

**SC186 WG4 Meeting Notes, October 23-25, 2002**  
**NASA Ames**

**Attendees:**

<b>Jonathan Hammer, (MITRE CAASD)</b>	<b>Michael Petri (FAA WJHTC)</b>
<b>Joel Wichgers, (Rockwell Collins)</b>	<b>Bernauld Smith (Glider Association of America, Oct 23-24)</b>
<b>Steve Koczo, (Rockwell Collins)</b>	<b>John Brown (Boeing ATM, Oct 23-24)</b>
<b>Jim Maynard (UPS-AT)</b>	<b>Bob Hilb (UPS, Oct 23-24)</b>
<b>Tom Foster (TRIOS)</b>	<b>Randy Bone (MITRE CAASD, Oct 23-24)</b>
<b>Andy Zeitlin (MITRE CAASD, Oct 23)</b>	<b>Ken Carpenter (Quinetic, Oct 23-24)</b>
<b>Bob Passman (FAA, Oct 23-24)</b>	<b>Rose Ashford (NASA Ames)</b>
<b>Ganghuai Wang (MITRE CAASD)</b>	
<b>Stan Jones (MITRE CAASD)</b>	

**Wednesday 10-23-02**

**0. Agenda Discussion**

Jonathan provided an overview of the agenda.

**1. Action Item Review**

Updated action items electronically.

ASA MASPS version is on the web. Issue paper is also on the web.

Web site: [Aadsb.tc.faa.gov/ADS-B](http://Aadsb.tc.faa.gov/ADS-B)

Action 06-17-08; concerning the wake vortex distance on ASIA. Bob Passman indicated that NASA and Volpe had done much research in the wake vortex area and had concerns on how WG1/WG4 would determine the appropriate wake vortex separation distance.

**2. Joel Wichgers' Discussion Topic -Situational Awareness Display Information Set**

Joel reviewed his view of how situational awareness information should be considered for display on the CDTI, particularly concerning the display of degraded traffic information. Basically he is indicating the benefits of the situational awareness and that one may get a false sense of situational awareness with an incomplete picture (if targets with degraded information are not allowed to be displayed) .

Bob Hilb - we are not using this display for separation nor for guidance, thus failure of this capability has no consequence to the pilot. The main concern would be that misleading data shown to the pilot may cause pilot to make assessments, e.g., such as ATC has made a mistake.

Tom – We don't rely on this display for conducting surface operations, so performance is not critical. However, "reasonableness" and "acceptability" is a consideration.

Displaying only half of the targets (that are equipped) on the display may not be considered “acceptable”. “Acceptability is a subjective consideration / determination.

“Intended function” is a certification requirement. There is judgement involved in approving this. What is the “desired quality” is a key? We are not asking for 100% of everything being correct, but we do need to have an “acceptable display”.

Bob H. – what if there are only 2 ADS-B equipped aircraft on the airport. You will not see most aircraft on the display in this case. This is expected. However of the 2 equipped aircraft, one would like to see them displayed a “reasonable/acceptable” amount of the time at reasonable quality.

Joel discussed the notion of “degraded useability”.

Bob H. – EFB certification example. Case of GPS being wrong as an example. 95% of the time GPS works.

Discussion of traffic density, number of targets that need to be processed by ASSA/FAROA. Bob H. referenced the numbers given in the ADS-B MASPS. Page 51, Table 2-8, 25 aircraft within 500 ft, 150 aircraft within 5 nm. See Note 4.

Discussion about Spectrum non-concur; transmission of traffic on the surface (in the ramp area).

Shelved the discussion on traffic density, count, number of targets for now. Back to ‘Degraded Information’ discussion.

‘Coupled applications’ – specifically selected by CDTI controls, determining that targets are suitable to perform the operation / application.

‘Background applications’ – target qualification must support service level 0 (it has to be displayable to be sent by ASSAP to CDTI).

Discussion on the case when several applications are running simultaneously.

Tom – TCAS has 3 symbols, with 3 colors, because there are 3 information states. We do need to minimize the number of symbols due to crew training issue, however, we may need multiple depictions to separate some information content. E.g, if accuracy is low, we do not want to drop the target off entirely.

Bob H. agreed that we do want to minimize the number of symbols used to depict traffic information for applications. For targets not good enough for any of the multiple applications, this should be shown as degraded. Targets that meet requirements for all applications can be shown another way. Targets selected for coupled applications that are not eligible need to indicate that they are not qualified / eligible for the application.

**The Working Groups (WG4 and WG1) agreed that the use of “degraded target” indication for situational awareness applications is desirable.**

#### **Thursday 10-24-02**

The discussion resumed on what was agreed on at the close of Tuesday.

Bob H. concerning what was agreed to at the Brussels meeting: “The crew shall be informed of any operating application that is not available for any specific target”. This was provided as comments for the CDTI MOPS.

This comment, “concerning operating / not operating” (qualified or not qualified for an application) differs from the notion of “degraded/not degraded”.

Bob H. – we need the 3 state condition 1) so bad that it shouldn’t be shown, 2) something is a miss (like missing altitude information) but we still want to show the target – thus a degraded state, and 3) target is good / meets all conditions.

The working group agreed on the following two statements offered by Ken:

*For any ‘coupled application’, the crew shall be informed of any display targets for which that the application is available.*

*For ‘background applications’, the display shall indicate displayed targets that have degraded information or for which the background application is not available (e.g., ACM).*

Editorial Action: Definition is needed for “display target” (versus tracked targets).

Editorial Action: Also, ‘coupled and background’ application terms need to be improved / renamed.

WG1 Action – address the open issue: should the flight crew be permitted to deselect the situational awareness application? Also ??? the fact that multiple applications (both background and coupled) may be operating simultaneously, with different requirements of goodness and degradation.

### **3. Discussion of EVAcquisition Analysis**

Steve K. led a discussion concerning the October 17 telecon which reviewed the EVAcquisition analysis results provided by MIT Lincoln Labs (Bob Grappel, Jonathan Bernays, Dave Spencer). The following items were discussed:

- Time alignment of targets for purposes of CDTI display. There was a general desire for CDTI display of traffic information to be time aligned to avoid ‘twinkling’ and ‘caterpillar’ effects of displayed targets. In addition, the goal is for ASSAP to provided an output of displayable target information on a 1 / sec rate. Displayable targets are expected to be updated in various ways, including using extrapolation using velocity data in order to obtain the 1 sec target outputs. It is left up to the design of the display processing system to determine if additional target updates / position extrapolations are needed to adjust for any processing delays.
- The group had considerable discussion about the fact that the analysis indicates a SIL = 0.01 as an integrity requirement, and that many existing navigation systems currently fielded do not provide outputs that allow determination of the SIL (including TSC C-129 GPS receivers). This is a particular problem since many GA aircraft fall into this category of equipage, and represent a primary end user of the EVAcquisition application.

The end result of the discussion are the following **action items**: 1) Joel Wichgers action - to address the possibility of using NAC as a surrogate for NIC. Specifically, to see if there is a way to achieve an indication of 99% containment bound / integrity from the 95% NAC accuracy bound. 2) MIT LL action - to determine the impact / effect of reducing the SIL requirement from 0.01 to 0.05. 3) Tom Foster action – to

address how to resolve the mismatch between our current definitions of NIC and SIL as it relates to the extraction / interpretation of this type of data from current equipment. 4) WG1 action – determine the implication(s) of operational considerations of displaying traffic as degraded; particularly for the case discussed where SIL does not meet the 0.01 requirement and numerous traffic targets would fall into that category (when ownship SIL fails the SIL=0.01 requirement, all displayed traffic would be shown as degraded). 5) Michael Petri action – generate Issue Paper #3 that discusses the issue of SIL=0.01 for EVAcquisition, and the need for depiction of displayed targets as ‘degraded’ when SIL requirement is not met.

#### 4. Review of CSPA Analysis

Ken provided a few introductory remarks to sensitize WG1 and WG4 to some of the issues related to Collision Avoidance relative to CSPA. Ken expects CSPA to require extensive discussions in the community before gaining acceptance. He noted that Collision Avoidance is the 3<sup>rd</sup> tier of safety. With respect to when CSPA disables TCAS RAs, then one no longer has Collision Avoidance to rely on (this is an area of concern). It was noted that we already have a case where TCAS is not used, e.g. for PRM.

Characterizing the CSPA alerting algorithm as Collision Avoidance raises some serious concerns / flags in the community (in terms of Collision Avoidance layers of protection). We should not claim CSPA as a Collision Avoidance function, because it challenges the 3<sup>rd</sup> tier of protection. (?)

##### CSPA Review

Jonathan briefed the group on the CSPA analysis work done by Shahar Ladecky.

Comment - Need to be clear on ATC role during CSPA. CSPA does not require an ATC role (for lateral spacing), but ATC may intervene due to non-CSPA traffic considerations.

**Actions for Shahar to consider in the CSPA Fault Trees: 1) Concerning the Fault Trees, we should take credit for both aircraft having to fail before CSPA is unable to perform.**

Caution: Do not forget that some failures may be common mode failures.

**Include the navigation system common mode failures in the fault trees, i.e., the deviations.** Question, have navigation failures been assumed to be dependent or independent.

**Take credit for ownship responding to path alerts.**

2.55e-8 is the TLS, i.e., NMAC probability, that was used by Shahar, which is acceptable to AFS (Flight Standards). This is the number that was approved for PRM. The top of the tree should read NMAC, not ‘mid air’ between blunder and evader (check with Shahar on this, refer to definitions in CSPA analysis report).

Rose – The most likely time for a blunder would be during a missed approach.

**Fault trees need some wording changes. Do not use ASIA names. E.g., bottom row of Figure 6 (use ownship rather than ‘lead’, persistent SV error on ‘Adjacent ship’, persistent bad information on ownship, ownship ASSAP guidance processing failure, adjacent ship navigation integrity failure). In the past we had “adjacent ship nav integrity failure” branch included under the “persistent SV error” branch of the fault tree).**

Joel – need to address navigation errors that could put both aircraft right next to each other.

We need to see the entire fault tree (detailed branches) and corrected terminology for further review.

Jonathan summarized the CSPA analysis results: Realistic NICs, NACs will be sufficient for a range of ADS-B latencies up to 2.5 seconds. In addition, sub-system integrity numbers are on the order of  $10^{-5}$  (bottom row of Figure 6), which are attainable.

## **5. ASSA / FAROA Status Update and Overview of Results - Joel Wichgers**

Joel has added some additional assumptions at the beginning of the document since the last revision.

Joel has been doing coordinating with a member of SC-181 to ensure compatibility of standards development between ASSA/FAROA and SC-181's development of MOPS for navigation display of an electronic airport map.

Concerning loss of function leading to a surface collision: Joel went through his fault tree. Comments received were that we do not need to show the full / big picture view, but only address the portions of the fault tree that are impacted by the use of the application being evaluated.

WG4 should only be focusing on the “traffic” aspects of surface operations.

Discussion about whether map is part of the analysis.

What are the safety applications of traffic on the map?

Bob H. - Anything that occurs on the taxiway is of no consequence.

Missing traffic – what is the safety hazard?

Usability requirements versus safety requirements.

Whenever we can navigate effectively, we can use ASSA for situational awareness (even in reduced visibility conditions).

Bob P – who is going to be impacted most by a minimally performing ASSA? The low-hour pilot, flying in marginal weather, at a strange airport.

Reviewed performance summary:

Joel described the performance limits for when traffic is displayed as good, degraded, and when it should not be displayed. The performance numbers that Joel presented for when traffic is no longer deemed acceptable for display were relatively conservative. For example, total error bounds for traffic, taking into account the various performance factors, allows for errors greater than 100m.

Tom expressed concern that we may be straying from our focus on surveillance by addressing the airport database in our analysis. There was discussion that there are currently not a lot of guidance / standards documents available for reference concerning the airport database relative to ASSA.

**Friday 10-25-02**

## **6. Conflict Detection Analysis Review – Ganghuai Wang**

Ganghuai presented the results of his CD analysis.

There was discussion about the PVT model used in the simulation / analysis. Tom F. suggested that SC-186 should request SC-159 to provide us with an acceptable, industry agreed upon model for PVT information.

Jonathan – would like us to make some assumptions on how we should be modeling GPS PVT information and to run this by SC-159. **Joel Wichgers action to provide us with a GPS PVT model, even if there is not an industry recognized model. Standard GPS, WAAS and LAAS PVT models.**

Tom – NAC of 7 is quite good for an RNAV system. Minimal equipment appears to be GPS for the GA operator for Conflict Detection.

### Terminal / Enroute Results - Jonathan

Ran recorded ARTS data from 11 facilities (from the days when analyzing TCAS) and used these for identifying / selecting GA scenarios for CD for evaluating CD alerting performances (e.g., CAZ alarms, false / unnecessary alarms). Jonathan provided some CAZ alerting results (proportion of unnecessary alerts versus late alerts) for perfect data, and data over a range of NAC and NAC<sub>v</sub>, for a range of vertical and horizontal detection thresholds. Currently, having some difficulty in drawing a line on acceptable NAC, and NAC<sub>v</sub> performance. Progress is being made.

## **7. Latency – Joel Wichgers**

Joel presented an end-to-end system ASA timing diagram, that identifies the various processing steps and latency involved in information processing from ADS-B/TIS-B surveillance and data transmission, to message reception, processing by ASSAP and output to the CDTI.

The group liked the diagram and indicated that this would be well suited to be included as an appendix that will be used to provide supporting information for determination of end-to-end system performance parameters.

Some additional time to integrity alerts are needed for ownship and TIS-B.

## **8. Service Level Presentation by Tom Foster**

Tom presented a potential framework for definition of ASA MASPS Service Levels. With his proposal, Tom suggested that SLs reflect primarily the capabilities of the surveillance equipment on-board the transmitting aircraft. SL is used by a receiving aircraft to evaluate the qualification of target aircraft for a surveillance application that involves that aircraft. The target aircraft SL is used in conjunction with the capabilities of “own” aircraft to determine if / how a surveillance application is accommodated.

Open issue - Role / use of Service Levels for TIS-B traffic data (?)

Jim M. – this is a different approach of defining SLs than the group has addressed in the past (a bottom-ups approach of grouping individual performance requirements). The idea / hope would be to have both of these approaches to converge / mesh.

Rose – some concern that our mapping of Service Levels to the PO-ASAS levels

Tom – ‘Integrity’ is one of the important differentiators of system performance / levels of performance.

Joel – this is a reasonable framework of grouping service levels at a high level. However, service levels need to reflect the capabilities of the transmitting aircraft to allow ownership to determine whether it can conduct an application with the transmitting aircraft. Joel listed a number of performance parameters that he believes should be included in the lower level description / grouping of service levels.

## **9. Group Drafting Sessions**

The balance of the meeting was spent in drafting sessions.

Brief wrap-up at the end of the meeting on our drafting / planning sessions.

Discussion concerning the flow / outline of our document (Airborne Surveillance Applications MASPS):

- Highest level system requirements: What do the applications need
- Flow-down of “application requirements” to the ASA System
- Allocation to the ASA Subsystems

Jonathan – Application Descriptions and Analysis are in Appendix. In the body of the diagram, we show systems requirements per the systems diagram in Figure 2-1.

“Applications are not our system”

Definition of Application?

Definition of System?

Service Levels represent the fundamental “Levels of Requirements”

**Action: Michael P. to develop a draft outline on high-level system requirements derived from the application requirements (section 2). This would precede our current Section 2 material.**

## **Summary of Action Items for October 23-25 WG4 Meeting**

- 1) Editorial Action: Definition is needed for “display target” (versus tracked targets).
- 2) Editorial Action: Also, ‘coupled and background’ application terms need to be improved / renamed.
- 3) WG1 Action – address the open issue: should the flight crew be permitted to deselect the situational awareness application? Also ??? the fact that multiple applications (both background and coupled) may be operating simultaneously, with different requirements of goodness and degradedness.
- 4) (EVAcq) Joel Wichgers action - to address the possibility of using NAC as a surrogate for NIC. Specifically, to see if there is a way to achieve an indication of 99% containment bound / integrity from the 95% NAC accuracy bound.

- 5) (EVAcq) MIT LL action - to determine the impact / effect of reducing the SIL requirement from 0.01 to 0.05.
- 6) (EVAcq) Tom Foster action – to address how to resolve the mismatch between our current definitions of NIC and SIL as it relates to the extraction / interpretation of this type of data from current equipment.
- 7) (EVAcq) WG1 action – determine the implication(s) of operational considerations of displaying traffic as degraded; particularly for the case discussed where SIL does not meet the 0.01 requirement and numerous traffic targets would fall into that category (when ownship SIL fails the SIL=0.01 requirement, all displayed traffic would be shown as degraded).
- 8) (EVAcq) Michael Petri action – generate Issue Paper #3 that discusses the issue of SIL=0.01 for EVAcquisition, and the need for depiction of displayed targets as ‘degraded’ when SIL requirement is not met.
- 9) CSPA Actions for Shahar: Consider the following in the CSPA Fault Trees:
  - a) We should take credit for both aircraft having to fail before CSPA is unable to perform. Caution: Do not forget that some failures may be common mode failures.
  - b) Include the navigation system common mode failures in the fault trees, i.e., the deviations. Question, have navigation failures been assumed to be dependent or independent.
  - c) Take credit for ownship responding to path alerts.
- 10) CSPA Action - Fault trees need some wording changes. E.g., bottom row of Figure 6 (use ownship rather than ‘lead’, persistent SV error on ‘Adjacent ship’, persistent bad information on ownship, ownship ASSAP guidance processing failure, adjacent ship navigation integrity failure). In the past we had “adjacent ship nav integrity failure” branch included under the “persistent SV error” branch of the fault tree).
- 11) Joel Wichgers action to provide us with a GPS PVT model, even if there is not an industry recognized model. Joel will gather data on standard GPS, WAAS and LAAS PVT models.
- 12) Action: Michael P. to develop a draft outline on high-level system requirements derived from the application requirements (section 2). This would precede our current Section 2 material.

#### Future WG4 Meetings

November 19-21, DC at Rockwell Collins Offices (Near Rosslyn Metro stop)

December 17-19 editing sessions (via internet) or meeting

January 14-16 editing sessions (via internet)

January 27-29 WG4, January 30-31 plenary DC

February 11-12 editing session (via internet)

March 4-6 West Coast

*End of meeting notes*