

Working Group 6
 RTCA DO-242A ADS-B MASPS
 Minutes of 8th Meeting held in Washington, D.C.
 September 25-27, 2001

The attendees included:

Tom Foster, Rockwell Collins	Bill Flathers, AOPA	Robert Manning, AF/XOR-GANS
Stuart Searight, FAA / ACT-350	Robert Granville	James Maynard, UPS AT
Jerry Anderson, FAA / AIR-130	Jonathan Hammer, Mitre/CAASD	Tony Warren, Boeing Air Traffic Mgmt.
Richard Barhydt, NASA Langley	Gary Livack, FAA / AFS-400	

Tuesday, 25 September

1. Introductory Remarks

- Tom began the meeting by announcing the postponement of the upcoming SC186 plenary and the WG4 meeting's plans to link Mitre/CASSD (McLean, VA), Honeywell (Redmond, WA., and EUROCONTROL (Brussels, BE) together via videoconference.

2. Review Agenda

- It was agreed that the TCP/Intent white paper and MASPS changes are the main priority of this meeting and if the agenda needs to be trimmed to accommodate covering these topics properly, that is what will be done.
- Gary Livack requested that 242A-WP-8-05 be added to the agenda. This paper documents the response from WG2 (TIS-B) on IP 42 proposing using ADS-B for altimetry self-testing

3. Review and Approve Minutes of Last Meeting

- Tony commented that the discussion regarding our changed work schedule was not explicitly put in the minutes. Stuart will add notes on that discussion.
- The minutes were approved without further comment.

4. Discussion on Intent/TCP Changes (IP21) [R. Barhydt, T. Warren]

- Review draft Intent/TCP White Paper (242A-WP-8-06)
 - Tony began his presentation of the white paper by reviewing ARINC Characteristic 702A. This material justifies some of the horizontal and vertical leg-types called for in the draft white paper and documents its availability.
 - On Table 4, which documents Trajectory Change Report (TCR) elements:
 - a. It still must be determined if the necessary data is readily available needed to categorize a trajectory as "command" or "planned". If it isn't, elements 14-17 will need to be designated as reserved for future MASPS revisions.

- b. There is some confusion with the labels for elements 12&13 (“TCP Validity”) and 16&17 (“Data Available”). These terms probably need to be refined. (Perhaps “TCP Conformance”?)
 - It was agreed that the discussion of TCPs – especially in the MASPS text, if not throughout the white paper – needs to be from the point of view (and in the terminology of) the aircraft’s trajectory, rather than in the automated system(s) that might be controlling the aircraft.
 - It was agreed that a glossary of all of the terms used in regards to TCPs, flight paths, leg-types, etc. is needed in the white paper.
 - It was agreed to base the required resolutions on the following numbers based on the RNP MOPS:
 - a. 1/10 minute arc for latitude and longitude,
 - b. 1.0 degree for track angle, 0.1 nmi for range,
 - c. 1.0 seconds for time,
 - d. 1kt if speed < 600 kt, and
 - e. 4kt if speed ≥ 600kt.
 - [AI 8-01] WG4 will need to be examine and comment on these proposed resolutions.
 - Figure 1 changes:
 - a. Title changed to “Aircraft Control States”;
 - b. “Autopilot” will be changed to “Autopilot/Flight Director”;
 - c. TSR and TCR will be mapped directly to the middle and outer loops, respectively;
 - d. another figure showing an active flight segment and future TCPs will be added to further illustrate what information TSRs and TCRs will convey.
5. Issue Paper 42, Altimetry Self-test feature [Gary Livack, Bill Flathers] (WP-242A-8-05)
- Gary briefed the group on WG2’s deliberation on this Issue Paper. (WP-242A-8-05)
 - WG6 noted that two bits are reserved for vertical integrity for non-GPS altitude sources in the NIC/NAC white paper (vertical NIC), and [AI 7-11] Jim Maynard is to include in his SV rewording that both altitude sources are to be broadcast when available. Given this, WG6 felt the MASPS addresses this issue as far as it can, and that any self-test application will have the required data from ADS-B to perform an altimetry self-test.

Wednesday, 26 September

4. Discussion on Intent/TCP Changes (IP21) (**continued**)
- Jim Maynard’s proposed introductory text for Trajectory Change Report (TCR) and Target State Report (TSR) was reviewed. (242A-WP-8-07).
 - The paper was accepted favorably with only a few comments. Jim agreed to add an additional figure and will redistribute as 242A-WP-8-07a.
 - The group then went back to its review of 242A-WP-8-06.

- While WG6 agreed that update rates need to be specified for TCRs and TSRs, it was noted that no analysis has been done to determine those values. Tony said he would propose some values in the next draft of the white paper and leave some TBD. This will be discussed during the review of the next draft.
6. Discussion on Air Reference Velocity Vector (IP37) [R. Barhydt, Tony Warren] {AI 6-8, AI 6-9}
- The group reviewed 242A-WP-8-09. This paper showed the effects of wind on a constant radius turn, and closed AI 6-9.
 - It was agreed that Jim Maynard's addressing of air-referenced data in 242A-WP-8-01 closes AI 6-8 and will be reviewed under that agenda item.
7. Discussion on Re-Organization of SV and MS Report Elements (IP33, IP42) [J. Maynard] {AI 7-3, AI 7-7, AI 7-12}
- Review draft text of MASPS changes (WP-242A-8-01)
 - 2.1.2.1.3 "Participant Category":
 - Jim will add two more notes. One note will mention that weights given for participant categories are gross-weight and not operating-weight. The second note will be a copy of note 2 following Table 2-16 in DO-260 on category assignments for aircraft operating within the US NAS.
 - Rather than create more arbitrary weight classes, it was agreed to attempt to split the ICAO categories into 3 categories that would more directly map into the US coding. However, backwards compatibility considerations for DO-260 will factor into any decision to alter these category definitions.
 - 2.1.2.1.4 "Aircraft Size Code":
 - A capability class code will be defined that an aircraft is broadcasting its Aircraft Size Code.
 - Aircraft size codes will be broadcast when an aircraft is on the surface. Determination of when an aircraft is on the surface is to be defined by Ken Staub and Bill Flathers [AI 7-16].
 - 2.1.2.2.2.1 "Horizontal Velocity Vector": The ranges of velocity need to show negative values since these are north-south and east-west referenced vectors.
 - 2.1.2.2.2.2 "Altitude Rate": Jonathan reported that Bob Grapple from MIT Lincoln Laboratory contacted him to report that there are other filters that would perform better than the Kalman filter documented in Jonathan's proposed appendix. Jonathan stated he didn't mind which filtering algorithm is referenced, as long as a standard is set. It was proposed to reference the filter used by TCAS in DO-185A instead of having an additional appendix. This decision affects the already agreed to resolution of IP02. [AI 8-4] Jonathan will rewrite this section to reflect the agreements reached by WG6 and referencing DO-185A rather than the new appendix.
 - 2.1.2.3 "Status Information":
 - It was agreed to due some slight reorganization of the paragraphs under 2.1.2. The paragraphs will be as follows: 2.1.2.1 "Identification", 2.1.2.2 "State Vector Information", 2.1.2.3 "Status Information", 2.1.2.4 "On Condition Information",

2.1.2.5 “Other Information”. *On Thursday morning it was decided to entirely eliminate this level of sections which group data by type. (See below.)*

- It was agreed that Operational Mode (OM) Parameter Codes should be moved to On-Condition reports.
- 2.1.2.3.1 “Capability Class Codes”
 - Jim will write brief paragraphs describing each of the CC codes listed.
 - Tony had agreed to write brief paragraphs describing each of the Intent CC codes proposed in 242A-WP-8-08. However, after realizing these CC codes are hierarchal, it was agreed to rename this material Intent Capability Levels. [AI 8-5] Tony will still write brief paragraphs defining each of these levels.
 - 3.4.3.7 “On-Condition – Request for Information Report”:
 - ✓ To assist in the discussions of CC Codes, Jim asked the review of 242A-WP-0801 skip ahead to this section. It was agreed that this idea was intriguing and possibly very beneficial, however, this “pseudo-crosslink” is controversial enough that WG6 would need direction from the plenary to include this material in DO-242A.
 - ✓ Tom felt WG6 should not bring this issue before plenary, but stated any individual(s) are welcome to raise this topic at the next SC-186 meeting.
 - ✓ It was agreed that this material will be removed from the draft DO-242A since it is beyond the scope of what WG6 has been tasked with addressing.
 - After returning to 2.1.2.3.1, it was agreed to delete the 4 bullets that list CC codes beginning with “Capability of transmitting . . .”
- 2.1.2.3.2.1 “Navigation Integrity Category”:
 - Jerry Anderson inquired about the safety effects of moving the accuracy (NAC) and integrity (NIC) components of data into the Mode Status report and thereby separating them from the actual PVT data itself which is in the State Vector report. Jerry stated his belief that it must have been assumed in all analysis of DO-242A that each position report had an associated NUC value. With these elements being transmitted separately and at different update rates, potential latency of accuracy and integrity must be considered.
 - It was agreed that the NIC - due to warning times and the potential variability of this component of PVT data - should remain in the State Vector. Due to limitations of some data links (i.e. 1090 MHz), the NAC will be in the Mode Status report.
 - Jim will need to examine the final NIC/NAC white paper and make sure this section of drafts MASPS text has all of the material added to the white paper in response to feedback from the final review at the August WG6 meeting.
 - Definitions for HFOM, VFOM, and EPU will need to be pulled from GPS documents and included in Appendix B. [AI 8-6] Stuart will research this material.

Thursday, 27 September

7. Discussion on Re-Organization of SV and MS Report Elements (*continued*)

- Table 2.1.2.3.2.3:
 - The column labeled “Vertical Velocity Error (95%)” will be changed to “Vertical Geometric Velocity Error (95%)”.
 - The values of both columns will be shown in both meters and feet.
 - Appendix J of DO-260 which explains how the velocity component of NUC_R is determined will be slightly modified and added as a stand-alone appendix for DO-242A.
- Table 2.1.2.3.2.4:
 - In the “Comment” column, the parenthetical hazard levels (None, Minor, Major, Severe Major) will replace the criticality levels (Non-Interfering, Non-Essential, Essential, Critical).
 - [AI 8-7] Tom Foster and Tony Warren will draft a note - or text if needed - for Table 2.1.2.3.2.4 clarifying the limits of what integrity components are encompassed by the SIL value. This material will state clearly that SIL only represents the integrity of the sensor providing the current data. (The note might read along the lines of “SIL is for reporting the sensor source integrity that is associated with the containment radius of the data being transmitted.”)
- 2.1.2.3.3 “Emergency/Priority Status”: The bulleted list will be enumerated and have two values reserved for future growth for a total of 8 values (3 bits)
- 2.1.2.3.4 “Short Term Intent”:
 - Tony will provide Jim with a different definition of “Target Altitude”.
 - Jim will delete the note in this section.
- It was decided to eliminate one layer of section grouping. Jim will remove the level which groups the elements by information type (2.1.2.1 “Identification”, 2.1.2.2 “State Vector Information”, 2.1.2.3 “Status Information”, 2.1.2.4 “On Condition Information”, 2.1.2.5 “Other Information”.)
- Table 3-3(b) needs to be completed to reflect operational capabilities for B and C equipage classes.
- Table 3-4: Either another row needs to be added to show required update rates for Mode Status when these values change, or these requirements need to be defined elsewhere in the MASPS.
- Table 3.4.3.1:
 - Since all remaining elements in the SV are designated as “Time-Critical”, this column can be deleted.
 - Since 8c and 8d are not minimum requirements, they will be removed, and the “Minimum Equipage Level . . .” column can now be removed.
- 3.4.3.2 Mode Status Reports
 - NIC will be moved to SV.

- “ACAS/TCAS resolution advisory active” will be moved to On-Condition, and all OM fields will be deleted.
 - A MASPS version number will be included in the MS report. Jim will also place some text within section 2 on backwards compatibility.
 - IAS/TAS/Mach airspeed will be moved to OC-ARV.
 - Flight Mode Specific Data will be kept for future growth, however the note will be changed to say this field will be defined by a higher-level document (ASA or ASSAP MASPS), not lower-level documentation. Also, the examples in the note will be deleted.
- 3.4.3.3 “On-Condition Reports”:
 - As agreed to on Wednesday, the OC-RFI report will be deleted.
 - Jim will remove all text on defining the conditions for transmitting OC-ARV report elements, and replace it with “TBD”. All times of applicability and resolutions will be left as TBD until the next version of this material is reviewed.
- 3.4.3.5 “On Condition – Target State Reports”
 - “Minimum Equipage level . . .” column will be deleted and moved into the text of this section
 - [AI 8-8] Upon completion of the next draft of the TCP/Intent white paper, Richard will fill in the “TBD text” areas of this section.
8. Discussion on Proposed Integrity Changes (NIC/NAC) [J. Maynard, T. Warren] { AI 6-1, AI 6-4, AI 6-5, AI 6-21, AI 6-22, AI 7-1 }
- All agreed that the Accuracy and Integrity White Paper was suitable for official distribution outside of WG6, and that attention in this area must now be turned towards producing actual MASPS text changes.
9. Security Issues and the September 11 terrorist attack [R. Jones] (242A-WP-8-03)
- Everyone agreed that, unless given different direction from the plenary, WG6 must continue to move forward with the DO-242A development as planned and only address the issues already agreed to. If SC-186 feels security issues need to be addressed immediately, WG6 will need to reevaluate its schedule and work load and report back to plenary.
10. Review of Action Item Status [et al]
11. Review Date and Place of Next Meetings [et al]
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| October 23-26 | Rockwell Collins, Arlington, VA |
| December 10-11, 14 | RTCA, Washington DC |
| January 28-31 | Washington DC Area |
| April 8-9 | Washington DC Area |

12. Action Items

Action Number	Action Item Description	Assigned to	Status
8-1	Review and comment on proposed resolutions (LSBs) for TCR elements	Jonathan Hammer (WG4)	
8-2	Ask WG1 to examine possible con ops for air-ground uses of TCPs	Gary Livack	
8-3	Provide WG6 with the finalized SC-193 definitions of Movable, Point, Line, and Closed-Polygon obstacles for incorporation into Appendix B.	Gary Livack	
8-4	Rewrite section 2.1.2.2.2.2 to reference data smoothing algorithms in DO-185A rather than the new appendix previously agreed to which defined a simple Kalman filter.	Jonathan Hammer	
8-5	Write brief paragraphs defining each of the Intent Capability Levels. (242A-WP-8-08)	Tony Warren	
8-6	Pull definitions for VFOM, HFOM, HPL, VPL, and EPU from GPS and/or RNP documents	Stuart Searight	
8-7	Draft a note - or text if needed - for Table 2.1.2.3.2.4 clarifying the limits of what integrity components are encompassed by the SIL value. This material will state clearly that SIL only represents the integrity of the sensor providing the current data along the lines of "SIL is for reporting the sensor source integrity that is associated with the containment radius of the data being transmitted."	Tom Foster, Tony Warren	
8-8	Upon completion of the next draft of the TCP/Intent white paper, fill in the "TBD text" areas of draft section 3.4.3.5 "OC-TSR".	Richard Barhydt	
8-9	Create and Issue paper regarding On-Condition – Request for Information reports and include Jim’s draft material on this topic from 242A-WP-8-01.	Stuart Searight	
7-1	Consider from an operational point of view whether a change in value which improves NIC or NAC needs to be updated at the same rate as the state vector just like a detrimental change does, or if it can be update at the lower update rate of the Mode Status report.	Jonathan Hammer	
7-2	Formally forward 242A-WP-7-16 to WG4 for consideration in their ASA MASPS work, and inform Pierre and Jean-Claude Richard of our review and actions of their submitted comments.	Tom Foster	Completed (9/7/01 email)
7-3	Update draft of the MASPS language for re-organization of the SV and MS reports (242A-WP-6-11A) and distribute it to WG6 prior to the September meeting.	Jim Maynard	Completed (242A-WP-8-01)
7-4	Inform Steve Heppe of the agreed upon resolution of IP46 and it’s impact on closing of IP03	Stuart Searight	Completed (9/7/01 email)
7-5	Confer with Steve Heppe, Stan Jones, and Bill Harman and attempt to resolve IP35 to everyone’s satisfaction.	Jonathan Hammer	
7-6	Incorporate into Appendix J the supporting study on altitude rate that demonstrated that geometric was the best altitude source followed by barometric, and then derived barometric.	Jonathan Hammer	
7-7	Develop changes to Section 3.3.2, and Tables 3-3(a)&(b) addressing what messages each equipage class will be required to broadcast.	Jim Maynard	Partially Completed (242A-WP-8-01)
7-8	Write letter stating WG6 concerns with RNP MOPS and submit it to SC181.	Tom Foster	

Action Number	Action Item Description	Assigned to	Status
7-9	Examine the MASPS and propose specific changes to clarify the MASPS requirements for surface position update rates to resolve IP13.	Carl Evers Rick Cassell	
7-10	Propose a label for an Emergency/Priority Status, and some new text for Appendix E to handle crash situations and Emergency Locator Transmitter functions. (IP41)	Bill Flathers	
7-11	Tighten the wording in the State Vector requirements, that both barometric and geometric altitude shall be reported when available, and clarify what is meant by "when available". (IP42)	Jim Maynard	
7-12	Submit an addendum to IP43 discussing reasons why it was withdrawn.	Bill Flathers	
7-13	Rework 242A-WP-6-02 per WG6's discussion at their August meeting on this Issue Paper	Stuart Searight	Completed (242A-WP-8-01)
7-14	Determine what changes are needed for removal of Turn Indication as a required SV element	Stuart Searight	
7-15	Implement proposed changes for IP 36	Stuart Searight	
7-16	Propose language that will define when an aircraft is considered on the ground and when it is airborne and the transitions in-between these states and propose what needs to be broadcast dependant on these states..	Ken Staub Bill Flathers	
7-17	Reword Issue Paper 19 to reflect the broader context of runway incursion alerting this paper now represents.	????	
6-1	Draft letter to SC-181 asking if accuracy fields can be output on an avionics bus so that they can be used by ADS-B and if DO-229A GPS receiver's outputs (HFOM, VFOM, HPL) satisfy the requirements of DO-236A. (This will also close AI's 3-1 & 4-6.)	Tony Warren	
6-4	Search entire MASPS for instances of "NUC", "integrity", and "accuracy" to assure NIC/NAC changes are complete.	Stuart Searight	
6-5	Clarify Tables 2-2 and 2-3 and all text referencing these tables. (This material is not ADS-B requirements, but is rather "anticipated application requirements".)	Stuart Searight	
6-8	Write specific MASPS changes for air-reference velocity vector and IP37.	Richard Barhydt Jim Maynard	Completed (242A-WP-8-01)
6-9	Collect simulator data that will justify/support the MASPS IP37 changes.	Tony Warren	Completed (242A-WP-8-09)
6-10	Draft specific MASPS changes that addresses Aircraft size characteristic (IP04) and navigation reference point (IP14).	Ken Staub	
6-11	Clarify or change wording in proposed MASPS changes for IP05 so that anonymous addresses will be reset if duplicate addresses are detected.	Ron Jones	
6-18	Review the proposed revision of Table 3-5 in 242A-WP-6-11 and determine if it adequately resolves IP29 on the reporting of both geometric and barometric pressure altitude.	Steve Heppe	
6-21	Examine to what accuracy does heading need to be recorded for aircraft on airport surface.	Ken Staub	
6-22	Verify the accuracy of Note #3 on page 8 of 242A-WP-6-11.	Tony Warren	
5-1	Write an Issue Paper documenting the issues and concerns related to passive ranging. This Issue Paper will <u>not</u> be addressed in Rev A.	Jim Maynard	

Action Number	Action Item Description	Assigned to	Status
5-3	Author a proposed footnote to the definition of ADS-B which talks to the link flexibility and protocol issues in response to the groups discussion on IP30.	Dan Castleberry	
5-15	Propose any needed additional aircraft/vehicle categories listed in 2.1.2.1.3. (IP06)	Gary Livack	Closed (242A-WP8-01)
5-20	Coordinate about work being done to resolve IP23 and IP32 regarding a way to map ADS-B capabilities, applications, features, and intended functions to the draft Advisory Circular on Guidelines to the Operational Approval for ADS-B Avionics.	Gary Livack Jim Maynard	
4-4	Write a note for Table 2-1a and 2-1b to address the independence of the accuracy and integrity values and to clarify the reference to DO-236A	Tony Warren	
4-6	Consult with Boeing navigation experts to obtain inputs on the MASPS definitions of navigation containment and integrity for consistency with RNP and GNSS standards	Tony Warren	
4-7	Provide IP on proposal for ADS-B requirements to address formation flight characteristics	John Gonda	Also see AI 5-21
3-1	Formulate proposed requests of SC-181 regarding placing requirements on DO-236 (RNP) to provide inputs for ADS-B as it relates to NIC/NAC.	Tony Warren	
3-6	Write White Paper on backward compatibility subject	Tom Foster	
3-9	Write comments to IP15 explaining rationale for rejecting	Dan Castleberry	
2-15	Produce IP on protecting ADS-B services from other services provided by a shared data link	Tom Foster	
2-16	Write ad hoc group's response to issue #3 of IP7 that will put issue in broader context and serve as proposal to WG#4 for consideration in the ASA MASPS.	Dan Castleberry	