBE "Aviamettelecom of Roshydromet," ATM MET Service Department
Nikitina, Larisa	Russian Federation	FSBE "Aviamettelecom of Roshydromet," ATM MET Service Department
Ouellet, Mario	Canada	Environment Canada, Aviation and Defence Services
O'Rourk, Sue	Australia	Australian Bureau of Meteorology, Meteorological Authority
Peterson, Melissa	United States	FAA (CTR), Aviation Weather Division
Rennie, Graham	IATA	IATA
Romero, Raul	ICAO	ICAO
Rutledge, Bob	United States	NWS, Space Weather Prediction Center
Ryuzaki, Jun	Japan	JMA, Administration Division, Forecast Department
Shun, CM	China (Hong Kong, China)	Hong Kong Observatory
Steinkopff, Thomas	Germany	Deutscher Wetterdienst (DWD)
Strahan, Matt	United States	NWS, Aviation Weather Center
Zhangh, Zhongfeng	China	Civil Aviation Administration of China, ATM Bureau, Aviation Meteorological Center

Listing of meeting attendees for WG-MISD/1 Release of Radiological Material Work Stream Meeting (17 November)

NAME	STATE AFFILIATION	ORGANIZATIONAL AFFILIATION
Albersheim, Steve	United States	FAA, Aviation Weather Division
Banse, Dorothea	Germany	Deutscher Wetterdienst (DWD)
Berechree, Michael	Australia	Australian Bureau of Meteorology, Weather & Ocean Services Branch
Burch, Larry	United States	FAA (CTR), Aviation Weather Division
Desbios, Stephanie	France	Météo-France, Meteorological Services for Aviation, Toulouse
Engelbart, Dirk	Germany	German Ministry of Transport and Digital Infrastructure, Meteorological Services
Gait, Nigel	United Kingdom	UK Met Office, International Aviation
Grechuk, Brian	Canada	NAV CANADA, Aviation Weather Services
Hart, Dennis	EUROCONTROL	EUROCONTROL
Helms, Jr., Tom	United States	FAA (CTR), Aviation Weather Division
Heuwinkel, Rick	United States	FAA, Aviation Weather Division
Hord, Colin	United Kingdom	UK Civil Aviation Authority
Husson, Phillipe	France	Météo-France, MET Services for Aviation - Volcanic Ash Advisory Centre (VAAC) Toulouse
Igarashi, Yohko	Japan	JMA, Volcanic Ash Advisory Center (VAAC) Tokyo
Ivanov, Dimitar	WMO	WMO
Ivanova, Anna	Russian Federation	FSBE "Hydrometeorology Research Centre of Russia," Aeronautical MET Department
Kiley, Tom	United States	FAA (CTR), Aviation Weather Division
Lau Sum Yee, Sharon	China (Hong Kong, China)	Hong Kong Observatory, Aviation Weather Services Branch
Mackersy, Keith	New Zealand	Civil Aviation Authority of New Zealand
Naryshkina, Yuliya	Russian Federation	FSBE "Aviamettelecom of Roshydromet," ATM MET Service Department
Nikitina, Larisa	Russian Federation	FSBE "Aviamettelecom of Roshydromet," ATM MET Service Department
Ouellet, Mario	Canada	Environment Canada, Aviation and Defence Services
O'Rourke, Sue	Australia	Australian Bureau of Meteorology, Meteorological Authority
Peterson, Melissa	United States	FAA (CTR), Aviation Weather Division
Rennie, Graham	IATA	IATA
Romero, Raul	ICAO	ICAO
Rutledge, Bob	United States	NWS, Space Weather Prediction Center
Ryuzaki, Jun	Japan	JMA, Administration Division, Forecast Department
Shun, CM	China (Hong Kong, China)	Hong Kong Observatory
Sievers, Klaus	IATA	IATA
Steinkopff, Thomas	Germany	Deutscher Wetterdienst (DWD)
Strahan, Matt	United States	NWS, Aviation Weather Center
Stunder, Barbara	United States	NWS, Air Resources Laboratory
Zhangh, Zhongfeng	China	Civil Aviation Administration of China, ATM Bureau, Aviation Meteorological Center

Listing of meeting attendees for WG-MISD/1 Space Weather Information Work Stream Meeting (18 November)

NAME	STATE AFFILIATION	ORGANIZATIONAL AFFILIATION
Albersheim, Steve	United States	FAA, Aviation Weather Division
Banse, Dorothea	Germany	Deutscher Wetterdienst (DWD)
Berechree, Michael	Australia	Australian Bureau of Meteorology, Weather & Ocean Services Branch
Burch, Larry	United States	FAA (CTR), Aviation Weather Division
Burov, Vyacheslav	Russian Federation	Institute of Applied Geophysics of Russian Federation, Analytical Department
Desbios, Stephanie	France	Météo-France, Meteorological Services for Aviation, Toulouse
Engelbart, Dirk	Germany	German Ministry of Transport and Digital Infrastructure, Meteorological Services
Gait, Nigel	United Kingdom	UK Met Office, International Aviation
Grechuk, Brian	Canada	NAV CANADA, Aviation Weather Services
Hart, Dennis	EUROCONTROL	EUROCONTROL
Helms, Tom	United States	FAA (CTR), Aviation Weather Division
Heuwinkel, Rick	United States	FAA, Aviation Weather Division
Hord, Colin	United Kingdom	UK Civil Aviation Authority
Husson, Phillipe	France	Météo-France, MET Services for Aviation - Volcanic Ash Advisory Centre (VAAC) Toulouse
Igarashi, Yohko	Japan	JMA, Volcanic Ash Advisory Center (VAAC) Tokyo
Iishi, Mamoru	Japan	NICT, Space Weather and Environment Informatics Laboratory
Ivanov, Dimitar	WMO	WMO
Ivanova, Anna	Russian Federation	FSBE "Hydrometeorology Research Centre of Russia," Aeronautical MET Department
Kiley, Tom	United States	FAA (CTR), Aviation Weather Division
Lau Sum Yee, Sharon	China (Hong Kong, China)	Hong Kong Observatory, Aviation Weather Services Branch
Mackersy, Keith	New Zealand	Civil Aviation Authority of New Zealand
Naryshkina, Yuliya	Russian Federation	FSBE "Aviamettelecom of Roshydromet," ATM MET Service Department
Nikitina, Larisa	Russian Federation	FSBE "Aviamettelecom of Roshydromet," ATM MET Service Department
Ouellet, Mario	Canada	Environment Canada, Aviation and Defence Services
O'Rourk, Sue	Australia	Australian Bureau of Meteorology, Meteorological Authority
Peterson, Melissa	United States	FAA (CTR), Aviation Weather Division
Rennie, Graham	IATA	IATA
Romero, Raul	ICAO	ICAO
Rutledge, Bob	United States	NWS, Space Weather Prediction Center
Ryuzaki, Jun	Japan	JMA, Administration Division, Forecast Department
Shun, CM	China (Hong Kong, China)	Hong Kong Observatory
Sievers, Klaus	IATA	IATA
Steinkopff, Thomas	Germany	Deutscher Wetterdienst (DWD)
Strahan, Matt	United States	NWS, Aviation Weather Center
Trichtchenko, Larisa	Canada	Natural Resources Canada, Space Weather Forecast Centre
Watanabe, Nobuhiro	Japan	NICT, North-America Center
Zhangh, Zhongfeng	China	Civil Aviation Administration of China, ATM Bureau, Aviation Meteorological Center

Listing of meeting attendees for WG-MISD Volcanic Ash Information Work Stream Meeting (19 November)

NAME	STATE AFFILIATION	ORGANIZATIONAL AFFILIATION
Albersheim, Steve	United States	FAA, Aviation Weather Division
Banse, Dorothea	Germany	Deutscher Wetterdienst (DWD)
Burch, Larry	United States	FAA (CTR), Aviation Weather Division
Engelbart, Dirk	Germany	German Ministry of Transport and Digital Infrastructure, Meteorological Services
Fisher, John	United States	FAA, Aircraft Certification Service
Gait, Nigel	United Kingdom	UK Met Office, International Aviation
Husson, Phillipe	France	Météo-France, MET Services for Aviation - Volcanic Ash Advisory Centre (VAAC) Toulouse
Igarashi, Yohko	Japan	JMA, Volcanic Ash Advisory Center (VAAC) Tokyo
Ivanov, Dimitar	WMO	WMO
Kibler, Jaime	United States	Volcanic Ash Advisory Center (VAAC) Washington
Kiley, Tom	United States	FAA (CTR), Aviation Weather Division
Lechner, Peter	New Zealand	Civil Aviation Authority of New Zealand
Ouellet, Mario	Canada	Environment Canada, Aviation and Defence Services
O'Rourk, Sue	Australia	Australian Bureau of Meteorology, Meteorological Authority
Rennie, Graham	IATA	IATA
Romero, Raul	ICAO	ICAO
Rutledge, Bob	United States	NWS, Space Weather Prediction Center
Schneider, Dave	United States	USGS, Alaska Volcano Observatory
Sievers, Klaus	IFALPA	IFALPA
Zhang, Zhongfeng	China	Civil Aviation Administration of China, ATM Bureau, Aviation Meteorological Center