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Washington, DC

RTCA SC-231 Plenary #18 “Terrain Awareness Warning System (TAWS)” - Minutes
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Date	April 9, 2024
Place	Virtual
Hosted by	WebEx

Meeting Summary:

The plenary of RTCA Special Committee 231 (SC-231) (#18) was held April 9th, 2024. The meeting was conducted as virtual meeting via WebEx with the following attendees participating.

Display Name	Company
Richard Adler	Federal Aviation Administration (FAA)
Xavier Audouze	EASA
David Carlu	Airbus
Linda Chism	Alaska Airlines (A4A)
Edward Hahn	Air Line Pilots Association (ALPA)
Alexander Hasp Frank	Saab Group
Jens Henning	GAMA
Marie Hogestad	Federal Aviation Administration (FAA)
Esther Hoyas Vicente	EUROCAE
Yasuo Ishihara	Honeywell International, Inc.
Jon Kirtz	Collins Aerospace
Tom Lawrence	Universal Avionics Systems Corp.
Duncan Macklin	Garmin Ltd.
Kevin Prosser	Gulfstream Aerospace Corporation
Angelo Rossi	The MITRE Corporation
Brandi Teel	RTCA
Monica Vafiades	U.S. Air Force

Brian Ratcliff	Air Line Pilots Association (ALPA)
Rick Ridenour	L3Harris

1. Welcome, Introductions and Administrative Remarks

The Plenary of SC-231 convened April 9th, 2024 at 10:00am EST by Co-Chairs Yasuo Ishihara (Honeywell International, Inc.) and Rick Ridenour (L3 Harris). Welcoming remarks were made, followed by each attendee introducing themselves. RTCA anti-trust statement, proprietary policy and membership policy were read by Brandi Teel (RTCA).

2. Agenda, Meeting Minutes and Action Item Review

The meeting had one agenda item which was to consider potential changes needed to DO-367 to address both the FAA's and EASA's desire to resolve international safety findings.

FAA GAR Rich Adler listed a number of items for the committee to consider for discussion and potential incorporation into the TAWS MOPS.

1. Inclusion of an auto-uninhibit requirement in the MOPS to address Part 23 issues with the terrain inhibit being left on. Rich indicated that this is currently a hot topic in the FAA. If SC-231 does not incorporate some sort of requirement in the MOPS, then the FAA would likely update the TAWS TSO to directly capture the requirement. Rich prefers that the committee incorporate the requirements rather than the FAA. Rich would like to start with the white paper that the committee generated in 2020.
2. Addition of a low-energy alerting mode to detect cases like the Asiana B777 that crashed just short of the runway at KSFO in 2013.
3. Discussion of how future GCAS requirements might affect TAWS requirements.
4. Modification of the Premature Descent Alerting mode, based on a request from EASA.

Ed Hahn (ALPA) indicated that he would like the issue of GPS Spoofing and how it impacts TAWS to be discussed by the committee. He would like to understand if the current use of GPS by TAWS is robust enough to detect spoofing.

No additional topics were raised by committee members, so each of the five topics above was discussed further.

Auto Uninhibit

Rich Adler clarified that the concern is mainly for the inhibition of forward-looking TAWS modes as opposed to the inhibition of classic GPWS modes.

Rick Ridenour asked if the goal was to have the MOPS prescribe a particular type of inhibition that was required or to have the MOPS just require a means.

Yasuo Ishihara indicated he thought it would be better if the MOPS just required that there be a means, rather than defining what that means had to be.

Rich indicated that some level of specificity would be required to ensure that any compliant implementation would address the various accident cases. For instance, a means to uninhibit only at power-up would not address some of the accidents where TAWS was inhibited at the start of a flight and then the aircraft crashed later in that same flight.

Tom Lawrence pointed out that some of the possible implementations the committee had discussed in 2020 would involve changes to the installation, rather than changes to the TSO'd article itself.

Rich agreed and stated that we would not want MOPS to dictate how to accomplish the uninhibit, just indicate what conditions needed to be detected.

Rick added that we would still need to be careful not to put a requirement on the equipment in the MOPS that the equipment itself could not meet.

Rich reiterated his preference that the MOPS be updated to address this issue, rather than having the requirement added directly to the TSO.

Low-Energy Monitor

Rich reviewed the Asiana B777 accident that occurred just short of the runway at San Francisco in 2013. This accident is what triggered the concern for a low-energy alert. Although the pilots received a low-speed alert, the alert came too late to avoid the accident. The engines took too long to spool up and provide adequate thrust.

Yasuo asked if this new alert would be an optional mode for TAWS or mandatory?

Rich indicated that the NTSB would like this to be a required mode, at least on some aircraft. There has been no discussion yet on how this would be included in the regulations. Rich likes the idea to make the alerting mode optional in the TAWS MOPS, and then mandate if necessary, in the regulations, based on the type of operation.

Linda Chism asked what type of operations would require this new mode. Rich indicated that a final answer is not known, but perhaps the requirement would be applicable by part (for instance, required for Part 121 but not Part 135) or applicable by aircraft type (for instance, required for high bypass turbofan engines but not turboprops).

Xavier Audouze agreed the mode should be optional from a TAWS perspective and allow regulators to decide where it goes.

Yasuo stated that a similar energy awareness mode has recently been added to the HTAWS MOPS. It is an optional mode, and it considers airspeed and torque. The MOPS does not define an envelope, but provides things to consider. UKCAA makes the mode a requirement for UK registered aircraft. It is referred to as Mode 7A.

Yasuo noted that all major turbine-powered helicopter OEM's participated in the HTAWS committee as they discussed this alerting mode and their participation was instrumental in defining the mode. Yasuo said SC-231 would require a similar level of input from fixed-wing OEM's if the committee is to include a low-energy alert in the TAWS MOPS.

Rick noted that a low-energy alert is not a terrain function, per se. It is analogous to the reactive windshear detection function: it is active at low radio altitudes, its goal is to keep aircraft from hitting the ground, and a given vendor might choose to implement the function inside a TAWS computer. However, it has its own TSO and performance requirements, and the skill set required to define requirements for windshear detection are distinct from the skill set required to define requirements for terrain awareness. Developing requirements for a low-energy monitor will likely require expertise that is not necessarily present in SC-231 today.

Xavier indicated that he feels a low-energy monitor is related to terrain awareness because the aircraft could hit terrain.

Ed said that he believes a low-energy alert is a good function for the aircraft. He believes the committee should discuss the issue to determine if the TAWS MOPS is the most appropriate place to list the requirements.

Yasuo questioned what the output from the committee would be. Ed and Brandi both indicated that the committee could produce a white paper.

Yasuo reiterated that the HTAWS committee had all major turbine OEMs participating in the development of the low-energy mode requirements in the HTAWS MOPS. He emphasized that SC-231 would need the right performance experts from a good sample of aircraft OEMs if the committee is to have meaningful discussions on the topic.

David Carr asked if there was a white paper available that describes the function. Rich referred to an open NTSB safety recommendation that requests development of “a context-dependent low-energy alerting system.”

Linda indicated that on the B737 there is a low-airspeed alert that has been available for 10 years or more. She believes it is based on the minimum maneuver speed.

Yasuo indicated that he was involved in an energy awareness study as part of a JSAIT. It was challenging to get the minimum speed (corresponding to the top of the amber band on the speed tape) from a lot of aircraft. It was particularly difficult with non-production aircraft.

Yasuo stated that while the committee could discuss the topic, we cannot sign up today to generate requirements for the mode in SC-231. SC-231 does not have the right expertise.

Linda said she thought it would be instructional to hear a high-level performance engineering review of what the necessary inputs would be for any unit to calculate this low-energy state and related context. What inputs could be harvested from the aircraft to determine the appropriate thresholds?

Rich indicated that there is a paper that was written describing the function. He will check to see if it can be released.

The group concluded that SC-231 can look at seeing if we have the expertise. Yasuo noted that the HTAWS committee spent six months just discussing if the aural alert message should be “speed” or “power”, etc.

Ground Collision Avoidance System (GCAS) Discussion

Yasuo asked if the intent was to include GCAS requirements in the TAWS MOPS or to keep GCAS in its own MOPS and just make sure the TAWS MOPS is compatible with the GCAS MOPS.

Rich said he doesn't have that answer today. That is the type of question that needs to be discussed. Rich pointed out that a GCAS MOPS is not a near-term objective, but the discussion should start in the near term and SC-231 should be involved in the discussion.

Yasuo suggested that the TOR could say that SC-231 would discuss a potential framework for how GCAS requirements might be addressed in the future. This seemed acceptable to the group.

Xavier asked for clarification on the functionality of GCAS. Rich indicated that he has a presentation describing GCAS that he can provide. Basically, GCAS expands on TAWS to include lateral maneuvering to avoid terrain.

Rich indicated that work is proceeding under an FAA contract to study the GCAS concept and provided a screenshot of some of the current work.

Marie Hogestad stated that GCAS had three functions: 1) Pilot activated recovery system, 2) Standard GCAS, 3) Auto-GCAS, where the alert triggers the flight control system to perform the escape maneuver, even in the absence of pilot input.

Marie indicated that the Part 25 investigation was put on hold by the FAA and is expected to restart this month. A requirements guide is expected to be ready in the first quarter of 2025.

Rich indicated that the Part 23 research is ongoing. The effort will not result in a marketable article. Rather, the research is to define a capability. Current contracts expire in July. Rich does not know if there will be follow-on work.

Yasuo indicated that there is probably enough information on GCAS today to allow SC-231 to have discussions about how TAWS would interact with GCAS.

Rich suggested that the TOR could say that we need to establish the framework for future requirements discussions. He indicated that the generation of MOPS-level GCAS requirements would be a longer-term effort that would go beyond the probable timeline for the next TAWS OPS release.

EUROCAE

As an aside, Yasuo asked if SC-231 would be a joint committee with EUROCAE going forward. Brandi indicated that was not necessarily the case and would need to be discussed once the PMC approved the TOR.

Changes to the PDA Envelope

Xavier provided an overview of the desired change. He indicated that EASA is requesting a change based on a recent incident that involved an A320 on an RNAV approach to Paris. The report has not been released yet, but when it is released, he expects it to include a recommendation to review the PDA envelope relative to a 3-degree approach to the runway. EASA would like the Must Alert portion of the PDA envelope to be expanded to ensure that an aircraft approaching the runway 280ft below a nominal 3-degree approach profile would receive a timely alert. As the PDA envelope is currently defined, an approach path that is 280ft below a nominal 3-degree approach path to zero feet at the runway threshold would not intersect the envelope until less than 100ft above the runway.

Changing the PDA envelope would require agreement from all TAWS manufacturers, as the envelope defined in the MOPS was based on the definitions of currently-certified systems.

Ed indicated he would support a modification to the PDA envelope.

GPS Spoofing

Ed explained that there recently has been an increase in GPS spoofing, particularly in conflict areas, Europe, and the Middle East. Ed would like the committee to discuss how GPS information is used by TAWS and whether or not it is robust to GPS spoofing.

Marie indicated that currently a lot of the mitigation is operational. EASA released a SIB and the FAA released a SAFO on the subject.

Yasuo said he is aware of work going on within navigation groups to address this. In TAWS, it may be difficult to address this issue on our own, particularly for Class B and C installations. Navigation specialists have suggested that the IRS is the best place to do the monitoring and comparison between inertial and GPS positions.

David noted that the operational concern is when a spoofed GPS receiver provides an incorrect position but flags it as valid.

Yasuo recalled that in the early days of TAWS, the problem of "FMS map shift" was the concern. GPS position was considered the better position source. Today, GPS spoofing can persist for 30 minutes or more.

The committee agreed that we can discuss in SC-231 what, if anything, could be done within the TAWS to mitigate the issue. We would likely need navigation experts in the room as well.

From a TOR perspective, we would say that we would discuss the issue and write a white paper.

Ed thought this sounded like a good approach.

Summary

The committee agreed to propose a TOR update to the PMC to consider updating the MOPS and generating one or more white papers to capture our conclusions. The auto-unihbit feature and a modified PDA envelope are likely candidates to be included in a MOPS update. Consideration of a low-energy monitor, GCAS implications on TAWS, and impacts of GPS spoofing would likely result in white papers.

Rick volunteered to draft the TOR updates. One issue raised that TOR updates include proposed deliverables with expected completion dates. Because the current committee does not include all of the experts that would be required to address many of the issues, it was suggested that perhaps the first deliverable would be a proposed schedule. Once the committee determines what level of support we will have from experts outside of the TAWS field (aircraft performance, GPS accuracy, GCAS, etc.), we can confirm when and if we will be able to generate all of the white papers and the MOPS update being requested.

A draft TOR will be provided to committee leadership by 16Apr. At this point Brandi will determine if only having a schedule deliverable would be acceptable. Once that issue is resolved, the TOR will be sent to the committee for review. A one-hour phone call is scheduled for 22May for the committee to discuss and hopefully approve the TOR update. The TOR would need to be submitted to the PMC by 13Jun to support the PMC meeting on 27Jun.

It was also noted that Zach Reynolds has changed roles at his company and will no longer be serving as secretary for SC-231. The committee will need to choose a new secretary if the PMC approves us for additional work.

3. Adjourn (Plenary)

The meeting was adjourned on April 9th, 2024 at 12:45pm EST.

CERTIFIED as a true and accurate summary of the meeting.

Yasuo Ishihara
Co-Chair, SC-231

Rick Ridenhour
Co-Chair, SC-231