

Date: May 4, 2016

RTCA Paper No. 107-16/SC230-017

**EUROCAE WG-95 / RTCA SC-230 WG8 Plenary 3 (April 12 - 14, 2016) - Meeting minutes**

**Attendance list:**

<b>Name</b>	<b>Company</b>	<b>Attendance</b>
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
Harrah, Steve	NASA	x
Proctor, Fred	NASA	x
Campbell, Brian	ASAMEC Safety Committee (ALPA)	x
Blake, William	Garmin	*
Fedoseev, Evgeny	GosNIIAS	*

\* - Via Telecon/WebEx  
x - In person

Date: May 4, 2016

April 12<sup>th</sup>, 2016

The day began with the entire WG-95 membership getting together at the Hilton to go through introduction of new members, review current status and schedules for each subgroup.

Once back into our individual sub-group meeting, we walked through the action item list to review closed actions from our previous meeting and reviewed document updates since our last plenary.

There was some early discussion on the potential for new information from other classes of aircraft (ex. Embraer aircraft) and the current issues being seen in regional jet aircraft. Brian (ALPA) provided information stating the limits on when ICI conditions have been present in the fleet he represents are between 31kft-39kft. **Action** - Brian (ALPA) will work to see if additional data can be provided on events that have been recorded amongst the ALPA members.

Steve Harrah presented results of the NASA flight test campaign which will be uploaded to the EUROCAE Workspace. The airplane used during the flight test campaign was equipped with various probes designed to measure different ice crystal characteristics and with an RDR-4000 WXR. The standard RDR-4000 WXR was available for the pilots while the raw data collected by the RDR-4000 WXR was available to NASA for data processing and evaluation. This allowed the NASA team to look at individual tilt angles and elevation slices prior to the data being processed by the RDR-4000 Radar Processor.

**Action** - Steve agreed to provide graphs showing plots of time vs. Ice Water Content (IWC) for the Pitot events described in his presentation to help show IWC over time for each probe event.

As some of the weather analyzed during the flight test campaign was in the vicinity of tropical storms, there was some discussion on the fact that tropical storms or hurricanes might be areas of concern given the high amounts of moisture lifted aloft without significant returns (yellow/red cores) below resulting in extended time in high IWC.

It was noted that one precaution taken by NASA during the campaign was to constantly (every 5 minutes or so) adjust Engine thrust settings and to ensure all 4 engines were at slightly different thrust settings.

One initial result of interest -- NASA's results show that the WXR's measured reflectivity is showing ranges of very low reflectivity (~10 dBz) to high reflectivity (~30-40 dBz) for the same IWC measured by the probes.

Note: Notable Events slide has "multiple tracks >10 min duration tracks with IWC > 1.5 g/m<sup>3</sup>."

Steve also shared a brief plan for future test campaigns (next one in August 2017), which will be more focused on testing/demonstrating a multi-frequency radar for detecting high IWC.

Date: May 4, 2016

**April 13<sup>th</sup>, 2016**

We began the day with a presentation from NASA (Fred Proctor) regarding the work being done to model high IWC. It was noted by NASA, based on the data collected to date and initial analysis, their position is that they believe measurements of  $>3\text{g}/\text{m}^3$  are rare and probably localized to overshoot areas and/or mixed phase or graupel areas.

It was commented that probe manufacturers are telling us their probes freeze up at  $3\text{g}/\text{m}^3$ ...and we have several events in service...so it seems that there are instances of  $>3\text{g}/\text{m}^3$  and we have to assume it is in regions that are not painting red on the displays.

NASA commented that the reflectivity recorded against actual measurements of IWC can vary from black/green/yellow and red...meaning you are not always going to get a red return over  $3\text{g}/\text{m}^3$  regions based on their analysis and data collected to date. Steve provided some information from the HIWC campaign in Florida to show statistics on IWC vs. reflectivity. **Action** - Steve was going to provide the graphs shown during the meeting to the team.

**Action** - Camille mentioned she will ask but does not believe there is data available for her probe events that would have ground based radar data available, but Brian mentioned he may have a chance to get data for probe events in the US which would have ground based radar available and potentially the pilot's report. This would help us understand the reflectivity being seen by the pilot when encountering these probe icing events and help validate whether we need to display higher concentrations or if they are already addressed by existing HMI (red reflectivity or other convective threat icons/features).

**Action** - Boeing will be sending requests to both RCI and Honeywell to request A453 data with the existing high IWC symbology proposed by Airbus (and anything else they may have available for evaluation) for review on our displays. It was suggested that perhaps we should all evaluate the same symbology/scenarios to ensure we are all comparing apples to apples when we discuss further in June/October.

We had a phone call with members of the HAIC team to discuss the Ice Crystals topology and W-Band RASTA Radar results (Delphine Leroy from CNRS and Julien Delanoe from LATMOS). We will request to obtain a copy of the presentation material, but it was mentioned by the team on the phone that the longest period of  $>1.5\text{g}/\text{m}^3$  was 15 minutes in Cayenne at warmer temperatures ( $\sim -10/-15\text{C}$ ). The team used live calibration for their relationship between IWC and reflectivity (at 95 GHz).

**Action** - A request was made for Steve to produce a graph similar to the ones he provided separating the data out by tropical storm data sets vs. typical convective systems (MCS systems).

Rockwell provided data to show there are some correlations between reflectivity and IWC to some extent (acknowledging there are areas when it isn't or where the ratio changes). The point being that provided you don't look at it too closely (measure with a micrometer), there seems to be some correlation. We spent the remainder of the time going through the updated sections of the document and making live edits.



RTCA, Inc.  
1150 18<sup>th</sup> Street, NW, Suite 910  
Washington, DC 20036  
Phone: (202) 833-9339  
Fax: (202) 833-9434  
[www.rtca.org](http://www.rtca.org)



EUROCAE headquarters  
1102 rue Étienne Dolet  
92240 Malakoff, France  
Phone: +33.1.40.92.79.30  
Fax: +33.1.46.55.62.65  
<https://www.eurocae.net/>

Date: May 4, 2016

**April 14<sup>th</sup>, 2016**

The morning of the 14<sup>th</sup> was spent further discussing the working document and walking through the section on the HMI concept currently proposed by Airbus and Honeywell. It has been indicated that some RTCA/EUROCAE committee are working on Weather Display for Uplinked data. **Action** - Boeing and Airbus will review what are the progress of those committees and if they are specifically working on Ice Crystals.

At the conclusion of the meeting, we collectively decided that the next sub-group Plenary would be held in Seattle, WA on the days of June 28<sup>th</sup> - June 30<sup>th</sup>. A meeting notice will be sent out shortly to allow for time to book travel.

Finally, the group reconvened at the Hilton to de-brief the reset of the working group on our progress and plans going forward.

Date: May 4, 2016

Action Items:

#	Text	Actionee	Due date	Comment
43	Send requests to both suppliers for a A453 playback file for our review of the HMI. Honeywell to send request internally, but Luke will also send a request to Roland at Honeywell and also Jeff at RCI for playback files for evaluation on our displays.	Luke	5-May-16	
48	Dawn to investigate whether she can share an example A708 data file for the current HMI proposal for everyone to evaluate the same scenario/HMI.	Dawn	13-May-16	
8	Writing Assignment - 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	15-May-16	The majority of this section is complete and in the working draft. The remaining portions of the section will be worked prior to the next meeting.
36	OEMs need to separately 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	15-May-16	Initial draft contains a 1st order cut for engine data from Boeing & probe data from Airbus. The section will require some clarity and additional graphs to show where the thresholds are being put in place and why. Luke to work this prior to the next meeting.
47	Camille to provide additional information to NASA for a subset of probe events to help in the validation/evaluation of the models for HIWC.	Camille	27-May-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 Jeff Brian	17-Jun-16	Dawn/Jeff still working to get contacts at other aircraft OEMs: Gulfstream & Embraer (Dawn) Bombardier (Jeff) Cessna (William)  Brian to check into seeing if airlines can contribute any information from other aircraft/airlines events (likely more probe issues than engine issues).
31	Based on the results of the discussions 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	

Date: May 4, 2016

42	Honeywell/Dassault to evaluate the HAIC HMI in the integrated cockpit (including Synthetic Terrain on Navigation display)	Dassault Honeywell	17-Jun-16	
44	Brian (ALPA) will work to see if additional data can be provided on events that have been recorded amongst the ALPA members.	Brian	17-Jun-16	
45	Steve to provide graphs showing plots of time vs. IWC for the events described in his presentation for Pitot anomalies to help show IWC over time for each event.	Steve Harrah	17-Jun-16	
46	Steve to produce a graph similar to the ones he provided for reflectivity against IWC, but separating the data out by tropical storm data sets vs. typical convective systems (MCS systems).	Steve Harrah	17-Jun-16	
12	OEM to list all the display constraints	Luke Camille Jérôme	27-Jun-16	Boeing and Airbus constraints are currently in the draft. Waiting to see if Dassault (or others) have any additional constraints.
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	27-Jun-16	Yes we can, I am working out which case will work best and will provide at least one option for the team later this week.  Luke to provide details of the two test cases that have been downselected for actual engine events.
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	27-Jun-16	Boeing: Recommendations placed in the current draft. We will also need to work on ensuring we include the appropriate restrictions on what cannot be done or what is NOT being detected as well. Airbus : No specific procedure concerning the Ice Crystals, only generic weather avoidance procedures.
26	Provide feedback on the results of the flight test campaign to be held in January 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	



RTCA, Inc.  
 1150 18<sup>th</sup> Street, NW, Suite 910  
 Washington, DC 20036  
 Phone: (202) 833-9339  
 Fax: (202) 833-9434  
 www.rtca.org



EUROCAE headquarters  
 1102 rue Étienne Dolet  
 92240 Malakoff, France  
 Phone: +33.1.40.92.79.30  
 Fax: +33.1.46.55.62.65  
<https://www.eurocae.net/>

Date: May 4, 2016

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	