

Special Committee 147

**MINIMUM OPERATIONAL PERFORMANCE STANDARDS FOR TRAFFIC ALERT AND
COLLISION AVOIDANCE SYSTEMS AIRBORNE EQUIPMENT**

The 85th meeting of the SC-147 was held on September 21st, 2017 at RTCA in Washington, DC. In accordance with the Federal Advisory Committee Act, Ms. Sheila Mariano, Federal Aviation Administration (FAA) was the Designated Federal Officer (DFO) for this meeting.

J. Stuart Searight	Co-Chairman, Federal Aviation Administration
Ruy Brandao	Co-Chairman, Honeywell
Donna Froehlich	Secretary, Aurora Sciences
Al Secen	RTCA

Note: All presentations from the agenda items summarized below can be found on the RTCA Workspace (<http://workspace.rtca.org/kws>) in the SC-147 Traffic Alert & Collision Avoidance System area.

Agenda Item 1.a-1.d – Opening Plenary Session

Stuart Searight opened the meeting and thanked everyone for their participation and efforts in the Working group meetings held during the week. Mr. Searight noted that this was a joint Plenary with EUORCAE WG75 and welcomed Bill Booth, chair of WG-75.

Al Secen welcomed SC-147 and WG-75 to RTCA and provided logistics information regarding physical layout of the facility, basic emergency information, and the RTCA ethics policy with focus on proprietary information.

Mr. Searight asked the committee if they approved of the minutes from Plenary Meeting #85. There were no comments or objections so the minutes were approved. Mr. Searight presented the agenda for this Plenary. Mr. Brandao indicated he had TCAS Operational information that would be interesting to the group and asked to be included on the agenda. The Leadership anticipated sufficient time for the briefing, Mr. Brandao was added to the agenda.

Additionally, Sheila Mariano, the Designated Federal Official (DFO), read the public meeting announcement.

Bill Booth opened the meeting for EUROCAE WG-75, agenda and ethics policy were provided. Mr. Booth noted the parallels between the two organizations.

Agenda Item 2 - WG-75 Activities ([WG-75 Activities Report to SC-147](#))

Mr. Bill Booth opened his brief noting that this is WG-75 Plenary Meeting #52. He indicated that the two groups' schedules and processes are aligned.

Team members are developing a CAS Interoperability MASPS based on the Interoperability Requirements deliverable from the ISRA between SC-147 and SC-228. Bill stated that comments have been received on the draft and are being addressed. – Some comments require discussion with WG-105 DAA folks.

Mr. Booth indicated the ACAS Xu Sub-Group Chair is Dierk Steinbach. That Sub-Group is providing support to RTCA ACAS Xu Group, participating on CAFÉ – Encounter Modelling Work and some individuals are also focusing their efforts in the ACAS Xu Tiger Teams

We will hold October meetings for our coordination with Xu Tiger Teams, will be supporting Xu meetings in November, and supporting pre-FRAC and FRAC Xa/Xo efforts including December meeting in US. That is, our upcoming meetings are:

- WG-75 Meeting in October 2017
- ACAS Xu SG meeting October 2017
- ACAS Xa Validation Workshop TBD
- Joint meeting in USA with SC-147 5-7 Dec.
- Others to be scheduled in line with the FRAC (and pre-FRAC) timeline

Agenda Item 3 – SESAR Brief on CAPITO Efforts ([CAPITO RTCA EUROCAE](#))

CAPITO PJ11 Solutions (Work Packages) were reviewed, with some focus on the Xu Validation Roadmap PJ11-A2. Ongoing V1 (Scoping) validation exercise (EXE-01) – until 31st October. Additionally the SESAR Consortium is continuing work on V2 (Feasibility) Preparation activities: Encounter modelling and Platforms preparation for EXE-02 and EXE-03. Delivered: Initial ACAS Xu OSED for V1 (ConOps) – Delivered 27th July 2017, V1 Validation Plan – Delivered 16th August 2017. Next deliverables include V1 Validation Report (due 1st January 2018) and V1 OSED (due 1st March 2018).

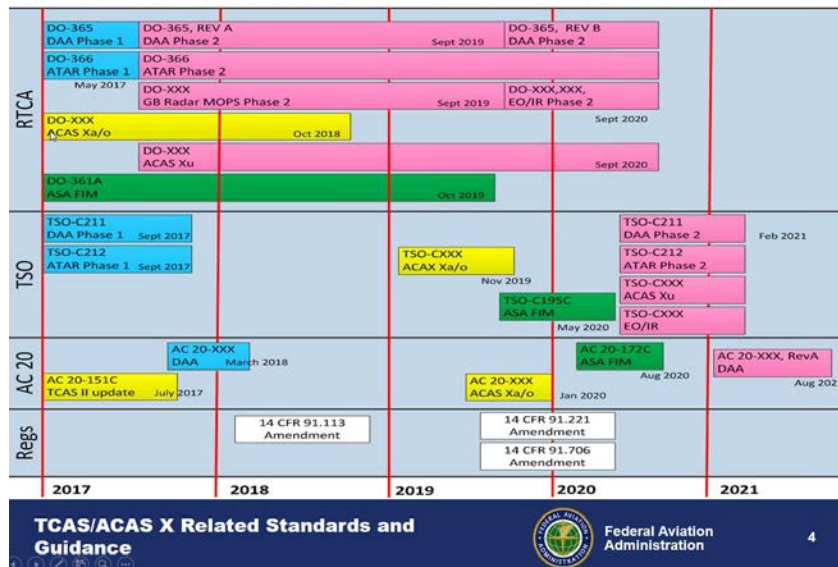
Mr. Booth then discussed the Encounter Modelling for V2 (CAFÉ); of interest is Automatic TCAS Removal (of encounters) from RADAR data. This uses anonymized encounter data. – Presentation to ACAS Xu Working Group will be scheduled in October or November 2017

Mr. Booth then presented the validation schedule showing participation of Honeywell and Airbus for prototypes. Please contact Mr. Booth if your organization is interested in participating.

Agenda Item 4 – Updates on TSO Schedule ([Regulatory Products and Timelines for SC-147](#))

Ms. Sheila Mariano highlighted the timelines for various products (ACAS, DAA, ATAR and ASA FIM) that are in process. She highlighted the “Cert” Products on the Timeline and noted that the “yellow” activities/products are ACAS X. Ms. Mariano also highlighted various regulations that need to be updated for these products.

Current Regulatory Products & Timeline



Mr. Kevin Hallworth commented that EASA has started on its European TSO draft. (“I have talked with Mr. Plummer, will have to follow-up and discuss the Advisory Circular with you so we can be in coordination on that also.”)

There was some discussion about how to approach the regulations for ACAS Xa/Xo where the Xo functionality is included in the software specification, but the capability is enabled/or disabled based on each vendor’s product plan. This was taken off-line, see Action Item to Mr. Rowlan under Agenda Item 5c, Threat Working Group Report.

Agenda Item 5a – Coordination Sub-Group (CSG) Report (SC-147 CWG ProgressUpdate September2017)

Mr. Panken reviewed activities and progress of CSG. His points included:

- CSG team members have made significant progress on Coordination Bench Tests; have some more to do on these, including some iterations with manufacturers so we can harden them from their inputs. ADD Review and MOPS Review.
- The ARA Review team will look more closely at the Display Rules related to the Xo functions
- Mr. Panken highlighted the HAZOP Resolution Progress and the final chart with hazards and mitigations – then JHU APL and MIT LL expanded the HAZOP chart and created a Tracking Worksheet. In the Tracking Worksheet, green means we are good, orange means we changed our minds/used a different, or additional, approach. We are satisfied with the status presented in the worksheet.
- The CSG has started work on addressing the ACAS Xu Coordination. – Mr. Leeper provided an overview of the Xu ISRA and how we will make sure we are following the requirements in the alerting coordination. – Mr. Leeper also highlighted that the vertical bands work differently from Vertical RAs and that there needs to be some examination in this area also.

Agenda Item 5b – Surveillance Working group (SWG) Report ([SWG Report Out](#))

Mr. Bender indicated that this week SWG held their 100th meeting. He continued that there was a lot of progress at the SWG on Tuesday:

- Mr. Jessen reviewed all Run15R2 STM updates; there were no objections to the changes. Specifically:
 - Approved the proposed updates for tracking in polar regions as presented by Mr. Wikle
 - Approved the updated MODE C MOPS tests as presented by Mr. Panken.
 - Approved transponder failure mitigation text provided by Mr. Teller
 - Approved additional passive surveillance tests from Mr. Eich
- The SWG reviewed the updated interface section and agreed to have it incorporated in the MOPS Draft.

Mr. Bender continued by providing an Overall Status Update for the SWG:

- Regarding Action Tracking Log:
 - Closed out 9 actions
 - Plan to close 7 additional items in time for Pre-FRAC
 - Have 5 longer term actions to resolve
- Some MOPS test review still remaining; plan to have as many tests as possible complete for Pre-FRAC
- Mr. Bender and Mr. Brandao to make another pass at resolving ADD|MOPS comments
- Noted that preliminary results (with vendor data) on LA Basin Analysis does not pass the false track rate. However, the current analysis uses a surveillance volume larger than the MOPS ; a re-run may actually pass.
- SWG generated 6 comments that will be “submitted” during the Pre-FRAC period.

Agenda Item 5c – Threat Working group (TWG) Report ([Report from TW 09212017](#))

Mr. Rowlan summarized accomplishments of the TWG:

- Ms. Charlene Mari presented DSNA Brief ([SC147-WG75 DSNA inputs to SESAR ACAS Xa Run 15 validation ASept2017 v1.1](#))
- Mr. Rowlan highlighted OWG/OWS results of ID07 and ID33. Follow-up discussion on ID33 TA ‘Aural’ annunciation during an RA. Mr. Bess indicated he was only individual on OWG/OWS survey that dissented with suppressing TA ‘Aural’ during an RA. His logic was that it was additional information that the pilot/crew could use for situational awareness (e.g., aid in traffic identification) or ignore if deemed appropriate. Mr. Searight asked Mr. Bess to reach back to ALPA cohort for any additional insights. One participant pointed out: The way it is written now it is consistent with Advisory Circular (AC) 2532 (title) which indicates “MUST”.
- ACAS Xa Operational Evaluation status ([ACAS Xa OpEval SC-147+WG-75 20170920](#)) was presented by Tom Teller, he highlighted flights, flight-hours of data collected and some alerts/scenarios that were of interest.

- Airbus Concern related to timing of TAs in certain formation flight with slow closure rate (flight following) in high altitudes. The TRM developers indicated that additional changes to high altitudes have affected the alert timing in those high altitudes, it appears to be in line with what Airbus was recommending/requesting.
- ACAS Xo Reversal Concern – After some discussion, the group agreed no change to be made unless data/evidence can show this is actually an issue that needs to be dealt with.
- ACAS Xa/Xo MOPS Cert TSO AC discussion resurfaced. The AIR-130 position paper will be posted in the plenary briefs folder for review and further discussion.
 - Ms. Mariano indicated we will differentiate the boxes with different capability. Mr. Brandao indicated the box has both capabilities but the installer doesn't have to enable one or both of the Xo applications.
 - Ms. Mariano explained the TSO ensures that the box is fully tested and operational. Need to make sure we are handling the TSO properly, but that some people might not understand the full intent of the reg.

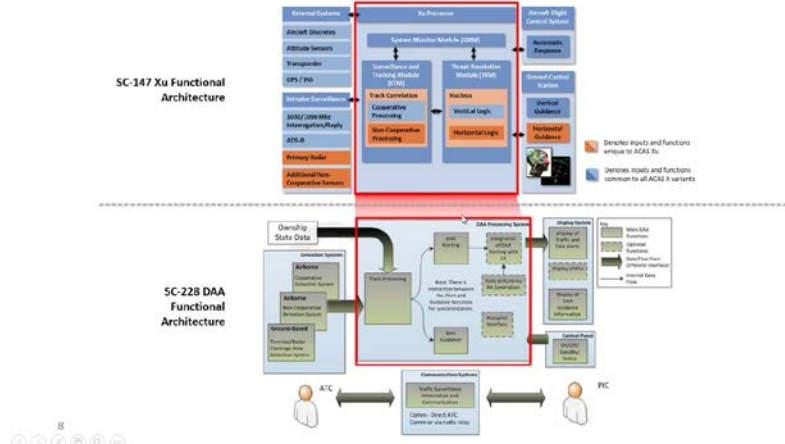
Action Item: Mr. Rowlan took the action to summarize the concerns/positions related to certifying avionics with Xa/Xo even if Xo will not be enabled in the installation. He will refer to the AIR-130 position paper and schedule a follow-up with Ms Mariano and interested parties to discuss further.

Agenda Item 6 – ACAS X_U Working Group/Tiger Team Updates ([XU WG Update Sep SC-147](#))

Xu WG Recent work:

- Review of Xa MOPS for baseline/conversion to Xu MOPS –Xu Working Group has reviewed several up-front sections. The Xu Tiger Teams (Sub-Groups) have been assigned worksheets from the Xa/Xo MOPS for review regarding applicability to, edits for, the Xu MOPS.
- Coordination with SC-228, DAA Architecture Alignment – we will specify everything inside the red box on the architecture diagram; the Xu Test Requirements will be performed within those boundaries.

DAA Architecture Alignment



- New efforts in ACAS Xu Working Group: developing Xu MOPS (and algorithm specs) based on SC-228 Phase I MOPS and keeping up to date on Phase II so we can be in alignment with the Phase II MOPS also. – Surveillance and Terminal Operations are big topics in Phase 2. Highlighted DAA Phase II Topic Areas for Xu to consider (as of Aug 2017)
- Mr. Leeper noted: Xu Working Group needs to address Safety work for operational areas like Oceanic in order to leverage the expanded scope in DAA Phase II.
- The 2nd ACAS Xu Flight Test was successfully performed this summer (first was in fall of 2014)

2017 Flight Test

- June 13 – August 1, 2017
- Second airborne flight test of ACAS Xu
- Restricted airspace (R-2515) near Edwards Air Force Base
- 245 test cards, 12 sorties
- 12 encounter geometry categories
- Responsible Test Organization: NASA Armstrong
- Three test aircraft: one unmanned, two manned
- Method: ACAS Xu flown in scripted encounters against one or two intruders

- Implementation of the full Xu DAA solution
 - Mature and integrated Run 3 STM and TRM
 - RWC and CA alerting and guidance
 - Nucleus that selects optimal vertical or horizontal maneuver
- Two prototypes of Xu: Honeywell and L3-ACSS



2014 vs. 2017 Flight Test Comparison

	2014	2017
Xu Threat Logic	Separate TRMs for horizontal and vertical logic	Single TRM issues horizontal and vertical advisories
Nucleus	None	Incorporates encounter geometry, ownship performance, and available surveillance
Xu Surveillance Sources	Active 1000/1500 1000ES ACSS-B Primary Radar, DRR	Same
Surveillance Logics	Honeywell Fusion STM FAA STM ADS-B only FAA STM CRSS only	STM with FAA correlation tracker STM with Honeywell Fusion tracker*
Coordination	Responsive, ACES	Active (same as TCAS II: ACAS Xu)
RWC Advisories	Not presented to flight crew during CA encounters	Two alerting modes, DAA Mode and Policy Mode, alerts presented to pilots
Airspace Manufacturers	Honeywell	Honeywell and ACSS
Ownship Aircraft	NASA X-45 (Prod E), OA Capital Asset (Prod E)	NASA X-45 (Prod E)

Next ACAS Xu (WG) Face-to-Face meetings will be at RTCA In Washington DC on 4, 15, 16 November 2017 and then 10, 11, and 12 April 2018.

ACAS Xu Run4 is scheduled to be released later this CY will include a release of the ADD.

Xu Variant for Smalls (20170921-ACASXu small RTCA for workspace)

Mr. Olson briefed the Plenary group on the 16 August 2017 Demonstration of sUAS concept research, a joint MIT Lincoln Laboratories (MIT LL), Johns Hopkins University Applied Physics Laboratories (JHU APL), & FAA funded Research and Development effort. Mr. Olson explained assumptions, test constraints and the surveillance used for the sUA. The demonstration included a scenario with a manned aircraft, which highlighted difficulties with Line-of-Sight visual identification of the other aircraft.

This effort demonstrates feasibility of using the ACAS Xu concepts for sUAS. The TCAS (ACAS X) Program Office is interested in conducting further research. He noted that there is interest in establishing a standard for CAS capability ensuring interoperability for smalls. We need to find the right venue (Association/Committee) to establish the standard. We are working with decision makers to figure out how the regulation/regulator will work – that is TBD. But given pace of technology, we need to work the standards and the policy in parallel now.

Agenda Item 7 – TCAS Operations –Kunming Airport RA Event(s) Summary ([Kunming Airport RA Event Summary RTCA SC147 20170921](#))

Mr. Brandao indicated that his presentation describe TCAS II Operational Alerting at Kunming airport (IATA KMG = ICAO ZPPP) – He described the airport as having 2 parallel runways, and, in many ways is “China’s Denver”.

Analysis shows that the TCAS tau cap feature gets capped/latched at 28 seconds about 2 minutes out (i.e., 2.85 NMi) and 1000ft vertical separation. At 1.1 NMi, the horizontal closure is essentially nil (0), but the tau cap feature is latched and the vertical separation has closed, so an RA is generated.

Brandao commented: This is similar to the Hybrid Surveillance “feature”/symptom. We have already noted that latching a value can be problematic. Mr. Rowlan asked “Does ACAS X Resolve this?” Mr. Klaus responded that: There is no tau cap feature in ACAS X and we have been working parallel approaches as documented by our effort to resolve Xa-0066. So this should be resolved in ACAS X.

Agenda Item 8 – Closing of SC-147 and WG-75

Mr. Searight and Mr. Booth again thanked everyone for a productive week and reminded everyone that the December ACAS X_A/ X_O Face-to-Face working meetings and Plenary will be held at Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland.

[Note: Logistics information was sent to the SC-147 mailing list on 28 September 2017.]

Meeting was adjourned.

Certified as a true and accurate summary of the meeting.

Co-Chairman

Co-Chairman

-S-

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Mr. Stuart Searight

Mr. Ruy Brandao

FAA

Honeywell

Meeting Attendance for SC-147 Plenary on September 21st, 2017
Attachment 1

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