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RTCA Paper No. 072-19/SC230-038
Date: March 13-14, 2019

RTCA SC-230 Meeting Minutes (March 13-14, 2019)

Attendance list:

March 13th - WG10

Name	Company
William Blake	*Garmin*
Luke Tschacher	*Boeing*
Kenny Ren	*Boeing*
Lee Nguyen	*FAA*
Rebecca Morrison	*RTCA*
Thibault Lefez	*Airbus*
Dawn Gidner	*Honeywell*
Jan Lukáš	*Honeywell*
Marius	*Collins Aerospace*
Mark Smith	*Collins Aerospace*
Venkata Sishtla	*Collins Aerospace*
Jeff Finley	*Collins Aerospace*
Steven Harrah	*NASA*
Tom Ratvasky	*NASA*
Fred Proctor	*NASA*
Matthew Lug	*USAF*
Rockee@OU	*OU*
Angelo Rossi	*MITRE*

March 14th - WG11

Name	Company
Masatoshi Abe	*Mitsubishi Electric Co.*
Chi Nguyen	*NASA*
Steven Harrah	*NASA*
Shigeru Machida	*JAXA*
Hamaki Inokuchi	*JAXA*
tomohiro	*JAXA*
Naoki Matayoshi	*JAXA*
Dawn Gidner	*Honeywell*
Jeff Finley	*Collins Aerospace*
Marius Irimia	*Collins Aerospace*
Venkata Sishtla	*Collins Aerospace*
Marius Irimia	*Collins Aerospace*
shibusawa.makoto	*Mitsubishi Electric Co.*
Shumpei Kameyama	*Mitsubishi Electric Co.*
thibault lefez	*Airbus*
Luke Tschacher	*Boeing*
Kenny Ren	*Boeing*
Lee Nguyen	*FAA*
Rebecca Morrison	*RTCA*
Jan Lukáš	*Honeywell*
Roberto Dias	*Embraer*

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March 13, 2019 (11:00-14:00 EDT)

Welcome/Administrative Remarks - Provided by Rebecca Morrison from RTCA.

Introductions/Agenda/Minutes Approval - Minutes were approved without comment.

Review WG-10 Schedule and Deliverables - Presented by Jeff within the agenda presentation which will be posted on the RTCA workspace.

Review Preliminary HAIC Requirements

Thibault presented the draft of the HAIC requirements which is available to all SC-230 members on the workspace. The Terms of Reference opened up for WG-10 has the task of updating DO-220, so the plan will be to eventually integrate this material into DO-220 directly. Dawn will be working with Karen to get the official word copy of DO-220A Change 1 to begin that integration based on the content of the current requirements draft. The consensus is that we will keep the material together in a separate document until we are ready to start that integration for ease of reviewing the new material.

There was some discussion on whether it makes sense to have HAIC covered in a separate document rather than incorporating it into an updated version of DO-220. There were arguments on both sides but the decision was made to continue to proceed down the path of this being a revision to DO-220 per the terms of reference and further evaluate this decision when we have more well defined requirements & test procedures in place.

There was some discussion on the use of 'Shall' within the requirements to ensure we are using it in the appropriate locations and to provide some room for alternative approaches where it make sense and keeping in mind the various applications (aircraft operating environments & antenna size for example)

It was suggested that we may want to include some background as to where these requirements came from by either referencing other material (feasibility study for example) or directly including the background in the document.

Section 4.1 - Suggested update - Update Altitude to Mean Sea Level (MSL) and add Static Air Temperature (SAT) specifically after the temperature.

Section 4.2 - There was a suggestion to make the list a bit more generic by pointing to 'all other radar functions installed' or similar in place of listing the functions currently in DO-220. This might help avoid a need to continually update this list going forward.

Section 4.3 - Further discussion on the use of shall in this section. There was a suggestion to perhaps ensure there are statements in place to ensure multiple thresholds are not required, but if there are multiple thresholds they should follow the requirements below. There was also a comment that we will

need to ensure the use of 'alert' is consistent with the rest of DO-220 and the definitions captured in regulatory sources such as AC 25.1322 and others.

There was some discussion on whether the limits currently in 4.3.1 are accurate or realistic. On the low end, there was concern that we don't have enough information to ensure 1 g/m3 is the right number. If we have enough new data to confirm or alter that number, we could use it, otherwise we could potentially allow the radar manufacturers to define a threshold and ensure they can meet a given threshold for probability of detection/missed event.

On the high end, there was questions whether we have even seen 3g/m3 in flight test campaigns. The discussion was that certainly 3g/m3 has been seen in flight test campaigns and though not over long spans, there are a number of reasons to believe that concentration is being seen in revenue flights where they are flying in regions our flight test campaigns.

Request to add a distance or time attribute to the thresholds. For example, detections with an rms average over a given distance.

With regards to the Must-Detect, Must-Not-Detect and Missed annunciation, there was a general statement that we will need to have further discussions on this subject and what all will be used to demonstrate the radar manufacturers can meet the requirements and that other information may be required aside from radar reflectivity in order to meet these requirements. This was acknowledged by everyone in the meeting as an item that will require further discussion and establishment of test cases and procedures that could be used by all manufacturers to demonstrate compliance.

Section 4.3.5 - There are concerns from the radar manufacturers with the ability to meet the minimum requirements specified at 80 nm, especially with smaller antenna sizes. A parallel was drawn to turbulence detection minimum ranges (12 nmi) being used to get people seated vs. avoidance (longer ranges). The OEMs took an action to help define what we would consider the minimum range with respect to the required immediate action by the crew for each threshold vs. the 'nice to have' or market driven longer ranges.

Section 4.4.1/4.4.2 - There was an action given to ensure it aligns with other similar requirements in DO-220 today for the ATA functions. The action was concluded during the meeting and they are in alignment today.

Section 5.2 - There were multiple concerns with the notion of having to perform a demonstration in HAIC conditions for each radar manufacturer. There was generally agreement that an instrumented flight test would not be required but that test cases would be made available against given weather models or some other method for demonstrating performance. We ran out of time, but will continue this discussion going forward.

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Review Action Items - Action items reviewed and noted in the table at the end of the meeting minutes

Time and Place Suggestions for Next Plenary - Tentatively 6/25-6/27 at NASA Langley. Steve to confirm with Lee and Jeff to confirm with WG-11 during tomorrows Plenary.

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Date: March 13-14, 2019

March 14, 2019 (17:00-20:00 EDT)

Introductions/Agenda - Provided by Rebecca Morrison from RTCA.

Review WG-11 Schedule and Deliverables - Shared by Jeff and captured in the agenda to be posted on the RTCA workspace.

Mitsubishi Electric to review flight test campaigns and results

JAXA reviewed material documenting results of their flight test campaign using LIDAR for clear air turbulence detection, both in Japan and in the Pacific Northwest during multiple flight tests. Results shared for low altitude windshear detection using the LIDAR. The presentation will be posted on the RTCA workspace under the WG-11 documents.

There were general questions raised surrounding the low level windshear detection information shared by JAXA and whether those measurements were taken in 'clear air' or if there was more moisture. It was noted that there were no external/separate sensors characterizing the environment, but visually the team was flying in clear air for turbulence measurements and low level windshear were thought to have been dry windshear events.

One suggestion for the feasibility report was to consider how the crew would be made aware of the LIDAR signal being absorbed or scattered by clouds/moisture/etc. in order to know they may not have LIDAR protection in those areas for CAT or other functions provided by the LIDAR equipment.

Review OEM requirements and LIDAR manufacturer capabilities

- OEM Requirements:

The OEMs presented material on current considerations for LIDAR applications including the main objective (Clear Air Turbulence (CAT)), and also other potential applications of LIDAR that may or may not be able to be performed with the same equipment. The material will be posted on the WG-11 workspace.

There was discussion on whether a LIDAR can cover an area of +/-25 degrees as currently in the OEM requirements. Further discuss will need to be held with LIDAR manufacturers as this requirement may add undesirable complexity and latency into the system.

For Gust Load Alleviation, there was a question of whether an accuracy needs to be specified at this time. The conclusion was that it will need further discussion should we chose to go down the path of defining requirements for this function. One suggestion was to have the LIDAR manufacturers define what accuracy could be obtained in the feasibility study rather than putting in a requirement

at this time. The bulk of the requirements would be surrounding the main objective (CAT) with other subjects open to discussion within the feasibility study.

Action given to the OEMs to put the CAT requirements into a document format for the team to review ahead of the next plenary and to consider adding wording for the other functions as a secondary objective of the LIDAR manufacturers.

- LIDAR Manufacturers Capabilities:

Mitsubishi Electric then provided some background and slides on the history of clear air turbulence detection using LIDAR in flight test campaigns. Also presented were alterative designs and types of LIDAR that have been studied for use in detecting CAT. The slides will be posted on the RTCA Workspace following the Plenary.

The feasibility study template with information from the background/capabilities will be put on the RTCA workspace. The aircraft OEMs will use this template for adding to the OEM requirements section.

Mitsubishi Electric also shared information showing the 'voice from Japanese airlines.' This information can be included in the OEM section perhaps and/or a separate section created to include this perspective in the Feasibility Study. The OEM's took the action to summarize the information and include in the feasibility study to allow others to add to and/or comment on the information.

<u>NASA progress on atmospheric models which may be used for validation</u>

NASA to provide a summary/presentation on what current models are available and the parameters that are currently in the models. The LIDAR manufacturers can then provide feedback on what parameters are of value and if any additional parameters are needed. NASA will also provide a bibliography of models used in the past for background material for the working group.

It was commented that a LIDAR simulation will need to be produced and/or made available in order for LIDAR manufacturers to use the simulation and weather models to validate the system is meeting some level of performance. It was then noted that the model should be made available as an example that could be used, but also specify the requirements of the model in-case LIDAR manufacturers need to make modifications or would like to use their own model for their specific application. There was discussion that at this time, perhaps the feasibility report can be used as a means to define what would be required within a weather model and simulation for verification and validation of the system and the model itself would be a deliverable when a performance standard is written.

NASA will investigate what simulation capability they currently have and whether it could be made available or what it would take to complete a model.

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Review Action Items - Action items were reviewed with the team and are provided below.

Time and Place Suggestions for Next Plenary - Tentatively 6/25-6/27 at NASA Langley (In Hampton, VA). Steve to confirm with Lee.

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Action Item #	Action	Person(s)	Estimated Completion Date
WG-10 - HAIC			
1	Dawn to work with Karen to get copy of DO-220A Change 1 to start integrating the material into a DO-220B revision.	Dawn / Karen	To be set in next WG Meeting
2	OEMs to go back and consider what minimum range requirements would be for each scenario (engines / probes) when testing for performance requirements vs. the desired ranges in practice (currently ~80 nmi).	Aircraft OEMs	To be set in next WG Meeting
3	Overall Action for WG-10 to review the comments in the minutes and discussion held during the plenary to revise the current requirements draft as needed for the next plenary review.	Steve / Thibault	To be set in next WG Meeting
WG-11 - LIDAR			
4	Ven to post material shared on the WG-11 workspace.	Venkata	
5	Action given to the OEMs to put the CAT requirements into a feasibility document format for the team to review ahead of the next plenary and discuss/review in the plenary.	Aircraft OEMs	To be set in next WG Meeting
6	The feasibility study template with information from the background/capabilities will be put on the RTCA workspace.	Venkata	To be set in next WG Meeting
7	NASA to provide a summary/presentation on what current models are available and the parameters that are currently in the models. Shumpei and other members of WG-11 will be able to respond and discuss accordingly.	Fred Proctor	To be set in next WG Meeting
8	NASA will investigate what simulation capability they currently have and whether it could be made available or what it would take to complete a model.	Steve Harrah	To be set in next WG Meeting
9	Fred to provide a bibliography of the simulator models currently available at NASA to Ven for inclusion in the feasibility study.	Fred Proctor	To be set in next WG Meeting
10	Action for Shumpei to request information from NASA (Steve as a point of contact) on historical research information on CAT LIDAR research available from NASA.	Shumpei	To be set in next WG Meeting