

# Report of ICAO MET Panel WG-MISD Space Weather Work Stream

**Based on PPT from Tom Helms, Tom Kiley  
(on behalf of Steve Albersheim,  
Space Weather Work Stream Coordinator)**

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# Background

- Since several years ago, there have been activities in ICAO to use SWx information as a mandatory meteorological information for civil aviation.
- Amendment 77 of Annex 3 is discussed in ICAO/MET on 2014 but the approval was postponed.
- Before the meeting we could input our opinion through WMO/ICTSW, but after that the function (seems to be) disappeared and it is difficult to know what has been discussed in there.

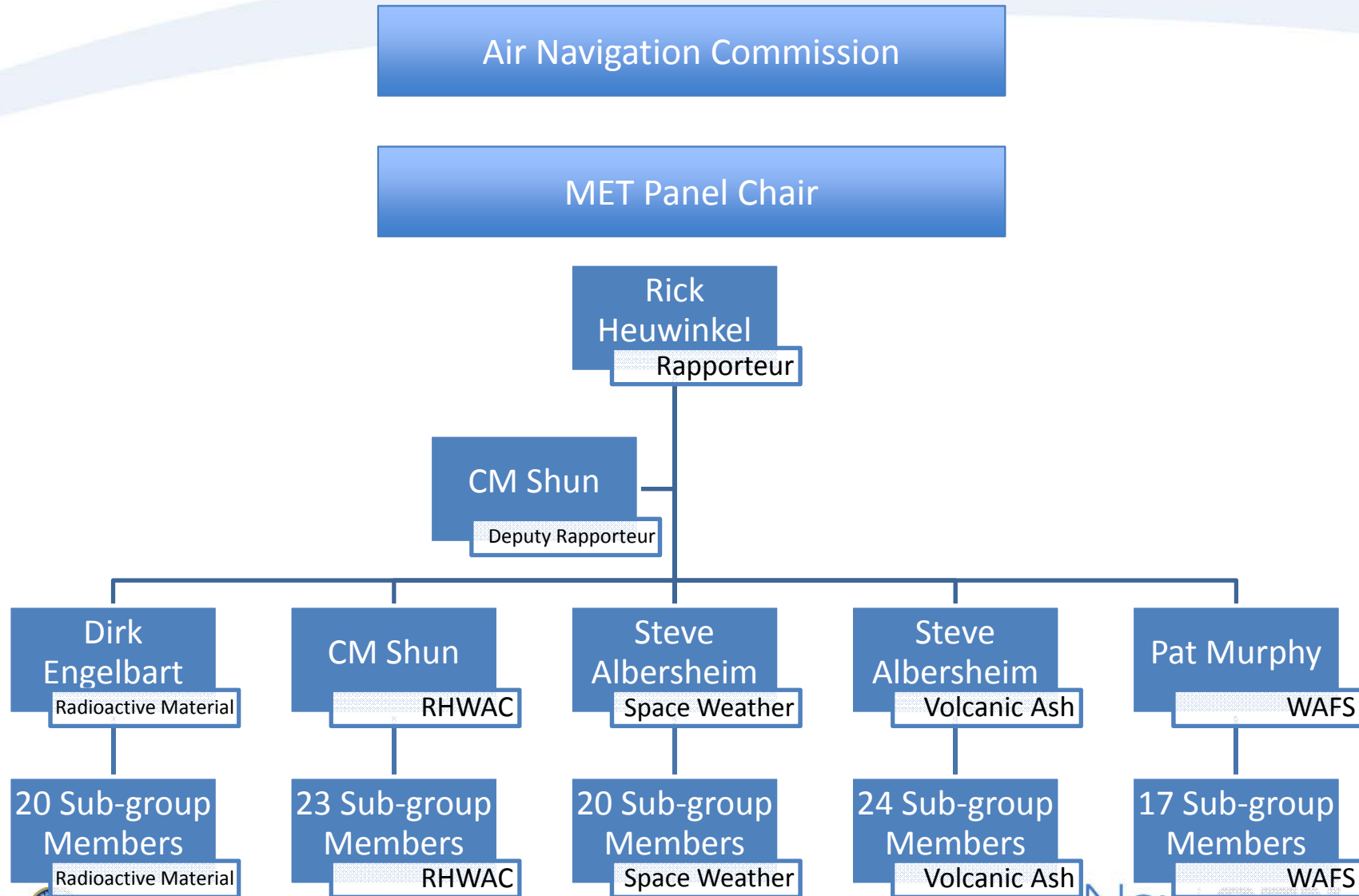
## Responsibilities of WG-MISD

- Identify, mature, and justify new requirements, in support of the Aviation System Block Upgrades, for: release of radioactive material information, regional hazardous weather advisory centers, space weather information, volcanic ash information, and the World Area Forecast System
- Coordinate with the World Meteorological Organization to mature the scientific capabilities in support of new requirements
- Develop Concepts of Operations, functional/performance requirements, Standards and Recommended Practices, guidance material, and, when appropriate, global/regional center selection criteria, necessary to satisfy validate user needs



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# WG-MISD Reporting Structure



Action: Please review the WG-MISD and sub-group membership spreadsheets and identify any errors or omissions and provide changes to Tom Helms.



# Review of WG-MISD Job Cards

Job Card	Title	Deliverable(s)
4	Further development of the International Airways Volcano Watch (IAVW)	<ul style="list-style-type: none"> <li>Proposals to update Annex 3 to meet current and evolving operational requirements in line with GANP and to integrate IAVW information into the SWIM</li> <li>Based on Annex 3 amendment, update plans as necessary</li> <li>Update related guidance material to support the implementation of Annex 3 Amendment</li> </ul>
7	Further development of provisions for information on the release of radioactive material into the atmosphere	<ul style="list-style-type: none"> <li>Proposals for inclusion in Amendment 78 to Annex 3 to meet operational requirements in line with the GANP and to integrate the information on the release of radioactive material into the atmosphere into SWIM</li> <li>Based on Annex 3 amendment, update plans as necessary</li> <li>Update related guidance material to support the implementation of Annex 3 Amendment</li> </ul>
8	Implementation of a regional advisory system for select en-route hazardous meteorological conditions	<ul style="list-style-type: none"> <li>Proposals for inclusion in Amendment 78 to Annex 3 to meet operational requirements in line with the GANP and to integrate the information on the provision of hazardous weather into the SWIM environment.</li> <li>Update related guidance material to support the implementation of Annex 3 Amendment</li> <li>Develop criteria necessary for ICAO regions to select advisory centers</li> <li>Based on Annex 3, update plans as necessary</li> </ul>
10	Development of provisions for information on space weather to international air navigation	<ul style="list-style-type: none"> <li>Initial proposals for inclusion in Amendment 78 to Annex 3 to meet operational requirements in line with the GANP and to integrate the space weather information into the SWIM</li> <li>Finalize the concept of operations and associated roadmap</li> <li>Based on Annex 3, update plans as necessary</li> <li>Initial related guidance material to support the implementation of Annex 3. New user Manual</li> </ul>
11	Further development of the World Area Forecast System (WAFS)	<ul style="list-style-type: none"> <li>Proposals for inclusion in Amendment 78 to Annex 3 to meet operational requirements in line with the GANP and to integrate WAFS information into the SWIM environment.</li> <li>Based on Annex 3, update plans as necessary</li> <li>Update related guidance material to support the implementation of Annex 3 Amendment</li> </ul>



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## Space Weather Sub-Group Activities

No.	Activity	Predecessor	Due Date
3.1	Revised Space Weather Concept of Operations for endorsement by the MET Panel		May 2016
3.2	Space weather information performance requirements for endorsement by the MET Panel	3.1	June 2016
3.3	Space Weather Center selection criteria for endorsement by the MET Panel	3.2	July 2016
3.4	Proposals for Amendment of ICAO Annex 3 with respect to space weather information	3.1	September 2016
3.5	Space Weather Information Manual	3.1 and 3.2	September 2017



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# Disposition of Comments

Disposition	Description	#
Tech Edit	Simple typographical or formatting error.	3
Administrative Comment	General comment re: overall document flow and/or readability.	44
Scientific Edit/Update	Comment identifying potential scientific error and/or update necessary due to change in status or passage of time.	24
Substantive Comment	Comment suggesting substantive change in the content and/or tone of the document.	53
Critical Comment	Comment suggesting substantive change in the scope of the document. Likely cannot continue drafting document, without consensus.	3

NOTE: Disposition of comments on Space Wx ConOps v3 is similar to previously disposition of comments on earlier versions of the Space Wx ConOps

**Total Comments: 127**

# DRAFT List of Issues to be Resolved

(Based on comments identified as critical or substantive)

1. Definitions
  - Space Weather
  - Principal User
2. Description of impacts on aircraft operations
3. Inclusion of suborbital flight in scope of ConOps
4. Degradation of aircraft-to-ground UHF and VHF communications, associated impact
5. References to, and use of, NOAA Space Wx scales
6. Current provision of Space Wx information
  - Work Stream members/advisors are invited to identify any other issues to be resolved at the 18 November F2F
  - Information Papers are requested for these issues



# F2F meeting

- Nov. 18, 2015 at RTCA, Washington D.C.
- Anybody can find all the documents discussed on the first WG-MISD F2F meeting
- <http://www.icao.int/airnavigation/METP/MISD/Pages/First-Meeting-of-the-MISD.aspx>
- IP:6 WP:2 (conOps comment adjudication Process, requirements)



# Expectations for Space Wx ConOps Revision

- Since Space Wx is a new service, v4 of the ConOps will be distributed in the agreed-upon format for MET-P ConOps documents
- All comments received on Space Wx ConOps v3 will be adjudicated; however, due to reformatting, not all proposed changes will be visible in Space Wx ConOps v4
- Functional and performance requirements will be documented in a separate artifact

# Functional Requirements

- Definition
  - ❑ A requirement that specifies a task, action, or activity that a system or a system element must be able to perform, and, where appropriate, the precision required in the performance of a specific action. (Alexander Kossiakoff and William N. Sweet, *Systems Engineering: Principles and Practice* (Hoboken, NJ: John Wiley & Sons, Inc., 2003), 448)
  - ❑ “Functional requirements describe what the system should do” – Ulf Eriksson, Founder, ReQtest (5 April 2012)
- Examples from ConOps v3, Appendix C
  - ❑ Good: Space weather conditions shall be forecast
  - ❑ Bad: Space weather impacts on aviation operations will be defined
- Questions to be answered by the Work Stream
  - ❑ Do the functional requirements satisfy the identified user need?
  - ❑ Are any functional requirements missing?
  - ❑ Are any functional requirements extraneous?

# Performance Requirements

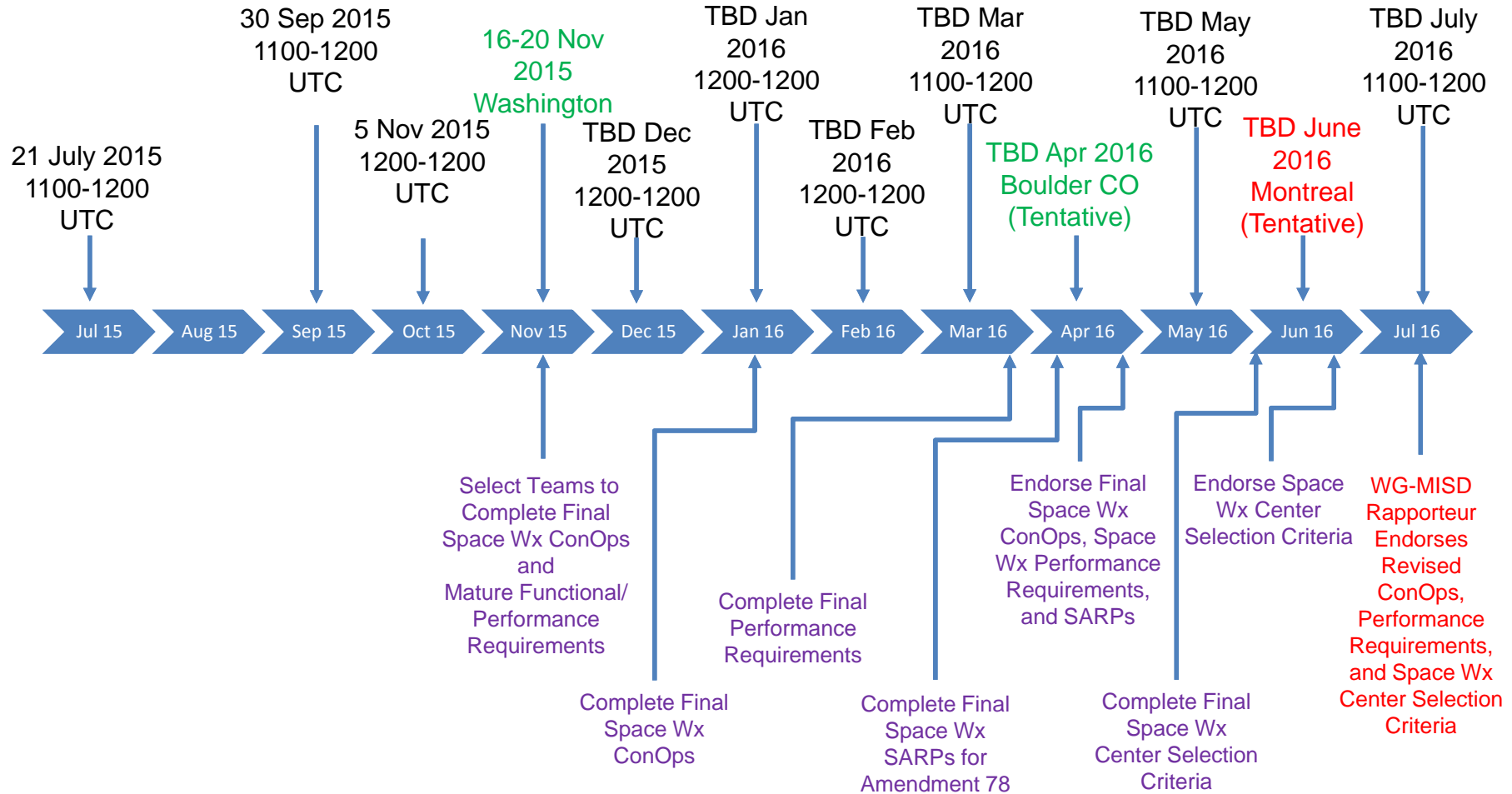
- Definition
  - ❑ A criterion that identifies and quantifies the degree to which a particular attribute of a function must be accomplished, and, the conditions under which this capability is to be achieved. (Alexander Kossiakoff and William N. Sweet, *Systems Engineering: Principles and Practice* (Hoboken, NJ: John Wiley & Sons, Inc., 2003), 448)
  - ❑ “[Performance] requirements specify the system’s ‘quality characteristics’ or ‘quality attributes’” – Ulf Eriksson, Founder, ReQtest (5 April 2012)
- Examples from ConOps v3, Appendix C
  - ❑ Good: A space weather 30-hour forecast shall be provided every 6-hours
  - ❑ Bad: Galactic cosmic rays shall be forecast when greater than 10 above the median background
- Questions to be answered by Work Stream
  - ❑ Are the performance requirements correct and complete? (Validation)
  - ❑ Do the performance requirements achieve user needs? (Verification)
  - ❑ Are the performance requirements achievable?

# SWx Work stream small group

- Feb. 12, 2016: A small editorial team to review the revised SWx ConOps (Action 5/1) and to review and refine the draft functional and performance requirements (Action 5/2)
- Members
  - Robert Rutledge, Jerome Lafeuille, Mike Terkildsen, Dorothea Banse, Xiaoxin zhang, Mamoru Ishii
  - Steve Albersheim, Thomas Kiley, Larry Burch, Tom Helms

# Space Wx Webex/Meeting Schedule

## Webexes and Face-to-Face Meetings



# ICAO-APAC/ISTF

- ICAO-Asia and Pacific office/Ionospheric Study Task Force started on Feb. 2012 and will close once with ISTF/6 on Jan. 2016.
- Main products
  - Guidance on GBAS Threat Model
  - Guidance on GBAS safety case related to anomalous ionospheric conditions
  - Space Weather – proposed improved services to mitigate ionospheric effects on CNS systems
    - \*CNS: Communications, Navigations and Surveillance



**Sixth Meeting of the Ionospheric Studies Task Force (ISTF/6)  
ICAO Regional Office, Bangkok, Thailand, 19-21 January 2016**





# Future plan of ICAO/ISTF

- Prepare to input “the space weather effect on CNS” into ICAO/WG-MISD
- Establish the following WG “ISTF-2”
- Documents are available on

<http://www.icao.int/APAC/Meetings/Pages/2016-ISTF6.aspx>