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RTCA Paper No. 252-15/SC230-009
 Date: September 24, 2015

RTCA SC-230 Seattle Plenary (June 16 - June 18, 2015) - Meeting minutes

Attendance list:

Name	Company
Do, Mai	Airbus
Piau, Gérard-Pascal	Airbus
Bernus, Christophe	Airbus
Moreno, Irene*	Airbus
Campagna, Franck*	Airbus
Tschacher, Luke	The Boeing Company
Baker, James	Federal Aviation Administration
Nguyen, Lee	Federal Aviation Administration
Blake, William	Garmin
Gidner, Dawn	Honeywell International, Inc.
Bunch, Brian	Honeywell International, Inc.
Dancejic, Goran*	Honeywell International, Inc.
Logan, Gloria*	Honeywell International, Inc.
Harrah, Steve	NASA
Marczinko, Jeno	Nordam
McBride, Scott*	MI Technologies
Finley, Jeff	Rockwell Collins, Inc.
Fersdahl, Mark*	Rockwell Collins, Inc.
Robertson, Roy*	Rockwell Collins, Inc.
Sishtla, Venkata*	Rockwell Collins, Inc.
Beutelman, Peter*	Rockwell Collins, Inc.
Bousquet, Sophie*	RTCA
Tatas, Hulya	STM A.S

* *Virtual Attendee*



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Irene provided a summary of the current activity with EUROCAE WG 95. EUROCAE recommended the following approach:

Create a report on the feasibility to standardize In-Flight Ice Crystals Long Range Awareness capabilities by Weather Radar (WXR), with at least the following objectives:

- 1) Take into account the impact of the new icing atmosphere characterized by the Appendix "D/P" definition introducing the Ice Crystals and mixed Icing conditions.
- 2) Describe intended function of Ice Crystals Long Range Icing Awareness functionality by Weather Radar and the Operational need of such function.
- 3) Identify possible standardization activities of short term functionalities, with the definition of minimum acceptable performance and validation and verification approach.
- 4) After 12 months, describe the maturity of the Ice Crystals Long Range Icing Awareness function by Weather Radar and provide recommendations on the way forward of the sub-group and the way to standardize Icing WXR functions using new or existing EUROCAE / RTCA documents.

The EUROCAE TAC agreed to the WG-95 Terms of Reference (TOR) with this change in place (May 2015) to propose the updated TOR and move forward with the feasibility study. EUROCAE will launch a request for participation following the council's approval of the revised TOR (ECD 6/19/15). Estimated kickoff for the WG95 subgroup would be end of August/ beginning of September. RTCA has discussed making this a joint effort with SC-230. Two options resulted from the discussion on RTCA/EUROCAE collaboration:

Option 1: There was one recommended to wait until the March PMC presentation of DO-220/DO-213 to extend SC-230 until September 2016 when the EUROCAE feasibility study is complete in order to determine if and how the High Altitude Icing awareness MPS will be coordinated between EUROCAE/RTCA and in what form (i.e. within DO-220 or a new MPS all together).

Option 2 (recommended by RTCA): SC-230 could jointly participate in the generation of the feasibility report being put together by EUROCAE WG95 up front since the majority of those in the room are also planning to participate in the WG95 subgroup. The TOR would need to be updated for this purpose (could be added to the September PMC). **Action** for SC-230 leadership/RTCA - If this route is chosen, the ToR would need to be updated fairly soon and we would need to get on the agenda for the next PMC. This is all to occur AFTER the official approval of EUROCAE for the WG95 subgroup.

DO-220 Section 1 - There was a recommendation to include a requirement that the Radar Manufacturer shall meet all requirements for all functions simultaneously if the functions occurred simultaneously. The overall team agreed there would not be a need to add a requirement since the verification statement would simply point to other requirement verifications.

DO-220 Section 2.2.1.3 - There was more discussion on whether there should be any display characteristics in the WXR MPS at all. In the end, it was determined that in order for a display



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manufacturer to know what they are required to display (if they are going to display information based on information from the radar) these requirements must remain in the Minimum Performance Standard (MPS). A note was added to attempt to clarify this section is really attempting to define requirements for how the radar outputs display information and how that output can be verified. This would allow a manufacturer to obtain a TSO with and without a dedicated WXR display. If the display is handled by a third party and not part of the TSO application, the display system can use this information as guidance, but would obtain an installation certification independent of a requirement for documenting meeting the requirements of the WXR TSO.

There was an extended discussion regarding whether the MPS should include descriptive information for the features we have today (ex. Lightning, hail, etc.). This would include minimum ranges as an example. The radar manufacturers were of the position the material should not be included in the MPS and it should be left as generic and applicable. The OEMs were of the opinion we could update the document to include some information on the features we have now (lightning/hail). In the end, it was determined we don't have enough operational use (and time under this MPS revision) to work through more specific requirements for lightning and hail, and those requirements may be addressed in the near future as more operational use and experience is gathered with existing systems.

DO-220 Section 2.2.3.14 - There was further discussion regarding the use of track vs. longitudinal axis for the windshear requirements and test cases. In the end, Garmin informed the team they had reviewed the MPS and only found one instance in which you get different results in the test cases. In the test case with an added drift angle, the longitudinal axis use will result in a caution, which turns to a warning, whereas the use of track would result in a warning from the beginning. In the end, all parties agreed that there is not necessary to require a deviation for use of track. Clarification was added to this section to allow for the use of either axis provided the applicant ensures all of the requirements and test cases are reviewed and proven to have an equivalent level of safety.

DO-220 Section 2.4.3.3.19 - Windshear Icon - Discussion resulted in a conclusion that any symbology used different from this MPS will require a deviation. With this in mind, all terminology surrounding doing a human factors study for alternate symbology was removed from the MPS with regards to windshear icons.

There was discussion regarding if there is a reason we can't display/annunciate new windshear events above 1200 feet AGL. It was brought up that the assumptions that go into the algorithms for windshear are based on the correlation of the outflow to the downdraft of the windshear. That relationship breaks down as you increase in altitude above the ground. The work done in the original MPS for windshear had information describing this relationship. It was concluded that without good evidence and justification for a new number, we would leave it as is and require deviation and justification if using an altitude beyond the 1200 feet limit.



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June 17, 2015

DO-220 Sections 3 & 4 - The latest understanding of the group for sections 3 and 4: Section 3 would be for the radar manufacturer to use in showing their radar meets the requirements of DO-220 and by the OEM for guidance on installation certifications and perhaps as certification data for those items which are not able to be tested in the final configuration (i.e. turbulence, atmospheric threat awareness (ATA) features, etc.). Section 4 would be utilized as guidance for the end operator (airlines) for how to use the system.

Action (Luke) - verify in section 3 that we have adequate integration testing specified for displays, controls and automatic activation (activation of specific functions and W/S automatic activation and/or others potentially).

Action (Luke) - Section 4 - Look at AC 20-182, section 8.0 for information that is currently in the AC for operations, if anything is found missing, then WG7 will provide recommendations for the FAA for incorporation into an update to the AC, then remove information in Section 4, making reference to section 8 of the AC.

Action (Luke) - Need to ensure the penetration flight test requirements are in section 3 or covered elsewhere in DO-220 to ensure the OEM has data they can rely on for use in certification.

WG 7 - DO-213 Discussions:

There was a discussion regarding how the average transmission efficiency is measured and how the requirement is interpreted today. The majority of those in the room and on the phone agreed that this requirement should be (was intended to be) a minimum average transmission efficiency for each azimuth and elevation specified in DO-213. One interpretation was that an average of the whole RF window could be used to determine the Radome class for the average transmission efficiency. This method has been in use for some time on one OEMs radome. These two different interpretations of the requirement can result (and have been resulting) in different Radome class determinations. The group as a whole agreed the clarification should be added to ensure it is a minimum line average, not an average of the whole window.

There was also agreement clarification should be added that you don't have to have continuous scan/elevation data, you can have discrete data points taken by near field measurement techniques and provide an equivalent 'continuous' scan. **Action** - WG7 will provide this clarification in the next draft to this effect.

There was also extensive discussion on the clarifications needed for the category of radome (i.e. Category 1 and Category 2 as it relates to side lobe performance). The general consensus was that the categories should be considered completely independently from class so that you could have any combination of

Class and Category. **Action** - WG7 will clear this up in the document and perhaps add an illustration to help further clarify the category definitions.

There was extensive discussion, regarding the new proposal for the side level allowance being much higher than desired by the radar manufacturers. In reality, radomes in production today would not meet the current requirements if measured in the near field with more measurements than just the planes defined in the current MPS (primarily due to the location and orientation of the lightning diverter strips with relation to the antenna pattern). The question was raised as to what levels the radar manufacturers would require?

Actions for WG7 - Figure in DO-213 Section 2.2.2.1 (Allowable increase in side lobe levels) - Consider a 30dB side lobe level and the extension of the knee of the curve to closer match the existing curves. Also to consider the impact of the new side lobe level determinations from the previous discussion on this methodology and curve.

Action for radar manufacturers - Figure in DO-213 Section 2.2.2.1 (Allowable increase in side lobe levels) - Consider where this line needs to be for the radar from a performance standpoint as 30 dB was chosen as a best guess during the call and will need vetted (and perhaps documented somewhere as to why 30 dB was chosen).

There was further discussion on the need for separate criteria for side lobes vs. reflection lobes and why we need to specify different requirements for small vs. large antenna. Radar manufacturers would like to see the <22" antenna side lobe upper limits to something closer to -23 or -25 dB. There was also discussion as to whether this requirement (DO-213 Section 2.2.2.2 - Side Lobe Upper Limit) is even needed since we have side lobe increase. The consensus is this is probably more of an issue for smaller radomes with shaper angles of Radome structure. William is going to take an **action** to consult Radome manufacturers for smaller Radome manufacturers and to address the concern with the upper side lobe limits only being allowed 1 dB (from -24dB to -23dB) at the upper end of the -24dB to -34dB side lobe range.

There was a question from Airbus whether end of life performance (specifically with humidity) test should be placed into the MPS. There is currently a line in the MPS that says humidity has negligible effect on the radar performance. There is evidence to say it does in fact have an effect on the overall transmissivity (transmission efficiency decreased by 1 to 3% in test cases depending on materials). There is a recommendation to add a requirement to test for humidity (current testing done by Airbus is a test done after being submitted to hot and wet conditions (usually 70degeesC / 85% humidity) until composite skin saturation (observed on the weight increasing and eventually leveling out as the radome cannot soak up any more moisture. This process was referred to as 'wet aging').

June 18, 2015

There was discussion on a need to ensure the use of the horn/receiver method of testing transmission efficiency is restricted and well described to avoid under sampling the Radome since the current azimuths/elevations provided in the MPS were not sufficient for small aperture horns. WG7 will take this **action** to put in some text to ensure this and other restrictions are clear.

There is an **action** for MI Technologies to update the TBDs in DO-213 Section 2.4.1.1 with their best educated guess on what the values should be based on current experience. There is an **action** for the radar manufacturers to review the WG7 proposal from MI Technologies for the TBDs currently in DO-213 section 2.4.2.1.1.

There was an extended discussion regarding having 'shall' statements in DO-213 section 2.4 without procedures for verification of those 'shall' statements. The conclusion is that there will be a requirement in DO-213 section 2.2 to ensure the range is qualified per the specifications in a future appendix which will describe each test set-up/range. Currently clarification is added to DO-213 section 2.4.2. Most in the room agreed with this approach, but Dawn will take the **action** to re-format DO-213 to comply with the MPS standards and then WG7 will take the **action** to review and adjust/comment as needed. MI Technologies will take the **action** to take the information currently in section 2.4.2 and attempt to remove the 'shall' statements (or will Dawn do this as part of her exercise?).

With regards to DO-213 section 2.4.2.1, WG7 took the **action** to get together to help determine the appropriate phase taper and field quality in general to specify in place of the exact distances in DO-213. There was a request to reach out to other stakeholders not currently on the team that this might affect (essentially anyone with a range for testing a Radome would be impacted).

MI Technologies also took an **action** to propose a text for DO-213 section 2.4.2.4.3 (Emulation of Non-Intersecting Gimbals).

DO-213 section 2.4.6.3 - There was discussion on the need/requirement for stenciling the polarization of the antennas that have been qualified for the Radome on the Radome itself. The conclusion was that the information should be included in the maintenance manual for the Radome so that those doing the repair can ensure they have one of the qualified radar polarizations for use during any return to service (post repair) work done on an individual radome.

DO-213 Section 2.4.7.1 - There was discussion regarding the need for the requirement to have some language for what range of elevation/azimuth the Radome needs to be tested for and where that information is stored. The final decision from the radar guys was that we can leave this as is without change to the angles that have been used. Also, there was a request to reduce the number of angles in elevation from every 5 degrees to every 10...**Action** - WG7 will provide some examples of data to justify this request for the team to review and make a final decision. Initial reaction from the team was to leave them as is.