

Minutes of Meeting #15 of RTCA SC-186 Working Group 3
Development of Revision A of the ADS-B 1090 MHz MOPS
<http://adsb.tc.faa.gov/ADS-B/186-subf.htm>

The meeting was called to order by Co-Chair Dr Vincent Orlando at 1pm 12 November 2002, at the RTCA Headquarters in Washington DC. Dr. Orlando welcomed all attendees and asked that each attendee introduce themselves and their organization. The attendees included:

Jerry Anderson, FAA – AIR-130	James Maynard, UPS Aviation Tech.	Stuart Searight, FAA TC – ACB-420
Larry Bachman – Johns Hopkins – APL	Vince Orlando, MIT Lincoln Lab	Ronald Staab, Trios Associates
Bob Burns, Titan Corp. FAA TC – ACB-410	Azhar Osmanboy, Boeing ATM	Greg Stayton, L-3 COM, ACSSD
Gary Furr, Titan Corp. FAA TC – ACB-410	Tom Pagano, FAA TC – ACB-410	Rick Stead, ARINC
Bob Granville, Retired FAA	Bill Petruzell, FAA – AFS-400	David Thomas, Titan Corp. FAA TC – ACB 410
Bill Harman, MIT Lincoln Lab	Bob Saffell, Rockwell Collins	John Van Dongen, FAA Tech Center – ACB-410
Ron Jones, FAA ASD-140	Mark Schneider, Sensis Corp	Gene Wong, FAA – AND-530

1. Following the introductions, the following known regrets to attendance were announced:
 - Bob Semar, United Airlines
2. Following Agenda Item #1, Vince Orlando made a few introductory remarks specifically remarking on the SCRSPS meeting which he attended for the previous two weeks in Langen, Germany.
3. Following Agenda Item #3, the Working Group reviewed the Minutes of Meeting #14 held at the Eurocontrol Headquarters in Brussels, Belgium. Gary Furr pointed out that there was a mistake in assigning Action Item 14-01 to Larry Bachman in the original copy of the Meeting 14 minutes. This error was corrected and Action Item 14-01 was assigned to Bill Harman and the revised Minutes were posted on the web site. Otherwise, the Minutes of Meeting 14 were accepted as published.
4. Following Agenda Item #4, the Working Group reviewed the locations, dates and times of the next several meetings, which are shown below. WG-3 continued to plan meetings through the expected presentation of DO-260A to RTCA SC-186 Plenary as shown in the table below. It was noted that the SC-186 Leadership has specifically requested that the Plenary Days be Thursday, 30 January 2003 and Friday, 31 January 2003. This means that WG-3 will meet as originally planned on Monday through Wednesday to discuss any comments to the Plenary draft of DO-260A.

Dates/Time	Meeting Place
Tuesday, 10 Dec at 9am through 5pm, Friday, 13 December 2002	Meeting at RTCA in Washington DC extending through 5pm Friday 12/13 Travel info and lodging details are available on the ADS-B/1090 web site
Monday, 27 Jan '03 at 9am through 4pm, Friday, 31 January 2003	<u>Confirmed at RTCA - PLENARY DATES ARE CONFIRMED</u> WG-3 meeting on Monday, Tuesday and Wednesday to resolve any comments, and the SC-186 Plenary to approve DO-260A meeting on Thursday and Friday

5. Meeting #15 was started earlier than originally announced and several Working Group members were not able to attend the Tuesday afternoon part of the meeting. The Agenda actually followed was changed from the published Agenda to accommodate their absence. The first order of business was to review Agenda Item 6c, which is Working Paper WP-15-14 as presented by Mark Schneider on the topic of the automatic shutoff requirement for ground vehicles. Following Working Group discussion, it was agreed that some changes needed to be made to the original proposal in WP-15-14,

which called for a new requirement being created in §2.2.3.3.2.12. Mark took an Intra-meeting action item to revise WP-15-14 and present it again to WG-3 later during the meeting. Upon his revision of the proposal, Working Paper WP-15-14R1 was discussed and accepted by WG-3 and Gary Furr was directed to implement the proposed change into the next draft of DO-260A, and post the revised Working Paper on the 1090 web site. It was also pointed out that a Test Procedure would be required for this new requirement in §2.4.3.3.2.12.

6. The Working Group moved to Agenda Item 8g for review of Working Paper WP-15-18 presented by Mark Schneider entitled “Ground Vehicle and Fixed Obstruction Transmission Period.” In the Working Paper, Mark pointed out that Non-Transponder-Based transmitters are required to transmit with a period of 5 seconds (low rate) while they are stationary in the On-Ground status. However, the DO-242A MASPS calls for update periods on the order of 1.5 seconds for surface applications. Mark believes that there is no way to achieve 1.5 second update periods with 5 second transmission periods. Mark proposed that ADS-B equipped ground vehicles and fixed obstructions should transmit position information at the high rate, twice per second, any time they are transmitting. After Working Group discussion, the Working Group agreed to reject the proposal and leave the transmission rate as defined in DO-260A, Draft-5.
7. Next, the Working Group moved to Agenda Item 8h for review of Working Paper WP-15-20, entitled “Proposed Accommodation of the Broadcast of Mode A Codes” presented by Ron Jones. This Working Paper proposed a possible technical approach for implementation of the transmission of the Mode A Code on the 1090 data link. After Working Group discussion, it was agreed that since there is currently no specific requirement in the ADS-B MASPS for the transmission of the Mode A Code, no solution for this will be implemented in the draft DO-260A submitted for Plenary review. However, it was agreed to accept Ron’s proposal for adding a subtype code to the TEST Message (TYPE=23).
8. The Working Group then moved on to Agenda Item 8i for the review of Working Paper WP-15-02, entitled, “Proposed Revisions to DO-260 Appendix H” presented by Ron Jones. After review of the proposed changes, the Working Group agreed to accept the changes and directed Gary Furr to implement WP-15-02 as the next review version of Appendix H, and to post it on the web site after the meeting.
9. The Working Group continued on to Agenda Item 8j for the review of Working Paper WP-15-05, entitled “Version 0.3 of the Draft for Proposed DO-260A Appendix O” presented by Ron Jones. After review of the proposed changes, the Working Group agreed to accept the changes and directed Gary Furr to implement WP-15-05 as the next review version of Appendix O, and to post it on the web site after the meeting.
10. It was decided by the Working Group to continue into the review of Draft-5 of DO-260A and review certain items until Wednesday morning when a full complement of Working Group members were expected to attend and other Agenda Items should be addressed. Therefore, Gary Furr began the review of Agenda Items 8a, 8b and 8c to review the current status of the DO-260A overall effort, to describe the state of the “Test Procedure Matrix” and to review changes that were made to the DO-260 versus DO-260A Comparison Matrix. The Comparison Matrix will be distributed with the Plenary review draft of DO-260A in order to help reviewers understand better where changes were made.
11. It was then decided to begin the Agenda Item 8k for the review of Working Paper WP-15-07, entitled “Draft 0.1 of the Proposed Appendix F: ADS-B MASPS Compliance Matrix” presented by Stuart Searight. After review of each individual MASPS Requirement and the corresponding sections of

DO-260A addressing that requirement, Stuart agreed to make several changes and submit the updated matrix for review at Meeting #16.

12. On Wednesday morning, 13 November 2002, after completing the review of Appendix F, the Working Group began with Agenda Item 5a for the review of Working Paper WP-15-19, entitled “Performance of the 1090 Extended Squitter in Future High Density Airspace (LA 2020), presented by Larry Bachman. Since there are differences in the simulation results being presented by JHU-APL versus those from MIT Lincoln Lab, it was stressed that Larry and William Harman are working closely to determine the source of the differences and come to an agreement on a single set of simulation results to be presented in Appendix P. Larry Bachman will draft a version of Appendix P for review at Meeting 16 and distribution for Plenary review.
13. The Working Group then continued with Agenda Item 6a for the review of Working Paper WP-15-13, entitled “Air-to-Air Performance in LA2020” presented by William Harman. This Working Paper addresses Action Item 14-01. In parallel with the performance assessment being done by Johns Hopkins APL, a similar assessment is being performed at Lincoln Laboratory, making use of two simulation tools developed previously. This Working Paper describes the simulation techniques being used, and summarizes the results for the LA2020 interference environment and an expanded interference environment, LA2020-Plus. As mentioned above, Bill and Larry are working hard to determine the source of their differences and to come to an agreement on a single set of simulation results to be presented in Appendix P.
14. The Working Group then continued with Agenda Item 6b for the review of Working Paper WP-15-11, entitled “Proposed Change to the Time Limit for CPR Global Decoding” presented by William Harman. This Working Paper addresses Action Item 14-04. This Working Paper proposes a change to the time limit for global decoding when receiving messages from a transmitter on the Airport Surface. Given that the transmitted rate currently defined in DO-260 is only once per 5 seconds, Bill proposes that the 10 second time limit to receive both an “even” and “odd” position squitter should be increased. Bill originally proposed increasing the time period to 100 seconds, but after Working Group discussion, it was *agreed* to make the time increase equal to 50 seconds. WP-15-11 was revised and additions were made in WP-15-11R1 for specific paragraphs in §2.2.10 and Appendix A that will be addressed, in addition to those originally proposed by Bill. WP-15-11R1 will be implemented and posted on the web site after the meeting.
15. Tom Pagano then presented Agenda Item 6d for the review of Working Paper WP-15-16, entitled “ATCRBS Signal Generator Characteristics.” This Working Paper contained measurements of pulse timing and pulse width characteristics of ATCRBS and Mode S signals produced by 1090 MHz Generators used at the FAA Technical Center for bench measurements in support of enhanced decoding techniques and performance analysis.
16. John Van Dongen then presented Agenda Item 7a for the review of Working Paper WP-15-08, entitled “Enhanced Squitter Reception Test Procedures Revision and New Materials for Appendix I.” This Working Paper presents a revision to the Enhanced Squitter Reception Test Procedures that separates the performance required of A2 class equipment from that of A3 class equipment. The intent is to base the required performance of A2 class equipment on the performance measured using an 8 MHz sampling rate implementation and to use the 10 MHz sampling rate implementation results to set the required performance for A3 class equipment. In addition, this Working Paper includes new text for Appendix I to address the effect of sampling rate on reception performance. Changes were made to this Working Paper following Working Group discussions and WP-15-08R1 was produced. The Working Group *agreed* that WP-15-08R1 would be implemented into DO-260A and Appendix I and posted to the web site after the meeting.

17. John Van Dongen then presented Agenda Item 7b for the review of Working Paper WP-15-15, entitled “Enhanced Squitter Reception Test Procedures Four-Pulse Preamble Detection Tests Proposed Revisions.” Section 2.4.4.4.2.2 Four-Pulse Preamble Detection Tests were written to test the enhanced preamble detection process when it was defined in Appendix I with an 8 MHz sampling rate. Appendix I currently attempts to present the techniques independent of sampling rate but bases the description on a 10 MHz sampling rate for A3 equipment and an 8 MHz sampling rate for A2 equipment. The Four-Pulse Preamble Detection Test as currently defined pose problems for equipment that use either sampling rate. Working Paper WP-15-15 attempts to solve these problems. During Working Group discussion, some minor changes were made to WP-15-15 to ensure that the test procedures could be understood. These changes produced WP-15-15R1 that will be posted on the web site after the meeting.
18. Following Agenda Item 9, Ron Staab presented Working Paper WP-15-01 entitled “Further Analysis of the 1090 MHz ATCRBS Fruit Arrival Time Data.” WP-15-01 is a preliminary comparison of the Negative Binomial Distribution (NBD), expressed in non-customary terms of mean and variance, applied to the 1090 MHz ATCRBS Fruit arrival time data previously reported in Working Papers WP-12-14, WP-13-05, WP-13-14, WP-14-12, and WP-14-15. Ron offered additional plots during the meeting and these plots will be added to the original WP-15-01 and posted on the web site after the meeting as WP-15-01R1.
19. Next, in conjunction with Agenda Item 6e, Mark Schneider presented Working Paper WP-15-17 in response to Action Item 14-02, entitled “Operational Requirements for Ground Vehicles.” Working Group 3 has been working in previous meetings to define the transmit power requirement for Non-Transponder-Based ADS-B transmitters on Class B2 Ground Vehicles. This Working Paper addresses requirements for ground vehicles only. Bill Harman has prepared [in WP-15-21] some simulations that characterize the performance of the data link between a ground vehicle based transmitter on the runway surface and an approaching aircraft. Working Paper WP-15-17 is intended to provide some of the success criteria needed to interpret the results of Bill’s simulations [in WP-15-21].
20. To follow in the theme of Class B2 transmit power, Bill Harman presented Working Paper WP-15-21 in response to Action Item 13-04, entitled “Transmitter Power for Class B2.” Class B2 vehicles, such as snowplows, will broadcast their positions but not receive. In one application being considered by WG-3, these broadcasts may be received by aircraft on approach to land at that airport. In the event of an operational error in which the transmitting vehicle is located on the landing runway, the surveillance information would alert the pilot to the conflict, which could avoid a serious accident. The question of what transmitter power would be appropriate for these broadcasts was discussed at the previous two meetings. To support the discussions, Lincoln Laboratory made performance assessments for several possible values of transmitter power. The results are presented in this Working Paper. At the proposed transmit power of 10 watts, it is shown that even at a transmission rate of 2 per second, the transmitting subsystem would not meet the MASPS requirement R3.4 for providing a 5NM coverage range for Class A receivers. Further Working Group discussion on this topic led to the creation of Working Paper WP-15-26 for the creation of a Class B2 Low Power equipment class.
21. The Working Group began the review of Working Paper WP-15-23 that was originally prepared by Stacey Rowlan in response to Action Item 9-9 as a proposed test procedure [§2.4.4.4.3] to verify that the Sliding Window Error Correction is not being used. During Working Group discussion, it was agreed that Greg Stayton and Bill Harman would make some modifications to the original Working Paper and present it again to the Working Group later in the meeting. Working Paper WP-15-23R1 is the revised proposal presented by Greg and Bill and the Working Group agreed that it was a proper test procedure and directed Gary Furr to include it in the next draft of DO-260A.

22. Next the Working Group began the review of Working Paper WP-15-22 presented by William Harman in response to Action Item 10-03. A simulation was used to determine whether the ID transmission rate can be reduced to one per 5 seconds. To do this, a comparison was made of performance in two cases, using one transmission per 5 seconds in one case and one transmission per 2.5 seconds in the other. The results indicate that performance is essentially the same. The conclusion is that the ID transmission rate can be made once per 5 seconds. After Working Group discussion, it was agreed to accept a transmission rate of once per 5 seconds.
23. In conjunction with Agenda Item 8f, the Working Group began review of Working Paper WP-15-03, presented by Bob Saffell, entitled “Proposed DO-260A, Appendix A Additional Notes in regards to Longitudinal CPR Accuracy.” Appendix A currently implies an approximate end –to- end CPR accuracy of 5.1 meters in the Airborne state and 1.25 meters in the Surface state. Analysis has demonstrated that such is not the case near latitudes of either 87 degrees North or South. This Working Paper proposes the addition of appropriate notes to Appendix A that address the established situation. After Working Group discussion, it was agreed that the proposed text of this Working Paper be implemented in Appendix A. Gary Furr will implement the changes and offer them in the next draft of Appendix A for review.
24. In conjunction with Agenda Item 8l, the Working Group began review of Working Paper WP-15-12, presented by William Harman, entitled “Review of and Proposed Changes to Appendix L: Integrity.” Bill proposed several changes that were discussed by the Working Group and additionally some minor editorial changes were made to WP-15-12 to produce WP-15-12R1 that will be posted to the web site after the meeting.
25. In conjunction with Agenda Item 8d, the Working Group began review of Working Paper WP-15-06, presented by Gary Furr, entitled “Open Issues related to DO-260A.” As each item in the Working Paper was reviewed, the resolution of action was entered into the text of WP-15-06R1. All actions will be implemented by Gary Furr into the next draft of DO-260A for Working Group review, and WP-15-06R1 will be posted to the web site after the meeting.
26. In conjunction with Agenda Item 8e, the Working Group began review of Working Paper WP-15-04R1, presented by Ron Jones, entitled “Proposed Changes to DO-260A to Account for Data that has not been recently refreshed.” Each of the items in WP-15-04R1 have already been implemented into Draft-5 of DO-260A and also into Appendix A. The only issues discussed was a question related to item #11 dealing with the NIC Supplement. The text of this item was revised to ensure that the NIC Supplement was used to select the lower NIC value and did not have anything to do with setting the Radius of Containment to “Unknown.”
27. Working Paper WP-15-24 was submitted by Robert Saffell during the meeting as proposed changes to test procedures to correct directional problems. All of the proposed changes in WP-15-24 will be implemented into the next draft of DO-260A, and it will be posted on the web site after the meeting.
28. Working Paper WP-15-25 was submitted by Ron Jones during the meeting as proposed changes to §2.2.5.1 to account for omitted data items from the Operational Status and Target State and Status Messages. All of the proposed changes in WP-15-25 will be implemented into the next draft of DO-260A, and it will be posted on the web site after the meeting.
29. Working Paper WP-15-26 was submitted during the meeting by James Maynard as a proposal to add a Capability Code bit in the Surface version of the Operational Status Message for flagging Ground Vehicles (Class B2 equipment) with less than 70 watts of transmitted power. This is a follow up to discussions related to Working Papers WP-15-17 and WP-15-21. This will allow a vendor to

produce a Ground Vehicle Non-Transponder device with a transmitter power of less than 70 watts to operate only on the surface, and will allow other A/V receiving the Surface version of the Operational Status Message to be aware that the vehicle that is transmitting the message is doing so from a Class B2 vehicle with less than 70 watts of transmit power. WP-15-26 was reviewed and the Working Group agreed to have Gary Furr implement the proposed changes into the next review draft of DO-260A. WP-15-26 will be posted to the web site after the meeting.

30. 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 remained OPEN at the end of this meeting.

Action Number	Action Description	Assigned to	Status
8-1	Provide the results from testing with the directional 1090 MHz receive antenna. (Flight Tests scheduled for 24-25 April 2002. LDPU had a problem and this may be delayed until Fall 2002)	Carl Jeziarski	
14-05	Review WP-14-14 and add LL numbers of the 8 MHz versus 10 MHz for Meeting 16 in order to complete the 2.4 tables.	Bill Harman	

31. 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/ADS-B/186-subf.htm>

Working Paper	Size	Description	Introduced At:
1090-WP-15-01R1	19KB	Further Analysis of the 1090 MHz ATCRBS Fruit Arrival Time Data, presented by Ronald Staab, Trios Associates	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-02	99KB	Proposed Revisions to DO-260 Appendix H: Report Assembly Guidance, presented by Ron Jones	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-03	19KB	Proposed DO-260A, Appendix A additional Notes in regards to Longitudinal CPR Accuracy, presented by R. H. "Bob" Saffell	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-04R1	9KB	Proposed Changes to DO-260A to Account for Data that has not been recently refreshed, presented by Ron Jones	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-05	32KB	Version 0.3 of the Draft for Proposed DO-260A Appendix O: Accommodation of Trajectory Change Reporting, presented by Ron Jones	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-06R1	14KB	Open Issues Related to DO-260A Completion, presented by Gary Furr	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-07	297KB	Draft 0.1 of the Proposed Appendix F: ADS-B MASPS Compliance Matrix, presented by Stuart Searight	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-08R1	41KB	Enhanced Squitter Reception Test Procedures Revision and Proposed New Material for Appendix I, presented by John Van Dongen	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-09	246KB	Draft #2 of the DO-260A Test Procedure Matrix, presented by Gary Furr	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-10	160KB	Draft #2 of a Matrix to Compare the Structure of DO-260A versus DO-260, presented by Gary Furr	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-11R1	8KB	Proposed Change to the Time Limit for CPR Global Decoding, presented by William Harman in response to Action Item 14-04	Meeting 15, 11/12/02 RTCA, Washington DC

Working Paper	Size	Description	Introduced At:
1090-WP-15-12R1	19KB	Review of and Proposed Changes to Appendix L, presented by William Harman	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-13	123KB	Air-to-Air Performance in LA2020, presented by William Harman, in response to Action Item 14-01	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-14R1	18KB	Ground Vehicle Auto Shutoff Requirement, presented by Mark Schneider, in response to Action Item 13-05	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-15R1	34KB	Proposed Revisions for the Enhanced Squitter Reception Test Procedures for the Four-Pulse Preamble Detection Tests, presented by John Van Dongen	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-16	10KB	ATCRBS Signal Generator Characteristics, presented by Tom Pagano, in response to Action Item 12-04	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-17R1	147KB	Operational Requirements for Ground Vehicles, presented by Mark Schneider, in response to Action Item 14-02	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-18	13KB	Proposed Revision to the Ground Vehicle and Fixed Obstruction Transmission Period, presented by Mark Schneider	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-19	183KB	Performance of 1090 Extended Squitter in Future High Density Airspace (LA 2020), presented by Larry Bachman	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-20	14KB	Proposed Accommodation of the Broadcast of Mode A Codes by the 1090 System, presented by Ron Jones	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-21	169KB	Transmitter Power for Class B2 Equipment, presented by William Harman, in response to Action Item 13-04	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-22	13KB	Proposed Rate for Transmitting the ID Squitter, presented by William Harman in response to Action Item 10-3	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-23R1	8KB	Proposed Test Procedure to verify that the Sliding Window Error Correction is not being used, prepared by Stacey Rowlan in response to Action Item 9-9 and modified during the meeting by Greg Stayton and William Harman	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-24	8KB	Proposed Changes to Test Procedures to Correct Directional Problems, presented by Robert Saffell	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-25	11KB	Proposed Changes to 2.2.5.1 to Account for Omitted Data Elements, presented by Ron Jones	Meeting 15, 11/12/02 RTCA, Washington DC
1090-WP-15-26	10KB	A Proposal for A Capability Code Bit for Flagging Ground Vehicles (Class B2 Equipment) With Less Than 70 Watts of Transmitted Power, presented by James Maynard	Meeting 15, 11/12/02 RTCA, Washington DC