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RTCA Paper No. 299-22/SC230-069  
11/8/2022

### Summary of the 31<sup>st</sup> SC-230 Plenary

Virtually held on 31 October and 2-3 November, 2022

<b>Attendees list</b>	<b>Organization</b>	<b>Dates Attended</b>
Bob Avjian	The MITRE Corporation	31 Oct   2 Nov   3 Nov
Dawn Gidner	Consultant	31 Oct   2 Nov   3 Nov
Divesh Lakhi	Collins Aerospace	31 Oct   2 Nov   3 Nov
Eldridge Frazier	Federal Aviation Administration	31 Oct   2 Nov   3 Nov
Emily Wang	Collins Aerospace	31 Oct   2 Nov   3 Nov
Ghassan Maalouli	Honeywell	31 Oct
Jacob Teague	Honeywell	31 Oct   2 Nov
Jan Lukáš	Honeywell	31 Oct   2 Nov   3 Nov
Jean-Baptiste Berthier	Airbus	31 Oct   2 Nov   3 Nov
Jeff Finley (Chair)	Collins Aerospace	31 Oct   2 Nov   3 Nov
Karan Hofmann	RTCA, Inc	31 Oct   2 Nov   3 Nov
Marius Irimia	Collins Aerospace	31 Oct   2 Nov   3 Nov
Mariusz Starzec	Garmin	31 Oct   2 Nov   3 Nov
Mark Smith	Collins Aerospace	31 Oct   2 Nov   3 Nov
Matthew Lug	USAF	31 Oct
Moin Abulhosn (GAR)	Federal Aviation Administration	31 Oct   2 Nov   3 Nov
Rockee Zhang	University of Oklahoma	31 Oct     3 Nov
William Blake	Garmin	31 Oct   2 Nov



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**Summary of Day 1 (October 31<sup>st</sup>, 2022)**

**Welcome and Administrative Remarks**

- RTCA Opening remarks on Anti-Trust Laws, IP Policy, and Membership Policy provided by Karan Hofmann.
- Jeff Finley led introductions of attendees.
- Minutes from July 2022 Plenary (Meeting #30) were approved without comment or amendments.
- The current secretary, Mohammed Ahmed, was unable to attend. Mariusz Starzec agreed to be the acting secretary for this plenary meeting.
- New attendees: Eldridge Frazier (FAA), Emily Wang (Collins), Divesh Lakhi (Collins)

**Agenda**

SC-230 Agenda

- **Monday Oct 31, 2022 (all times Eastern Daylight Time)**
  - Opening Announcements 11:00 – 11:05 A.M. (RTCA/FAA)
  - Introductions 11:05 – 11:10 A.M. (Committee)
  - Summary of July Plenary 11:10 – 11:15 A.M. (Ahmed)
  - Review Schedule/Deliverables 11:15 – 11:20 A.M. (Finley/Gidner)
  - Detailed technical agenda 11:20 A.M – 2:50 P.M (All)
    - Review and resolve any comments from previous review
    - Review statistical requirements
    - Review verification of the statistical requirements
    - Review simulation test cases.
    - Discuss extending TOR to provide to provide guidance for spectrum interference
    - Discuss extending TOR to provide windshear detection guidance for other classes of aircraft.
  - Review Action Items 2:50 – 3:00 P.M. (Ahmed)
  - Adjourn 3:00 P.M.

The agenda for all three days was the same: continue working on topics listed in the “detailed technical agenda.”



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### Day 1 effort:

- Reviewed and resolved comments in the D0-220B draft document.
- Discussed and accepted proposed sections D.2.4 through D.2.4.4 submitted by Mariusz, which discussed the weather model information, weather model data, extrapolation techniques that may need to be applied to the data, and the intro/summary of the scenario tests cases.
  - Discussed whether Section D.2.4.1 and D.2.4.2 are needed since this information is all included in the NASA documentation for each weather model, but the NASA documentation has errors that may be misleading. Decided to keep sections, and include a statement saying information in sections D.2.4.1 and D.2.4.2 take precedence over the NASA documents, which will also be included.
  - [Action Mariusz] For each weather model, send references and/or file names of the NASA documents to Dawn, so that they could be referenced in the D.2.4.2 tables.
  - Discussed whether aircraft speed should be a variable. Decided on a constant aircraft ground speed of 450 knots for each event event scenario.
- Addressed the statistical requirements and whether the radar manufacturers thought they are realistically achievable, including the change to the Must Not Indicate High criteria changing from  $2 \text{ g m}^{-3}$  to  $1 \text{ g m}^{-3}$ . Collins and Garmin both reported the statistical requirements are valid.
- Started going over the proposed event scenarios; eventually completing the Must Indicate High and Must Indicate Moderate scenarios.
  - [Action Group] Decide what figures should be included in the document.
  - [Action Emily\Divesh] Investigate differences in the coordinates for Must Indicate Moderate Darwin 2a and Darwin 2b scenarios between Garmin and Collins and confirm whether they are acceptable or not.
- Looking over the proposed event scenarios resulted in a long series of discussions about what the “truth field” is declared as and what is it exactly we are trying to detect. In this discussion, William argued that the IWC field after a 3 NMI running average filter with the appropriate thresholds applied was considered the truth field and that any designed algorithm that can exactly replicate what the filtered field looks like is the ideal scenario. Jean-Baptiste argued that the “ideal field” is the raw, unfiltered IWC field with the appropriate thresholds applied but noted that clearly current radars cannot pick out those features. William proposed that what we call the “truth field” or a “minimum truth field”/“must detect truth field” is the thresholded IWC field after the averaging filter and the “ideal truth field” is the raw, thresholded IWC field. Preliminary consensus reached that the document should say that the “minimum truth field” is what the MOPS are requiring but if the radar manufacturers can do better they should try to match the “ideal truth field.”



- [Action Group/William] This discussion led to an action item for the group to think about how to define the truth field for Day 2 of the plenary and how to put this discussion all into words. William to write up a section to add into the Appendix as a starting point for Day 2.

### **Summary of Day 2 (November 2<sup>nd</sup>, 2022)**

*Continued with items listed on agenda.*

#### **Day 2 effort:**

- Went over and discussed the Must Not Indicate High and Must Not Indicate Moderate event scenarios.
- Consensus reached on fourteen scenarios and that each scenario is distinct enough that it is worth including. The preliminary scenarios:
  - Must Indicate High ( $\geq 3 \text{ g/m}^3$ )
    - Knowlton [170, 289, 20, 0] (later changed to [160, 289, 20, 0])
    - Danny [882, 720, 26, 90] (later changed to [882, 715, 26, 90])
    - Danny [965, 840, 28, 0]
    - Danny [872, 775, 42, 0]
  - Must Indicate Moderate ( $\geq 1 \text{ g/m}^3$ )
    - Danny [790, 1010, 26, 90]
    - Darwin 2b [315, 413, 28, 90]
    - Danny [530, 610, 26, 0]
    - Danny [933, 995, 40, 270]
    - Darwin 2b [230, 348, 38, 0]
  - Must Not Indicate High ( $< 1 \text{ g/m}^3$ )
    - Danny [487, 917, 13, 90]
    - Darwin 2a \*
    - Darwin 2b [381, 469, 30, 90]
  - Must Not Indicate Moderate ( $< 0.2 \text{ g/m}^3$ )
    - Darwin 2a [246, 542, 37, 90]
    - Danny (New) [400, 825, 20, 90]
  - \* - For the Must Not Indicate High Darwin 2a scenario, the original location/heading proposed by Garmin was [170, 300, 45, 0] but this was deemed as a challenging case. Collins proposed an alternate location/heading of [439, 446, 37, 180].
    - [Action Mariusz] Garmin to investigate proposed location for next session.
  - [Action Mariusz] Create draft of all scenarios to be put into the document, including tables, descriptions, figures, and summary of what the figures show. Verify everything is ok with Emily and Divesh and then send to Dawn.



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- Continued discussion from Day 1 about the “ideal truth/reference field” and “minimum required truth/reference field.” William presented his proposed edits to include the difference in the document.
  - Related discussion about where to include the 3 NMI filter discussion and if it is in the right place.
  - Further discussion in section D.2 and D.2.1, and the fact that we are no longer looking for reference “fields” but trying to define exact target locations with the scenarios. Re-organization of D.2 and D.2.1 may be needed.
  - Temporarily incorporated changes and moved on.
  - [**Action** Group] Continue to work on the definitions and text of the “minimum required reference field” and “ideal reference field.”
- In-depth discussion about definitions of Must Detect and Must Not Detect scenarios. By current definitions, a  $2 \text{ g/m}^{-3}$  target can be defined as Moderate or High since Must Indicate Moderate is  $\geq 1 \text{ g/m}^{-3}$  while Must Not Indicate High is  $< 1 \text{ g/m}^{-3}$ ; therefore, technically 1.00001 can be deemed as High; however, the statistical requirements should limit or almost completely circumvent this issue.
  - Multi-level definitions discussed where multiple indications may be declared a success. For example, a Must Indicate Moderate can be a “may detect high.” But can each scenario have two verification criteria? What would be considered a pass/fail? What about the “must not indicate” categories?
  - How do we handle indications within a 3 NMI radius of the target region? Group agreed that the *majority* of indications within the 3 NMI radius circle have to match the criteria of the case to be a pass but may include other categories as a minority. Text adjusted to match for the “must indicate” and “must not indicate” sections.

### **Summary of Day 3 (November 3<sup>rd</sup>, 2022)**

*Continued with items listed on agenda.*

#### **Day 3 effort:**

- Continued discussion over simulation requirements to determine what the pass/fail criteria are and whether we are evaluating the “detection” or the “indication.” Jeff submitted rewritten sections D.2.1-D.2.3, which the group agreed to use as a baseline going forward. Group worked on edits to this section and the previous action items of defining the “minimum” and “ideal” truth fields have been completed.
  - Discussion about detection vs indication. Detection is specific to the radar be able to detect the actual phenomena, but there are two levels of indication: 1) the display and associated symbology and 2) the radar indication of ice crystal concentrations. Need to clarify what is being talked about.



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- Verified and group agreed that display indication is a separate category and that this documents is setting standard for the radars and not the displays.
- Bob mentioned that “detection” and “indication” is confusing and Mariusz mentioned that there are many different levels of “indications,” “references,” and “truths” scattered across the document and may get confusing.
- After discussion and altering appendix D, added couple of sentences in the simulation section that indication refers to “radar indication” of ice crystals and not display indication.
- **[Action Group]** Read appendix D to make sure everyone is in agreement with the changes.
- Identified and fixed issues in the definitions of operation range and display range; fixed throughout document and adjusted Notes to match.
- Eldridge Frazier inquired about lidar detection of turbulence and Jeff provided a brief background/history about the topic.
- Discussion about extending TOR to provide guidance for spectrum interference, which would require research and drafting a white paper. Group is supportive of the idea.
  - Will need to make assumptions such as solid-state receivers, etc. to limit problem. Need to research what level of interference radars can tolerate with regards to predictive windshear and the sensitivity to interference across radar systems. Each radar manufacturer will likely have to share basic characteristics of their radars.
  - **[Action Group]** Companies and organizations to inquire about funding and time commitments to support this effort.
- Discussion about extending the TOR to provide review wind shear detection guidance for small antennas. Jeff and Karan shared feedback to letter send out seeking input/support from various companies and organizations as to whether windshear detection should be re-investigated, with emphasis for smaller antennas. Feedback was generally positive, but not unanimously so. This effort would require more substantial resources, funding, and time commitments.
  - Jeff suggested, instead, to generate a white paper with the purpose of investigating the current windshear requirements, looking for what, if anything, could be changed or improved, to better define and limit the problem, and to identify types of aircraft that may need specialized wind shear environments in the future (e.g., UAM), which could lead to a MOPS down the road. Alternatively, if we find that the more conservative requirements are already valid or would require too much effort for only minor changes, then no changes to windshear detection will be made/proposed.



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- **[Action Jeff]** Jeff to draft letters to eventually send out to group inquiring about support for researching and drafting white papers regarding spectrum interference and windshear detection for small antennas.
- Jan mentioned that SAE icing conference occurs in Vienna 20-22 June 2023, where some of this work may be presented. Abstracts are due on 30 November. Group is supportive of presenting at conference and Jan will be attending.
  - **[Action Jan]** Work towards putting together an abstract summarizing this effort.



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**Upcoming Meetings:**

- |                                |                          |                  |
|--------------------------------|--------------------------|------------------|
| • 8 November 2022              | WG Meeting               | Virtual          |
| • 22 November 2022             | WG Meeting               | Virtual          |
| • 6 December 2022              | WG Meeting               | Virtual          |
| • 10 January 2023              | WG Meeting               | Virtual          |
| • 24 January 2023              | WG Meeting               | Virtual          |
| • 31 January – 2 February 2023 | 32 <sup>nd</sup> Plenary | RTCA and Virtual |
| • 12 – 14 April 2023           | 33 <sup>rd</sup> Plenary | RTCA and Virtual |

The WG Meetings are expected to meet virtually at 11:00 AM ET.

The 32<sup>nd</sup> and 33<sup>rd</sup> plenary meetings will be held in-person at RTCA in Washington D.C. at 9:00 AM to 5:00 AM ET, with a virtual option for those unable to attend in person.

The purpose of the 32<sup>nd</sup> plenary is to open the document for Final Review and Comment (FRAC) and the purpose of the 33<sup>rd</sup> plenary is for FRAC resolution and approval to forward document to the PMC.





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**Action item summary**

Action Item #	Action	Person(s)	Estimated Completion Date
<b>Day 1:</b>			
1	Send NASA references for each weather model Dawn.	Mariusz	<del>Next WG Meeting</del> Completed
2	Declare what “truth”. Is there a difference between “truth” and “must detect truth”? What is needed for a minimum detection? William to write a summary on the difference between the two, which would put together starting wording for the document.	Group/William	<del>On-going</del> /Plenary Completed
3	Decide what figures need to be included for the event scenarios.	Group	On-going
4	Investigate coordinate differences for Must Indicate Moderate Darwin 2a and Darwin 2b cases.	Emily and Divesh	<del>Day 2</del> Plenary Completed
<b>Day 2:</b>			
5	Investigate new coordinates for the Must Not Indicate Darwin 2a case supplied by Collins.	Mariusz	<del>Day 3</del> Plenary Completed
6	Complete all scenario descriptions, tables, and get initial figures completed. Coordinate with Emily and Divesh. Eventually send to Dawn.	Mariusz, Emily, and Divesh	<del>Next WG Meeting</del> Completed
7	Continue to work on definitions and text of the “minimum required reference field” and “ideal reference field.”	Group	<del>On-going</del> /Day 3 Plenary Completed
<b>Day 3:</b>			



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8	Read Appendix D to make sure everyone agrees with the changes.	Group	Ongoing
9	Organizations to inquire about funding and time/effort commitments for investigating spectrum interference.	Group	Next Plenary
10	Send email seeking support regarding generation of white papers related to X-band spectrum interference and revisiting wind shear.	Jeff	Next Plenary
11	Work towards putting together abstract to present at SAE Icing conference.	Jan	By November 30

CERTIFIED as a true and accurate summary of the meeting.

Mariusz Starzec, SC-230 Acting Secretary

Jeff Finley, SC-230 Chair