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Date: February 18, 2016

RTCA Paper No. 125-16/SC230-019

EUROCAE WG-95 / RTCA SC-230 WG8 Plenary 2 (February 16 - 18, 2016) - Meeting minutes

Attendance list:

Name	Company	Attendance
Caruhel, Camille	Airbus	x
Tschacher, Luke	The Boeing Company	x
Gidner, Dawn	Honeywell International, Inc.	x
Lukas, Jan	Honeywell International s.r.o.	x
Finley, Jeff	Rockwell Collins, Inc.	x
Darby, Bob	EUROCAE	x (day 1)
Lagarde, Jerome	Dassault Aviation	x
Fedoseev, Evgeny	GosNIIAS	*

* - *Via Telecon/WebEx*

x - *In person*

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February 16th, 2016

The day began with the entire WG-95 membership getting together to review current status, schedules, GKN Historical presentation and the latest information available from the recent HAIC Flight Test campaign in January provided by Alice Calmels from Airbus. As testing has just completed two weeks prior, the pitch was fairly high level with further preliminary results available throughout the rest of this year as the analysis is completed on various sensor data from the flight.

Once back into our individual sub-group meeting, we reviewed the action items from the previous plenary and made necessary updates where needed. The team decided the documentation gathered as part of the working group would be stored on the EUROCAE workspace as all members currently have access to the workspace.

Jan presented preliminary results and data from his participation in the HAIC January 2016 flight test campaign. The flight test was completed with multiple ice crystal detection/characterization probes along with a software modified RDR-4000 WXR system. ([HAIC Prototype Honeywell IntuVue®RDR-4000 Validation Presentation](#)).

Airbus presented an internal HMI concept and the background for the process behind selecting the current proposed HMI concept ([Airbus HAIC HMI Evaluation](#)). This material will be reviewed by all members and discussed in more detail in the April meeting. Finally, all the OEMs have been asked to provide results of their own internal HMI study in time for the June meeting.

Also on the subject of HMI, Dassault provided some preliminary concerns on the current high level HMI guidance recommended by Airbus. The comments were mainly surrounding the concern for how the HMI would interact with WXR returns overlaid on synthetic terrain display along with other symbology from other systems. These concerns will be further evaluated in the April meeting. Dassault also provided some preliminary information on the Engine Events they have had believed to be caused by ice crystals. More details on the three events recorded to date will be provided to the team prior to the next meeting in April.

Finally we began with an initial review of the draft material put together for Section 1 (The artist formerly known as Section 0) by the OEMs and Radar Manufacturers.

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We began the day with a working review/edit of the updates made to Section 1. Once we reached a stage where further actions were needed offline, we moved on to the next section for review.

Further discussion on the general outline of the remaining sections lead to conversation on the capabilities of the radar and what will be done (standard operating procedure) with the information provided by the Radar. Specifically, limitations of the current radar technology were discussed as it relates to the Moderate Ice Crystal threshold, which may result in only being able to display information out to ~20-30 Nmi depending on the threshold provided. Higher concentrations of ice crystals could be

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detected at longer ranges. Actions were given for further conversations. Boeing will provide a template for this information for the team to review in our next meeting in April.

The request was made to ensure 'correct annunciation' and 'missed/false annunciation' terms have appropriate caveats (a word believed to be of French origin) to state the conditions in which the requirements should be met. We put together an initial input for the team to review at a later date once we better understand the problem space.

There was discussion of a need to have a programmable threshold due to the variability in installation susceptibilities (some engines/probes may not be susceptible to ice crystals whereas others need very low densities of ice crystals identified). This will be defined in the operational goals section of the document.

We should consider clarifying the FHA classification to state it follows the same restrictions and perhaps is part of the 'hazardously misleading weather' category. We may want to consider including the typical structure of an FHA which provides details on the failure, failure category, passenger/airframe impacts and justifications.

We then worked on the basic outline and initial information for Section 4.

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The morning of the 18th was spent further discussing the problem space (altitude, temperature, IWC thresholds, etc.) and outlining Section 5 for the next meeting.

With this in mind, we drafted several questions to review with the rest of WG-95 in the afternoon.

- 1) What altitude is relevant for remote detection of conditions leading to engine issues?
 - WG-95-SG Initial Thoughts - We are still validating this answer and the OEM's plan to have a more mature answer by the April meeting. There is general data available from the OEM's (see graphs in Section 4.0 of the current draft), but further discussion is needed before we select a preliminary altitude/temperature.
 - WG-95 Response - They are using the Convective Cloud Ice Crystal Envelope in [CFR Part 33 Appendix D](#) for the minimum envelope in which the IC detection probe must operate.
- 2) What altitude is relevant for remote detection of issues leading to air data probe issues?
 - WG-95-SG Initial Thoughts - Initial recommendation is 10,000 feet based on the information currently in Section 5.0 of the draft feasibility report.
 - WG-95 Response - They are using the Convective Cloud Ice Crystal Envelope in [CFR Part 33 Appendix D](#) for the minimum envelope in which the IC detection probe must operate.
- 3) What IWC threshold/duration is relevant for remote detection of conditions leading to engine issues / probe issues?
 - WG-95-SG Initial Thoughts - This needs to be further evaluated and will be discussed further in April, but initial values used from the flight test campaign were:

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- Moderate 1 g/m³ for 10 minutes
 - Severe 3 g/m³ and avoid by 20 nm
 - WG-95 Response - The IC probes are required to be able to detect as low as 0.5 g/m³ and there is a [curve provided in ED-103 Appendix 1](#) (may be tilted Chapter 7 in the current draft) which provides the curve which accounts for velocity and duration for both engine and probes. They did note that the threshold/duration for probes would likely not detect the IC until very near or after the probe had been blocked. This would seem to give some validity for the need to detection ahead of time.
- 4) What are the key ice parameters which cause engine/probe issues, i.e. size, density, temperature, shape, concentration?
- WG-95 Response - Key parameters are ice water content and velocity (see draft ED-103, Appendix 1 (currently named Chapter 7) for the curve). There was also a comment that they do not believe IC shape/size/density play a significant role in the end effect on the probes/engine issues.
- 5) What could be the use of data after the detection? Is the 0.5 g/m³ used?
- WG-95 Response - They do not define an operational action for the crew in ED-103, but agreed that the response is likely to be very installation dependent and the thresholds used will likely have to be configurable.

Action Items:

#	Text	Assigned To	Due Date	Comment
10	EUROCAE/RTCA to release a joint letter to solicit NASA on IC model creation.	RTCA EUROCAE	26-Feb-16	2/18/2016 - Joint letter was sent to NASA. Action complete.
19	Airbus to set a telecon with CNRS (The National Center for Scientific Research) for Ice Crystals particules discussion (size/density...)	Camille	18-Mar-16	preliminary data available.
4	Airbus to propose a section 3 content in accordance with presentation Operational concept - cockpit implementation - Airbus vision_final.pdf	Camille	18-Mar-16	Camille to prepare and provide a draft for section 2 for other OEMs/Radar Manufacturers to evaluate.

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12	OEM to list all the display constraints	Luke Camille Nicolas M.	1-Apr-16	Boeing - Use of Cyan would drive displays updates on all models (other than 787). Will need to consider retrofittable options as well as forward fit. Further constraints will be placed in the document by OEMs prior to the April meeting
2	OEM to update Section 1 on the history of Ice Crystals related events on OEM side and the effect on the airplane.	Boeing Airbus Dassault	1-Apr-16	Initial draft in place, but needs cleaned up and expanded.
21	LRA SG members to provide relevant and sharable documents for Section 1. i.e. Description of the problem, history of flight test campaigns and industry groups, radar current state.	All WG-95 LRD members	1-Apr-16	Additional material still remains to be added. Team to work on this again for the April Meeting.
29	Provide a presentation and/or timeline on when IC models will be available to the team.	Steve Harrah	1-Apr-16	
33	Dassault to provide more information if available on their 3 engine events (altitude, temperature, location, time and date).	Dassault	1-Apr-16	
34	See if we can use one of the events in our database as an example in the paper (i.e. can we give a more complete set of information (location, time, date, details of issue, pilot report) for an event with nexrad data available (ideally not the Minneapolis case).	Boeing	1-Apr-16	
35	Section 3: Review procedures internally and provide a list of potential recommended procedures when encountering IC (with a note that you have to review your specific FCOM) & what our recommended IC density and duration.	Airbus Boeing	1-Apr-16	

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30	Based on the presentation provided during this weeks meeting, other OEMs/Radar manufacturers will take it back and provide a preliminary update in the next meeting.	Boeing Honeywell Rockwell Dassault	8-Apr-16	
8	Writing Assignent - Radar constraints/expected results in regard to Section 5 requirements and assumptions. Jeff will coordinate with other radar suppliers and Gosnias with a draft and others will provide comment and supporting material. [Section 5 Draft]	Rockwell Honeywell	12-Apr-16	
36	OEMs need to sperately bring a proposal for the recommended altitude/temperature/flight phase in which we want this feature to be active and what probabilities of detection and miss-detection is acceptable.	OEMs	16-Apr-16	
37	Contact other OEMs to make them aware of the project and see if they have any information to contribute regarding IC events.	Dawn William	16-Apr-16	
38	Provide initial draft of section 6 (Validation and Verification Strategy)		16-Apr-16	
39	Provide initial draft of section 7 (HMI Concept)	Camille	16-Apr-16	
40	Add a document comment excel file to the workspace to accommodate the working draft.	Camille	16-Apr-16	
31	Based on the results of the discussions to be held in the April meeting, OEMs/Radar manufacturers will provide results of their own HMI studies in the June Meeting.	Boeing Airbus Honeywell Rockwell Dassault	17-Jun-16	

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26	Provide feedback on the results of the flight test campaign to be held in February 2016 to NASA to ensure results are comparable and in line with existing events. Recommendations can be made as to whether things line up or further evaluation/data sets are needed. There are two aspects to this action: (1) microphysics and (2) reflectivity data analysis	HAIC Members (Jan/Fabien) NASA (Steve)	1-Jul-16	
22	LRA SG members to ensure that the bibliography list is complete & provide all available/shareable data to the secretary to post to the EUROCAE workspace.	All WG-95 LRD members	1-Oct-16	
16	OEM to contact their test pilots participation in the working group (at least consultation)	Upon Request TBD	As needed	