RTCA Paper No. 316-16/SC147-795
September 29th, 2016

Special Committee 147

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

The 84th meeting of the SC-147 was held on September 29th, 2016 at RTCA in Washington, DC. In accordance with the Federal Advisory Committee Act, Mr. Steve Plummer, 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. Stuart noted that this was a joint Plenary with EUORCAE WG75 and welcomed Bill Booth, chair of WG-75. Bill concurred with Stu on the opening of the Plenary.

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.

Stu asked the committee if they approved of the minutes from Plenary Meeting #83. There were no objections and the minutes were approved. Stu presented the agenda for this Plenary which was approved by the attendees.

Additionally, Steve Plummer, the Designated Federal Official (DFO), read the public meeting announcement.

Agenda Item 2 - WG-75 Activities (RTCA SC-147WG-75 29 Sep 2016)

Bill Booth presented a briefing on WG-75 activities. He focused on SESAR 2020 PJ11 and CAPITO work-packages. The funding and tasking are expected to span 1 Nov 2016 to 30 Oct 2019. Four of the five tasks address X_A, X_O, X_U and Xp. (Xp tasking would just establish a need and begin to define the scope and/or concept.) There is a Wave 2 expected where Mr. Booth expects to be able to coordinate work through the MOPS approval timeframe (2020). There were no questions raised during his briefing.

Agenda Item 3a – Surveillance Working group (SWG) Report (SWG Report SC-147WB 20160929)

Ruy Brandao and Walter Bender co-briefed on SWG status/progress. Presentation and discussion included:

- Received tech briefs from Ian Jessen and Adam Panken on STM.
- Agreed on surveillance related metrics. Actual values to be finalized and documented in MOPS; Related Test Suite will be provided. Airbus requested a Mode-S surveillance change; SWG agreed to incorporate into next MOPS draft (see SWG presentation to get more info on track drop at close range of non-diversity Mode-S transponder.
- Completed ADD review of 35 algorithms, downlink message algorithm(s) deferred due to an SME being unable to attend.
- Discussion about ACAS display indicated we would leverage results from OpSuit and TOO studies; assess Display Out and demonstrate we meet requirements for the display.
- Stacey asked about the test section review. Walter summarized the approach for ensuring test coverage/completeness with appropriate tests to the requirements.

AI: Adam and Robert to make sure there isn't degraded surveillance with regard to correlation process and suggested algorithms. [We don't anticipate this affecting MOPS timeline.]

Agenda Item 3b – Threat Resolution Working Group (TWG) Briefing (TWG Briefing to SC-147 Plenary 09_29_2016)

Robert Klaus presented updates incorporated into the final Run15 since the mid-tune freeze (Run15mtf). The analysis shows performance of all key metrics to be significantly better than TCAS. Where stakeholder feedback had indicated a need to make adjustments to the performance seen in Run15mtf, the consensus is that the tradeoff in Operational Suitability and Safety concerns are acceptable.

Robert Moss followed with a presentation on the TA performance analysis for Run15 final. There were way fewer surprises in the final TA metric results than expected considering the programmed changes in alerting behavior.

Barbara Kobzik-Juul presented status of the Test Suite built against Run14R3C. This test suite is being Beta tested by FAA's OpEval team members. The Test Suite team is incorporating additional pass/fail parameters, and additional encounters; they are also improving tools. The updated suite will be available for Run15

Stacey Rowlan presented a quick status report and plan forward for drafting the MOPS. Key aspects from the discussion included the following:

- Discussed the RF Message population (see AI for review/update).
- Josh Silbermann and Stacey explained DO-185B (TCAS MOPS) CAS requirements include a large number of notes including explanatory and/or how-to notes. These need to be reviewed to identify which would be better captured in the ADD to improve the description of how the algorithms work. Stu contributed that there are high-level sections of text (e.g., two pages of sense-related reversals explanation that might not go with a specific algorithm, but at a higher level; Josh's insights should help in the placement. Ann Drumm reminded attendees that there are many pages of coordination notes; and that some of that may be part of the overall description as it gives you the whole flow of

the process. Josh indicated that he had not started assessing the coordination piece, but he is checking for suggestions and will follow up with Ann for her inputs.
Stu commented that he would like to have the MOPS, ADD and Look-Up Tables updated and in-synch as a full package. A short discussion indicated that ADD as Volume II of MOPS would correlate with TCAS DO-185B containing Pseudocode in its Volume II.

- Stacey summarized TWG's kick-off to reviewing MOPS against the algorithms. The TWG broke into 3 groups and took notes on what went well for us, will compare with SWG and come up with good process guidance (steps) for continuing review. Stacey and Stu both noted the MOPS vs ADD comparison needs a global review (multiple people, from different viewpoints) The WG leads will segment out the work and will need everyone to sign-up/commit to look at specific algorithms. – Everyone will be expected to review the sections they are signed up for, and welcome to make additional contributions if they are able.

- Stacey's next comments tied to need for Configuration Control for the Look-up Tables as well as the MOPS and Algorithms. The Joint committees indicated that it would be best if there was one master copy and we could devise mechanisms for distribution through RTCA and EUROCAE. It was agreed that Steve Plummer and Kevin Hallworth would develop an initial proposal.

  AI: Ann and select other CSG members will review the RF Message population and make updates based on the TCAS Table 2-16

  AI: Josh to schedule/coordinate continued review DO-185B notes. Ann will provide inputs regarding the placement of coordination explanation.

  AI: Plummer and Hallworth to develop an initial proposal for configuration control and distribution of the ACAS X artifacts throughout the complete life cycle. This process will propose a single master repository for the, Look-up Tables. The MOPS would be controlled and distributed using existing RTCA/EUROCAE processes. Joint access (RTCA and EUROCAE members) is needed for the tables; Security controls including Access control, and Configuration control will be needed to ensure data integrity. That is: Develop a consensus CM and logistics process for dissemination of MOPS package that will meet the legal requirements of both RTCA and EUROCAE.

Stacey summarized a briefing from earlier in the week, Jean-Luc Robin had briefed the Joint Working Groups on a reported occurrence of undesirable interaction between TCAS and TAWS. In a low altitude situation TCAS issued a *Descend RA,* followed by TAWS issuing a *Don't Sink Advisory*. Since this was below TAWS threshold, and near but above the TCAS lower threshold this contradictory advisory needs to be analyzed and a solution determined. Several action items were identified:

AI: Wes to request and analyze FOQA data to determine how common this is and if possible when/where this is triggered.

AI: FAA ACAS Team to double-check the lower threshold for *Descend* RAs, and how *Descend* advisories are avoided at low altitudes; analysis to include any hysteresis factor. Also, research the threshold for TAWS *Don't Sink* Advisory, how that advisory is handled and whether it's any different from the predecessor system, GPWIS.

AI: Develop approach to (have ACAS X) avoid this *Descend/Don't Sink* sequence of advisories.

One of the planned points of discussion was to review the climb inhibit triggers analysis resulting from Jean-Luc Robin's presentation from the June Face-to-Face session. Discussion was deferred due to (un)availability of a key contributor. One outstanding question is:

AI: Cross- reference and compare the climb inhibit triggers suggested by committee with the previous solution reported by the TWG

Agenda Item 3c – (Safety Status SC-147 AZ 29.9.16)

Andy Zeitlin presented status of the Safety/Hazard work for ACAS X. Andy touched-on next steps to address the Do Not Alert (DNA) (instead of Designated TA Only) functionality in the safety assessment for X_A /Xo.

AI: The ACAS X_A/X_O Safety Analysis will need to be reviewed for appropriate coverage of DNA (in lieu of DTA Only).

Andy also presented status of the ACAS X_U Safety Hazard Analysis: Kickoff was a successful level-set, showing how this effort is building off of the hazards developed for ACAS X_A/X_O and examined/documented for an ACAS X_U Flight Test. The meeting had participation from stakeholders with varied backgrounds and roles. This diversity of perspectives is essential for a sound safety and hazard analysis; additional participants are always encouraged. The next meeting is scheduled for Thursday, 13, October 2016.

Note: If you are interested in being included in the X_U Safety Assessment or review, please contact Mr. Zeitlin to be included on the distribution list.

Agenda Item 4a –Coordination Sub-Working Group (CSG Progress Update 29 Sep 2016) [Drumm/Panken]

Ann Drumm briefed on the status of CSG activities.

- We are participating in Review and Comment for SC-228 DAA MOPS FRAC, including participation of disposition of comments related to our ISRA inputs to the DAA. We want to make sure we maintain ownership of the interoperability requirements as they go through the SC-228 FRAC process. [There are already~100 comments]
- Focused ACAS X MOPS review on Coordination following process introduced at SWG; started MOPS review at Monday's working group
- Participated in SC-209/ACAS Working Group related to message proposed surveillance message changes. Have some additional follow-up with them.
- There was a lot of discussion on topic Xo DTA Only (or DNA) touching on coordination between aircraft as well as safety and Operational Suitability studies. [Note: using proposed "Shadow" RA, where coordination message for an RA is sent, but the ownship doesn't display the RA information.. In some encounters this was a safer approach and in other encounters safety was not improved.]

Agenda Item 4b – ACAS X_O (X_O Briefing to SC-147)

Mike Petri briefed the committee using the slides presented to the TWG and SWG earlier in the week. He indicated that discussion at the CSG concurred with OWG/OWS preferences for Do Not Alert (DNA) over Designated TA Only (DTA Only). Further, the presentation to SWG and TWG elicited comments that usage scenarios were more operationally suited in the DNA presentation.

The committee agreed that the two (2) X_O applications that would be addressed by this ACAS X MOPS would be Do Not Alert (DNA) and Closely Spaced Parallel Operations >=3000ft (CSPO-3000).

Note: See AI in Safety Agenda item, above.

Agenda Item 4c – ACAS X_U Working Group (ACAS X_U Brief-Out to Plenary)

Charles Leeper presented breaking news that development of the ISRA artifacts and coordination with the SC-228 Detect and Avoid (DAA) Working Group has presented ACAS X_U with an opportunity to provide a DAA function integral with the X_U Collision Avoidance System. This opportunity is being actively worked by including additional scenarios and "boundary" information in the most recent revision of the ACAS X_U CONUSE. Regarding feasibility of this approach, it was noted that the X_U MOPS lags X_A/X_O by about 2 years and as such can be worked to align with SC-228 alerting guidance due in Spring 2017, and the SC-228 Phase 2 timeline.

Regarding the technical compliance/alignment with the future SC-228 MOPS, SC-228 will have a suggested algorithm in an Appendix. The X_U algorithms meet all requirements that have been identified. The X_U team has noted that ACAS X_U actually performs better with respect to the timing of guidance and alerts if the DAA's Tau requirement is deferred. As such, the SC-147 X_U MOPS will be consistent but not strictly compliant with the SC-228 DAA MOPS. It is anticipated that mapping ACAS X_U RAs and guidance to SC-228 DAA alerting will be more than sufficient for our prescriptive algorithms to receive a TSO from FAA Certification.

At the July ACAS X_U Face-to-Face meetings, the X_U Working Group reviewed the updates to the ACAS X_U CONUSE. Updates included material which repositioned the algorithms as an integrated solution for both DAA and Collision Avoidance. No significant rework resulted from this review. The CONUSE presentation included the Categories of UAS that will be covered by the X_U MOPS. The Working Group received the concept of ACAS X_U operating with a "Nucleus" to select the horizontal or vertical advisory (reference to Michael Owen's technical paper). Of note was the discussion that Auto-Response may be required if certain manual response requirements (e.g., timing) cannot be met. It was also noted that the Tuning will be optimized for Auto-Response (with a given delay). The X_U team is highly recommending Auto-Response and anticipates a change only if contraindicated by the X_U Safety/Hazard study.

Agenda Item 4d – RTCA SC-147 Operations Working Group (OWG) and EUROCAE WG-75 Operations Working Sub-Group (OWS) (Joint Summary Report to SC-147/WG-75 Plenary)

Tom Teller and Stan Drozdowski presented the coordinated work plan for the OWS/OWG and invited the Working Group leads to refer additional questions to OWG/OWS. Additionally, Mr. Teller walked-through

the Issue/Question Tracking worksheet used to capture the context and question for the OWG/OWS as well as each group's feedback and the resolution.

The presentation reminded Mr. Brandao of a concern related to DO-300A and Hybrid Surveillance: No TAs are (supposed to be) issued while operating on the ground. As soon as you are rolling for take-off (rotate), TCAS is allowed to issue TAs. There is a need to make sure that you have sufficient information about this transition even with hybrid surveillance.

> **AI:** Request for SWG and TWG to examine the requirements and ADD to ensure ACAS X addresses this concern regarding when TA may/may not be issued while in transition from ground to air operations (and from air to ground) while using hybrid surveillance. (May want to start with looking at TCAS implementation of managing TAs in the Air-to-Ground transition space.)

Agenda Item 5 – MOPS Schedule Review

A detailed discussion to schedule section-by-section MOPS review was deferred to subsequent SWG and TWG meetings.

Instead the committee performed a one-year look-ahead for Face-to-Face SC-147 meetings as having a facility to hold regular Face-to-Face meetings is considered critical for the MOPS review and approval. The following dates were agreed upon, with the confirmed and/or tentative venues. – Not all meetings will include a Plenary.

Year	Dates	City	Venue	Host Organization	Focus
2016	November 15-17	Washington, DC USA	RTCA	RTCA	ACAS X_U
2016	December 5-8	Washington, DC USA	RTCA	RTCA	ACAS X_A/X_O
2017	March 6-9	Phoenix, AZ USA	ACSS or Drury Hotel *	ACSS *	ACAS X_A/X_O
2017	June 12-15	Seattle, WA USA	Boeing *	Boeing *	ACAS X_A/X_O
2017	September 18-21	Washington, DC USA	RTCA	RTCA	ACAS X_A/X_O
2017	December 4-7	Köln, DE (Cologne, Germany)	EASA *	EASA *	ACAS X_A/X_O

*Confirmation of Venue and Host Organization Based on Availability of Conference Rooms

Agenda Item 6 – Closing of SC-147 and WG-75

Mr. Searight and Mr. Booth again thanked everyone for a productive week and reminded everyone of the November ACAS X_U Working Group Face-to-Face and the December ACAS X_A/ X_O Face-to-Face working meetings, both at RTCA.

Addendum

The Federal Register announcement referred to this session as the 86th Plenary of SC-147. It should be noted that was a typo and September 29, 2016 was the 84th Plenary of the SC-147.

Certified as a true and accurate summary of the meeting.

Co-Chairman	Co-Chairman
-S-	-S-
Mr. Stuart Searight	Mr. Ruy Brandao
FAA	Honeywell

Attachment 1

Meeting Attendance for SC-147 Plenary on September 29th, 2016

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