

Special Committee 147

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

The 101st meeting of RTCA SC-147 and 70th meeting of EUROCAE WG-75 was held on 10 March 2022; this was a virtual (WebEx) Plenary hosted by RTCA.

The following Leadership was present:

J. Stuart Searight	Co-Chair, Federal Aviation Administration
Ruy Brandao	Co-Chair,
Garfield Dean for Bill Booth	Co-Chair, EUROCAE WG-75
Matt Haskin	Government Authorized Representative
Donna Froehlich	Secretary, Aurora Innovations
Rebecca Morrison for Al Secen	Program Director RTCA
Alex Engle	Tech PM EUROCAE

1. Chairmen's Opening Remarks / Introductions
2. Anti-Trust Statement & RTCA/EUROCAE Policies
3. [Approval Of Minutes From 100th Meeting of SC-147](#) (10 June 2021)
4. Approval of Agenda
5. EUROCAE WG-75 Work-plan update
6. ACAS Xa MOPS Update Plan
 - a. EUROCONTROL ACAS Xa Validation Assessment
 - b. Response to Findings
7. EASA ACAS Xa Rulemaking Status and Updates
8. Status of US Regulatory Efforts
[Break]
9. ACAS Xr Joint MOPS Development
10. Review of Comments and Resolutions from ACAS sXu pre-FRAC
11. Decision Whether to Approve FRAC of ACAS sXu MOPS
12. Future Meeting Scheduling (Silbermann/Searight)
13. Adjourn
Close With Invitation to Join STM and TRM Working Group WebEx at 13:15 EST which will start with a status briefing on ASTM DAA V2.

1. Open

Mr. Stuart Searight welcomed everyone to our Plenary. Mr. Searight announced that Mr. Kevin Hallworth retired since our last Plenary; continuing he said that his participation would be surely missed. Then, he indicated that his role would be covered by Mauro Pagliarini and Dominique Guillerm of EASA, and welcomed them to our group.

Mr. Searight also mentioned that Mr. Al Secen was on (bereavement/personal) leave this week; (Mr. Searight added that an e-card is available for everyone to sign and that the link is posted in the chat.) Then, Mr. Searight noted that Ms. Rebecca Morrison is our point of contact this week, Mr. Searight thanked her for all she has done in helping us prepare for this meeting and getting it launched today.

2. [Anti-Trust Statement & RTCA/EUROCAE Policies](#)

Ms. Rebecca Morrison reviewed membership policy and anti-trust policies. She indicated policies for EUROCAE are similar, and presented the EUROCAE slide for comparison; Mr. Garfield Dean confirmed the EUROCAE policies

3. [Approval Of Minutes From 100th Meeting of SC-147](#) (10 June 2021)

Ms. Donna Froehlich indicated that the minutes have been available in the SC-147 folder on the AerOpus site; she added that there have been no questions or comments

Mr. Searight asked if the Committee would approve the minutes. Mr. Stacey Rowlan made the motion to approve the minutes; Mr. Garfield Dean seconded the motion. The Committee approved the [10 June 2021 Plenary Minutes](#).

4. Approval of [Plenary Agenda](#)

Mr. Searight shared the agenda for today's meeting. He asked for any comments, questions changes or additions. There was no discussion and as there were no changes, the agenda was accepted as posted.

5. EUROCAE WG-75 Work-plan update - AND -

6. ACAS Xa MOPS Update Plan

- a. [EUROCONTROL ACAS Xa Validation Assessment](#)
- b. Response to Findings

Mr. Garfield Dean presented the status of the EUROCAE WG-75 ACAS Xa validation efforts. First he provided some background, then segued into the primary focus, their analysis result that differs significantly from the analyses performed in conjunction with the ACAS XaXo approval process. Bottom Line Up Front: this appears to occur in simulated Layer 2 of the altitude layers, with Equipped-Equipped (EE) encounters in simulated European airspace. However, these results warrant some context to actually understand these results.

The graph on slide 3 depicts the perceived residual risk of equipped ownship vs equipped intruder with various combinations of auto-response and pilot-response compared to the baseline of TCAS version 7.1 ownship vs TCAS version 7.1 intruder. In this graph it appears that ACAS X induces some NMACS that are not evident in TCAS V7.1. It appears that the TCAS v7.1 results depict less than 10 NMACS per 6 million encounters and that ACAS Xa induces about 15 NMACS per million encounters.

Mr. Dean indicated analyzing the significance of these results it is beneficial to weight the results to ensure the altitude layers have appropriate representation; the next slide shows weighted results across the 4 altitude layers simulated for European airspace. Note that the title slide points out that the results are from encounter simulations that are equivalent to about 1000 years of encounters in the airspace. The bars charted in the graph show that for 3 of the 4 airspace layers, ACAS Xa with CP1 performs comparably to or better than TCAS v7.1. The increased risk seems to occur in Layer 2 of the simulated European airspace with ACAS Xa simulations creating approximately 1 additional NMAC per 1000 years of encounters.

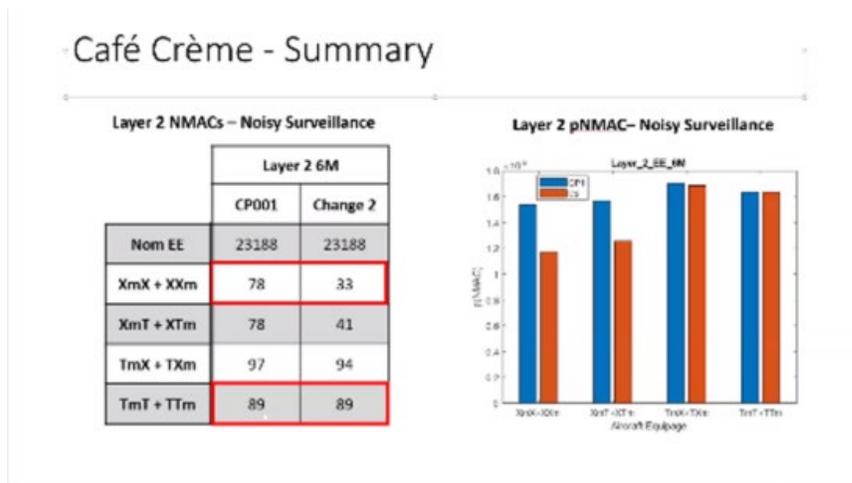
The summary slide further clarified:

- The effects of sensor noise are not assessed.
- The possible variability in the encounter model is not assessed.
- No statistically significant difference in EE performance is observed when looking at the whole airspace (all layers)

Mr. Neal Suchy expressed concern that simulating the encounter data without sensor noise may produce misleading results. Real life encounters would have sensor noise and there are accepted noise models for ADS-B. Further, ACAS X assumes there is some noise in the sensor data. Accurate position data without sensor noise would still be treated with the same level of reliability when Xa calculates ownship and intruder positions (belief states). This would be one additional factor that we should control in order to compare results between US and European airspace.

Garfield indicated that manufacturers can produce systems with better surveillance (less noise) the standards need to be able to support those with same level of safety that it supports legacy systems. .. We want to consult you to compare results and get your opinion; EASA may have other perspectives Both are needed for us to get to a good result and the best decision.

Mr. Michael Owen indicated [he was] glad you were able to run the full 6 million encounter set. He observed, It is interesting they show a different trend. Mr. Owen indicated curiosity whether this result is due solely to surveillance noise; he indicated he was unsure what else could contribute. MIT LL received European encounters a few months ago and ran them in their simulation and didn't see the same disparity observed with the EUROCAE Café Crème model. Mr. Owen displayed a slide: Café Crème – Summary (below).



Mr. Owen's slide shows that with noisy surveillance, the Layer 2 results for ACAS Xa is comparable to TCAS (v7.1) results. He added MIT LL is running noiseless simulations as a point of comparison on the Layer 2 6M set Mr. Owen indicated he would dig into the encounter model a little more to see if I can make a useful summary of any differences between the current model and other encounter models that they use.

Mr. Suchy recommended that the report and any presentation to EASA present the caveats (that appear on the summary slide) as early in the CP1 Assessment Report. Mr. Searight added: It is best to explain the approach and what was able to be simulated and what wasn't simulated what they'd like to have done, all up front in the report. It creates a mindset that is more open to analyzing the final numbers. He indicated without indicating (assumptions and) limitations prior to the results, the audience tends to latch onto results and immediately think about impact without considering the bigger picture.

Mr. Dominique Guillerm contributed: The Report from EuroControl is very important. With receipt of the report, EASA can start the rulemaking task. Mr. Guillerm continued: I can tell you I have been asked by EASA to start drafting the CS ACNS; and with Mauro Pagliarini to work on the ETSO C219. He added, the Plan is to move forward, as you will see when I present my slide. - When we are ready to move on to the next topic.

Mr. Dean stated: when we have a draft report, we can supply to EASA and to RTCA/EUROCAE SC-147/WG-75 joint meeting for review and comment. Then a final report to be presented to EASA. Mr. Searight responded that it would be great to get manufacturer and ALPA perspectives on what you are highlighting in this analysis. I understand this is not a consensus report, but I believe that the review will help create a better report, a better product.

Mr. Dean responded: There are many areas where ACAS Xa is a better product. We show a lot of green check marks in the analysis results; there are only a few negative results. This needs sufficient context in the report. Mr. Searight contributed: I know you have a broader presentation that shows the system in a good light over all. Mr. Suchy added if there are conclusions that are not favorable, then the conclusions should include an actionable recommendation so we can take this forward. He requested that if changes are desired, then a CP would be the best way to raise

the concern to the committee. Mr. Searight recommended scheduling a joint session at a good time for further discussion

7. [EASA ACAS Xa Rulemaking Status and Updates](#)

Mr. Dominiq Guillerm presented the rulemaking status on ACAS X. He indicated that RMT.0682 is scoped an amendment to Regulation (EC) No 1322/2011 (ACAS IR) “to permit the operation of aeroplanes equipped with ACAS II version.1 or ACAS Xa within the European airspace.” It is scheduled for NPA in 2022 with Opinion due in 2023 and a Decision scheduled for 2024. The updated Easy Access Rules for Airborne Communications, Navigation and Surveillance (CS-ACNS) and European Technical Standard Order C219 (ETSO-C219) for CAS that will accompany this action are currently drafted and purported to be in synch with FAA documents.

Mr. Guillerm highlighted: We currently have ETSO-C119; the discussion is to have an ETSO-C219 like FAA. He continued: I would like to note that there is no confirmed need for ACAS Xo in Europe, so the focus is on ACAS Xa. Then: We may choose to add Xo to remain in alignment with RTCA/FAA, but this is for discussion

Mr. Haskin asked: Can the ETSO go out before the Change 2 that is under consideration? If ETSO is against Change 1 then the ETSO will need the same Appendix. Mr. Guillerm responded: This will be discussed in the upcoming week(s)

Mr. Searight contributed: If a Change 2 helps you get out of the starting gate, we could get that pulled together and get that submitted for FRAC/OC.

Mr. Haskin asked the Co-Chairs: Do we need to do a TOR modification since we will miss a milestone here? Mr. Searight responded that we have already noted that this will slip.

Mr. Searight volunteered: We are poised to issue a Change 2, if that change is desired. Mr. Dean stated: We will try to get approval that ACAS Xa is good “as is”; I will try to get approvals from the committee. If acceptable, then we can get the rulemaking done. He continued: Part of that process we will have time to develop Change 2 of the MOPS. – If Michael Owen’s “Change 2” Proposal improves performance then we can incorporate that too. I hope this is an acceptable plan. forward. Mr. Suchy replied: Yes, this sounds like something we can do. The Program Office can support that up to end of Fiscal Year (Sept 30 2022); if we can work this in parallel, instead of serially.

The conversation continued to clarify scope of Change 2. Mr. Ruy Brandao asked if Change 2 is “Pacing item”. Mr. Searight clarified that Change 2 is something to combine DO-385 Change 1 and the updates that were included in the TSO. Ms. Donna Froehlich asked if this, Change 2, will also include the change that Mr. Owen had mentioned. Mr. Suchy clarified: The TSO, Appendix A, includes a logic change (DO-385 CP-001) and Mr. Owen’s update has a logic change. We will have to determine whether we can limit these updates and make this a Change 2, or whether will it require a Rev A.

Mr. Dean asked Mr. Alexander Engel about the EUROCAE policy on naming of changes. Mr. Engel responded that if they are only minor changes then we can label it as a Change; if it is a larger change, then we need to go through Revision process.

Mr. Searight took a note to coordinate /schedule (meeting) for DO-385 Change 2 document [Stu, Neal, Garfield, Al, Alex Matt, Donna, Dominique.. others?]

8. [Status of US Regulatory Efforts](#)

Mr. Matt Haskin presented the status of the US-FAA Rulemaking efforts related to ACAS X. First, he reviewed 14 CFR§ 135.180 Traffic Alert and Collision Avoidance System, indicating that part (a) states “Unless otherwise authorized by the Administrator, after December 31, 1995, no person may operate a turbine powered airplane that has a passenger seat configuration, excluding any pilot seat, of 10 to 30 seats unless it is equipped with an approved traffic alert and collision avoidance system. If a TCAS II system is installed, it must be capable of coordinating with TCAS units that meet Technical Standard Order 219 (TSO C-219). Mr. Haskin confirmed that FAA legal has confirmed that no update is needed to allow ACAS X operation in FAA airspace.

Then, Mr. Haskin recapped that the TSO-C219: Airborne Collision Avoidance System (ACAS) Xa/Xo was published on 28 February 2020 and that TSO-C119e is (was) accepted for new applications until 30 March 2022. He added that TSO-C211: Detect and Avoid (DAA) Systems is expected to include ACAS Xa in TSO-C211a which is expected to be published in Autumn of 2022.

Regarding the Advisory Circular (AC), Mr. Haskin indicated New AC covering Airworthiness Approval of Collision Avoidance Systems (CAS) with Automatic Dependent Surveillance-Broadcast (ADS-B)/Hybrid Surveillance. He stated that the initial draft is completed and in FAA internal review. He added that this document will not include transponder guidance since a new transponder AC is in the works for publication.

Mr. Stacey Rowlan asked if the new AC be updated to the new TSO number. Mr. Haskin indicated he would check on that.

Mr. Randy Jacobs asked about forward-fit rulemaking to require hybrid surveillance for all aircraft (presumably to help with RF clutter). Sheila was working on/exploring this before she moved on. Neither, Mr. Haskin or Mr. Suchy, had an update on this. Mr. Haskin indicated that government rulemaking works very slowly and will of course go through the comment phase so manufacturers and other stakeholders will get plenty of notice.

There was no further discussion and the Committee took a short break.

9. [ACAS Xr Joint MOPS Development](#)

Mr. Benjamin Zintak began by providing the status of the Xr Working Group. The long anticipated effort to develop an ACAS X, ACAS Xr, for rotorcraft is officially underway. The

ACAS Xr MOPS is in the approved TORs; a kickoff meeting was held in February and our “bootcamp” Preparations are scheduled for May. Additionally, ACAS Xr V2 algorithms-libraries have been released to stakeholders to help determine requirements. The requirements will be based on review of existing requirement set from ACAS sXu, more information later in this presentation. Mr. Zintak added that the requirements effort will be supplemented through the Xr Operations Working Group (OWG) which is led by Ms. Margarete Groll. OWG has started meeting bi-weekly and interested members can add themselves to that group or contact Ms. Groll for more information.

Mr. Zintak indicated that the Xr MOPS will be developed jointly with EUROCAE WG-75 (CAS) and even participation from WG-105 (UAS) and WG-112 (VTOL). He added that RTCA SC-228 has scheduled several documents in their work-plan to ensure future OSEDs address ACAS Xr near-term and mid-term concepts.

Regarding the ACAS Xr V2, Mr. Zintak stated that NASA is integrating ACAS Xr into their Human-In-The-Loop (HITL) analyses and we are working with several other stakeholders to get ACAS Xr integrated into their environments. At this time, takeaways on the system performance are that: ACAS Xr provides strong safety performance, especially with regard to Risk Ratio (RR). He indicated that at this time: some Loss of Well Clear (LoWC) numbers, particularly against non-cooperative intruders, are unsatisfactory, but the metric for Severity of Loss of Well Clear (SLoWC) looks good. Next he indicated that in order to assess Operational Suitability (OpSuit) the team needs to establish targets. – The OWG is working on defining the context and targets for acceptability for OpSuit.

Then Mr. Zintak reviewed the ACAS Xr “Development Buckets” presented on slide 6. He described the Near-Term scope as addressing Rotorcraft/Urban Air Mobility (UAM) using Detect and Avoid (DAA) with onboard or dedicated remote pilot, covering the NAS environment as-is including terminal areas. This is covered in the SC-228 Phase III OSED which is in Review and Comment (RAC). Mr. Zintak proceeded to describe the Mid-Term concept as addressing Rotorcraft/UAM using DAA with onboard supervisor or non-dedicated remote pilot. This is to include UAS Traffic Management (UTM), DFR and other anticipated modifications to NAS/flight rules (i.e., corridors, vertiport). The Mid-Term segment of the Xr concept is being worked in parallel with SC-228 Roadmap and NASA work. Long-Term concepts are characterized as desired – the team plans to address items that will meet into the timeline for ACAS Xr MOPS assuming sufficient FAA and industry guidance regarding autonomous operation and integration into other services.

Mr. Zintak continued to slide 7 where he addressed updates planned for ACAS Xr V3. Scope-functionality will be updated to address:

- Incorporating feedback from flight test/simulation and document review.
- Big focus on tuning to airspeed and performance numbers specific to rotorcraft (should reduce LOWC issues).
- May recommend a separate non-cooperative intruder set that more accurately models these intruders’ airspeeds and performance.
- Benchmark system(s) and targets needed for metrics matrix.

He went on to explain that the development team plans to introduce configuration bits to control what features will be included (active) in each instance of ACAS Xr. This will allow different types of users to customize a build for their planned usage. Features considered for control by configuration bits are: suggestive guidance, terminal area behavior, altitude inhibits/ground point obstacle awareness, and others. Then Mr. Zintak reviewed the ACAS Xr Integrated Work-Plan. He highlighted key dates related to ACAS Xr V3 and indicated how the team has coordinated its schedule with the sXu milestone and Plenary dates. He indicated that after sXu MOPS approval, ACAS Xr MOPS development would be the primary focus of SC-147.

Mr. Walter Bender assisted with presenting the concept of a BootCamp for defining ACAS Xr requirements (slides 9-12). This approach was used previously for ACAS Xu and ACAS sXu to map out required functionality and scope of the MOPS work, ACAS Xr will use the same approach.

Then Ms. Margarete Groll presented [progress on the ACAS Xr OWG](#). She indicated that the OWG had started meeting and had some preliminary actions identified for their first 2 items on their Coordinated Task List. She summarized some of the items on the task list (slides n-m) and indicated OWG members had access to this and meeting summaries on AerOpus site, in the OWG workspace. Ms. Groll and Mr. Zintak stressed that there is still outreach and coordination ongoing to ensure broad participation by European representatives, the user community and manufacturer/vendor community. Mr. Dean contributed that he would reach out to a few individuals in EUROCAE that might not have heard about the ACAS Xr OWG and extend the invitation to participate. Anyone interested can join the OWG and attend the meetings held at 2pm Eastern time on alternate Wednesdays; please reach out to Ms. Groll or Mr. Zintak to get more information on the OWG.

10. Review of Comments and Resolutions from ACAS sXu pre-FRAC

a. [SWG Comment Summary](#)

Mr. Ruy Brandao and Mr. Adam Panken reviewed the comment resolution. First, they summarized the comments “By the Numbers”: there were 390 comments that were resolved and implemented in MOPS Volume 1. Additionally, 2 Non-Concurs are still being worked (see below), 11 Comments Deferred to FRAC which were summarized in the backup slide and 3 additional comments that were coordinated and resolved with commenters but did not necessarily incorporate a change to the document.

In addition to the Non-Concurs, the main changes to the MOPS were resulting from some recurring topics of the comments:

- Clarity and organization on what inputs are required
- Permissible surveillance Clarified
- Improvements to Degraded Surveillance, Appendix B
- Updates to Generic Track Accuracy Requirements, Appendix C
- V2V Performance Assumptions (Requirements), Appendix G
- Updated AGL Requirements, Appendix J

The process for resolving the 2 Non-Concurs was summarized as:

- Initial Discussions between SWG/PO/Commenter, Internal PO Discussions
- Fact-Finding tasks and discussions with SME's, FAA NAV SME's, FAA PO Safety Team
- More Discussions with SWG/PO/Commenter and with SC-147 Chairs
- Proposal on how we can agree to a process to address these concerns in FRAC

The two Non-Concurs are:

- #53103, Vertical Integrity – Vertical Protection Level (VPL) – Comment raised concern about necessity, impact and feasibility of new integrity checks (for ADS-B and V2V0 and proposed accounting for the stated risk in the safety case.
 - Agreed to remove all integrity checks from the ADD Algorithms (Volume II – allocate FRAC comment to development team)
 - Include note in Volume I, mentioning Safety Work includes integrity checks, but given low risk of hazard exposure, they are not required
- #53098 Own pressure altitude – Comment questioned need for own pressure altitude as a minimum requirement
 - Mutual Understanding of each position
 - Minimum Requirement for Baro is tightly tied to the MOPS' baseline safety case
 - Runs throughout the Operational Validation Report with all safety assumptions and difficult to remove at this stage
 - Provide better understanding of why the Operational Validation Report assumed the presence of Pressure Altitude up front, rather than exploring if it would indeed be needed to make the safety case.
 - Fundamental difference here seems to be believed likelihood of encounters between sXu and manned aircraft. To paraphrase: "Pressure Alt would not be needed vs a radar track and likely not needed vs another UAS. This makes use of Pressure Alt almost a corner case." This would seem to differ greatly from the sXu development team which emphasized sXu-manned encounters as a primary case. Suggest including the ASTM perspective into these discussions
 - Ensure that within that material there is something that shows how to account for not using pressure altitude, and that the MOPS contains a note citing that analyses. This would allow the MOPS to keep the requirement while also defining the conditions under which a deviation on this requirement would be acceptable.
 - WG to continue to identify key issues to be examined, identify work to be done to provide a path for a deviation and still be agreeable to all parties.

Mr. Panken closed the presentation by encouraging Committee members to continue supporting the WG meetings.

b. [TWG Comment Summary](#)

Ms. Samantha Smearcheck and Mr. Ruy Brandao reviewed the ACAS sXu pre-FRAC comments and resolution status. In summary there were 204 comments; there were no (0) Non-Concurs. Additionally: no Editorial comments; 139 Low comments where 138 were resolved and 1 carried forward to FRAC; 50 Medium comments where 48 were closed and 2 carried forward to FRAC; and of 15 High comments, 14 were closed with 1 carried forward to FRAC.

The four TWG comments carried forward to FRAC were described as follows:

#53671 Suggests adding a reference to a document that is not yet complete. Once that document is complete, the citation can be added/updated

#53672 Suggests adding a reference to a document that is not yet complete. Once that document is complete, the citation can be added/updated #54262

#54262 An agreement was reached, but capturing that agreement as language in the MOPS was not completed. As part of FRAC, the necessary text updates will be made.

#53912 Pertains to Appendix H Test Suite Encounter List, which relies on having the final version of the logic and final test suite encounter determined.

c. [ADD Comment Summary](#)

Mr. Randal Guendel reviewed the resolution of the RAC (aka pre-FRAC) comments against the algorithms defined in the ACAS sXu MOPS Volume II, the Algorithm Design Description (ADD). Sixteen (16) comments concerned text only; 13 comments affected ADD algorithms with the key functional areas being:

- V2V_UID accommodates 128-bit addresses
- AGT input validity checks consistent with ORNCT
- Quality-based track source selection refinements
- Hysteresis in choice between pressure altitude and HAE altitude
- Consistent horizontal and vertical RA output when track coasts out (1000 vs. 0000)
- POA deletion at beginning of STM cycle instead of end; refined prioritization in TRM
- Non-functional code cleanup – variable naming, helper functions, improved clarity

Regarding the two (2) pre-FRAC comments that are still in process. One pre-FRAC comment addressed ADD changes that had already been discussed and approved; 39 of 51 these change requests are complete. Some of these were non-functional changes had been deferred to FRAC due to time constraints: Variable naming; Unreachable branch/unused constants cleanup; Coding style cleanup. Additionally, this comment covers potential functional changes dependent on incomplete analysis: Reset surveillance minima based on degraded surveillance analysis, and Update V2V coast time.

The other in-process comment is #53835 – Existing correlation algorithms/behavior/parameters may need adjustment for new surveillance sources. Since correlation analysis is dependent on surveillance requirements, the team was not able to address this comment in time for the V4R1 ADD (FRAC version of MOPS Volume II)

freeze. At least one algorithm will need to be modified to address the 1 second max coast time for decorrelation. Analysis of the other requirements may identify other algorithms impacted by changes required for correlation. These will continue to be worked through FRAC.

11. Decision Whether to Approve FRAC of ACAS sXu MOPS

Mr. Stu Searight presented the Committee's ACAS sXu FRAC Timeline, and asked for comments and questions. There was a motion by Mr. Wes Olson to move ACAS sXu MOPS into FRAC. This motion was seconded by Mr. Alan Sigman. There were no objections; the motion was approved to commence FRAC on Tuesday 15 March as presented in the Timeline. It was agreed that the FRAC announcement will also be distributed to SC-228 WG-1 (DAA) team.

12. Future Meeting Scheduling (Silbermann/Searight)

- May 19 ACAS Xr BootCamp prep
- June 6-10 WG Meetings sXu FRAC/OC Resolution with **June 9 Plenary** to Approval of FRAC/OC
- **June 16 Tentative Plenary** for Approval of sXu MOPS
July TBD dates ACAS Xr Bootcamp
- August or September and November WG dates for ACAS Xr – to be determined

13. Adjourn/Close of Plenary

Motion to adjourn Plenary was made by Mr. Wes Olson. The motion was seconded by Javier Caina.

The meeting was closed with an invitation for committee members to join STM and TRM Working Groups joint WebEx at 13:15 EST starting with a status briefing on [ASTM DAA V2](#).

ATTENDEES

First Name	Last Name	Company/Organization
Jorge	Alvarez	Collins Aerospace
Luis	Alvarez	MIT Lincoln Laboratory
Richard	Beckwith	Federal Aviation Administration (FAA)
Walter	Bender	The Johns Hopkins University
Ruy	Brandao	Honeywell International, Inc.
Kara	Breeden	MIT Lincoln Laboratory
Jeff	Brush	The Johns Hopkins University
Ann	Drumm	MIT Lincoln Laboratory
Javier	Caina	DJI Technology
Sean	Calhoun	Calhoun Analytics
Paul	Campbell	Federal Aviation Administration (FAA)
Joslin	Carino	Federal Aviation Administration (FAA)
Arthur	Chu	MIT Lincoln Laboratory
Kathy	Ciaramella	Federal Aviation Administration (FAA)
Jeff	Coltvet	VIAMI Solutions
Chris	Cooper	Aircraft Owners and Pilots Association
Anshuman	Das	MIT Lincoln Laboratory
Armando	De Abreu	NIAR
Garfield	Dean	EUROCONTROL
Kevin	Dimond	L3Harris
Aaron	Dutle	NASA
Randal	Guendel	MIT Lincoln Laboratory
Matt	Edwards	MIT Lincoln Laboratory
Alex	Engel	EUROCAE
Donna	Froehlich	Aurora Innovations

ATTENDEES Continued

First Name	Last Name	Company/Organization
Adam	Gjersvik	MIT Lincoln Laboratory
Maggie	Groll	MIT Lincoln Laboratory
Dominique	GUILLERM	European Aviation Safety Agency (EASA)
Florent	Hagemann	Lilium
Ravi	Haksar	MIT Lincoln Laboratory
A.K.	Harrison	Garmin Ltd.
Matt	Haskin	Federal Aviation Administration (FAA)
Tom	Hastie	Transport Canada
Ruth	Hirt	Federal Aviation Administration (FAA)
Pejman	Iravani	3UG Autonomous Systems Limited
D. J.	Winkel	Garmin Ltd.
Randy	Jacobson	Collins Aerospace
Salim	Janjua	Constellation Aviation Solutions, LLC
Rudy	Johnson	Sagetech Corporation
Silbermann,	Joshua M.	Federal Aviation Administration (FAA)
Pavel	Klang	Honeywell International, Inc.
Andrew	Klappert	BAE Systems, Inc.
Barbara	Kobzik-Juul	The Johns Hopkins University
Charles	Leeper	The Johns Hopkins University
Anthony	Long	Federal Aviation Administration (FAA)
Jessica	Lopez	The Johns Hopkins University
Ian	Jessen	MIT Lincoln Laboratory
Pat	Maggard	Federal Aviation Administration (FAA)

ATTENDEES Continued

First Name	Last Name	Company/Organization
Guido	MANFREDI	Volocopter
Walt	Monk	Constellation Aviation Solutions, LLC
Rebecca	Morrison	Constellation Aviation Solutions, LLC
wes	olson	MIT Lincoln Laboratory
Gustav	Otto	MIT Lincoln Laboratory
Michael	Owen	MIT Lincoln Laboratory
Adam	Panken	MIT Lincoln Laboratory
Mohammed	Rahman	Federal Aviation Administration (FAA)
Joseph	Raynes	The Johns Hopkins University
Mark	Reed	Air Line Pilots Association (ALPA)
Stacey	Rowlan	L3Harris
Sam	Smearcheck	The Johns Hopkins University
Lucia	Sanz	Egis Avia (EUROCAE)
Jonathan	Saunders	Aurora Innovations
Stuart	Searight	Federal Aviation Administration (FAA)
Christopher	SHAW	EUROCONTROL
Alan	Sigman	Federal Aviation Administration (FAA)
Virginia	Stouffer	Aura Network Systems
Neal	Suchy	Federal Aviation Administration (FAA)
Chris	Swider	Federal Aviation Administration (FAA)
Andy	Thurling	Northeast UAS Airspace Integration Research Alliance (NUAIR)
Brian	Ulm	L3Harris
Jared	Wikle	MIT Lincoln Laboratory
Tyler	Young	The Johns Hopkins University
Sebastian	Zanlongo	The Johns Hopkins University
Lucas	Ziemba	The Johns Hopkins University
Benjamin	Zintak	The Johns Hopkins University