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RTCA Paper No. 026-23/SC230-072  
2/7/2023

### Summary of the 32<sup>nd</sup> SC-230 Plenary

Hybrid in-person (at RTCA in Washington DC) and virtual meeting, 31 January – 2 February.

*(All plenary agenda items were completed on 31 January and plenary was adjourned. Working Group session and additional discussions were designated for 1 & 2 February).*

#### Attendees list

Bob Avjian  
Dawn Gidner  
Divesh Lakhi  
Emily Wang  
Jan Lukáš  
Jean-Baptiste Berthier\*  
Jeff Finley\* (Chair)  
Karan Hofmann\*  
Marius Irimia  
Mariusz Starzec\*  
Mark Smith  
Moin Abulhosn\* (GAR)  
Rockee Zhang  
Venkata Sishtla  
William Blake\*

#### Organization

The MITRE Corporation  
Consultant  
Collins Aerospace  
Collins Aerospace  
Honeywell  
Airbus  
Collins Aerospace  
RTCA, Inc  
Collins Aerospace  
Garmin  
Collins Aerospace  
Federal Aviation Administration  
University of Oklahoma  
Collins Aerospace  
Garmin

\* - Denotes in-person attendance at RTCA.



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## Summary of Day 1 (January 31<sup>st</sup>, 2023)

### **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, overview of the previous plenary meeting, scope of WG-10, and previous schedule.
- Minutes from October/November 2022 Plenary (Meeting #31) 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.

### **Agenda Presentation**

The main agenda was to prepare the document for FRAC release and address any received pre-FRAC comments. Additional agenda items included updates and discussion with regards to small antenna wind shear and spectrum interference.

During Day 1, an additional agenda item was added to the list, to discuss basic weather performance and “auto mode” requirements by Jean-Baptiste.

### **Day 1 effort:**

- Spent time addressing pre-FRAC review comments, which were captured in the review replies document. No major contentions regarding replies given.
  - [Action Dawn] Update figure text “three nautical miles” to match the “three NMI” nomenclature used in the text for consistency.
  - Discussion on ‘display range’ vs ‘operational range’ came up again, and the definition of each range. Slightly differing definitions for the ‘display range’ existed between the definition and a how it was defined in a notes section. The discussion centered around wording on whether the display range should be defined as “... greater than *and equal to* the operational range.” The possibility of meeting the operational range requirements but not the display requirements at a particular range was identified, whereas the intent of the display range was that it should never be less than the operational range. Language was adjusted.
- Incorrect figure was discovered.
  - After some investigation, it was a logistics error and copy/paste error between the figures in a zip file and a draft document, leading to a duplicate figure being added into the document. The figure was correctly swapped out.
  - [Action Mariusz/Group] Verify all images and values related to the images are correct.



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- No dissention on submitting the document for public FRAC release once images are confirmed.
- Jan presented the current progress on the SAE HAIC overview article.
  - Looking for co-authors to write additional sections: statistical evaluation/analysis, simulation scenarios, simulations, and summary with overall polishing.
  - Jean-Baptiste mentioned the possibility of adding in a limitations or operational relevance section/discussion.
  - Volunteers were found and will meet during the working group meetings every two weeks until the next plenary to discuss progress.
  - Early April due date (internal due date end of March)
  - [Action Jan] Send out email with due dates, latest draft, link to registration with SAE, etc. to authors.
  - [Action SAE paper contributors] Work on assigned sections, register with SAE if applicable, sync at working group meetings, etc.
- Jean-Baptiste added a discussion topic: “Auto mode” performance, expectations, and requirements.
  - Jean-Baptiste’s points:
    - No requirements whatsoever for basic weather detection.
    - “Lacking common ground [across radar manufacturers] to be able to explain basic performance of the weather radar.”
    - When complaints are fielded by pilots, such as “how far out can we trust the radar?” Mentioned that he has no way to address or answer them.
    - “Auto modes” are a black box. If pilot goes from one aircraft to another with different radar system, how does he know what stays the same vs what is different? No expectations set for pilot.
    - Interested in: At which range, is the weather display “accurate” or “won’t change” in the context of 95% of the image will not be different. “At what range can I make a tactical decision based on what the radar is showing me?” Is there an equivalent of operational range vs display range for basic weather?
    - Somehow measure and quantify performance of the auto modes across manufacturers. A common characteristic or metric to test against?
  - Discussion on what does “accurate” mean and how to quantify accuracy led to lengthy discussion on what the weather radar is actually showing. Are the radars showing reflectivity/backscattered power or are they displaying a perceived hazard level? Are there adjustments made to the display reflectivity field to account for hazards or lack of hazards? Filters to hid “undesirable” weather?



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- Radar Manufacturers: How will this effort (which is a major effort) answer any questions? Any manuals likely won't be read and what happens to corner cases or things not included due to imperfect simulations. How do you directly address "customer confidence?"
  - "Too many variables and permutations at play. Too complex to test"
  - Likely all manufacturers simulate this already to some degree, and each manufacturer has their own simulators and way of simulating all these features, which are all likely to be very different.
  - **[Action Jean-Baptiste]** To come up with a common list of questions and operational needs that need to be addressed and provide them to radar manufacturers (RMs) so they could perhaps better understand what is needed and work on answering them.
- Plan to continue with these discussions on day 2, set as a Working Group session.
- *Day 2 was not a plenary session, but short summary from the discussion during the Day 2 Working group meeting regarding auto mode requirements is added:*
  - Jean-Baptiste presented a few slides of what he is looking for in regard to auto mode and basic weather performance, kickstarting a lengthy discussion. In a very high level summary, looking for a sense of radar performance in terms of basic weather detection as any requirements are missing from the MOPS and a way to highlight radar expected performance to pilots, airlines, etc.
  - Discussion of what the radar is showing has followed, with maybe identification of a discrepancy in understanding of whether it is showing pure reflectivity vs hazard levels (or just convective regions). Since it is showing reflectivity, is that at flight level, composite, layer composite, is it filtered in any way, etc.?
  - Discussion of filtering weather: is it a good idea or not? RMs talked about what they do. Some pilots want to see all the weather while others only want to see weather that is hazardous to them; there is no right or wrong answer. How to deal with this? If non-hazardous echo is suppressed, some pilots complain weather radar is not working properly, doesn't look like NEXRAD, or isn't depicting what they are seeing. If everything is shown, some pilots complain about too much weather cluttering the screen or non-relevant weather being distracting, and don't know if they have to deviate or not. Have to be very careful with weather filtering as it may filter incorrectly filter weather since weather characteristics vary by location, season, etc.



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- RMs discussed that there is auto-tilt and auto-mode, which are not the same. Auto mode can be, at a high-level, broken down into two parts: 1) weather vs ground classification and 2) weather color depiction. Discussion further continued about whether the display colors adjusted for hazard or not, and if pure reflectivity is shown. How does this relate to what pilots do when they have manual mode? RMs argue auto mode should mimic what the pilot does in a quick, objective manner.
  - RMs discussed that every measurement is a statistical estimate, and there are, in essence, PDFs associated with almost all aspects of the radar.
  - Outcomes: Group agreed to work towards tackling a component of auto mode that every RM has, which is a form ground clutter suppression, and potentially working on standards to address that in following working group sessions. Further discussion led to the possibility of developing a white paper on the expected performance of a radar and why it performs the way it does or why it displays what it does to give a better understanding of the system and so that document can be referenced by airlines or aircraft manufacturers when explaining the radar performance to pilots.
- Discussion regarding reply to SC242. Only knowledge is that everyone sticks to FCC guidelines for band info, which is only on transmit. Nothing on band rejection or interference or out of band leakage.
    - Tentatively agree to adjust TOR in the future to come up with white paper that provides guidance on interference.
    - [Action Jeff] Setup a discussion with SC242 and come up with a reply regarding spectrum interference.
    - *Day 2 was not a plenary session, but short summary from the discussion during the Day 2 Working group meeting regarding spectrum interference is added:*
      - Call with SC242 was arranged at 3:30 PM ET. After discussion of what their and our needs are, SC242 gave guidance that a white paper isn't necessary at this time, but a high-level overview of what spectrum ranges are occupied by airborne weather radars, what is in the MOPS regarding spectrum utilization, etc. would be helpful. Mentioned 6G looking at the the 6 to 15 GHz window and suggested to start looking at out of band interference.
      - Jeff to forward email with brief summary of what interference into the X-band airborne weather radar spectrum would/could cause.
  - Discussion regarding updating MOPS for small antenna wind shear.



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- Challenging from a cost and time commitment perspective.
- Questions on how to achieve this and how to determine f-factor and other engine performance requirements. Steve Harrah led that effort in the past and may be interested in pursuing this further.
- F-factor determination based on 747 taking off from Denver on a hot day. Not characterized during different aircraft, phases of flight, or phases of microbursts.
- [Action Moin] Find out if it is possible to get FAA support to run simulators and analyze data if require.
  - Moin mentioned there are a flight simulators for certain aircraft, but it will take a lot of time to setup.
  - Can simulate/evaluate aircraft performance following same experiments done in the past, setting a “baseline” simulation case repeating the 747 experiment in the simulator. Then take different aircraft and see how the same f-factor affects performance.

All agenda items have been completed or at least addressed by the end of Day 1, and document released for public FRAC. Decision reached to adjourn the plenary meeting but take advantage of that fact that people have traveled to DC to meet in person, so setup next day(s) as working group session(s) to continue discussions and work on action items (of which some notes were captured and presented in the section above).

**Upcoming Meetings:**

- |                 |                          |                          |
|-----------------|--------------------------|--------------------------|
| • 14 February   | Working Group            | Virtual                  |
| • 28 February   | Working Group            | Virtual                  |
| • 14 March      | Working Group            | Virtual                  |
| • 28 March      | Working Group            | Virtual                  |
| • 12 – 14 April | 33 <sup>rd</sup> Plenary | Hybrid; RTCA and Virtual |

The Working Group (WG) Meetings are expected to meet virtually at 11:00 AM ET for one hour. The purpose of the WG meetings is to continue discussing the topic of auto mode/basic weather performance requirements, the SAE icing summary article regarding the SC230 HAIC requirements, and any updates that many occur for the small antenna wind shear, spectrum interference, and other topics.

The 33<sup>rd</sup> plenary meeting 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 33<sup>rd</sup> plenary is for FRAC resolution and approval to forward the document to the PMC.

**Action item summary**



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Action Item #	Action	Person(s)	Estimated Completion Date
<b>Day 1:</b>			
1	Coordinate with Karan and submit the storm model data to RTCA.	Mariusz	Before Next Plenary
2	<i>Update figure text to match text throughout HAIC sections for consistency.</i>	<i>Dawn</i>	<del>Plenary</del> <i>Completed</i>
3	<i>Double check all figures and send new images if needed.</i>	<i>Mariusz/Group</i>	<del>ASAP</del> <i>Completed</i>
4	<i>Regarding SAE Icing paper: Send out email with latest draft of SAE HAIC overview paper, due dates, and link for registration of new authors.</i>	<i>Jan</i>	<del>Next Working Group</del> <i>Completed</i>
5	Regarding SAE Icing paper: Continue working on overview paper. Add new sections: [Divesh, Jeff] Statistical Evaluation, [Mariusz] Simulation cases, [Mariusz, Venkata] Simulation overview, [Dawn] Summary. Jean-Baptiste to provide input regarding expected operational relevance. New authors need to register with SAE.	SAE Icing paper contributors	End of March (Submission due at the beginning of April)
6	<i>Come up with a list of operational needs for radar performance regarding basic weather detection and auto mode to continue discussions.</i>	<i>Jean-Baptiste</i>	<del>Day 2 Working Group Session</del> <i>Completed</i>
7	<i>Set up discussion with SC242 regarding spectrum interference and their/our needs.</i>	<i>Jeff</i>	<del>Before Next Plenary</del> <i>Completed</i>
8	To check if FAA can support looking into small antenna wind shear (via simulator time and/or analysis)	Moin	Next Plenary



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CERTIFIED as a true and accurate summary of the meeting.

Mariusz Starzec, SC-230 Acting Secretary

Jeff Finley, SC-230 Chair