

**Minutes of Meeting 5 of SC-186 Working Group 3
Development of Revision A of the ADS-B 1090 MHz MOPS**

The meeting was called to order by Dr Vince Orlando at 9am on 10 July 2001, at the William J. Hughes FAA Technical Center at the Atlantic City International Airport. Dr. Orlando welcomed all attendees, and asked that each attendee introduce themselves and their organization. The attendees included:

Gary Furr, Titan Corp. (FAA TC - ACT-350)	Ian Levitt, Titan Corp. (FAA TC – ACT-350)	Stuart Searight, FAA TC – ACT-350
Bill Harman, MIT Lincoln Lab	James Maynard, UPS Aviation Tech.	Bob Semar, United Airlines
Carl Jezierski, FAA TC, ACT-350	Vince Orlando, MIT Lincoln Lab	Ron Staab, Trios Associates
Ron Jones, FAA ASD-140	Tom Pagano, FAA TC, ACT-350	John Van Dongen, FAA TC, ACT-350
Greg Kuehl, UPS Airlines	Stacey Rowlan, L-3 Communications	

1. Following the introductions, the following known regrets to attendance were announced:

- Pio Blankas
- Jerry Anderson
- Gene Wong
- Bob Saffell

2. Following Agenda-A Item #2, Vince Orlando made a few introductory remarks. Vince summarized the debate that has gone on over the last few weeks with regard to Flight ID/Call Sign in the ADS-B MASPS. The ADS-B MASPS in Section 2.1.2.1.1 calls for the Flight ID/Call Sign of up to 7 characters in length. But, in Section 3.4.4, Table 3-6, the definition for the Mode Status Report calls for “up to 8 alpha-numeric characters.” The conclusion of numerous emails was to suggest that the number in Section 3.4.4, Table 3-6 be changed to a minimum requirement of “7” characters. During a brief discussion on the topic, Jim Maynard informed the Working Group that this topic was discussed at the last AEEC Meeting in Atlanta and that they had agreed to suggest to WG-6 that the MASPS Section 2.1.2.1.1 be changed to a minimum of “8” characters. WG-3 agreed that this issue should be taken forward to the next meeting of WG-6 for Revision A of the ADS-B MASPS.

Vince requested that Jim Maynard summarize the status of the AEEC meetings. Jim indicated that there was an AEEC Meeting in July in Annapolis and that many open action items would be cleaned up with regard to document 718A at that meeting.

Vince requested that Stuart Searight summarize the status of the MASPS, Revision A efforts. Stuart reported that there is another WG-6 meeting scheduled in Seattle for the week of 16 July and that at this meeting WG-6 hopes to finalize the list of changes that will be considered for DO-242A. Several significant issues will be discussed at the WG-6 meeting, to include, but not limited to, NIC/NAC, TCP/Intent Changes, State Vector and Mode Status Report format definitions, etc. Stuart indicates that the current plan is to remove the text dealing with TCP and Intent from the body of DO-242 and place it into an Appendix until the requirements are better defined. WG-3 discussed the state of TCP/TCP+1 in DO-260 and Gary Furr accepted **Action Item 5-1** to draft a “Note” to be placed into Section 2.2.3.2.7.1 of DO-260 indicating the status of TCP in DO-260A.

WG-3 further discussed the relationship of the completion of DO-242A and the submission of DO-260A for an SC-186 Plenary approval. There is concern that there could be major changes in DO-242A when it is submitted for Plenary, which is currently planned for the week of December 10, 2001. WG-3 will discuss this further at the next meeting in Redmond WA, after the upcoming MASPS meeting to finalize their list of changes.

3. The Working Group reviewed the Minutes of Meeting #4 at MIT Lincoln Laboratory Liaison Office in Washington DC. Hearing no objection, the Minutes of Meeting #4 were approved as published.

4. The Working Group reviewed the locations, dates and times of the next meetings, which were scheduled. The following table indicates the currently agreed upon meeting dates and places for proposed future meetings of Working Group #3 for the production of Revision A of the 1090 MHz MOPS (RTCA/DO-260).

Dates/Time	Meeting Place
Tuesday, August 21 at 9am through 5pm, Wednesday, Aug 22	Confirmed at Redmond Washington, hosted by Honeywell at the Honeywell Learning Center, 15001 NE 36 th Street, Redmond WA 98052 See the 1090 web site for travel maps and lodging information
Wednesday, October 17 at 9am through 5pm, Thursday, October 18	Tentatively set at MIT/Lincoln Laboratory Aviation Liaison Office But could be switched to the Rockwell Collins office in Arlington VA after research by Bob Saffell
Tuesday, December 4 at 9am through 5pm, Thursday, December 6	Meeting Site TBD, but could be in Paris at Eurocae Headquarters depending on the outcome of discussions concerning their ED-102.

The Working Group discussed concerns over the timing of the meeting planned for December 4-6 possibly in Europe with the currently planned DO-242A Plenary. WG-3 agreed to revisit this issue at the next meeting in Redmond WA after the WG-6 has met to firm up their list of proposed changes for DO-242A.

5. The Working Group then reviewed the List of Open Action Items as it has been updated for this meeting. It was agreed that AI-1-1 could be closed based on actions taken for changes made to DO-181C. Additionally, AI-2-9 could be closed as having been taken care of by other proposals.
6. Working Paper WP-5-05 was presented by Gary Furr as the proposal to implement the changes agreed to in Working Paper WP-4-01, wherein WG-3 agreed to explicitly state that the Aircraft Operational Status Message should be transmitted by all Class A Aircraft, as well as Class B1 Aircraft. It was additionally agreed during Meeting #4 that a “Note” would be added to Table 2-4 indicating that if the formats for Class B2 and B3 Aircraft changed in the future, then they would be required to transmit the Status Message containing the Version Number. Working Group 3 approved the changes outlined in WP-5-05 and directed that they be implemented in DO-260A. Gary will prepare change pages to be posted on the 1090 ADS-B web site as changes to be applied for DO-260A.
7. Working Paper WP-5-01 was presented by Vince Orlando as the proposal to implement the changes required to eliminate Range-based Decoding from Appendix A as agreed to by WG-3 during Meeting #4. The Working Group approved the changes as outlined in WP-5-01 and directed that they be implemented in DO-260A. Gary will prepare changes pages to be posted on the 1090 ADS-B web site as changes to be applied for DO-260A. Stacey Rowlan agreed to be added to Action Item 4-4 along with Bob Saffell to recommend changes to Sections 2.2 and 2.4 to eliminate range-based decoding requirements and references.
8. Working Paper WP-5-02 was presented by Vince Orlando as the proposal to implement changes to Appendix I to prohibit sliding window error correction as was agreed to by WG-3 at Meeting #4, because of its high undetected error rate in high interference environments. With review of WP-5-02, the Working Group decided to change some of the text as proposed in Section I.3.3.2. Changes were made to WP-5-02 during the session until the Working Group agreed with the text. This new text proposal was then saved as Working Paper WP-5-02A, which will be posted on the ADS-B 1090 MHz web site after the meeting. The Working Group directed that the changes to Appendix I proposed in WP-5-02A be implemented in DO-260A. The basis of the changes identified in WP-5-02A were originally reported in WP-4-04. Gary will prepare the changes to Appendix I, based on WP-5-02A, to be posted on the ADS-B 1090 MHz web site as changes to be applied for DO-260A. Vince agreed to propose a requirement statement for section 2.2.4.4 to prohibit sliding window technique as part of **Action Item 5-2**.

9. Continuing in conjunction with Agenda-A Item 7, Working Paper WP-5-08 was then presented by John Van Dongen. Following discussion by the Working Group, the proposals set forth in WP-5-08 were rejected as proposed. However, changes were proposed and implemented during the meeting to subparagraph I.4.1.2.2.2 as a result of suggestions originating in WP-5-08. These changes will be captured by Gary along with other changes made to Appendix I and posted on the ADS-B 1090 MHz web site as agreed to changes to be applied for DO-260A.
10. Working Paper WP-5-03 was presented by Vince Orlando as the third draft of the proposed Enhanced Surveillance Test Procedures proposed for section 2.4.4.4, and suggested text for the corresponding requirement in subparagraph 2.2.4.4. During discussion of WP-5-03 by WG-3, there were numerous changes to the document proposed by the Working Group. Those changes were captured in WP-5-03A, which will be posted on the ADS-B 1090MHz web site after the meeting. WP-5-03A will be used as the basis for continuing development of the Enhanced Surveillance Requirements and Test Procedures to be reviewed again at the next meeting.
11. John Van Dongen then presented Working Paper WP-5-09, which represented his draft of a series of test procedures to be run using the RMF Gold Standard Bench Test Configuration against the drafted Enhanced Surveillance Test Procedures being considered for Section 2.4.4.4. After discussion, the Working Group approved John's approach and agrees with the data that John plans on collecting.
12. John Van Dongen then presented Working Paper WP-5-07, which proposed to compare the reception performance of various enhanced reception techniques. Data presented in WP-5-07 was an extension of data presented in Section 4.7 of the Final Frankfurt Report and compared the performance of the RMF Gold Standard Enhanced Reception technique with the LDPU and TCAS reception methods. In WP-5-07, the same 6 minute sample from May 24, 2000 at Frankfurt FII – N40 air to air reception rate was examined using two additional enhanced reception techniques. One is the Center Sample enhanced reception technique like the method defined in the 1090 MOPS Appendix I, and the other is a Multiple Amplitude Sample enhanced reception technique that does not use lookup tables and which is not described in the MOPS. These reception rates are compared to the RMF Gold Standard multi-sample technique (described in Appendix I) and the LDPU. A description of both the center sample and multiple sample techniques was contained in WP-5-07. After discussion, John agreed that in order to validate the performance of his Multiple Sample technique, he would run the MOPS tests with (1) the Gold Standard, (2) the Center Sample technique and (3) his Multiple Sample Technique. If the performance holds up, then the Working Group agreed that we should include the write-up for his techniques in Appendix I.
13. Starting at 9am Wednesday morning, the Working Group recognized Mike Pietre representing the ACM and Greg Kuehl representing UPS Airlines in a discussion on the issue of TCAS RA. At issue was WP-4-15 wherein WG-3 expressed concerns over the inclusion of the TCAS RA issue in Revision A of the MASPS. After discussion, the Working Group agreed to await further discussions to be held on the subject at the WG-6 meeting being held the week of 16 July in Seattle. The WG-3 request was that the TCAS RA issue be deferred to a later MASPS revision until the issue is more clearly understood. It was agreed by the Working Group that if WG-6 decided to defer the TCAS RA issue, then WG-3 would simply state in DO-260A that there are bits reserved, possibly in the Emergency Message for future TCAS RA. If the issue is accepted by WG-6 as a revision in DO-242A, then WG-3 will define the TCAS RA as originally proposed in WP-4-03A.
14. Following the discussion on TCAS RA, Greg Kuehl indicated that he also had a proposed paragraph that should be entered into Section 3 regarding the installation of non-transponder based 1090 MHz ADS-B equipment in airplanes equipped with Mode-S transponders. The Working Group reviewed the proposed paragraph and agreed that it should be entered after the first paragraph in Section 3.0 as a "Note." The text of the agreed upon "Note" is as follows:

Note: Installation of non-transponder based 1090 MHz ADS-B equipment in airplanes equipped with Mode-S transponders is prohibited. The transmission of squitters in addition to TCAS interrogation responses contributes unnecessary RF energy to the spectral environment. TCAS systems (in other airplanes) cannot take advantage of hybrid surveillance on the ADS-B data, since the non-transponder data cannot be validated by TCAS interrogation. ADS-B data is not directly available to ground interrogators as when read from transponder registers.

Gary will implement the agreed upon paragraph as a “Note” in Section 3.0 and will post the change pages on the ADS-B 1090 MHz web site for inclusion in DO-260A.

15. James Maynard presented Working Paper WP-5-10 concerning proposed text changes in DO-260 required to accommodate the NIC/NAC/SIL proposed changes that are beginning considered by WG-6 for Revision A of DO-242. This Working Paper was submitted during the meeting and was not distributed prior to the meeting. Following various discussions, Working Group 3 disagreed with Jim’s proposal to change all references in DO-260 from the “TYPE Code” to the “Message Type Code.” There were also a number of other changes that were discussed during review of WP-5-10, which led to the production of WP-5-10A, which will be posted on the ADS-B 1090 MHz web site after the meeting. Further, James Maynard will present changes that WG-3 has discussed to WP-5-10A during the meeting of WG-6 during the week of 16 July. Any changes or requirements coming out of the WG-6 meeting will be incorporated into another revision of the NIC/NAC/SIL proposal and presented at the next WG-3 meeting at the Honeywell facilities in Redmond WA.
16. James Maynard also presented Working Paper WP-5-11 concerning his proposed changes to the formats of the Capability Codes (CC) and Operational Modes (OM) Subfields in the Aircraft Operational Status Message. This Working Paper was submitted during the meeting and was not distributed prior to the meeting. Following discussion by the Working group, there were a number of changes that were required and some of those changes were reflected in WP-5-11A, which will be posted on the ADS-B 1090 MHz web site after the meeting.
17. In conjunction with Agenda-A Item 8, Vince Orlando presented Working Paper WP-5-04, as his second draft of Appendix material for 1090 TIS-Broadcast. This Working Paper was not significantly different from the first draft, except for the reorganization of the materials to conform to the agreement reached on the presentation of materials into Appendix A for TIS-B and potentially FIS-B. Vince pointed out that there were several typos and incorrect paragraph references that he wanted to correct, and he wanted to forward the corrected version of WP-5-04 to Andy Zeitlin for review and comment. Any comments received would be discussed at the next WG-3 meeting.
18. In response to Action Item 3-11, Vince Orlando presented Working Paper WP-5-06 as an update to information on FIS-B Service on 1090 MHz. This presentation is basically the same as the one presented in WP-2-06, except that this Working Paper presents the improved performance provided by the revised graphical weather encoding technique. Given the uncertainty of the course of FIS-B in the ADS-B MASPS, Revision A, it was agreed by the Working Group that WG-3 will await the outcome of the next WG-6 meeting prior to proceeding on FIS-B.
19. The following **Action Items** were identified at this, or previous, meetings of this Working Group. The asterisk (*) beside a name or organization indicates that they are the lead for the resolution of that Action Item. Actions shown here are those Action Items that will remain OPEN.

Action Number	Action Description	Assigned to	Status
1-7	Compare performance of their non real-time test sets.	MIT/FAATC	Deferred to later meeting

Action Number	Action Description	Assigned to	Status
2-16	Draft a candidate SVID Management Message for service volume coverage.	Jim Maynard	
2-17	Review the NL equation at A.7.2.d and possibly reword for latitudes at 87.	Jim Maynard	
3-2	Report on all of the necessary changes to DO-260 to fully incorporate the changes suggested by WP-3-01, with the proposed Version Number Subfield.	Gary Furr	
4-4	Recommend updates to Sections 2.2 and 2.4 to eliminate range based decoding references and requirements.	Bob Saffell Stacey Rowlan	
4-10	Take a look at DMTL issue and wording in Section 2.2.4.3.4.1, and Appendix I, based on the discussion around Working Paper WP-4-14	Bill Harman	
4-11	Add material on dynamic bandwidth control for the proposed Appendix M	Bob Saffell	
4-12	Pursue available antenna that provide additional gain in the forward direction and vertical aperture.	Bill Harman Carl Jezierski	In process
4-16	Is getting accurate enough UTC time for range validation achievable in low cost GPS receivers?	James Maynard	
5-1	Create a note in Section 2.2.3.2.7.1 to indicate the status of TCP for DO-260A	Gary Furr	
5-2	Generate the next version of 1090-WP-5-03 to include combined statistical tests for preamble and data block and a test to verify conservative error correction. Prohibit the use of sliding window in 2.2.4.4. Other changes include allow an average of 5 pulses. Recommend rather than require 100 samples per second. Change random to pseudo-random.	Vince Orlando	
5-3	Revise four-pulse preamble test procedures to exclude DMTL	Stacey Rowlan	
5-4	Incorporate any modifications to WP-5-10A as necessary based on the MASPS meeting discussion, any changes in the Report Assembly Function, and resubmit at Meeting #6	James Maynard	
5-5	Send the latest version of WG-3 TIS-B formats to Andy Zeitlin for comments	Vince Orlando	
5-6	Take a look at writing necessary to insert TIS-B material into Section 2.2	Vince Orlando	
5-7	Conduct interference testing as described in WP-5-09 and provide required performance for the enhanced surveillance processing techniques in 2.4.4.4	John Van Dongen	
5-8	Propose a "Note" to explain why only A0 is allowed to have non-transponder based ADS-B transmitting device.	Vince Orlando	

20. The **Working Papers** shown in the following table are specifically for the Meeting being reported in these Meeting Minutes. Working Papers for all WG-3 Meetings, as well as the Meeting Agendas, Meeting Minutes, Meeting Schedules and modifications to DO-260 for the production of Revision A, will be posted on the ADS-B 1090 MHz web site located at: <http://adsb.tc.faa.gov>

Working Paper	Size	Description	Introduced At:
1090-WP-5-01	12KB	Proposed Revisions to Appendix A to Eliminate Range-Based Decoding, presented by Vince Orlando in response to Action Item 4-3	Meeting 5, 07/10/2001 FAA Tech Center
1090-WP-5-02A	9KB	Proposed Revision to Appendix I to Prohibit the Sliding Window Error Correction, presented by Vince Orlando in response to Action Item 4-8	Meeting 5, 07/10/2001 FAA Tech Center
1090-WP-5-03A	44KB	3 rd Draft of the Proposed Test Procedures for Enhanced Surveillance Processing, presented by Vince Orlando in response to Action Item 4-9	Meeting 5, 07/10/2001 FAA Tech Center
1090-WP-5-04	50KB	2 nd Draft of the Proposed Materials for ADS-B TIS-B for insertion as Appendix A.2, presented by Vince Orlando in response to Action Item 4-17	Meeting 5, 07/10/2001 FAA Tech Center
1090-WP-5-05	26KB	The Implementation of the Proposal outlined in 1090-WP-4-01, modifying Table 2-4, presented by Gary Furr in response to Action Item 4-5	Meeting 5, 07/10/2001 FAA Tech Center
1090-WP-5-06	527KB	FIS-B Coding Update, presented by Vince Orlando in response to Action Item 3-11	Meeting 5, 07/10/2001 FAA Tech Center
1090-WP-5-07	75KB	A Comparison of Different Methods of Enhanced Reception, presented by John Van Dongen	Meeting 5, 07/10/2001 FAA Tech Center
1090-WP-5-08	15KB	Conditions for Declaring Preambles in Reference to Lead Edge Positions, presented by John Van Dongen in response to Action Item 3-8	Meeting 5, 07/10/2001 FAA Tech Center
1090-WP-5-09	15KB	Radio Frequency Measurement (RMF) Gold Standard Bench Test Configuration for the Enhanced Surveillance Test Procedures Draft, presented by John Van Dongen	Meeting 5, 07/10/2001 FAA Tech Center
1090-WP-5-10A	71KB	Proposed text to accommodate the NIC/NAC/SIL Proposal, presented by James Maynard in response to Action Item 3-16	Meeting 5, 07/10/2001 FAA Tech Center
1090-WP-5-11A	18KB	Proposal to change the format of the Capability Codes (CC) and Operational Modes (OM) Subfields in the Aircraft Operational Status Message, presented by James Maynard	Meeting 5, 07/10/2001 FAA Tech Center

21. As per Action Item 4-7, a review of DO-260 was accomplished and the following table of open, or unresolved, issues has been generated, along with two issues defined during Meeting #4. WG-3 members should review this list and ensure that there are not other issues known to them that should be on this list. This list will be review at each future meeting for addition or deletion of items.

Un-resolved Issues or Questions not tracked specifically by Action Items

Issue #	Issue/Question Description	Raised by	Date Raised	Status
1	DO-260 Table 2-11 in Section 2.2.3.2.3.1, NUC _P code for Type Code=22 is still shown as TBD	Gary Furr	15 May 01	

Issue #	Issue/Question Description	Raised by	Date Raised	Status
2	DO-260 Table 2-30 in Section 2.2.3.2.6.1.13, “Turn Indicator” coding is still TBD and the implementer is directed to set the code to ZERO until further notice. If this requirement is deleted, then sections 2.2.3.2.6.2.13, 2.2.3.2.6.3.13, 2.2.3.2.6.4.13, 2.2.5.1.10, 2.2.5.1.15 and 2.2.8.1.19 must also be addressed, along with all of their section 2.4 mates. Also Appendix F, MASPS Ref #R.2.26.	Gary Furr	15 May 01	
3	DO-260 Table 2-43 in Section 2.2.3.2.7.1.4, the “TCP/TCP+1 Data Valid Subfield” was declared not to be useful during the June 2000 Plenary and the field was declared to be “reserved” and set to ZERO in the initial version of the MOPS. Section 2.4.3.2.7.1.4 only tests for the case where the code is set to ZERO. Until this field has validity, no TCP data will be considered valid! All sections relating to TCP/TCP+1 were left as written in the initial DO-260.	Gary Furr	15 May 01	
4	Sections 2.2.3.2.7.3.3.1 through 2.2.3.2.7.3.4.4 defining both the “Capability Classes” and the “Operational Mode” of the Aircraft Operational Status Message, including Tables 2-54 through 2-61 are full of TBDs . Also affects Appendix F, MASPS Ref R2.31 and R2.32.	Gary Furr	15 May 01	
5	DO-260 Table 2-67 in Section 2.2.8.1.5, the “NUC _P Coding Requirements” contains numerous TBDs .	Gary Furr	15 May 01	
6	DO-260 Table A-2 in Section A.4.1, NUC _P code for Type Code=22 is still shown as TBD	Gary Furr	15 May 01	
7	DO-260 Section A.4.9.4 was never altered after the June 2000 Plenary which declared the “TCP Data Valid” subfield to be ‘reserved’ and hard wired to ZERO in the initial DO-260.	Gary Furr	15 May 01	
8	Sections A.4.11.3 through A.4.11.10 defining the CC_4, CC_3, CC_2, CC_1, OM_4, OM_3, OM_2 and OM_1 Operational Capabilities and Statuses are full of TBDs	Gary Furr	15 May 01	
9	Appendix F, Ref. #R2.38, the effective coverage of the ground receiver is still TBD .	Gary Furr	15 May 01	
10	Implementation of the Working Papers WP-4-03 and WP-4-06 for TCAS RA, are pending a decision by the Ad Hoc MASPS Working Group on the requirement.	WG-3	15 May 01	
11	Address the issue of whether or not to write a requirement into Section 2.2 of DO-260A for using the “Conservative Error Correction Technique.”	WG-3	15 May 01	