SC186 WG4 Meeting Minutes, May 7-9, 2002

Attendees:

Gene Wong (FAA)
Lee Etnyre, UPS AT
Jonathan Hammer, MITRE CAASD
Joel Wichgers, Rockwell Collins
Martin Eby, Source Code Systems
Tim Rand, Rockwell Collins
Rose Ashford, NASA Ames
Steve Koczo, Rockwell Collins
Shahar Ladecky, ATSI / FAA AFS-420
Michael Petri, FAA WJHTC
Dave Spencer, MIT LL (via phone)

WG4 met at the Rockwell Collins facility in Cedar Rapids, IA on Tuesday, May 7 to Thursday, May 9, 2002. Much of the agenda for the meeting centered on detailed review and discussion of the various ASA MASPS applications. The first application reviewed was the simulation analysis of CD&R/ACM being conducted by Martin Eby.

1. Conflict Detection & Resolution (CD&R) / Airborne Conflict Management (ACM) – Review of Simulation Analysis Work (Martin Eby)

Martin presented his analysis approach and provided preliminary results of his Monte Carlo simulation analysis to determine requirements of key performance parameters for the CD&R / ACM application.

Martin indicated that his simulation assumes use of State Vector (SV) information only (i.e., no intent information is used) in detecting and resolving conflicts. The CD&R being simulated uses implicit coordination between aircraft. 5 conflict scenarios and 3 equipage scenarios are being evaluated. Key simulation parameters used in Monte Carlo simulations are 1) transmit interval (of SV data), 2) turbulence, 3) alert delay, 4) piloting interval, and 5) position / velocity errors. Martin also discussed that aircraft in the simulation used a limited flight performance model, i.e., limits were placed on how aggressively aircraft were allowed to maneuver to avoid collisions, thus leading to conservative assumptions.

Martin presented his assumptions on the data values, ranges and distributions for the parameters in his simulation. Many of the distributions used uniform distribution of data values, which typically are on the conservative side. Martin then presented results of sensitivity analyses to determine data requirements for the CD&R probing analysis.

There was considerable discussion concerning the use and interpretation of the various parameter distributions (e.g., radio model – 95% reception period, broadcast rate, turbulence (used Dryden model), pilot model, position error (static and dynamic error bounds), use NACv (but not NICv). Particular focus was on how position / velocity errors are being modeled.

One shortcoming of the simulation was that false alerts were not evaluated. Thus, while good correct detection and separation assurance performance was observed from simulation results, no indication on false alarm performance was available.

Martin took the following actions items: 1) incorporate false alarms as part of the simulation analysis, and 2) to review the distributions that were selected to ensure that they are compatible with those used in the ADS-B MASPS.

Sahar Ladecky indicated that the buffers used for separation are too large for the terminal area. **Martin took the action item to look at smaller zones / alert times in for the terminal area**.

2. RSP Parameters

The group reviewed the current list of RSP (required surveillance performance) parameters: Accuracy (95% position and velocity) which only reflects the measurement error => NACp; vertical EPU otherwise use baro altitude (Table 2.1.2.13 in ADS-B MASPS, DO-242A); NACv as the 95% vertical rate (Table 2.1.2.14 in DO-242A). Currently no NICv is defined. Latency refers to how old the data is, and is distributed across a number of sub-systems (need a diagram). NIC and SIL were discussed, where SIL is the surveillance integrity probability that position data is within the NIC containment bound. NIC is the limiting case that should be simulated.

3. Overview of AILS Monte Carlo Simulation – Shahar Ladecky

Shahar provided an overview of the ASAT simulation tool that he uses for Monte Carlo simulations to model various applications including AILS closely spaced parallel approaches. Examples of simulation models include a WAAS model for navigation data, aircraft model of a Beechcraft, collision risk model (CRM) tiles, Dryden turbulence model, pilot response time, ADS-B model, latency, AILS evasive maneuver, etc, that are then used to simulate / calculate the distribution of Closest Point of Approach (CPA) of scenarios that are simulated. Typically a 500 ft slant range is used as the Test Criteria Violation (TCV), which is used in collision risk evaluation.

4. Approach Spacing on Instrument Approaches (ASIA) – Review of Safety and Normal Operations Analysis Work – Jonathan Hammer

Jonathan‘s ASIA document underwent a detailed review, which covered most of the agenda for Wednesday, May 8. Numerous detailed comments were addressed, and Jonathan is incorporating them into the next version of the document. Here is a summary of some of the more significant comments and action items:

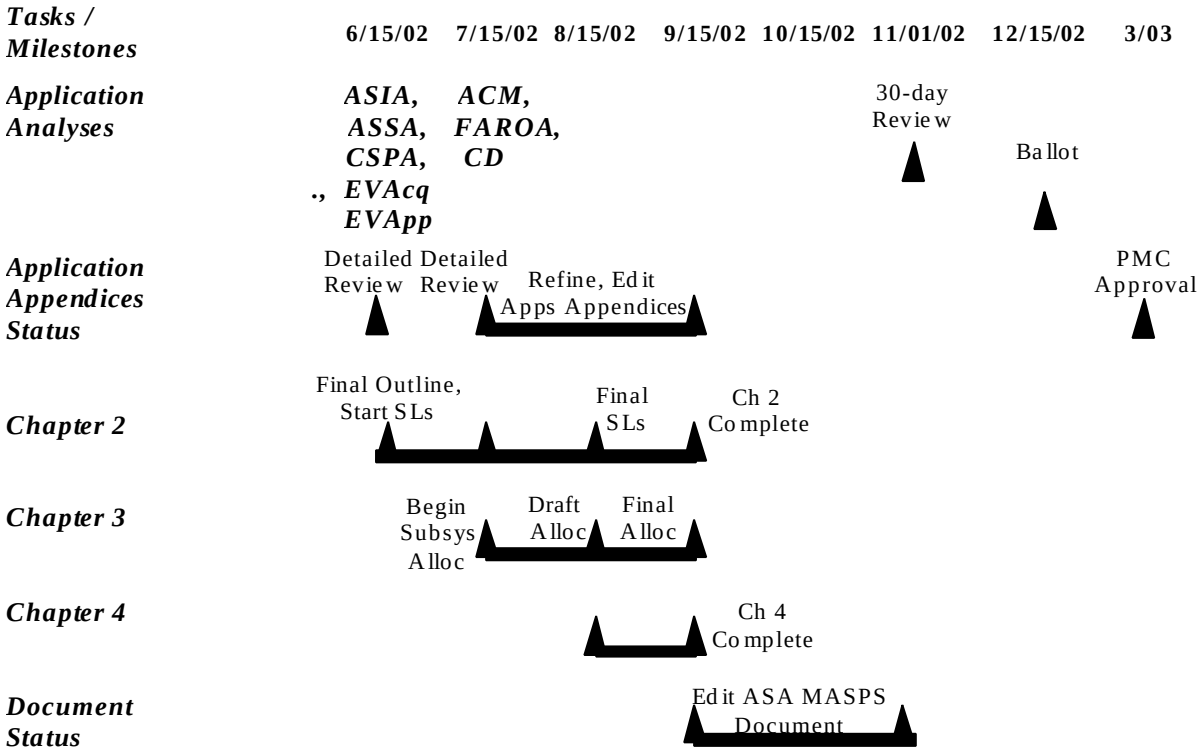
- **Jonathan took the action to group all “breakout maneuvers” into one block / phase in the ASIA phase diagram.**
- **Jonathan action to send an updated Ops Concept document to Shahar.**

- In discussing the fault trees for "wake vortex encounter" (page 15 of fault tree) and "persistent bad lead ship information", (page 17 of fault tree) the question was raised concerning the allocation to the transmit / receive integrity for ADS-B. Is it 10-5 or 10-7? **Steve Koczo and Lee Etnyre took the action to look into what the intended / expected ADS-B transmit /receive integrity allocation is expected to be**. Similar questions were raised concerning HW failure or internal communication failure.
- Rename "Trail" to O/S (ownship) for common terminology.
- For the RSP / normal operation analysis, need to trade NICs vs separation violation.

5. WG4 Schedule

The group discussed and developed a revised schedule for the completion of the ASA MASPS and selected the meeting schedule for future WG4 meetings:

June 17-19 meeting	-	Washington DC
July 16-18 meeting	-	NASA Ames Research Center (San Jose, CA area)
August 27-29 meeting	-	Washington DC
September 17-19 meeting	-	TBD – (Oklahoma City?)
October 15-17 meeting	-	FAA WJHTC, Atlantic City, NJ
October Editorial Meeting	-	Time and location is TBD



Revised WG4 Schedule for ASA MASPS Completion

6. Discussion of Common Events for Fault Trees

The following is a list of events that were identified by the group that are expected to be common across many ASA applications. Jonathan made real time edits to some of his ASIA fault trees to begin to develop a catalog of common events:

Common Events:

1) State Vector (SV) reports have persistent error (ADS-B or TIS-B)
- Identification (ID) reports have persistent error (ADS-B or TIS-B)
- Mode Status (MS) reports have persistent error (ADS-B or TIS-B)
- On Condition (OC) reports have persistent error (ADS-B or TIS-B)

(while common, these events are dependent on application-specific information content)

2) Lead ship, i.e., "other" aircraft Navigation Integrity Failure

3) Operational Consequence to Incidence Ratio, i.e., "At Risk Ratio"
e.g. 100:1, wake vortex present; traffic present for NMAC

4) SV missing report
MS missing report

5) "Other" aircraft navigation integrity failure (includes equipment failure), 10-5 or 10-7

6) Area (wide) navigation failure (10-7)

7) Own ship navigation integrity failure (includes equipment failure), 10-5

8) Separation alerting algorithm missed detection

9) Separation alerting algorithm false alarm

10) Separation alerting algorithm nuisance alarm

11) Data Entry errors / failures
- from systems (e.g. Nav)
- from humans (pilots, ATC, etc)

Entry errors – missing information, false information
(ownship data entry errors for own aircraft, for other traffic)
(other ship data entry errors)

Rose Ashford Action to get failure rate numbers on data entry & error checking.

12) ASSAP Surveillance Processing Failure (10-5)

13) ASSAP Application Processing Failure (10-5)

14) CDTI Failure – missing data (10-5), misleading data

15) Flight Crew Alert Recognition Failure (flight crew fails to act on alert or CDTI info) There was discussion about human's responding or failure to respond to alerts. Should this be included in fault tree? It was decided that for recognizing and responding to a maneuver alert, we would not include this in the fault trees (assume perfect response and execution of the maneuver. The group made the generalization not to include these types of failures in the fault trees for alerting applications, e.g., PRM , CSPA, ACM.

Action Item - Jonathan Hammer and Steve Koczo to make a list of introductory material / text that describe the general content and description of the ASA application analysis appendices (e.g., phase/process diagrams, terminology, etc) to avoid repetition of common text in each appendix.

16) Miscommunication of data

17) Mis-entry of data

18) Communication system failure (radio link)

19) Human "comm" crosscheck (error) failure (10-3)
(flight crew or controller crosscheck (error) failure)

20) Data crosscheck failure by system

Human to Alert discussion – Training (put this in common section of appendices). **Rose action to write the "human out of fault tree" disclaimer.**

Action item for Michael Petri to put ASA MASPS draft on web – version 2.7. (web site is adsb.tc.faaa.gov)

Action item: Jonathan to send WG51 action items to WG1.

End of minutes of May, 2002 WG4 meeting.