

**WORKING GROUP MEETING MINUTES
MEETING OF SPECIAL COMMITTEE 231**

TAWS - GPWS

Date: 22-24 September 2015

Time: 0900 EDT to 1700 EDT, 24 Sep 0900 to 1300 EDT

Place: RTCA Office, Washington DC

Co-Chairmen: Yasuo Ishihara Rick Ridenour

Designated Federal Official: Charisse Green

Attendees:

Name	Company/Agency
Baker, Kirk	FAA
Becerikli, Eylem	STM A.S.
Fleury, Stephane	Thales
Green, Charisse	FAA
*Hall, Michael	MITRE
Ishihara, Yasuo	Honeywell
*Kirtz, Jon	Rockwell Collins
*Kapytov, Vasily	IANS Inc.
*McKeon, Sean	Universal Avionics
Moses, Hal	RTCA
Mulkins, Jim	Honeywell
Reynolds, Zach	ACSS
Ridenour, Rick	ACSS
*Rossi, Angelo	MITRE
*Sadilov, Seva	IANS Inc.
Vafiades, Monica	U.S. Air Force
*Zapoluch, Steve	Garmin
*-attended by phone	

Note: throughout these minutes, references are made to actions/action log and the Strawman. The action log is as Exhibit 1 on the RTCA server under the SC-231 group, September 22-24 meetings. References to the Strawman can be found as Exhibit 2 at this same location.

September 22:

A review of the proposed consolidated Mode 1 Caution curve took place, led by Yasuo. The following remarks were made, but the proposed curve was accepted in concept:

- The consolidated curve will be split into a May Alert maximum value and Must Alert minimum value. These max/min also apply to the exiting of the alert area at 60 feet/10 feet for the Mode 1 example. Thus, there are 2 trapezoids for each curve.
- We would round the respective inflection points to the nearest foot.
- In conjunction with the curves, the equipment confirmation times will be noted. Thus, each alert can be delayed in its annunciation by this time frame.
- A concern exists that the interfacing equipment may introduce their own delays, beyond equipment confirmation times. These delay assumptions (500 msec thrown out as a first estimate) may be noted in conjunction with these curves. This became a longer, separate discussion.

It appears that the existing installation section can include this information. However, as a box level specification, the current curve should be sufficient to perform a box test. The original section from DO-161A makes reference to a 5% tolerance. In order to keep this concept present in our new MOPS, a section 1.7.3 has been used to describe delays and a section 3.2.4 has been added to describe a specific 600 msec transmission delay being acceptable. The citation for this 600 msec is from the DO-317B more recent description of ownship latencies. See below for this reference:

1.5.1.1 Ownship Position

The position source for ownship provides position updates at least once per second. Ownship horizontal position data will be delivered to ASSAP such that the Latency Compensation Error (between interfaces A3 and B3) is less than 600 ms.

Additionally, a section has been added for data smoothing. This is based on the below paragraph from DO-161A.

BEEN USED FOR THIS ADDITIONAL TOLERANCE BAND.
SMOOTHING OF THE INPUT DATA IS NECESSARY IN THE
GROUND PROXIMITY WARNING EQUIPMENT TO MINIMIZE NUISANCE
WARNINGS. THE TEST PROCEDURES OF APPENDIX B SPECIFY
CONSTANT RATE INPUTS, AND ARE DESIGNED TO ENSURE THAT
DELAYS TO WARNING ONSET RESULTING FROM SUCH SMOOTHING
ARE NOT SUCH THAT THE EQUIPMENT FAILS TO PROVIDE
WARNINGS BEFORE THE LOWER TOLERANCE LIMITS OF THE
WARNING ENVELOPES ARE REACHED. THE CURVES OF APPENDIX
A ARE NOT APPLICABLE TO INCREASING RATES, AND ADDITIONAL
DELAYS TO WARNING ONSET WILL BE EXPERIENCED IF
INCREASING RATES ARE USED.

Mode 2 was discussed as the next topic. There have been difficulties in applying the integral of the radio altitude rate to the existing dynamic DO-161 curve to create a static curve using each supplier's time delay. In order to more effectively describe the Mode 2 alerting and in the interest of recognizing that the Mode 2 alerting is now seen as a backup to existing FLTA modes, the Mode 2 curves are considered simpler to describe as dynamic curves as they were in the original DO-161. In conjunction with this decision, the time delay table would be adapted to show zeroes for the Mode 2 time delay for the caution and 2 seconds for the warning (allowing time for the caution). We would then add a footnote to the Mode 2 curve describing this application of time delay.

In addition, we have considered the lower left of each curve. These points are a consolidation of all suppliers' minimum values. With this done, we have some irregularities on the curves – for example, on Mode 2, the lower limit at 1975 feet per minute and 40 feet has a vertical line down to 1975 feet per minute and 25 feet, clearly not linear compared to earlier regimes. We will live with these irregularities, as there is not a requirement to simplify these figures to minimize the number of straight edges.

We have some concern that in Mode 2, one supplier has a separate Caution and Warning alert limit. While we feel that this supplier will likely meet the dynamic limit we are now proposing for Mode 2, there could be some misinterpretation if in fact this supplier has requested deviations to this warning curve. An action will be created to ensure this before we publish.

Action (S. Zapoluch / 23 September) – indicate if there are any objections to the re-use of the existing DO-161A Mode 2 minimum levels for both caution (no delay) and warning (2 second delay assumed).

Action closed – Steve indicates that the re-use of the existing minimum levels will be acceptable.

Mode 3 seemed to be straightforward when presented.

Mode 4 would have a combining of Envelope 1 (lower minimum level) and Envelope 2 (more extreme maximum) for each of Gear and Flaps.

Mode 4 Envelope 3 exists and is in good shape for the Too Low Gear. There still needs to be a similar curve for the Flaps entry, with maximum level set to 245 feet.

Action (Z. Reynolds / 23 September) – using existing GPWS curves as template, develop a Mode 4 Envelope 1 / 2 combined plot – one for gear and one for flaps.

Action closed within meeting.

Action (Z. Reynolds / 23 September) – using existing GPWS curves as template, develop a Mode 4 Envelope 3 Too Low Flaps plot and reproduce the Too Low Gear plot. Two plots here also.

Action closed within meeting.

Action (Y. Ishihara / 23 September) – using existing GPWS curves as template, develop a Mode 1-3 and Mode 5 plot.

Action closed within meeting. The entire set of Mode 1 – 5 curves are now found as Exhibit 3 on the RTCA server.

Action (R. Ridenour / 23 September) – reword the Mode 4 Method 2 alert descriptions to eliminate the numerical basis, but instead refer to the figure.

Action closed within meeting.

A decision was made to implement the confirmation time requirements embedded into each alert section.

The PDA curve was then introduced. A decision was made to only introduce a lower limit, as having a Must Not Alert does not appear appropriate for a PDA due to existing TSO-originated phrasing of approach circling and typical operations. Thus, the PDA only has a Must Alert and May Alert region.

Then, we went after defining a generic wording for the requirements around Must Alert and Must Not Alert. Then, a generic section has been created up front near the data smoothing section to introduce the trio of concepts of Must, Must Not and May Alerts.

Charisse has asked Barry Miller if he could please attend the next teleconference in October to discuss the System Crosscheck requirement found in AC 90-101A and use of the TAWS system as an independent check.

September 23:

A presentation of Mode 1 – 5 curves took place. The spreadsheet generated graphs were then reviewed and changed realtime. The next step is to insert these graphs into the new MOPS requirements.

An addition of a Mode 2 section to explain the use of a dynamic curve rather than static curve has been added.

A wording of the cessation of a visual and aural alert then took place to account for one supplier making use of pilot response as part of the algorithm to remove the visual indication.

A discussion began over the use of Phase Of Flight definition that is different than the TSO. One supplier makes use of distance to nearest runway only and not height above the runway height, where the latter value is part of the TSO recommendation. The committee debated whether the new DO document should accommodate this change or if the supplier should continue the existing deviation and/or exception for this implementation. The FAA accessed the Equivalent Level of Safety white paper/explanation and feels there are implementation details that mitigate this implementation. However a new applicant may not have this mitigation. Therefore, the best direction forward is to maintain both distance to runway and height above runway. If a given supplier wishes to avoid deviation and therefore is willing to describe their implementation for insertion into the new DO document, they could step forward. If not, it is acceptable to maintain the current requirements.

Another supplier desired moving the phase of flight height to a slightly different set of levels to accommodate specific implementations.

Action (S. Fleury/ Z. Reynolds / Y. Ishihara) – provide wording for alternate definition for flight phase, where past deviations have been filed. See 24 September discussion on the Honeywell presentation of this section.

Action closed within meeting: Y. Ishihara presented one proposal, shown in the graphic found in the 24 September summary. This led to further actions.

Action (R. Ridenour / 8 December) – Phase of Flight Assessment. Analyze phase of flight definitions compared to required test cases to identify and make recommendations where inconsistencies are found. For example, does departure phase end at 1500 feet above runway or 15 Nm from runway? Does enroute end at 15 Nm from a given runway when less than 3500 feet (which may not be the destination) or only when 15 Nm from the apparent (other parameter use) destination runway? [From 24 September] : Develop a bulletized presentation to show where the phase of flight transitions are used and an assessment of the pros and cons of the TSO standard compared to existing standards. This can then be shared with other manufacturers to poll their use to ensure that a consensus opinion is determined.

A discussion of the combination of supplier (a) maximum confirmation time and (b) lowest alert threshold while applying the 3.25 second confirmation time of the PDA alerting curve (as one example) then took place. This combination can create scenarios where the dynamic levels are lower than any one supplier meets.

The desire from the group is to create a PDA alert curve based on latency time of 1.25 seconds. ACSS/Thales can then create the corresponding PDA minimum alerting with vertical speeds between 500 feet per minute to 2000 feet per minute. Because their PDA is based on look ahead sensor, this is anticipated as causing an increase in the overall PDA curve compared to what has been created today.

Action (S. Fleury / Z. Reynolds / 15 October) – provide PDA alert curve based on latency time of 1.25 seconds, assuming vertical speeds between 500 feet per minute and 2000 feet per minute.

Action (R. Ridenour / 2 October) – improve graphs to include Office 2013 features of leader lines and parentheses around inflection points.

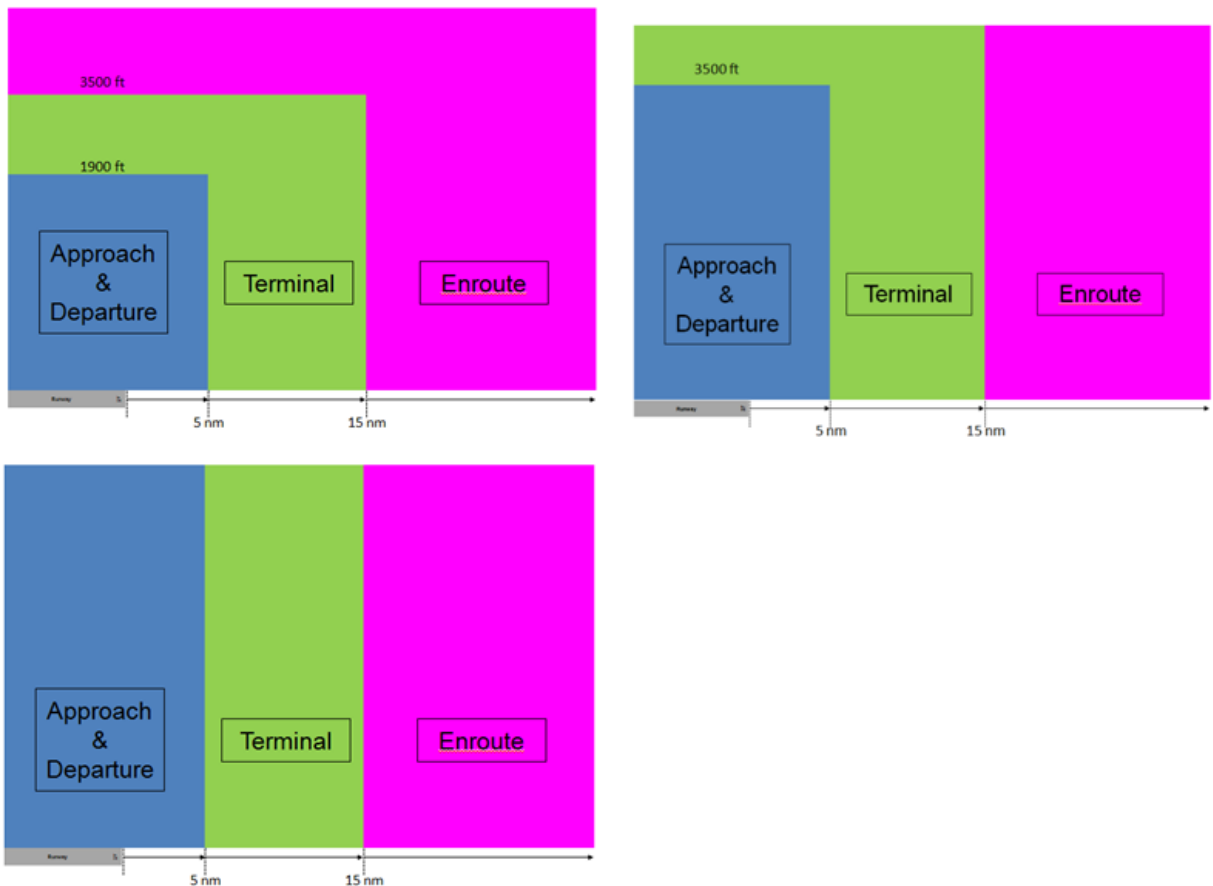
Action (Y. Ishihara / 2 October) – insert graphs of each mode, captions and cross-references into the strawman to lead to a reviewable copy of the requirement section.

A separate discussion took place over the Class B display requirements found already in the TSO-151c. However, by contrast both AC 23-18 and 25-23 indicate that Class B systems may include a TAWS display. It appears that historically, the TSO was an attempt to nudge manufacturers into including a terrain display functionality that would prove valuable. However, due to terrain database errors that might have been present in the past, this was not widely accepted at the point of installation. Today, with a wide range of TAWS equipment available, if some systems are available without a terrain display capability, an operator can easily find a display driving system – thus the nudge to industry is no longer necessary. So, in the introductory section, we wish to keep the optional nature of the Class B display.

September 24:

The question is asked about what alerting modes change based on phase of flight. However, one supplier points out that the phase of flight requirement has nothing to do with FLTA. The phase of flight is not used on this supplier's system.

A review was made of a proposed change to the Phase of Flight area, where a distance only implementation is described with no altitude limit. A slide was developed indicating the existing standards and the respective limits of the systems, where the caps on the approach area and the caps on the terminal area can be unlimited in some systems. Basically, the separate implementations are summarized below:



We are trying to determine how critical this phase of flight definition is to the overall alerting.

We are asking how these phases of flight are used in the document. They are only used as the means to identify the Table A through Table F test cases defined at these Phases of Flight. The Departure phase appears to be unused in test cases elsewhere in the TSO document, but described in the Required Obstacle Clearance table 3.1.1. Perhaps a take-off definition is needed.

An action was created above named "Phase of Flight Assessment" to develop a more informed position.

An application of the smoothing/time filter application has been written in section 2.1.12 (input data smoothing) and agreed to in this meeting.

A more holistic view of the document was then conducted, as this point represented the completion of the requirements section for Class A. Because the Class A requirements are the basis for some structured sections for Classes B and C, it seems wise to ensure that we agree on all of Class A description now before applying this section elsewhere.

A discussion of TAWS Class took place. We identified that there are two Class descriptions occurring in the document's sections 1.2 and 1.3. This should be taken as an action.

Action (Z. Reynolds / 15 October) – Combine the Class A/B/C descriptions and regulation found in section 1.2 and 1.3 into a common section.

Action (J. Mulkins / 15 October) – Develop a paragraph description of the use of obstacles throughout this document as an optional function. But if the function is included, the obstacle alerting methods are consistent with terrain alerting. We also need to include the fact that the obstacle function does not influence any of the other TSO functions. A sentence similar to the TAWS TSO of “Additional information such as human-made obstacles may be added as long as they do not adversely alter the terrain functions.” would be a good starting point. For specific requirements and testing, we might do better to place these in the AC document.

At this time, we will wait before having the full review of the Introduction and Class A section until the figures are dropped into the document which should occur by 2 October. As of that point, all participants will be asked to review up until the end of the Class A section through using a formal RTCA table approach, where the RTCA table will be provided.

Action (all committee members / 15 October) - review up until the end of the Class A section through using a formal RTCA table approach, where the RTCA table will be provided.

NEXT STEPS

The next planned meeting is a teleconference on Thursday, October 15. The next planned face-to-face meeting is planned for Washington from 8-10 December.