

**SC-186 WG-4  
Minutes of Meeting  
June 17-20, 2002**

**WG4 meeting from Monday June 17 to Thursday June 20 at RTCA in Washington DC**

Participants

Name	Organization
Rose Ashford	NASA Ames
Ken Carpenter	
Jonathan Hammer	MITRE CAASD
Steve Koczo	Rockwell Collins
Shahar Ladecky	ATSI / FAA AFS-420
Michael Petri	FAA WJHTC
Jean-Claude Richard	THALES AVIONICS
Dave Spencer	MIT LL (via phone)
Ganghuai Wang	MITRE CAASD
Joel Wichgers	Rockwell Collins
People who participated in part of the discussion: (7/18/02 PM)	
Terry Abbott	NASA - Langley
Randy Bone	MITRE CAASD
Bob Hilb	
Robert Morris	
Sethu Rathinam	
Rip Torn	
People who participated in part of the discussion: (7/19/02 AM)	
Gary Livak	
Mel Reese	
Mark Cato	

Papers

All papers referenced below are attached.

**Monday June 17, 2002**

**1. Review of Schedule**

Steve Koczo reviewed the ASA MASPS schedule that was developed at the May meeting. Plans call for a draft document ready for the 30-day review and comment period by Nov 1, 2002 for a December, 2002 ballot. The group discussed the

reasonableness of the schedule, recognizing that much work remains. It was decided to put out some initial material to the Plenary to expose other working groups to the ASA MASPS material. The plan is to submit Chapter 1 and the ASIA and ASSA application descriptions and analysis appendices for comment to SC-186 working groups.

## 2. Action Item Review

Action items were reviewed: WG51 actions; WG4 actions; Jonathan updated the action item tables. Jonathan and Steve took the action to update WG4 action item list with May action items.

We discussed TLS levels and the probability of collision events. Rose would like to see this resolved and documented. Ken noted the ICAO numbers. Ken – is the number for the failure of the system? If so, then it is  $10^{-9}$ . SASP panel uses  $5 \times 10^{-9}$  as attainable for an operation (doesn't look at the equipment). He feels  $10^{-9}$  is unattainable.

Ken Carpenter took the action to look-up and provide ICAO Target Level of Safety (TLS) numbers.

Rose provided an update on her action item on 'data entry' by the flight crew. She also discussed the action item concerning the disclaimer of crew not responding correctly to alerts. She will provide text for next meeting (a disclaimer that the practicality of responding to alerts is left out of the analysis). It's not just error, but the response time to an alert that have a significant impact.

## 3. ASIA Review – Jonathan

We discussed ATC separation assurance, monitor separation, wake vortex separation, wake separation versus traffic separation, and buffer for tolerance to deviations to minimums.

If controller gives 3 miles for a 3 mile standard, then one can have an immediate violation. For ½ mile buffer, issue to 3.5 miles, steps in at 3 miles. For benefits, we must fly close to minimums or benefits are lost.

Ken – transferring for one aspect but not for another is not reasonable (wake versus traffic)

We should have one label throughout that is consistent (ATC assure separation). Bring this issue up to WG1. Ken – consider this as a separation application rather than a spacing application.

Jonathan – Suggests postulating a new separation standard. **Action – discuss with WG1.**

Discussion about “loss of separation” versus “collisions”, should it be entered in ‘possible consequences’ column for H1.2.2.

How do you quantify the acceptability of “loss of separation”? Base it on operational experience. Ken – got feedback from SASPS based on SCRPS questions, SASPS said that one should address Collisions, not Loss of Separation. But then they said one should not lose separation in the first place.

“Possible Operational Consequences” is heading of column 4 in table.

Action – feedback to WG1 to include ASIA alert. Also, error checking of entered values.

Lunch Break

Dave – Table A(a) and A(b) are very detailed along with the text. Is this too much for the reader? Will it keep people from reading it. Summarize the bottom line, perhaps in Section 2.1? (Jonathan took the action to add a summary paragraph that captures the significant hazards).

Jonathan and Steve took the action to consider putting section 2.2 in common text section and to keep application specific portions in this section.

To WG-1: Make a CDTI features table for each applications.

Dave S. -- on Figure D and how it relates to Figure C: Are we dealing with the lead aircraft, or a 3<sup>rd</sup> aircraft when “lead traffic is misidentified”? For 3<sup>rd</sup> aircraft the Airborne Separation Violation alerting function may not be looking to detect against a 3<sup>rd</sup> aircraft, and shouldn’t be ANDed. (Discussed whether ASIA includes merging or occurs after lateral deviation capture (e.g., LOC intercept)? Jonathan – it’s after lateral deviation capture. Jonathan to update Figure B to reflect the fact that ASIA doesn’t start until after LOC intercept.)

It’s a linear problem. And what is the left branch on Figure D (3<sup>rd</sup> aircraft)?

Concerning Figure HA: Can we use GPS SPS? Do we need lesser NICs? How to select? Ken – the people that derive the tables for wake vortex spacing can help us decide. Rose -- Dave Hinton at NASA LaRC could help.

Joel: For better economics (less spacing buffers and thus greater throughput), one may need GPS augmentation, otherwise standard GPS positioning service would be adequate. If you don’t want site specific buffer spacings, then select lesser capability. Action: WG1 to provide feedback on Figure HA.

WG1 – or other: Feedback is also needed on how much distance inside WV separation is permissible.

A ¼ mile buffer results in ~10 to 15 seconds in extra spacing (could result in significant loss of efficiency).

Dave Spencer action – check with MIT LL colleague on “tail” in separation / spacing.

Discussing Table B: Jonathan added an additional column called “airborne surveillance”.

Ken – put the results (i.e., Table B) after the case is made.

We need requirement for maximum age of SV (scenesence) before you break off approach.

Continuity = 1 / 1000 approaches (99.9)

Availability = economic decision.

Figure “K” ‘lead traffic not found’ is not the same thing as ‘traffic misidentified’.

## **Tuesday June 18, 2002**

### **4. Enhanced Visual Approach Review – Dave Spencer**

Dave – not yet finished, has fault trees but has not led to requirements yet, one more step. On performance assessment, some thinking aloud on performance is captured. Dave looked at ASSA and likes that approach and would like to emulate it.

DO-259 is application description. Will we copy and paste this into ASA MASPS?

There are no mitigation and avoidances in safety table. The table uses Safety consequences.

Ken – Under Hazard for E1, this doesn’t include Controller providing ID for 3<sup>rd</sup> party aircraft to other aircraft. 3<sup>rd</sup> party aircraft could misunderstand the controller’s reference of it as an instruction to itself (thinks the instruction is meant for him), which could lead to a hazard. Action to Dave – think this through.

WG4 – WG1 Action – Consider this problem for all ASA Apps. We tend not to cover this hazard. This is unique to ADS-B since aircraft are now being addressed by their Flight ID, which is typically not done.

Safe Flight 21 and NUP are running into this. (It is not one solution, one solution is to make up a new code for instructions).

Joel W. – Question on E7, what is a low approach (low approach is like a landing, i.e., it terminates the approach) – ask WG1 for what the correct term is for “low approach”.

Michael P – will avoidance such as training be included in the ASA requirements? A note for the need for training should be included in the up-front text that puts things in

context. WG4 editorial action: Improper use of the equipment has been implicitly assumed not to occur, but should it be stated?

Dave – Section 2.2 and Table 2 identifies CDTI feature failures. Ties table 1 hazards to FMEA failures.

On fault trees, Dave is putting some numbers to the failure events.  $10^{-9}$  per operation is the intent (not per flight hour). Propagated the number down the tree, rather than bottom up. Dave assumed a  $10e^{-10}$  number for starters, as a guess of what would be adequate. For induced collisions (C2), Dave wants to keep this low, at least  $10e^{-10}$ .

TCAS was analyzed this way, because there was not collision rate data. Ken – not sure if this is the best way to present this. Ken – why make C2  $10e^{-10}$ , why not  $10e^{-10}$ .

No number on C0 and C1. Analyze C2.

Should C7 be excluded since it consists of improper use of the equipment? It doesn't do any harm. Leave it there.

C15 and C16 are very strong mitigators, which requires no requirements on C13 and C14.

Jonathan – it would be nice to expand these fault trees into more detail such as the common events that have been identified by WG-4.

Ganghuai took the action to capture the EVApproach fault tree using Fault Tree+ and expanding it to include of the common modules, e.g., C8. (Lee already offered to capture EVAcquisition).

Jonathan – Put these requirements into the “operational suitability section” to make the case for the numbers, allow feedback.

Wake Vortex fault tree – W's similar corrections as for C's. Joel – don't put entire number on W2, otherwise we cannot meet the requirements.

Joel on second to last paragraph on page 12. “No such potential for interference was identified”. Joel was wondering about some aspects that could occur and they should be captured.

Jonathan – a cross-reference to hazard numbers / FMEA failures would be useful to be referenced in the fault trees.

Jonathan – suggesting to bold face the sentence “no such potential for interference was identified” (p. 12 last sentence of second to last paragraph).

Morning Break

On Interaction with TCAS section:

Jonathan – 2<sup>nd</sup> paragraph; ASA should not interfere with the TCAS RA (rather than the current text about false / duplicate traffic, etc)

Ken – some have the desire to revert to a naked TCAS display when a RA occurs to maintain emphasis on TCAS. Ken agrees with current WG4 view of using the best data to display traffic, but defer to TCAS RA.

Michael – Section 2.4 belongs elsewhere in ASA MASPS, e.g., Chapter 1, and also in application appendices “common text” area.

Joel – Make sure not to preclude any applications (e.g. CSPA) where TCAS would prevent the operation.

Section 3.0 – Operational Performance Assessment: There are existing requirements for bearing accuracy in DO-243. Use of velocity vector is unclear. Dave makes some assumptions as noted.

To WG1 – What is the use of the horizontal velocity vector in the Enhanced Visual Approach application? Need feedback. (Is it used for spacing aspects? )

Dave likes the ASSA root mean square approach and wants to apply it to EVApp. A lot of questions about how to use NAC, NIC for ground radars and TIS-B, and other situations? Conflicting definitions of NAC are given in MASPS. Dave would like a tutorial written about this.

Including the biases in the NAC makes them potentially very large. May not be useful or easy to use? NAC may not be a good input at some point (concern about a best estimates)

Jonathan – NACs original use was intended to represent the covariance to allow data / track fusion / processing.

Jonathan – For CD application, they are looking at NACs and also radar covariance data to see how that supports CD.

Jonathan – For EVApp – we may not need to specify accuracy. NIC is sufficient. Could say NAC is ½ of NIC.

Joel – NAC / 95% is more of an operational acceptability requirement.

EVApp has a spacing aspect to it, which may influence whether 0.1 or 0.5 nmi NICs are allowable. It is to be discussed with WG1.

What bound on NIC is used before the Wake Vortex and Collision safety issues arise. This is what sets the NIC. Also, too many missed approaches due to the NIC can become an operational issue.

Joel – consider the notion of using degraded data with appropriate indication for EVApproach (and EVAcquisition for that matter).

Need feedback from WG1 on use and depiction of degraded data (for ASSA, FAROA and EVAs).

## **5. ASSA Review – Joel Wichgers**

Application Overview firsts, then 1.7 requirements summary, then 1.6 for rationale.

Dave – Global question concerning the capture of the application description. Randy Bone and Joel W. action item to coordinate which parts of 1.1 and 1.2 should be integrated into the current application description.

Dave – not putting numbers on the fault tree, what were the conclusions? Joel: Section 1.5.3 has some TBDs where this will be addressed. Jonathan has some of the same questions. The key is to relate the fault trees to some form of requirements, or no requirements if warranted.

Joel – Fault tree in Figure 1-8 to show the benefits of ASSA (right hand side – human errors). Look at new faults? Identify what dominates old faults and how much it helps. One can get numbers on NEW ASSA CDTI FAILURE contribution (Figure 1-8) but take a stab at benefit to reduce OWNERSHIP HUMAN ERRORS. (already noted in Ed Note). Leave out the parts of trees that do not affect things (e.g., OWNERSHIP FAILURE other than ASSA).

Joel will incorporate the “common blocks” into the fault trees.

Jonathan – regarding the equation on bottom of page 22, just determine the relative improvement. How much credit do we need for ASSA to overcome the bad contributions that ASSA provides. If the credit needed is not significant, then this makes a good case for ASSA.

Jonathan action item – obtain study material on the benefits of surface operations. (Paul Fontaine may have some of this information).

To WG1 – What is the status / plans for ASSA Apps description?

Joel to renumber the major headings.

Detailed Review:

Ken – Paper established a TLS, but does not use it in the analysis, therefore we don't need it. It could lead to a false sense of achieving the TLS, although it is not proven here. Jonathan – this is good info, but is not tied together. Joel is planning to tie it back together by suggesting that there is a factor of 5 (or thereabouts) improvement over the current system.

Jonathan – Too much detail that isn't tied down here (large number of ICAO tables). For example Figure 1-17, is it used in analysis?

Joel discussing Section 1.7 – the Summary of ASSA System Performance Requirements:

Discussed “degraded performance” versus “hiding information”. Joel prefers using “degraded performance” also to provide pilots with additional information.

Michael commented on “Time to Alert”: This is a confusing term from a surveillance perspective. Time to alert is the time to detect the integrity failure, when receiving HMI becomes unacceptable. Joel – no plan for an alert. The alert affects what NIC and SIL are transmitted.

Ken – “Permitted delay on integrity changes” as a time to alert – Joel action to offer a name for this parameter.

Ken – Concerning 10 sec time to alert, does this require everyone to have satellite navigation? Joel – DME-DME and other navs also meet this.

Joel action - to check on the ADS-B latency numbers to see if they are consistent with his ASSA numbers.

Jonathan – Heading, is it ground track, nose? Yes.

Dave – on coverage, 4 nmi gives you 60 sec look ahead, what altitude.

### **PM Break – Now meeting jointly with WG1**

Continue with ASSA review (Joel providing overview to WG1)

Discussing Section 1.7.2 ASSA Application Display Requirements  
Jonathan action to provide words to Joel on the Note concerning the CDTI MOPS.

Randy, what is meant by “field of regard” is the display field of view (for FAROA, don't want to clutter display with irrelevant traffic). CDTI used a term “displayed area”.

Randy - need definitions if we use SHALLs.

Rip Torn – at Atlanta 200 aircraft and 150 vehicles in 1 mile during a push. Use the word all “relevant traffic” and define the term relevant.

Potential use for target selection exists for ASSA – Randy (check on an aircraft taxi speed). Page 6, section 1.2.1 hints at a potential use of target selection for ASSA, e.g., following traffic. Joel, information hiding and filtering could have some safety implications.

Item 2 – Randy on SHALL being a testable requirements. Bob Hilb noted pilot discretion / judgement.

Item 3 – 1 pixel for 1 m. Michael, is this too fine? 680 pixels for a typical display. Comment withdrawn.

Item 4 – Joel described the issue of degraded data discussion. Bob Hilb, for some applications you may change the symbol depending on the type of application. Sethu, for situational awareness applications, withdraw data that is degraded. Bob Hilb, 2-level or 3-level system, gets complicated to maintain levels for all data elements. Sethu, one clock position is OK, pilots don't want too many, if any levels of gray.

Joel discussing Fig 1-27 to reinforce his point on degraded level.

Randy – is there a time factor associated with this data? Joel – discussed data age / senescence.

Rip – TCAS solid versus hollow diamond is an analogy? No that's an alert status, but TCAS targets come and go. Purely a situational awareness tool. Pilots not supposed to maneuver on this.

Randy – Need to run this past pilots via display prototypes, won't be able to figure this out.

Sethu – anecdote that pilots don't want to interpret between levels, just show it (came up several times at Memphis)

Show or not show it is one way to look it. How do we choose this?

Joel – the way we quantized things, that position will have to be very accurate.

Dave – how important is it that aircraft show up on the surfaces that they want to be on?

Jonathan – could go down to 4 satellites, do we pull all the traffic? Or leave it? Jonathan recommends to lay this down as a strawman and see if this should be adopted.

Rip – need to state what kind of situational awareness do we want? Clarify it.

Sethu – how often can this happen? Joel – highly likely without an augmentation system. 5-10% of the time.

Rip – this looks like several applications lumped into one; separate them.

Is Joel’s approach reasonable or do we need to do more work? What do pilots do with degraded information (how is it used)? Not good enough or useful?

Jonathan – WG1 action to take another look at this. How bad is it where you don’t want to see it any more, and how good is good enough.

Consider getting FAA certification view on this.

Ken – if degraded column causes that much argument, it shouldn’t be in it.

Joel’s Recommendation – WG1 to consider the strawman as is and provide feedback.

### **June 19, Wednesday AM – Joint WG1/WG4 Meeting**

These are the questions we posed from WG4 to WG1, which were mostly addressed late Tuesday PM and all of Wednesday AM (June 18-19).

#### **Issue - Question 1**

We should have one label throughout Jonathan’s fault trees that is consistent to state that “ATC assure separation”. Bring this issue up to WG1. Ken Carpenter noted that we should consider ASIA as a separation application rather than a spacing application.

#### **Initial Discussions on Wednesday 6-19.**

*Controller controls to new separation standards; flight crew deals with wake vortex aspects.*

*What should be the Buffer size? How are buffer sizes used?*

*Pilots don’t need/want to do surveillance during this phase of flight*

*Sethu’s example: Target is 2.5 nmi, controller will take action at 3.5nmi (speed control) and at 3 nmi (go-around). ASIA provides benefit by bringing 4 to 6 nmi arrival spacings, now most are around 4 nmi. Dave’s distribution example of long tail (2.5 nmi, 18 sec plus tail).*

*Jonathan – from safety analysis, for collision prevention, we need controller in the loop; this is not the case for wake vortex.*

*Jonathan – to get a capacity benefit, one has to reduce the mean, not just the variance of the distribution. There is a ‘cliff’ at the regulatory threshold level, if you move off of that, benefits diminish rapidly.*

## **Discussions on Thursday AM 6-20, on same topic**

*Issues:*

- *Controllers staying in the loop for ASIA*
- *From the analysis, controllers not needed to protect against the wake to achieve  $10^{-7}$*
- *Cannot see the controllers having a role and still seeing a benefit for the application*
- *Suggestion is to remove the controllers limit down to e.g. 2 nmi for sep. assur (from 2.5 nmi)*
- *Recall this is a probing application. Jonathan's suggestion is to leave it as it is. Bob H. – but this is not how it is done today. Jonathan question to WG1: Is it OK to assume the current path WG4 is pursuing in analysis?*
- *Bob H – 80% no wakes behind a heavy (Dallas study)*
- *WG1 Action to update the ASIA apps description to include the reduced separation for wake vortex (Jonathan)*
- *(Bob - Runway occupancy 45-50 sec - ~ 2 nmi)}*

### **Issue - Question 2**

Action – feedback to WG1 to include ASIA alert. Also, error checking of entered values.

*Bob H. – start to get interplay of applications (e.g., ACM), should each application do its own separation assurance or rely on ACM?*

*Jonathan - ASIA has an alert for the aircraft that you are spacing for, i.e., ASIA alert for target aircraft. Also, the case of a rogue aircraft (3<sup>rd</sup>), another system will cover that case. “Separation violation alert” not a “collision threat alert”.*

*Which PO ASAS category ASIA falls in is becoming murky.*

*Ken – not sure which category this falls in; others will group this; not an issue; what may confuse things is the two separation responsibilities (wake vortex, collisions).*

*Randy – should we get controller inputs on these issues? Desirable.*

*WG1 Action to update the ASIA apps description to include the ASIA separation alert for the target aircraft.*

### **Issue - Question 3**

*WG1 guidance on error checking of entered values:*

*WG1 Action to update the ASIA apps description to include words on error checking of entered values for specific parameter – Jonathan will work with Randy on this.*

*(Does this need to be in the Apps Description or sufficient to leave in the analysis work) = Action cancelled for WG1.*

### **Issue - Question 4**

To WG-1: Make a CDTI features table for each applications

*Randy - For ASSA/FAROA, WG1 went more to describing functionality versus specific CDTI features. Didn't want to dictate to manufacturers on how the display items look. Struggling with the map features.*

*Jonathan – Joel has done a pretty comprehensive analysis/view on the requirements.*

*Bob – we need to make sure the features are covered in SC-181 (or in SC-186 concerning the map.)*

*Jonathan – WG4 can put some requirements to Nav community (nav maps for SSA).*

WG1 Action to generate CDTI features table for each applications (per DO-259).

### **Issue - Question 5**

Joel: For better economics (less spacing buffers and thus greater throughput), one may need GPS augmentation, otherwise standard GPS positioning service would be adequate. If you don't want site specific buffer spacings, then select lesser capability. Action: WG1 to provide feedback on Figure HA.

This issue was not discussed with WG1.

### **Issue - Question 6**

**WG1 – or other: Feedback is also needed on how much distance inside WV separation is permissible.**

*Jonathan – we are flying close to the separation bound for wake vortex; NIC can introduce a bias. How far inside this limit are we allowed to fly? Bob H. – 0.5 nmi.*

*WG4/ Jonathan action – to determine what the buffers are today for wake vortex before we can answer this question. – Identify current rationale.*

### **Issue - Question 7**

Ken – Under Hazard for E1, this doesn't include Controller providing ID for 3<sup>rd</sup> party aircraft to other aircraft. 3<sup>rd</sup> party aircraft could misunderstand the controller's reference of it as an instruction to itself (thinks the instruction is meant for him), which could lead to a hazard. Action to Dave – think this through.

### **Issue - Question 8**

WG4 – WG1 Action – Consider this problem for all ASA Apps. We tend not to cover this hazard. This is unique to ADS-B since aircraft are now being addressed by their Flight ID, which is typically not done.

Concerning Flight ID:

Randy – NATCA indicating it will not use the three letter flight ID (they don't always know the 3-letter representation) and instead will use UNITED 456 instead. Randy has a document that states that position which he can make available.

Who in EUROCONTROL is responsible for phraseology. Melvyn Reese took an action item to find out.

Jonathan - From WG4 perspective, what hazards do we model as a potential source of confusion? This (phraseology) is of concern for misidentification of traffic and misunderstanding instructions and should be considered in our hazard analyses. WG4-analyses teams to consider this – action item or just an announcement. Randy – consider the outcomes of these things if they occur.

Ken – put it into the hazard tables (not fault trees) one could inadvertently take an action when it is not intended for you (wrong action).

WG4 action to think about this issue.

They try to use dissimilar numerical flight numbers (via computer), thus it is not likely to have similar numbers in the same region at the same time.

### **Issue - Question 9**

WG1 – What is the use of the horizontal velocity vector in the Enhanced Visual Approach application? Need feedback. (is it used for spacing aspects? )

*Bob H – just like CEFR to display if you are overtaking the aircraft or not, or matching speed. Used for spacing procedure, and sequencing (where the other aircraft will be in a minute). Provide feedback to Dave. Dave can call Randy for further clarification.*

### **Issue - Question 10**

**EVApp has a spacing aspect to it, which may influence whether 0.1 or 0.5 nmi NICs are allowable.**

*Jonathan – this was a NIC versus a NAC issue in setting this number*

*Randy – no less than 2 miles (2 nmi is the inner limit); Gary L. for parallel approaches this distance for seeing traffic as it turns on could be less. Talked about San Jose scenario.*

*Provide Dave with feedback. Dave also to consider the parallel approach scenario to avoid a target swaps. Dave to check with Randy for further clarification if needed.*

*Bob H. GPS is well within the 0.1 nmi for NAC and NIC. What about TIS-B?*

### **Issue - Question 11**

Need feedback from WG1 on use and depiction of degraded data (for ASSA, FAROA and EVAs).

WG1 – What is the status / plans for ASSA Apps description?

Randy - A clean-up is coming – TBD timeframe. If Joel needs feedback or timing info on the next document, he should contact Randy.

The following topics were discussed at the very end of the meeting on June 19, Wednesday late morning.

### **New Topic**

Jonathan would like some WG4 documents to be reviewed by a wider SC-186 audience (such as the Plenary) and have a telecon to receive comments.

Tom Foster - part of this is education for those that have not been exposed. How we will take requirements from the applications and how we will put those into general terms (e.g., service levels) and provide an outline for Chapters 2 and 3 for review.

Tom and Andy to provide a list of requirements from ADS-B and TIS-B that need to come from ASA MASPS. (SK and Jonathan action to ask for this officially).

Pole specific organizations to comment – SK / JH action.

### **About Degraded Data**

Desirable, minimum and degraded performance is being considered by Joel Wichgers in ASSA.

Sethu - Operational side looks at it as acceptable and unacceptable – two levels not three levels.

Bob H - This list of selection criteria may need to be made on a per info element case (e.g., for flight ID)

There needs to be a minimum – if it is worse than that, don't show it.

Inter application use – is it good enough for one application, but not the other – start getting to many selection criteria / levels.

Tom F- ADS-B has a fundamental difference for traffic (all have same fundamental accuracy). How to handle the issue of pilot use of the position information from a relative rather than absolute sense. (Radars have relatively good relative accuracy, ADS-B has varying absolute accuracies that could lead to large relative errors).

Tom F - If errors are outside of hazardously misleading info bound, then don't present it. – For Sit Awareness only (Sethu Q: Just how much enhancement beyond this level do you want?. If you don't know the position with reasonable certainty, then you can say that there is traffic, but one cannot tell you where it is.

## **6. CSPA Review – Shahar Ladecky**

### Simulation Results

Requirement for a predictive algorithm (not necessarily AILS). Levels of prediction for a 3000 ft spaced runway to achieve a TCV (Test Criteria Violation). Issue - criteria for pass and fail not firmly established. No current FAA guidance, except for center of gravity to center of gravity loss of separation below 500 ft.

Bob H. – doesn't like the TCV using this criteria; concern about over specifying for safety. Shahar – TLS number for collisions is  $2.5 \times 10^{-8}$ . What is the TCV to collision ratio? We can do a TCV sensitivity analysis between TCV and collisions.

Jerry Anderson action – determine TCV criteria that certification would prefer; 500 ft (+/- 500 ft ???) sphere or 500 ft horizontal +/- 100 ft vertical cylinder shape?

Shahar action – perform a TCV sensitivity analysis on the NMAC shapes / sizes (cylinder, sphere).

Shahar presented the TCV Rate versus Alert Time plot. 1:17 to 1:20 is the at risk ratio due to blunders. 30 degree blunder is assumed, this is quite severe (wrongly intercepting the localizer is an example).

6.8 collisions per hundred meets the TLS for his blunder simulation (baseline). No statistic on blunder rates available, thus the proof used the conservative assumption of 2 or 3 blunders per month at O'Hare.

Minneapolis blunders (Rip T. and Shahar will discuss off line).

Sim – 3000 ft runways, at risk blunders, generic predictor (similar to AILS) – second order predictor, did not use multiple lines / fans. Discussed the table of TCV percentage of alarm volume and alert time. (10-15 sec alert time – pilot response time).

Shahar - Simulation can tolerate a terrible update rate and still achieve separation.

Sim used an ADS-B model.

Jonathan – has simulation included biases (e.g., NIC) to determine the impact on TCV.

600 ft alarm bound, 13 sec alert time is suggested alerting target that achieves TCV below 6.8.

Safety case is an open and shut case – easy to achieve.

Nominal performance – we need numbers for the tables.

Need false alarm evaluation also.

Shahar - 0.5 sec latency was assumed + 0.4 sec system latency (0.9sec) (?)

## **AM Break**

### **Phase Diagram - Review**

Activity diagram has significant modification based on inputs from air traffic controller. This has been very helpful to have a controller on the CSPA analysis team.

ISSUE: Controller notifies pilot of adjacent traffic. “Crew identifying the adjacent traffic” has been added as one of the step (multiple aircraft). – Is this step needed?

Ken - if pilot is responsible for separation, he/she needs to be aware of traffic on CDTI. Group accepted this as a baseline.

What about when an adjacent aircraft is passed and a new traffic becomes involved / proximate (no more than 2 or 3)? Controller needs to point this traffic out also.

Bob H. - Identifying traffic is the same thing as ‘monitoring the aircraft’

Rose Action Item – Check if traffic association is automatic or selected / identified by flight crew for CSPA.

Crew monitoring the display for CSPA was removed as a “process” to be analyzed.

Missed approach was not addressed.

Phase / Process diagram:

Rip T. -- upon rejecting CSPA, need to capture the controller response in the diagram.

Participation Issue – What happens when crew rejects CSPA? How to capture this in process diagram?

Shahar - if ATC picks up a blunder first, controller will tell the flight crew (but CSPA does not rely on this to be able to achieve its task).

In PRM you don't do anything (i.e., maneuver) below 400 ft.

Rose – a badly performed Missed Approach is one possible source of blunder at low altitude.

### **Safety Table Overview**

Will require a telecon review.

### **Fault Tree Overview**

Will require a telecon review.

This concludes the meeting minutes.