

Special Committee 147

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

The 102nd meeting of RTCA SC-147 and 71st meeting of EUROCAE WG-75 was held on 16 June 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	Co-Chair, EUROCAE WG-75, acting
Pat Maggard	Government Authorized Representative, Designated
Donna Froehlich	Secretary, Aurora Innovations
Brandi Teel	Program Director RTCA
Alex Engel	Tech PM EUROCAE

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1. Chairmen's Opening Remarks / Introductions

Mr. Stuart Searight opened the meeting and thanked everyone for their flexibility. He noted how nice it is to have so many people be able to join this meeting. We planned to have everything ready for approval of resolutions at the end of our working meetings last week, June 6-10. But, we felt we weren't quite ready so we kept the working group format for the whole week and got a lot of agreed upon approaches and resolutions.

Mr. Searight reiterated his thanks to everyone who adjusted their schedules to attend the Plenary today.

Mr. Searight continued by explaining that Mr. Pat Maggard is acting as our Government Authorized Representative (GAR, aka DFO) today. He is acting for Mr. Matt Haskin who couldn't be here. He also noted that Co-Chair, Mr. Ruy Brandao, is attending – he was able to adjust his personal time-off in order to be here. Additionally, Ms. Sam Smearcheck can't be here due to prior commitments but her WG co-leads and SMEs are standing by to cover SWG topics.

Mr. Searight finished by stating how happy he was to see so many RTCA and EUROCAE participants.

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

Ms. Brandi Teel and Mr. Alexander Engel reviewed the anti-trust and attendance policies for meetings hosted by their respective organizations. There were no questions; no discussion was necessary.

3. Approval Of [Minutes From 101st Meeting of SC-147/70th Meeting of WG-75 \(10 March 2022\)](#)

Mr. Searight asked for a motion to accept and approve the minutes from our last (10 March 2022) Plenary. Mr. Stacey Rowlan moved; the motion was quickly seconded. The 101st Plenary Minutes were approved as posted.

4. Approval of [Agenda](#)

Mr. Searight presented the Plenary agenda; asked for comments or additions. There were no changes and the agenda was unanimously accepted.

5. [EUROCONTROL ACAS Xa Validation Report](#)

Mr. Garfield Dean presented Validation of ACAS Xa V15R4 (CP1) in European Airspace. Mr. Dean began by describing the methodology used for this analysis. The team used encounters from models and radar data with tools and models that have been validated internationally. Results with statistical significance were identified and SESAR acceptability metrics were applied. Mr. Dean continued by addressing the safety results – including Equipped-Equipped (EE) and Equipped-Unequipped (EU) encounters. He added that EE encounters included aircraft

with same ACAS Xa equipage as well as encounters where aircraft had different equipages. Mr. Dean also indicated that stressing encounters representing the SA01 – NMAC problem set were included in the analysis. Additionally, the analysis looked at encounters where one pilot does not follow the RA.

Mr. Dean continued presenting safety results comparing different TCAS/ACAS Xa systems across different layers of airspace. He indicated that the most significant difference in ACAS Xa system performance is in Layer 1 (<FL50). He also noted the lower airspace layer has less encounters, making any negative results (NMAC) in percent look artificially higher when compared between the TCAS/ACAS systems and to the results in the other layers. When depicting the safety results of the EU+EE encounters with simulated surveillance noise, he noted: “only a small degradation in performance from ideal conditions due to expected surveillance noise”; while the EE encounters with surveillance noise demonstrated: “TCAS EE layer 2 performance is slightly better than Xa, the absolute difference is very small and the overall performance of Xa is not statistically different from TCAS in EE encounters. This suggests an area for potential future improvement, rather than unacceptable behaviour.” When analyzing EE encounters with noisy surveillance (slide 7): “No statistically significant difference between TCAS vs. TCAS encounters and Xa vs. TCAS encounters when passive surveillance is available to Xa. This will normally be the case. Risk ratios stay less than 0.25% in all mixed equipage variants.”

Mr. Dean proceeded to describe the SA01 CAFÉ model and the safety results from that analysis. CAFÉ is a new SA01 model developed by EUROCONTROL; it uses Bayesian networks like the Lincoln Laboratories Correlated Encounter Model (LLCEM), but is based on newer (European) radar data. CAFÉ includes Vertical Miss Distance (VMD) between 0 and 200ft to assess induced risk in SA01-like encounters. – Previous model used 0-100ft. Mr. Dean continued by indicating that CAFÉ model was theoretically validated by QINETIQ, and then the model performance was validated by EUROCONTROL by comparing simulations of TCAS II v7.1 and v7.0. The safety results when one pilot does not follow RAs, ACAS Xa performs better (slide 11). Mr. Dean continued with the operational acceptability results from several perspectives. First he presented the RA rate using radar data: (slide 13 depicts) the total # RAs in simulation changed from 1624 to 638; the results demonstrate that with 95% confidence, the reduction is between 56% and 65% of all RAs. These are very good results.

Mr. Dean then described the operational acceptability results looking at the RA rate with 1000ft level offs; “In encounters where a single aircraft is levelling off 1000ft from another aircraft in level flight, radar data simulations show ACAS Xa CP1 reduces the number of (usually undesirable) RAs by about 86%.” There were some concern that this reduction in RAs shouldn’t adversely affect safety Mr. Dean also reviewed assessment of operational acceptability result of close encounters that don’t generate RAs (slide 15). The graph presented demonstrates: “These encounters do not have a substantial negative effect on the collision risk. SC147 and WG75 operational working groups discussed this SESAR metric and jointly agreed that the lack of alerting for some encounters with ACAS Xa CP1 is acceptable as part of a trade-off for reduced alert rate and collision risk.

Mr. Dean noted that with ACAS Xa encounters, an intruder can get closer prior to ACAS Xa alerting, than the same encounter(s) would alert if equipped with TCAS. He continued: “But analysis shows this does not adversely affect safety. This appears to be part of the trade-off space when reducing nuisance RAs in order to improve operational suitability.” He also indicated: “Although this doesn’t adversely affect safety, we would want to note this difference in pilot training. (Something to the effect: don’t be alarmed if you are close, you may not get an alert that you might have received with TCAS system; ACAS is working with some reduction in (nuisance) alerting.)”

Another assessment of operational acceptability was the RA alert rate when climbing (above)/descending (below) 1,500fpm (slide 17). “The effect of ACAS Xa increasing the number of RAs issued on an aircraft climbing or descending <1500fpm to level off was confirmed with an ATM encounter model. It is important to ensure that such RAs rarely occur. This was indeed the case, with only 6 cases observed in 12 million flight hours of radar data. Also ACAS Xa reduces the number of alerts in level off situations more than this when the pilot is not aware of adjacent traffic prior to levelling off.” The graphs (slide 17) reflect TCAS vs TCAS as the “standard” for the comparison-analysis. The graph shows statistically significant difference in results when comparing the ACAS Xa (CP-1) vs Unequipped & TCAS vs Unequipped bar graphs. We do see a difference, but the ACAS Xa improvement is enough that this is not an issue

Mr. Dean summarized the conclusions (slide 18):

Safety:

- Overall airspace safety with ACAS Xa improved between 16% and 24% compared to TCAS V7.1 depending on availability of ADS-B surveillance.
- Negligible safety difference in EE encounters
- SA01 improvements confirmed with a new CAFÉ SA01 model.
- Almost 50% safety improvement compared to TCAS V7.1 for encounters in which one pilot does not follow their RAs.

Operational Acceptability:

- Substantial reduction in alert rate expected between 56% and 65% with 95% confidence.
- Reduction in alert rate for level off encounters about 86%
- Some very close encounters do not generate RAs.
- More high vertical deviations – but it is expected that there should be less than 1 multi-threat RA in Europe per year.
- More RAs in encounters with low vertical rates prior to level off. Compensated by overall RA reduction

Mr. Dean finished his briefing with the recommendations from the CAFÉ analysis:

1. ACAS Xa CP1 is considered acceptable for European operations;
2. There should be assessment of whether the use of ADS-B out should be encouraged on smaller aircraft to benefit from the improvement brought by ACAS Xa CP1 passive surveillance;

3. There should be a revision to ACAS Xa MOPS that incorporates all accepted change proposals;
4. New training material should be developed for ACAS Xa;
5. There should be focused monitoring of ACAS Xa from its introduction into European operations

Mr. Dean indicated EASA has seen a draft of this report and has started on the ACAS Xa rulemaking activities.

Finally, he provided a list of suggested next steps:

- Evaluate (European recommended) CP2 over the next 2-3 months
- Over the longer term perform the following for Xa (with CP2): stress testing, multi-aircraft risk ratio, improve ATM encounter model
 - May want to refer to the backup slide (slide 21) showing concern with induced risk (by crossing). Recommend that analysis demonstrates the recommended CP2 change(s) do not degrade the safety metrics.

At the conclusion of the briefing, Mr. Wes Olson asked whether Mr. Dean had heard anything on the rulemaking process. Mr. Dean responded: “We have validated CP1. They are preparing the (European airspace) rules for ACAS Xa with CP1. Next, they will accept CP2, if they find the results are acceptable. – Then Mr. Dean added: “If the results are not acceptable (or if there is too much work) then the authorities should be willing to go ahead without CP2.” Mr. Dean continued: “It should take about two months to run the simulations; one month later we should have the report on CP2. ... [Right now,] EASA is going forward with (actively working) the rulemaking.

Mr. Olson followed up: “It would be nice to hear from EASA at a future meeting to get their projected timeline”

Mr. Dean responded: Since Mr. Kevin Hallworth’s retirement, there is no clear successor to coordinate that. Mr. Neal Suchy asked about the potential change discussed above: “CP2 doesn’t exist right now; the concept is only captured in some informal language between EUROCONTROL and SC-147. Will your group write it up and submit it?” Mr. Dean responded in the affirmative, but indicated: “it will take a bit.” Mr. Suchy followed up: “Are there any other CPs that you are considering? – Beyond the small patch that we sent you?” Mr. Dean responded: “It is unclear whether we will identify anything else. We find the system good enough now to start trying to get approval for operational airspace.” Mr. Dean continued: “EASA would like their rulemaking to refer to a MOPS Revision A. Mr. Pat Maggard responded: “Per my discussions with Mr. Matt Haskin: EASA is working on the ETSO and aiming to get that out by end of summer. They referred to CP1.”

Mr. Searight asked if WG-75 would need to update their TORs. Mr. Alexander Engel responded: “We don’t have a Rev A in TORs; we need to add that. ...want to remind/clarify that if

EUROCAE approves ED-256 Rev A as an addition to the TORs, the whole document would go out for comment (OC) to WG-75.”

Mr. Searight: We would like agreement/assurance that ETSO will go forward with the understanding that CP1 is acceptable. Mr. Olson contributed: SC-147’s TORs would also need to be updated. We will have to know whether we are publishing DO-385/ED-256 Change 2 or Rev A.

Mr. Engel indicated: We (EUROCAE) have put CP2 on hold for now; even though it is on our TORs). Mr. Dean added: I understand you would like Europe to take lead on any revision that is proposed for a CP2. Would you be willing to do validation? Mr. Suchy replied: Absolutely. We will have better efficiencies if we work in parallel to get this work done. ACAS Xa was approved/published in 2018 and we are finally getting close to the ETSO. Mr.

Dean agreed: Yes, they are working on the advisory and ETSO; just need to finalize [the scope of the ADD] change: “CP1” and/or “CP2”. Then Mr. Ruy Brandao asked: “Is EASA insisting on a “Clean” document; i.e., issuance of DO-385/ED-256 Rev A? – As opposed to a new Change document to cover: DO-385/ED-256 plus Change 1 plus TSO/ETSO and possibly the CP2.” Mr. Brandao explained: “As a manufacturer: I don’t care if there is a “Clean” MOPS. We have the standard with the TSO. We have everything we need. Of course I can’t speak for other manufacturers.” Mr. Dean responded: “I think EASA wants to make it easy for the community; but I understand that if you want to make things easy, someone has to pay for it.” Mr. Brandao indicated: “It would be nice if EASA could mirror the RTCA/FAA regulations [on ACAS Xa]”; to which Mr. Searight agreed. Mr. Suchy added: “If we work this in parallel and get the European rulemaking going for the existing solution, then we can also move forward (jointly) on the CP2 changes.”

Mr. Searight indicated: “We would need EUROCONTROL, EUROCAE, and FAA Cert (Mr. Haskin and Mr. Haggard) coordinating with EASA in order to make good progress with this change. Since CP2 would change the logic, we have to agree that this would require a Rev to DO-385/ED-256. This will take significant effort to analyze and coordinate then go through RAC and FRAC/OC.” Mr. Suchy continued that thought: “So I suggest that we progress in good faith. Because we’ll have to modify TORs, and that will take 6 months or so for this update. We just need to confirm that Europe is moving forward with their part so we can coordinate resources.” Mr. Engel contributed: “Next plenary where we plan to approve sXu, we could make it a joint plenary and include a briefing from EASA on the ACAS Xa rulemaking activities. We could also approve the update to the TORs to include changes up to/including ‘CP2’ to become a Rev A to DO-385/ED-256.”

6. [WG-75 Work-plan update](#)

a. ACAS Xr Joint MOPS Updated

Mr. Ben Zintak presented status on drafting the ACAS Xr MOPS. He started by presenting the timeline (slide#?), noting the “Bootcamp” in July. Then, he pointed out the ACAS Xr Run 2 milestone and noted that Run 2 logic is available. He also noted that the team is working on early safety and operational suitability studies. He also pointed out the cut-off point for novel concepts for ACAS Xr is in the summer of 2023. Mr. Zintak elaborated by stating that if you

don't see your concept or technology reflected as compatible with the Xr functions and concept of operations then we need to hear from you as soon as possible so we can work on incorporating as best as possible. Proceeding with the status of ACAS Xr, Mr. Zintak indicated that the operational concept has guided us to a decision to have 2 main configurations for ACAS Xr MOPS: one configuration will be ACAS Xa/CAS-like and the other configuration will be more like ACAS Xs and be targeted for smaller rotorcraft. Then, Mr. Zintak provided more details on the requirements effort mentioned earlier, he indicated it's an aggressive ("Bootcamp") schedule and will be on July 12-14. He added, we are "currently reviewing information from other formats to address in/around the "Bootcamp". Please contact Mr. Walter Bender if you would like to participate." Then, Mr. Zintak reminded SC-147 members that the Operations Working Group, meets on Wednesday on alternate weeks; He continued: "Please contact me or Margarete Groll. Have been scoping operational concept/questions."

At this point, Mr. Dean asked about FLARM. Mr. Dean indicated it is used by gliders for avoiding each other, adding "it works on different frequencies than the other surveillance used. He added: "It is extensively used in Europe." And Mr. Dean asked: "Can that [FLARM] information be incorporated into ACAS Xr?"

Mr. Suchy: indicated" Yes, he thought it was possible to incorporate that interface. He continued: "Not sure whether it would be allowed in US. He clarified: "The ability to have interface is easy, the heavy-lifting is to specify how it would work and to get specifications and/or regulations regarding use." Mr. Olson asked Mr. Dean: "Is there a performance standard or is this [FLARM] proprietary?" Mr. Dean responded: "It is proprietary, but it is sending signals out, [which other surveillance systems should be able to receive.] He continued: "The ability to see the extra traffic is good/beneficial to FLARM users. So I would expect it would be beneficial for them [FLARM] to keep a stable interface." Mr. Brandao contributed: "If someone wanted to assess FLARM against the V2V performance standards and feed the data through that interface to test that performance. Then we could include the information in the MOPS documentation." There was some further discussion where Mr. Olson surmised the surveillance could go through AGT; while Mr. Brandao thought it might be supported by a non-coordinating, e.g., V2V link. Mr. Searight and Mr Brandao reminded the Committee members that we shouldn't mention a proprietary standard explicitly in the MOPS, and we would need to figure out how to share any FLARM specific information. Then Mr. Brandon Suarez stated: "If anyone knows someone at FLARM's company, that would be helpful information." He added: "I've tried to reach out to them; as the idea of leveraging off the FLARM signals has come up with SC-228 and ICAO. I'd be happy to talk with them. It would be worth the conversation to see if they are even interested in compatibility with the standard. I'd also like to reach out to them from a SC-228 perspective."

Then, Mr. Searight asked: "Does EUROCAE WG-75 have a Chair identified to replace Mr. Bill Booth now that he has retired? – It would be good to have a point of contact to work on ACAS Xr." Mr. Dean responded: "Our highest priority until today was to get out this report, we have sent out some feelers. We feel most of the effort forward will be in the Xr arena. A

project/consortium is being identified within SESAR 3 project – validation of ACAS Xr. [I] Expect that lead would be a natural lead for WG-75.” Mr. Searight shared: “I hope you are not put in the unenviable position of representing people that aren’t engaged in the ACAS Xr process. As you saw in Mr. Zintak’s presentation there is a lot of technical work and decisions being made. The earlier they can engage, the more likely we can incorporate additional ideas.” Mr. Engel responded: “I agree, We need to get organized. I’d like to get back to same arrangement as for ACAS Xa, synchronize the meetings with WG-75 (pull the WG off back-burner) and coordinate with WG-102 and WG-175.

Mr. Suchy reminded the Committee members: “[In order to make progress,] We have been holding meetings for Xr out-of-cycle from our ACAS sXu working group meetings. ... we have been reaching out and interested parties can find them on the RTCA schedule. Additionally, we are coupled with SC-228 WG-1 (which is linked with EUROCAE WG-105),. There are a lot of (inter)dependencies on what is being designed and developed and we’d like to make sure the appropriate SMEs/POCs are included wherever possible.

Then, Mr. Searight noted if there is no more discussion, then we can transition to the next topic: ACAS sXu MOPS approval. He added; “It is late in Europe and I’d like to thank the WG-75 members for their attendance and welcome to you stay if you wish.”

7. Review of Remaining Comments and Resolutions from ACAS sXu FRAC/OC
 - a. [Chair review of setup/goals of the Plenary](#)

Mr. Searight opened this topic thanking the commenters for being so helpful in the manner in which they worded their comments and the most of the commenters included recommendations for their suggest corrections/improvements. That made it easier to address the volume of comments we received. In order to fully review FRAC comments and their resolution, our topics today include: Performance of system, SWG updates, TWG updates, and ADD changes.” Mr. Searight continued: “In today’s review we are summarizing all the hard work and what we have agreed to. Questions are welcome. Let’s make sure every single member of the committee is comfortable with where we are. We want everyone to feel that this document can be approved with the agreed upon resolutions.”

- b. Brief recap of [V4R1 performance and V4R2 updates](#)

Mr. Randal Guendel presented a summary of the ACAS sXu performance compared to V4R2 ACAS sXu FRAC Performance Summary, many thanks to Anshu Das, a lot of this material came from his presentation in March as well as material from Jared Wikel and Arthur Chu’s presentations in last 2 weeks. Then, Mr. Guendel showed a graph summarizing ACAS sXu V4R1 performance analysis. This was depicted as Encounter Set vs Surveillance Type with red-green color coding of results. – He noted that these “results prompted reconsideration of non-cooperative surveillance performance during FRAC resolution period.” Then on slides three and four, Mr. Guendel presented Highlights of changes from V4R1 to V4R2 for STM and TRM respectively. For STM, changes fell into the following categories:

- V2V Refinements,
- Altitude Type Selection,
- Track Filtering
- Correlation,
- Non-Cooperative Surveillance Performance

For TRM, updates are characterized as follows:

- Separate horizontal reversal online costs for point obstacles and airborne intruders
- Prevent early CoC cost to control “stair-step” behavior when between airborne intruder and ground
- Parameter tuning

Mr. Guendel summarized: “ACAS sXu V4R2 preliminary performance summary targeted in time for our next plenary (so the Committee can review results prior to approval of submitting the MOPS to PMC).” He continued: “A final performance summary report should be available to the Committee around the end of September.”

c. [Timeline and FRAC process](#)

Mr. Josh Silbermann presented a few slides: First he reviewed the process of FRAC resolution and explained how the agreed upon ACAS sXu MOPS Volume 1 edits were then coordinated with our MOPS editor, Alan Sigman, for incorporation into the document. – Having one focal person for all the edits minimizes the chance of overwriting or otherwise losing edits made to resolve a different comment. Then Mr. Silbermann showed a breakdown of all 1179 Volume 1 comments. Of these comments, 563 were characterized as editorial – specific comments were implemented, summary comments were addressed as other edits to the same-affected section were completed. Some comments, like pagination or consistency of names/spellings are being reserved for final review of the document. Of the remaining 616 comments; 270 comments were allocated to TWG, and 346 comments to SWG.

d. [TWG Update](#)

Mr. Stacey Rowlan and Mr. Josh Silbermann shared presentation responsibility. They noted that most comments for the TWG FRAC resolution are complete, or ready for group review. – Most of the comment resolutions have the updated text out to the TWG for review. They noted that the TWG members have about a week to review and respond with any additional edits or questions. Then they provided a breakdown of the types of resolutions for all 270 comments. Of significance, is that a few comments triggered actions for Volume 2 (slides 13, 14, 15) these are being tracked and going through the change board for algorithm changes.

Mr. Rowlan indicated the steps TWG was taking to resolve the requirement to Test Correlation Matrix, asked for concurrence/comments on the process. Mr. Rowlan pointed out that 6 comments still in process – all pertain to test procedures which are dependent

on the final version of the ADD to be available. He noted: there were 245 shalls that were added/updated during pre-FRAC and a good number of shall changes in FRAC (33), these will get additional scrutiny during test procedure work.

Mr. Rowlan continued: “Analysis of test procedures indicate we have 160 shalls that need to be addressed. He referred to them as “uncovered” shalls. Sixty-five (65) of these uncovered shalls will be assigned to the manufacturer for verification, while 95 uncovered shalls may need test procedures/or at least test guidance for manufacturer. There were no adverse comments or conversation.

Regarding comments on equipment classes – Mr. Silbermann indicated the SME discussions indicated that equipment classes are not needed here in DO-396, However, classes may be needed (defined) in the future for specific operations or operational environments.

Setting VRC and HRC values – Ms. Katherine Wu indicated that the FRAC comments generated multiple actions to resolve. She summarized the MOPS Vol. 1 changes and indicated scope of a Volume 2 ADD change to update STM to set vrc and hrc values in the STMReport..

Target Angle – Mr. Leeper assisted with the status and scope of the Target Angle comment. He said discussions indicated it would be better to provide the CC value for turn right /turn left that if you follow target angle you have to use the effective turn rate (from the ownship performance parameters) and turn *through* the target angle before decelerating the turn. Some parties were concerned that though this is OK for automated response, but unacceptable to tell pilot to “blow thru” the target angle. Mr. Leeper indicated the team worked with manufactures to provide instructions for manual response which are planned for inclusion in Appendix E.

Label 270 Decoding – Mr. Silbermann indicated that there are some edge cases where inconsistencies arise between generated label 270 codes and the computed dz_min/dz_max. – This is being addressed and will have minimal impact to the ADD.

e. [SWG Update](#)

Mr. Adam Panken and Mr. Ruy Brandao summarized for the Surveillance Working Group. They indicated the FRAC comments have a resolution the approach scoped out. After resolving 90% at the Face-to-Face last week; that last 25 comments were resolved over teleconferences and emails across the intervening week. Detailed text has been generated for 50% of the comments. The remaining 50% will be generated through the end of the month. They highlighted some comment topics that were of particular interest to the WG.

Integrity – Comment indicated: Do not specify required integrity but allow regulator requirements for integrity to set the bar. The resolution of this comment resulted in several steps in order to provide sufficient guidance to manufacturers/integrators:

- Removed the requirement to receive HPL and VPL

- Removed VPL checking in Volume II
- Replaced specific integrity requirements with a general requirement to monitor integrity
- Provided supporting information on alternate means of computing Integrity via RAIM.
- Provided a range of potential Horizontal Position integrity checks

Use of Pressure Altitude – The comment was described as “AGL performance assumptions / expectations are too strict and do not account for the variety of aircraft performance characteristics and terrain.” Mr. Brandao continued: “The loss or lack of Pressure Altitude would remove vertical RA alerting even though HAE is envisioned to be available on most small UAS.”

The team determined the MOPS could instead clarify situations when this would be a problem (see comment). They also decided to propose supplementing with ground based radar as a potentially acceptable approach.

AGL Accuracy – The comment that “AGL performance assumptions / expectations are too strict and do not account for the variety of aircraft performance characteristics and terrain” was resolved in two areas:

- Method of determining AGL requirements Performance added to the requirements and associated AGL appendix.
- Further clarification in discussions that a lower range for AGL would normally degrade NFIT performance but not NMAC.

Appropriate Terminology – Comments requested greater consistency between ADS-B MOPS and the ACAS-sXu MOPS including Use of the term Mode S Address, non-ICAO address etc.

Track capacity and Prioritization – SWG leadership indicated comments indicated:

- Track density determination needs correction/clarification
- Track capacity requirements were too demanding and needed flexibility for different use cases and environments.
- Divergent views on what appropriate track prioritization schemes

These comments were resolved with the following decisions:

- Track Capacity to be determined by the equipment manufacturer appropriate for the stated use case of the equipment
- Update Volume II code to pass the TRM 60 instead of 30 tracks.
- Generalize Track prioritization requirements for “Front end surveillance” to allow use case appropriate prioritization scheme.

Mr. Brandao summarized: of the 5 Non-Concurs, we have 2 resolved and sent to Mr. Sigman for MOPS incorporation and 3 which we have completed the process. – Essentially, we have agreement from the commenters on all of these.

f. [Editorial Comments](#)

Mr. Sigman outlined his two-pass approach to resolve the editorial comments. His first pass through comments, he:

- Examined each comment
- Marked those I can resolve myself
- Marked those that will be resolved by a higher level SWG or TWG comment
- Marked those needing SWG or TWG discussion to resolve
- Marked those needing assistance from a specific person (the commenter, Section Lead, or SME)

Mr. Sigman indicated the next pass addresses comments he reached out to the WG SMEs in order to reach an acceptable resolution. He identified different approaches to get to resolution:

- Resolve comments after SWG / TWG discussion [all completed]
- Resolve comments after receiving assistance from others [mostly completed; awaiting answers from 2 people]
- As higher level updates for a section are implemented, incorporate editorial comments for that section – some are overruled by higher level comments, or become OBE

Then, Mr. Sigman summarized the status of editorial comment resolution. He stated that a large number are not yet “complete”. He clarified this is because of the editorial process. – Many are unfinished, because a more significant change from a “bigger” impact FRAC comment will resolve the editorial. Additionally, he indicated that he is still working to resolve mis-spellings. – Mr. Sigman is in the process of addressing some quirks with MS dictionary and multiple document sources, as well as some cut and paste (style) issues especially with tables. The editorial process is on target.

g. [Volume 2, ADD Comment Resolution Status](#)

Mr. Randal Guendel presented the status of the ADDD Comment resolution. There was a total of one hundred ninety-three (193) comments. One hundred fifty-nine (159) comments were editorial or low (i.e, 66 and 93 respectively) and forty-nine (49) of these are complete (12 editorial and 37 low). He noted that ADD comments resulted in code changes as well as text changes, both types are being tracked (see breakout tables on slide 2).

Mr. Guendel indicated: Of the fifty-four (54) comments that addressed code: thirty-seven (37) are complete. While we are working on our internal (PO) change board process to manage the resolution(s) for the remaining seventeen (17).

Mr. Guendel then proceeded to summarize the resolution of the “High” comments:

Six types are complete:

- Resolved STM track filtering (increased total form 30-60)
- No change to TRM track filtering
- Correlation algorithm/parameter update
- Replaced use of TOA with time of receipt for decorrelation
- Addition of Boolean indicator of V2V-UID validity
- Eliminated use of VPL

And three are in-process with an agreed upon resolution:

- Revised language about short circuit evaluation
- Parameters file update to ensure values are consistent with intended data type
- Text clarification of correlation-related constants not being prescriptive

Mr. Guendel also noted that a few additional CRs (internal change requests) have been generated since FRAC comment period based on other FRAC resolution discussions. These are:

- Xs-219 Annunciation is not in HTRM – withdrawn based on committee discussion
- Xs-220 Add label270 rules for ownship zero vertical rate cases – After committee discussion there was agreement on the additional rules; Implementation will follow
- Xs-221 SetCoordination does not populate the STM Report's vrc and hrc. Mr. Guendel indicated the bug was identified during committee discussion of reachback behavior. He continued indicating the implementation (change) is known and is awaiting final steps of the change review process for review and confirmation (approval) of the change.

Mr. Guendel summarized status and timing for the resolutions.

- All ADD comments that affect code or (Volume 2) text have been completed or have a clear resolution path. – The parameter changes are scheduled to go through change board in next couple of weeks.
- Implementation/merge of Volume 2 text changes by June 30 and Implementation/approval/merge of code changes by July 1-15
- Mr. Sigman will be incorporating related edits to Volume 1 from July 11-15
- We will use 2 week at the end of July to review changes: July 12- July 26 and meet on July 26 Meet to accept final (Volume 2) edits in DO-396

Mr. Ruy Brandao noted: “You indicated a lot of work that happened in the background. I am impressed and thankful for all the effort from your team. Neal Suchy contributed: “This (ACAS sXu) is definitely not the “MOPS lite” that was suggested at the beginning of this

process. Mr. Searight: “Yes, there is a lot of good work/heavy lifting here.” He asked if there are: “Any additional comments/concerns on the work presented here or done over last week and a half?” – There was no additional concerns.

8. Decision to Approve ACAS sXu MOPS for submission to PMC

Mr. Searight proceeded: “If we approve this, based on approach to the resolutions we plan to have everything in document and out to committee members around July 11th, give the committee members 2 weeks for review and meet again on July 26 to ensure all comment-resolutions are incorporated correctly. I will emphasize that this is a tight timeline, but we will not rush through the process. Mr. Silbermann interjected: “I would also like to recognize and thank Randal Guendel for leading the ADD work down its path to completion.”

Then Mr. Searight indicated it is time to go through the decision process and asked for a motion to approve. Randal Guendel moved for approval then approval was seconded by multiple members. There were no objections. – The ACAS sXu MOPS was approved by the committee.

9. Future Meeting Scheduling

- July 12-14 – ACAS Xr Bootcamp
- ~~July 26 – Plenary Finalization of resolutions/updates (Ready to submit for RTCA PMC/EUROCAE ... Approval)~~ [NB: cancelled]
- September 8 – Plenary
- & August or September and November WG dates to be determined for ACAS Xr WG

10. Action Items Summary

- Mr. Alex Engel to get EASA to present at an upcoming plenary (Sept/Oct Plenary or sooner if possible)
- Matt to provide EASA rulemaking contacts to Alex Engel
- Mr. Searight and Mr. Dean to coordinate and track EUROCAE assessment of Café Crème analysis – request for update to ACAS Xa DO-385 – WG-75 to coordinate with EASA to get briefing at Plenary in September/October timeframe

11. Adjourn

Mr. Searight asked for motion to adjourn. It was so moved and seconded.

Mr. Searight closed the meeting, saying: “Many thanks for a great job in tight timeframe”
The Plenary Meeting closed at 12:30.

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