

RTCA DO-242A ADS-B MASPS
Ad Hoc Working Group
Minutes of 4th Meeting held at Eurocontrol, Brussels
April 03-06, 2001

The attendees included:

Tom Foster, Rockwell Collins	Richard Barhydt, NASA Langley	*Steve Young, NASA LARC
Tony Warren, Boeing	Pedro Rivas, ALPA/USAF	*Aleks Pavlovic, ICAO
James Maynard, UPS AT	Ken Staub, Trios Assoc.	*Walt Johnson, Rockwell Collins Flight Dynamics
Gary Livack, FAA / AFS-400	Patrice Behier, Eurocontrol	*Jens Schiefele, TU - Darmstadt
Christos Rekkas, Eurocontrol	Pascal Dias, Eurocontrol	*Bernard Smith, FAI/SSA
Graham Dooley, Raytheon	Pieter vander Kraan, Eurocontrol	*Steven Zellers, Rockwell Collins
Bob Darby, Eurocontrol	Jeau Marc Dufлот, Eurocontrol	*Bruce Smith, Rockwell Collins

Note: * attendees from SC-193 joint session

Tuesday April 3, 2001

1. Tom Foster began the meeting with a few opening remarks, and an outline of his goals for this week's meetings.
2. The agenda was reviewed and revisions were discussed to accommodate the European attendee schedules. Item 4 was moved to the start of the Wednesday meeting. Tony Warren's briefing (Item 5) was moved to follow the ODIAC presentation, (Item 8). Agenda items 7, 9, 10, and 12 were to follow, time permitting, or to be moved to Friday. A new briefing from Pedro Rivas on Military ADS-B requirements was added to the agenda for Monday afternoon.
3. The minutes from the January meeting were accepted without comment.
4. Discussed paper 242A-WP-4-02 from Jim Maynard.
 - Discussed the need to define the message requirements by the following categorizations; Minimum Required (for all participants except when declared unavailable), Equipage Required (per class A1, A2, A3, etc.), and Capability Required (CDTI, etc.). This affects several of the existing and new Rev A tables in the MASPS. The current "application class codes" will be replaced by "capability codes". The capabilities would be grouped to minimize the number of capability codes that need to be identified. When an application requires a unique capability that does not fit within one of the defined groupings, the capability coding would be "open ended" so that additional unique capabilities could be added. [AI 4-1] Jim Maynard to propose revised capability code definition that includes basic equipage capability class codes and initial unique capability codes. Jim Maynard's draft to be revised accordingly for review at the next meeting.
 - On Table 2-1a, discussed issues with the interpretation of the "Probability of Exceeding Containment" column. DO-229B defines a probability of horizontal containment of 1×10^{-7} which is the assessed integrity by the sensor of the position measurements. This ADS-B MASPS needs to define the integrity of the containment values to include the ability of the navigation equipment to provide the containment values and therefore must also include the equipment

integrity, i.e. probability of undetected equipment failures. [AI 4-2] Tom Foster agreed to create a note to Table 2-1 to define meaning of “Probability of Exceeding Containment” column values.

- The proposed NIC 4.5 was eliminated and NIC 5 was changed to <0.5 nmi and RNP-0.3 RNAV. [AI 4-3] Jim Maynard to write note on basis for eliminating NIC 4.5. [AI 4-4] Tony Warren to write a note to Table 2-1a and 2-1b to address the independence of the accuracy and horizontal containment values and to clarify the references to DO-236A RNP limits.
 - Discussed the desirability to define the probability of exceeding the containment values separate from NIC and NAC definitions. Ken Carpenter had defined the use of four integrity levels; no integrity, 1×10^{-3} , 1×10^{-5} , 1×10^{-7} which could be handled with 2 bits. An issue paper needs to be prepared to address this issue. [AI 4-5] Jim Maynard to write an Issue Paper to address the issues between containment values and the integrity associated with the assessment and reporting of the value. Jim’s draft paper (242A-WP-4-02) is to be revised for review at the May meeting. [AI 4-6] Tony Warren agreed to consult with Boeing navigation experts to obtain inputs on the MASPS definitions of navigation containment and integrity for consistency with RNP and GNSS standards.
 - Discussed the need to include Vertical Containment requirements, similar to Horizontal Containment, in the future work plan for the MASPS.
5. Pedro Rivas provided a briefing to the group on Military Unique Applications for ADS-B [242A-WP-4-10]. The purpose is to help the group assess the new ADS-B requirements that may need to be accommodated by the links. The military may need to remove or encrypt some of the message elements. The key areas of concern would be with the minimum message requirements and/or misleading information issues. Needs meter accuracy and navigation center of reference for the rendezvous application. SKE utilizes update rates of >5 times/sec to support the 4000 feet separation requirements of formation flying. Formations range from 3-9 aircraft. [AI 4-7] John Gonda to provide IP on proposal for ADS-B requirements to address formation flight characteristics. Pedro’s briefing needs to also be presented to WG 1 and WG 4.

Wednesday April 4, 2001

6. Tom Foster presented an overview of the AdHoc ADS-B MASPS work plan [242A-WP-4-08].
7. Patrice Behier, Chairman of ODIAC presented a briefing on “An Operational Perspective on ATM Requirements” [242A-WP-4-03].
- Classes of surveillance information need requirements: Elementary (position, identification, altitude), Enhanced (heading, speed, short term intent), Intent Based (full 4D FMS flight path intent)
 - NEAN (STDMA) is to be switched off mid April, with the transition to NUP (VDL Mode 4). NUP will include an operational evaluation of TIS-B.
 - FLIPCY is a proposed technique to verify that the flight plan on-board the aircraft agrees with the flight plan as known to the controller on the ground.

- Pilot preferences downlink items: TOD, preferred landing runway, min/max operating speed, preferred cruising level, operational climb/decent speed, min clean maneuvering speed, min uncorrected approach speed, preferred holding speed.
 - FREER is dealing with the human factors issues. Cooperative ATM will also be a hard sell in Europe with controllers and pilots.
 - Need to look for opportunities for closer cooperation and involvement between RTCA SC186 WG1 and the work of ODIAC. EUROCAE WG 51 is working with RTCA SC186 WG4.
8. Tony Warren, Boeing provided a briefing on “ADS-B Intent – TCP Concepts and Issues for ADS-B MASPS Revisions” [242A-WP-4-01].
- Harmonization issue of European classification based on weight and number of seats versus current MASPS capability levels, i.e. level of aircraft sophistication (A1, A2, A3)
 - Harmonization issue with definitions of non-TCP intent and flight mode indicators between DAPS work and Tony’s proposal. [AI 4-8] Christos Rekkas to report on the results of the ICAO SCRSP panel definition of Selected Altitude for Mode S DAP
9. Jean-Marc Dufлот, ARTAS Program manager provided a briefing on “European Surveillance Activities: An Integrated Surveillance Programme” [242A-WP-4-04].
- Primary system elements are Data Distribution (RMCDE), Data Acquisition (POEMS), Surveillance data Processing (ARTAS), Tools and Evaluations (SASS)
 - Multi-sensor tracker systems are well developed and mature. The tracker designs can support coverage gap filling, correlation errors, coordinate translations, asynchronous data and delay compensation, etc. They have been developed to support growth to advanced air-ground surveillance data systems and therefore, can accommodate new capabilities, such as Mode S DAPS and ADS-B.
 - Based on data distribution and LAN technologies to provide common surveillance picture to all users. Supports user flexibility in selection of surveillance data, i.e. tracks desired (sector definition), information desired, radar source priority, etc.
10. Pascal Dias, Mode S Program Manager provided a briefing on “Update from the Mode S Programme” [242A-WP-4-05].
- Enhanced surveillance decision is not yet made in Europe. The only decision is for Elementary Surveillance.

Thursday April 5, 2001

11. Joint session with RTCA SC-193 was supported by 10 attendees from their Working Groups. SC-193 is addressing aerodrome mapping and terrain database requirements. The group had prepared inputs on IP4, 6, 13, 14, 18, 19, 24.

- IP6: (See 242A-WP-4-12.) Obstacles defined as three types: point (tower), cluster (windmill farms), barrier (transmission lines). Also, temporary and permanent, fixed and moving. Need to consider changes to aircraft/vehicle category items for obstacles and use of Call Sign (ID) to convey obstacle type. Issues on accuracy may already addressed. Identified need to define a non-circular area to characterize the shape/size of obstacle.
- IP4: (See 242A-WP-4-16.) Aircraft make/model requirements were discussed. SC-193 is suggesting an increase in the number of aircraft/vehicle types that are currently specified on P.30 of the MASPS. [AI 4-9] Jens Schiefele of Technical University of Darmstadt Germany agreed to provide SC-193 recommendations for the minimum number of aircraft types needed to support airport surveillance applications by May meeting. Currently this IP is indicated as deferred. This is to be reconsidered at our May meeting.
- IP13: (See 242A-WP-4-17.) Discussed the update requirements for position data to support runway incursion applications. The ICAO A-SMGCS requirement calls for <1 sec @98% success rate. Velocity errors/noise at low speeds (when provided by GNSS) could impact detection reliability if used for this purpose. Recommend change 5 sec alert time for runway incursion to 1 sec time. Also, want the 2 Hz rates to be maintained on the ground.
- IP14: (See 242A-WP-4-13.) Discussed “certified navigation center” issue. Concerns with inconsistent and potentially misleading aircraft position location reference used by ADS-B, i.e. antenna position for GNSS. Issue is the definition of a common location and the accuracy of the location of this location. Navigation reference center become significant for the higher accuracy NAC categories. [AI 4-10] Ken Staub accepted an action item to provide a proposal for a definition of common reference location and accuracy of this location by the May meeting.
- IP19: (See 242A-WP-4-14.) Discussed issue of broadcasting brake on/off and throttle position to assist in determining an aircraft’s intent to move into a incursion situation. Concern was expressed in transmitting raw data on the ADS-B link that may not be uniformly provided by different aircraft types and uniformly assessed by the runway incursion application. An alternate means of determining the desired state on the transmitting aircraft and then broadcasting this state on the ADS-B link may be preferable multiple parameters and reduce the link loading demands. [AI 4-11] Ken Staub will provide a briefing on the recent work associated with runway incursion detection algorithms at May meeting.
- IP18: (See 242A-WP-4-15.) Discussed heading at Vstop issue. Primary concern is with the unreliability of track angle/heading from GNSS sensor when velocity levels are low. The use of heading for both ground and airborne operations is currently being considered by the group. This will be likely.
- IP24: It was agreed that the planned revisions associated with NIC/NAC will address the accuracy concerns of SC-193. Accuracies better than current LAAS requirements are expected to be needed, however, no new levels are to be added at this time.

Friday April 6, 2001

12. Pieter van der Kraan provided inputs on the European ADS Programme Plans.

- In ECAC area, the individual states will develop their own implementation plans. Validation activities will begin in September 2001 on infrastructure requirements and ADS-B MASPS is a key input to this activity.
- The TLAT results have been finalized and the report is now available. (See 242A-WP-4-11.) The TLAT work has identified concerns with all of the links being considered. Additional analysis is still needed to assess multi-link aspects, installation impacts, and other performance issues. Expect 1-2 years of additional work and reviews with stakeholders to establish a European conclusion. Early implementations however, may occur, but will be state specific, i.e. the Russian VDL Mode 4 program. These lead to vested interests in a link and architecture, as well as, backward compatibility issues with future ADS-B solutions.
- EUROCAE cooperation activities with RTCA on ADS-B is currently limited to WG 51 work on VDL Mode 4 and a new sub-group to address ASA MASPS. This level of involvement is of concern by Eurocontrol.

13. Potential European harmonization areas that will be considered for Revision A:

- Equipage Class definitions, e.g. A0, A1, A2, etc. European class needs will be compared to the current MASPS class definitions.
- Non-TCP intent data definitions. Look at consistent definition between for common parameters between ADS-B and Mode S Enhanced Surveillance
- Flight Mode Indicator definitions. This relates to the European Mode S Enhanced Surveillance requirements and concepts where common aircraft integration concerns can be coordinated. [AI 4-12] Richard Barhydt to provide addendum to his IP26 to address issues associated with flight mode indicators.

14. IP review

- IP1: A proposal was made to eliminate Turn Indication from the MASPS since there is no definition available for how to derive this parameter nor an application identified that requires this parameter. If appropriate requirements can be provided, this recommendation could be reconsidered. [AI 4-13] Tom Foster to provide commentary to this effect for addition to IP1.
- IP28: [AI 4-14] Richard Barhydt to review this IP and other air referenced parameter IPs for potential consolidation and provide a proposal to resolve by the May meeting.
- IP29: Discuss in May
- IP30: Discuss in May
- IP3X: To be consolidated with IP27. See above [AI 4-14]
- IP3Y: Discuss in May

15. Action Item review

- AI 2-3: Completed with IP3Y
- AI 2-5: Completed with IP3X
- AI 2-7: Open
- AI 2-8: Completed with Pedro Rivas presentation at this meeting
- AI 2-9: Completed with SC-193 presentation at this meeting
- AI 2-11: Open
- AI 2-12: Open
- AI 2-13: Open
- AI 2-14: Open
- AI 2-15: Open
- AI 2-16: Open
- AI 2-18: Open
- AI 2-21: Open
- AI 2-24: Open
- AI 2-25: Christos Rekkas indicated that there are European requirements for altitude rate and track angle rate. Currently not requirement for Turn Indicators when track angle rate is provided.
- AI 2-27: Completed. Was reported to WG4.
- AI 3-1: Open
- AI 3-2: Completed by IP3Y
- AI 3-3: Completed by IP28
- AI 3-4: Open
- AI 3-5: Completed by telecon and working paper from Jim Maynard
- AI 3-6: Open
- AI 3-7: Open
- AI 3-8: Awaiting results of simulation by Jonathan Hammer
- AI 3-9: Open

16. Meeting was called to a close. The group appreciated the involvement and inputs provided by the European participants.

Upcoming Meetings:

Discussed extending the May meeting by one day to provide enough time to review IPs and determine those the group will commit to include in Revision A.

The current future meeting schedule is as follows:

May 21-24:	ADS-B MASPS AdHoc Meeting - Rockwell Collins Arlington Office
July 17-19:	ADS-B MASPS AdHoc Meeting - Seattle
August 28-30:	ADS-B MASPS AdHoc Meeting - Washington DC Area
September 25-27:	ADS-B MASPS AdHoc Meeting - Washington DC Area
October 23-26:	ADS-B MASPS AdHoc Meeting - Washington DC Area

Action Items :

Action Number	Action Item Description	Assigned to	Status
1-1	Develop template for "Issue Paper" form to be used for submitted issues to be addressed by MASPS	Steve Heppe	Completed
1-2	Transcribe all submitted issues into our Issue Tracking Matrix and Change Issue Forms (where necessary)	Stuart Searight	Issue Papers: Done. Tracking Matrix: Pending
1-3	Give a preliminary evaluation on submitted comments as to whether those comments should be included in DO-242A or be deferred to later revisions of the MASPS.	Jim Maynard	Completed
2-1	Ask plenary for guidance regarding to what degree the ASA and/or ADS-B MASPS needs to address security /spoofing issues.	Tom Foster	Completed
2-2	Request WG1 to address Ops Concept on the use of Intent information. Result: WG1 Chair reported he did not foresee this activity in near-term.	Tom Foster	Completed
2-3	Produce Issue Papers that address four major conclusions of Intent briefing. (242A-WP-2-02)	Tony Warren	IP26, IP27, & IP3Y
2-4	Ask WG#3 to provide analysis for which 1.7 sec TCP update rate was based.	Stuart Searight	Completed (see above minutes)
2-5	Produce an Issue Paper proposing specific clarifications on the material in Section 3.4.3.1 regarding the Air Reference State Vector and required information in the SV	Jim Maynard	IP3X Completed
2-6	Break Issue Paper #4 into four separate Issue Papers	Stuart Searight	Completed
2-7	Propose MASPS Change to address IP 4b	Jim Maynard	
2-8	Report on the military's stance on IP 14 (center of navigation)	John Gonda	Completed
2-9	Report on SC-193's stance on IP 14 (center of navigation)	Gary Livack	Completed
2-10	Bring IP14 up during WG4 telcon on 1/29 and report back to our group on that discussion (center of navigation)	Tony Warren	Completed (see above minutes)
2-11	Provide further detail on information sources and specific requirements to better focus IP 4c.	Gary Livack	
2-12	Review and assess if section 2.1.2.1.2 of the MASPS needs clarification. (IP 5)	Dan Castleberry	
2-13	Propose editorial clarifications for Table 3-9.	Gary Livack	
2-14	Provide specific proposal on what clarifications or changes in requirements is needed in the MASPS to address item #2 of IP 6. (centenary and other continuous obstacles)	Gary Livack	
2-15	Produce IP on protecting ADS-B services from other services provided by a shared data link	Dan Castleberry	
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	
2-17	Write proposals specific MASPS changes to split Integrity and Accuracy into separate components.	Jim Maynard, Tony Warren, Jonathan Hammer	Presented at Feb. meeting Completed
2-18	Draft initial recommendations on IP9.	Jim Maynard Christos Rekkas	
2-19	Prepare briefing on trajectory leg types for ad hoc group consideration	Tony Warren	Presented on 2/14 telecon Completed

Action Number	Action Item Description	Assigned to	Status
2-20	Request more specificity from Capt. Hilb on IP 12	Jerry Anderson	
2-21	Write and Issue Paper on items 11 and 12 from Table 3-6 of DO-242	Dan Castleberry	
2-22	Propose language that clarifies MASPS regarding update rates and stationary/movement thresholds. (IP13)	Steve Heppe	
2-23	Combine Gary Livack's comments on certified navigation center into IP14.	Stuart Searight	Completed
2-24	Provide comments and preliminary recommendations from FAA Certification on IP10.	Jerry Anderson	
2-25	Determine if there are strong feelings in Europe about having Turn Indicators (IP01) and altitude rate (IP02) as required message elements.	Christos Rekkas	Completed
2-26	Provide expertise/thoughts/concerns regarding the necessity of requiring altitude rate as message elements.	Jonathan Hammer	
2-27	Communicate newly proposed requirement specified in IP3 to WG4.	Tony Warren	Completed
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	
3-2	Submit Issue Paper that proposes explicit operational requirements for TCP and TCP+1 update rates (even if TBDs must be used in DO-242A).	Tony Warren	IP3Y Completed
3-3	Write an Issue Paper discussing the use of air-reference data, how often must it be transmitted and when, and perhaps suggesting this can be On Condition data.	Steve Heppe	IP28 Completed
3-4	Write an Issue Paper to rework section 2.1.2.4, "Class Codes", in particularly making it less specific.	Jim Maynard	
3-5	Propose changes to Section 2.1.2.2.4 of the MASPS and coordinate telecon to review	Jim Maynard	Completed
3-6	Write White Paper on backward compatibility subject	Tom Foster	
3-7	Develop an initial draft of a normative appendix defining report data elements	Dan Castleberry	
3-8	Draft a response to IP2 (altitude rate issue)	Jonathan Hammer/Tony Warren	Awaiting results of simulation by J. hammer
3-9	Write comments to IP15 explaining rationale for rejecting	Dan Castleberry	
4-1	Propose revised capability code definition that addresses basic equipage capability class codes and initial unique capability codes	Jim Maynard	
4-2	Create note to Table 2-1 to define meaning of "Probability of Exceeding Containment" column values.	Tom Foster	
4-3	Write paper on basis for eliminating NIC 4.5	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	
4-5	Write an Issue Paper to address the issues between containment values and the integrity associated with the assessment and reporting of the value.	Jim Maynard	

Action Number	Action Item Description	Assigned to	Status
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	
4-8	Report on the results of the ICAO SCRSP panel definition of Selected Altitude for Mode S DAP	Christos Rekkas	
4-9	Provide SC-193 recommendations for the minimum number of aircraft types needed to support airport surveillance applications	Jens Schiefele	
4-10	Provide a proposal for a definition of common reference location and accuracy of this location	Ken Staub	
4-11	Provide a briefing on recent work with runway incursion detection algorithms	Ken Staub	
4-12	Provide addendum to IP26 to address issues associated with flight mode indicators	Richard Barhydt	
4-13	Write rationale for elimination of Turn Indication as addendum to IP1	Tom Foster	
4-14	Review air referenced parameter IPs for potential consolidation and provide a proposal to resolve	Richard Barhydt	
4-15			

Handouts from
DO-242A ADS-B MASPS
Ad Hoc Working Group Meeting
3-6 April 2001

1. Agenda
2. 242A-WP-4-01: Briefing by Tony Warren on ADS-B Intent
3. 242A-WP-4-02: Paper by Jim Maynard on MASPS revisions for NIC/NAC and other AI.
4. 242A-WP-4-03: Briefing by Patrice Behier on “An Operational Perspective on ATM Requirements”
5. 242A-WP-4-04: Briefing by Jean Marc Duflot on Eurocontrol Surveillance Activities
6. 242A-WP-4-05: Briefing by Pascal Dias on “Update from the Mode S Programme”
7. 242A-WP-4-06: New IP3Y from Tony Warren on “TCP Update Rate Requirements”
8. 242A-WP-4-07: New IP3X from Jim Maynard on “Should air-reference velocity be required in SV reports?”
9. 242A-WP-4-08: Briefing by Tom Foster on ADS-B MASPS Work Plan Overview
10. 242A-WP-4-09: Paper on “Airport Surface Moving Map Display: Op-Eval-2 Evaluation Results
11. 242A-WP-4-10: Briefing by Pedro Rivas on Military Unique Applications of ADS-B
12. 242A-WP-4-11: ADS_B Technical Link Assessment Team (TLAT) Report, March 2001
13. 242A-WP-4-12: SC193 Briefing on IP6 ADS-B Broadcast Moving and Stationary Obstacles
14. 242A-WP-4-13: SC193 Briefing on IP14 “Certified Navigation Center”
15. 242A-WP-4-14: SC193 Briefing on IP19 Brakes “on” / Brakes “off” Power Percentage”
16. 242A-WP-4-15: SC193 Briefing on IP18 “Heading at Vstop”
17. 242A-WP-4-16: SC193 Briefing on IP4 “Aircraft Make and Model”
18. 242A-WP-4-16:SC193 Briefing on IP13 “High/Low Broadcast Rates”