**Consolidated COMMENTS for the Draft UAT MOPS**
**RTCA Paper No. 132-02/SC186-196**

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 1 | Chris Moody | 1.1 | 2 | Description of Appendix K incorrectly refers to Appendix F. | Change reference to Appendix G.<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 2 | Chris Moody | 2.2.2.5 | 19 | Figure has incorrect terminology. | Change "short" to "basic."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 3 | Chris Moody | 2.2.4.5.4 | 46 | Several fields have no indication of which payload bits are MSB or LSB. | Add MSB/LSB indication to "Emergency/Priority Status," "UAT MOPS Version," "SIL," "$NAC_p$'" and "$NAC_v$."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 4 | Chris Moody | 2.2.4.5.4.1 | 48 | Text is missing from the "meaning" column for codes 4, 17, and 18. | **WG-5 Response:** Editorial – Agreed<br>**Done** |
| 5 | Chris Moody | 2.2.4.5.4.13.2 | 55 | Note is misplaced. | Move note up to follow first paragraph.<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 6 | Chris Moody | 2.2.5.4.14 | 56 | Incorrect reference. | Change "2.2.4.5.6.1.2" to "2.2.4.5.6.1.1."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 7 | Chris Moody | 2.2.7.1 | 70 | Numerous changes. | **a)** Elements #3 and 4: make all Mandatory (M) with footnote containing the existing text about accessibility of input<br>b) Element #7: add footnote about input accessibility<br>c) Element #8: same as b)<br>d) Elements #10: through 13 same as b)<br>e) Elements 15 and 16: don't we really want both inputs supported? And if so the geo could get the footnote about accessibility<br>f) Element #18: make all Mandatory (M) with footnote to indicate that the existing text about accessibility of input<br>g) Elements #23 and 24: add footnote about accessibility<br><br>**WG-5 Response:** WG Accepts: (a), (b), (c). For (d), WG amends Suggested Response to be both elements #10 and #11 instead of 10 thru 13. For (e), addressing element 15, for Barometric Vertical Rate, WG agrees to amend the requirement of 2.2.4.5.2.7.1.1 to require Barometric source "if available." For (f) and (g) WG accepts. WG also notes that these changes apply to table 2.4.7.1.<br>**Done** |
| 8 | Chris Moody | 2.4 | 97-277 | In many cases the number of section contents does not begin with "1" or "a." | Check sequencing.<br><br>**WG-5 Response:** Editorial – Agreed. Also see numerous comments from FAATC<br>**Done** |
| 9 | Chris Moody | 2.4.8.3.1.1 | 234 | Step 2, Note 2 has terminology error. | Replace the word "Short" with "Basic."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 1 | Warren Wilson | 3.4.1.7.1.5 | 288 | The difference between G and G' is not defined. | Add definition of the gain factor "G" and explain how it is different from "G'."<br><br>**WG-5 Response:** After consultation with the originators of the formula, the primes (') were switched from the bottom to the top of the formula. WG-5 will also pass this corrected information to WG-3 for inclusion on DO-260A<br>**Done** |
| 2 | Warren Wilson | App. A | A-6 | MTOR is not used in UAT. | Delete MTOR (UAT uses TOMR).<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 3 | Warren Wilson | App. A | A-16 | Definition of Payload Selection Cycle is incorrect. | Change to "A 16 second time interval during which each of up to 4 ADS-B message types is transmitted at least 4 times (in order to optimize the effect of antenna diversity)."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 4 | Warren Wilson | D.1.1.1.2 | D-4 | Grammar error in second sentence. | Sentence should end "…a relatively large product coverage (e.g., a circle of radius 500 nm) and a relatively low update rate."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 5 | Warren Wilson | E.1.1 | E-3 | Clarification | Change "does" to "must" in last sentence.<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 6 | Warren Wilson | App. H | H-1 | Title should be more descriptive. | Change title to "UAT Synchronization Process."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 7 | Warren Wilson | H.1 | H-3 | Clarification | Change first sentence of the introduction to read, "Appendix H discusses the UAT synchronization process."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 8 | Warren Wilson | I.1 | I-3 | Typo | On the second sentence of the first paragraph, change "are" to "is."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 9 | Warren Wilson | I.2 | I-3 | Clarification | In the list (item 2) change "context" to "rationale."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 10 | Warren Wilson | I-3 | I-4 | Typo | In item (a) change "~" to "=."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 11 | Warren Wilson | I-4 | I-5 | Typo | In the first bullet under Message Transmission Timing delete the word "source" between "coupled" and "time."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 12 | Warren Wilson | I.5 | I-6 | Clarification | At the end of the first sentence of the first paragraph, change "occur" to "be made."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 13 | Warren Wilson | I.5 | I-6 | Clarification | Delete the phrase "of time" in the middle of the first sentence of the second paragraph.<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 14 | Warren Wilson | I.6 | I-7 | Clarification | Change the second sentence under TOMR Range Filtering to read, "An alpha-beta recursive filter, which allows for uneven time between message receptions (due to dropped messages, etc.), can be used to both smooth and predict range values."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 15 | Warren Wilson | I.6 | I-7 | Clarification | In the Datalink latency paragraph under Correlation of TOMR Range vs. SV-based Range, change the beginning of the first sentence to read, "One other phenomenon affecting the TOMR range calculation…"<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 16 | Warren Wilson | K.1.3 | K-4 | Typo | Delete the word "antenna" in the last bullet.<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 17 | Warren Wilson | K.1.4 | K-6 | Incorrect reference. | The reference to "K-2" in the fourth sentence of the section on Receiver Performance Model should be changed to "K.3."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 18 | Warren Wilson | K.2 | K-8 | Possible missing information. | The penultimate paragraph in this section gives the median value of the azimuth gain. Can the average value also be provided?<br><br>**WG-5 Response:** Comment Withdrawn<br>**No Change to document** |
| 19 | Warren Wilson | K.4.1 | K-34 | Typo | Paragraph above Table K.4.1.1 should refer to Figure K-15 through K-35.<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 20 | Warren Wilson | K.4.2 | K-35 | Typo | The end of the second paragraph should refer to "MHz" instead of "Mhz."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 21 | Warren Wilson | K.4.5 | K-77 | Typo | The second sentence of the second paragraph should say "a lack" instead of "alac k."<br><br>**WG-5 Response:** Possible printer driver problem.<br>**No document change** |
| 22 | Warren Wilson | App. M | M-6 | The appendix does not adequately explain the process used to distinguish between Long and Basic ADS-B messages. | Add the proposed attachment to the end of Appendix M (just before the reference).<br><br>**WG-5 Response:** WG Agrees with proposed input, but suggests taking the bolding off of the text near the end of the addendum.<br>**Done** |
| 23 | Warren Wilson | App. M | M-6 | Typo | In the page header replace "E" with "M" in two places.<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done.** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 1 | Stuart Searight | General | -- | I have a concern that we are treating link-specific TIS-B requirements differently in the two ADS-B link MOPS under development. The UAT MOPS has defined the TIS-B message supporting State Vector for the UAT link. However, message and track management are not addressed within the document. The 1090 MHz ES MOPS currently under development (DO-260A) is addressing these issues and defining how TIS-B will operate on that link in much more detail than the UAT MOPS does. | This comment is not meant to infer that the UAT MOPS is deficient in this area. Rather, this comment is submitted in the hope that SC186 will make a clear decision on the extent to which the ADS-B MOPS need to specify link-specific TIS-B requirements.<br><br>Options include:<br>1. have all TIS-B requirements reside within the TIS-B MASPS;<br>2. have all data-link specific requirements reside in the ADS-B link MOPS; or<br>3. have a set of TIS-B link MOPS that will be coordinated with the ADS-B MOPS.<br><br>**WG-5 Response:** WG-5 has provisioned a format for uplink of TIS-B messages that should conform to the eventual TIS-B system design. Should the TIS-B system design mature in ways not anticipated in the UAT MOPS, two potential solutions exist: (1) the TIS-B message format in this document may be revised; or (2) Ground Uplink segment capacity can be used as needed. Ground Uplink segment capacity will be used for any TIS-B "service level" messages, e.g., indicating coverage volumes, etc.<br>**No Document Change** |
| 1 | William Harman | All | All | This MOPS seems to be very well written, and also appears to indicate a well designed system. | not applicable<br><br>**WG-5 Response:** WG-5 appreciates this comment. |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 2 | William Harman | E.1.2 | E-3 | The third sentence in this paragraph says that "in practice" the antenna gain model used in Appendix K is inaccurate. The phrase "in practice" seems inappropriate here, because all of the material in this appendix applies to the gain of aircraft antennas under operational conditions. Furthermore, I believe the sentence is incorrect. No evidence is offered to substantiate the claim that this represents a more correct value of antenna gain than the model used in Appendix K. Before we (SC-186) make such a statement, I believe we should be provided with data showing that the Appendix K analysis is inaccurate. | Delete this sentence.<br><br>**WG-5 Response:** WG-5 agrees to modify the third sentence as follows:<br>"In practice, equipment designers assume 0.5 dB less average gain in the azimuth plane than that given in the TLAT Antenna Gain Model."<br><br>**Done** |
| 3 | William Harman | K.2 | K-8 | Editorial: In the last paragraph, the phrase "in real-world scenarios, ..." seems inappropriate and unnecessary. | Delete the words, "In real-world scenarios"<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 1 | Ron Jones | 2.2.2.1 | 17 | **EDITORIAL:** Why is the transmission frequency tolerance not expressed in +/- Hz rather than indirectly with PPM. (acronym PPM is not defined in text nor Appendix A as meaning Parts Per Million)<br><br>: | Change frequency tolerance to +/- 19.56 KHz (since this equals +/- 20 PPM for a 978 MHz center frequency)<br><br>**WG-5 Response:** WG-5 agrees that PPM should be defined in Appendix A. The reason for using PPM is its use as a standard for specifying stability.<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 2 | Ron Jones | 2.1.11, 2.1.12 and Appendix K | 15 - 16 | **TECHNICAL:** Based on the results reported in Appendix K it appears that a medium transmitter power level as specified may not be adequate for aircraft that operate above 18,000 ft. The draft MOPS allows this for Class A1H and A2 avionics, however transmissions from aircraft so equipped may not be able to be received by class A3 receivers at adequate air-to-air range to support the MASPS requirement of 64 NM (A2 transmit to A3 receive and 45 NM for an A1 transmit to an A3 receive, as per table 3-2(b) of DO-242A). Appendix K fails to plot the performance for an A3 receiver when receiving A1H or A2 broadcasts at ranges beyond 15 to 35 NM respectively. However in looking at Figure K-17 it would appear that the effective range for the LA2020 scenario for an A3 receiver at high altitude successfully receiving intent information from an A1H is only approximately 20 NM. Since figure K-16 plots the A3 reception of A2 transmissions out to only 35 NM it is not possible to determine if the 64 NM MASPS requirement could be satisfied or not. I would contend that an A3 aircraft would need to be capable of receiving the ADS-B transmissions from all high altitude aircraft within the operational radius over which an flight path de-confliction application is allowed to generation de-confliction advisories to the flight crew, otherwise the action taken to resolve one conflict could unknowingly create other conflicts. The transmitter power levels specified for Classes A1H and A2 UAT equipment would limit the useful operational range for such air-to-air applications. A similar issue appears to exist for either an A2 or an A3 receiving either an A0 or a low-powered A1 where the MASPS requires a reception range of 28 and 45 NM respectively. For this case it appears from figures K-20 and K-26 that the reception range may be on the order of 25 NM. | Require Class A1H and A2 transmitters to operate at a higher power level. Also increase the Class A0 and A1 transmitters to operate at higher power. Perhaps a transmitter power of –3dB as compared to an A3 avionics would be more appropriate for Class A2 avionics. For Class A0 and A1 it appears that the transmitter power may need to be increased by 3 to 5 dB in order to satisfy the MASPS reception range requirements (i.e., A2 and A3 reception of A0 and A1 transmissions).<br><br>**WG-5 Response:** After discussion, WG-5 has determined that the Draft UAT MOPS is in compliance with DO-242A, but that this comment raises an important ADS-B MASPS issue. WG-5 agrees that we need Plenary consideration of the following scenario: two A3 aircraft, 90 NM apart performing long-range de-confliction, with an A2 aircraft 10 NM away from one of the A3 aircraft, and 80 NM away from the other A3 aircraft.<br>Question: Does the A3 aircraft, which is 80NM away from the A2 aircraft need to receive transmissions from the A2 aircraft prior to de-conflicting with the other A3 aircraft? And, if so, at what rate do those transmissions need to be received?<br><br>**ADS-B MASPS Referral** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 3 | Ron Jones | several | several | **EDITORIAL:** The number of tables and figures should be made consistent. | Suggest that all tables and figures be numbered using the paragraph number in which they appears.<br><br>**WG-5 Response:** WG-5 agrees that after Plenary approval, all tables and figures will be numbered as per RTCA standards.<br>**Done** |
| 4 | Ron Jones | Appendix K | general | **EDITORIAL and TECHNICAL:** As noted in Comment 2, the air-air ranges for which the projected reception performance have been plotted are too limited for several of the cases. Specifically, this applies to reception of ADS-B transmissions from users equipped with a lower avionics class. Also it is not clear why Appendix K needs to be included within the MOPS itself rather than simply presented as a working paper to the SC-186 plenary. | Consider removing Appendix K from the MOPS (i.e. approve the MOPS without Appendix K). Then update Appendix K to show performance out to longer air-air ranges when transmitting aircraft is using a lower class of avionics that the receiving aircraft. Present the updated performance estimates at a future meeting of SC-186 Plenary.<br><br>**WG-5 Response:** WG-5 believes that it is essential to present estimated ADS-B UAT Link performance against internationally agreed scenarios. Appendix K is therefore an essential component of the UAT MOPS. If the SC-186 Plenary decides that the ADS-B MASPS requirements need to be changed in DO-242B in light of Ron Jones' Comment #2, Appendix K will be modified as necessary and appropriate.<br>**No Document Change** |
| 1 | JHU-APL | K.1.1 | K-3 | **EDITORIAL/TECHNICAL**: Unclear what requirements results in Appendix K should be compared to | Insert the following sentence at the beginning of the 4th paragraph:<br><br>The results shown in Section K.4 are compared to DO-242A requirements as specified in Table 3-4(a) "SV and MS Accuracy, Update Interval, and Acquisition Range Requirements" and Table 3-4(c) "Summary of TS and TC Report Acquisition Range and Uplink Interval Requirements"<br><br>**WG-5 Response:** Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 2 | JHU-APL | K | K-20<br>K-37<br>K-60 | **EDITORIAL/TECHNICAL**: Lack of definition about what each point on plots represents | Insert the following sentence:<br><br>"Each point on the plot represents the performance of Aircraft/Vehicles within a 10 NM bin centered on the point."<br><br>into paragraphs leading into results after explaining what 95th percentiles mean:<br>1. K-20, 4th full paragraph, before 3rd sentence,<br>2. K-37, 1st full paragraph, before 3rd sentence,<br>3. K-60, in similar location (after 95/95 is explained)<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 3 | JHU-APL | G.4 | G-7 | Altitude Restrictions were not used in any results in Appendix K | a) remove Figure G-4<br>b) remove sentence that refers to G-4 in section G.4 at end of first paragraph<br><br>**WG-5 Response:** WG-5 agrees not to remove Figure G-4 and WG-5 amended the end of the first paragraph of section G.4 as follows:<br>"In early assessments of air-air surveillance performance, the aircraft population of interest was limited in elevation relative to the own aircraft in order to eliminate from consideration targets that were of no operational interest (see Figure G-4). However, this limitation of the aircraft population of interest was not used in the performance assessment reported in Appendix K because an alternate method of using "probes" was employed as described in Appendix K."<br>**Done** |
| 4 | JHU-APL | G.4 | G-8 | Table G-2 formatting inconsistent | a) Center and de-italicize "All currently planned 979 Assignments" in DME row, first column<br>b) Add MHz to all 978 & 979 text in DME row<br>c) Center text vertically in DME row<br><br>**WG-5 Response:** Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 5 | JHU-APL | K.4.5 | K-76 | Section K.4.5 results and conclusions do not correspond to requirements on surface | Replace text after first three paragraphs of K.4.5 with attached document "surface.doc", which updates Figures 110-125 and conclusions<br><br>**WG-5 Response:** Attached document inserted with summary having been modified from the original.<br>**Done** |
| 6 | JHU-APL | K.4.6 (addition to current K.4) | ? | In accordance with Table G-6, Overview of Scenario Assessments, no results for an A0 receiver on the surface receiving aircraft on approach at 2000' altitude are shown | a) Insert a new section K.4.6 with attached document "A0 on Ground.doc"<br>b) Change name of current Figure K-126 to Figure K-128 to reflect new inserted section<br>c) Add the following sentence at the end of the 4th paragraph of K.1.1: "Section K.4.6 presents the results for a A0 receiver on the surface receiving aircraft on approach."<br>d) Delete the 2nd paragraph under paragraph K.4.5<br><br>**WG-5 Response:** Attached document inserted having been modified from the original.<br>**Done** |
| 7 | JHU-APL | K.4.2 | K-36 | **EDITORIAL**: Number of aircraft on ground unclear | Change wording of third sub-bullet at top of page to "There are 25 aircraft on the ground within 5 NM radius of each TMA. Additionally, there are 25 aircraft not associated with a TMA randomly distributed through the scenario."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 8 | JHU-APL | K.4.1 | K-19 | **EDITORIAL/TECHNICAL**: A0 is only equipage listed with altitude restrictions | Change 1st sentence in 6th main bullet to "ADS-B MASPS equipage class A0 (and A1L as defined in 2.1.11) are restricted to fly below 18000 feet.<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 9 | JHU-APL | K.4.1 | K-34 | **TECHNICAL**: Ground vehicles in scenario incorrectly reported | Change first sentence on page K-34 to "Recall that the LA 2020 scenario includes 2694 aircraft and 300 ground vehicles transmitting on UAT."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 10 | JHU-APL | K.4.2.1 | K-36<br>K-37<br>K-60 | **EDITORIAL**: Incorrect cross-references | References are made to K.3.3 describing current/future European scenarios. Replace reference location to K.4.2<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 11 | JHU-APL | K.4.2 | K-35 | **EDITORIAL**: Typo | Change Mhz to MHz in last sentence of second paragraph of K.4.2<br><br>**WG-5 Response:** Editorial – Agreed – same as Warren Wilson comment #20<br>**Done** |
| 12 | JHU-APL | I.5 | I-6 | **EDITORIAL**: Typo | "microseconds" is spelled incorrectly in parentheses in 2nd paragraph of TOMR section of I.5<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 13 | JHU-APL | O | O-16 | **EDITORIAL**: Figure O-16 describes performance in ADS-B portion of UAT Frame | Add "in the ADS-B segment of the UAT Frame" to the end of the sentence in first paragraph on O-16 that reads: "Figure O-16 depicts the incremental change in interference that would be experienced by a DME receiver by the combined effect of UAT and JTIDS when compared to UAT interference alone."<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 1 | Tom Wright | 2.2.8.2.4 | 75 | The electromagnetic environment of UAT will include MIDS/JTIDS, TACAN/DME, and other UAT signals. The draft UAT MOPS specifies the required performance of UAT for TACAN/DME, and UAT signals but does not specifically address the performance with MIDS/JTIDS. | Insert the following text prior to the period at the end of the 2nd sentence in 2.2.8.2.4: "and other L-Band systems operating at levels specified in Appendix G (Table G-2) for the Standard Interference Environment."<br><br><u>Recommended Procedure to determine an equivalent TACAN/DME signal level and pulse rate to approximate the effect of MIDS/JTIDS</u> |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| | | | | It is suggested that MIDS/JTIDS be listed in the MOPS as a co-existing system with which UAT must operate. | the effect of MIDS/JTIDS<br><br>After a study of the Pre-MOPS test data, it appears that additional information would be required to estimate an equivalent TACAN/DME environment (i.e., signal level and pulse rate) that would approximate the effects of MIDS/JTIDS signals.<br><br>It is suggested that two data sets are necessary to identify the appropriate TACAN/DME signal to be used in the MOPS. One data set should contain the simultaneous presence of both MIDS/JTIDS and TACAN/DME signals and the other should include only TACAN/DME signals.<br><br>It is suggested that the data set containing the simultaneous presence of both MIDS/JTIDS and TACAN/DME signals be used by the MOPS working group to define the TACAN/DME signal environment for On Tune, + 1MHz and + 2 MHz UAT performance.<br><br>Then it is suggested that data from the NON-MIDS/JTIDS tests be used to identify the TACAN/DME environment for specifying receiver tolerance to pulsed interference. The NON-MIDS/JTIDS data set would differ from the standard TACAN/DME environment by employing an increased PRF or signal level to allow manufacturers to simulate the additional effect on message success rate due to the presence of MIDS/JTIDS signals.<br><br>**WG-5 Response: After discussion, WG-5 agreed to modify the first paragraph of 2.2.8.2.4 as follows:**<br><br>"The receiver **shall** be capable of receiving messages in the presence of interference from on channel and off channel sources of pulsed interference, such as TACAN/DME and JTIDS/MIDS. Informative Appendix G indicates, in Table G-2, the levels and pulse density of interference scenarios, against which UAT has been designed to operate effectively, as reported in Appendix K. The UAT receiver must also be tolerant of pulsed interference from other L-Band systems |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| | | | | | operating and located on the aircraft. These may include 1030 MHz ATCRBS/Mode S interrogation signals from on-board TCAS and 1090 MHz ATCRBS/Mode S reply signals from on-board ATCRBS/Mode S Transponders.<br><br>The UAT receiver may experience pulsed interference from TACAN/DME channels operating in the internationally allocated 978 MHz to 1215 MHz frequency range. The receiver **shall** be tolerant to pulsed interference from TACAN/DME. The receiver **shall** meet the reception probability dictated under the following conditions:"<br><br>**Done** |
| 1 | UPS AT<br>S Horvath | 1.3 | 8 | Since Payload type codes 11-29 are not considered defined ADS-B messages, and they do not have SV defined for them, these payload types cannot be used in the future for ADS-B messages. Was this the intention? This is a large number of payload types to reserve for future non-ADS-B use. | Reconsider the large number of payload types that are being reserved for future non-ADS-B usage.<br><br>**WG-5 Response:** After discussion and review, WG-5 agreed to leave the draft UAT MOPS as submitted.<br><br>**No Document Change** |
| 2 | UPS AT<br>T Mosher | Table 2-1<br>Note 3 | 15 | First sentence of Note 3 is confusing. | Modify as follows:<br>"…not required <u>if installation</u> does not degrade…" becomes<br>"…not required <u>if use of a single antenna</u> does not degrade…"<br><br>**WG-5 Response:** Agreed<br><br>**Done** |
| 3 | UPS AT<br>S Horvath | 2.2.3.2.2.1.1 &<br>...2 | 23 | Is there any requirement on the accuracy of the Ground station Lat. & Long? Since future TIS-B ranging checks might use this data, if the GS Lat & Long are off, the airborne ranging checks could fail. It shouldn't be too hard to force these values to be highly accurate, since the Ground station is probably stationary and relatively easy to locate. | Clarify minimum requirement for Ground Station Lat & Long accuracy.<br><br>**WG-5 Response:** Agreed and have clarified via adding Notes to both paragraphs<br><br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 4 | UPS AT<br>S Horvath | 2.2.3.2.2.1.8 | 24 | 15 codes are assigned to TIS-B Site ID field. The draft TIS-B MASPS doesn't indicate the range of possible TIS-B service identification (reqmt 3.2-18) Will 15 codes be adequate for this field? | Consult with WG2 to obtain clarified requirement from TIS-B MASPS.<br><br>**WG-5 Response:** Agreed – added to the note after Table 2.2.3.2.2.1.8.<br>**Done** |
| 5 | UPS AT<br>T Mosher | Table<br>2.2.4.5.1.2 | 29 | Text of Address Type descriptions are inconsistent. "Ownship" is misleading in this context. | Modify descriptions as follows:<br>0 = ADS-B Target with ICAO 24-bit address<br>1 = ADS-B Target with self-assigned temporary address<br>2 = TIS-B Target with ICAO 24-bit address<br>3 = TIS-B Target with track file identifier<br>(4 through 7 are OK as-is.)<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 6 | UPS AT<br>S Horvath | 2.2.4.5.1.3.2 | 30 | Is there any need to check & verify that 2 ADDRt temporary addresses are really 2 different a/c? I.e. Or, is it such a remote probability that this MOPs does not require extra checking. | Clarify or explain reasoning why this algorithm works well enough that the airborne equipment does not need to verify ADDRt addresses are not duplicate addresses from 2 different aircraft.<br><br>**WG-5 Response:** Agreed – clarified by adding a note at the end of 2.2.4.5.1.3.2.<br>**Done** |
| 7 | UPS AT<br>S Horvath | 2.2.4.5.2.1 | 32 | Since South pole and North pole have the exact same encoding, I'm assuming you intend users to determine the hidden most significant bit from using ownship latitude. | Clarify that MSB for latitude is determined by ownship latitude.<br><br>**WG-5 Response:** Agreed – added to the 1st note after Table 2.2.4.5.2.1.<br>**Done** |
| 8 | UPS AT<br>T Mosher | 2.2.4.5.2.3 | 34 | Is it permissible for surface vehicles (i.e. ADDR QUAL = 4) to transmit "Altitude information unavailable" as the normal operating condition? Or are surface vehicles intended to transmit at least their geometric altitude at all times? | Provide additional guidance. Refer to DO-242A if necessary. Modify Note 3 to Table 2.2.4.5.2.5.1 if necessary.<br><br>**WG-5 Response:** It is permissible, and no change to the MOPS is required.<br>**No Document Change** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 9 | UPS AT<br>T Mosher | 2.2.4.5.2.5 | 36 | Draft TIS-B MASPS §3.2.1.2 states that the A/G state is only provided in a TIS-B Target Report if it is available. This implies that the UAT A/G state will need to include a value for "unknown". | Change the definition of A/G State value = 3 from "Reserved" to "Unknown".<br><br>**WG-5 Response:** Reserved A/G State "3" for TIS-B Uplink Messages<br>**Done** |
| 10 | UPS AT<br>S Horvath | 2.2.4.5.2.5.1 b. | 36,37 | The conditions in the table could result in airborne aircraft providing an on ground indication.<br>Since the conditions are OR'd together, it might be possible to have a ground speed at <100 knots, while the air speed (the middle column?) is well over 100 knots due to a strong head wind. | I think the conditions in the table 2.2.4.5.2.5.1 should be AND'd together, when the data source is available.<br>This table is driven from DO-242A ADS-B MASPS, section 3.4.3.1.1 bullet 4., therefore it is really an issue with the ADS-B MASPS.<br><br>**WG-5 Response:** ADS-B MASPS Issue – WG-5 asks that WG-6 be asked to review this comment for DO-242B.<br>**ADS-B MASPS Referral** |
| 11 | UPS AT<br>S Horvath | 2.2.4.5.2.5.1 b.<br>& 2.2.4.5.2.5.2 | 37, 38 | Value of > 50 feet for radio altitude which overrides ON-GROUND condition is different from table on pg. 37, which states <100 feet would determine ON-GROUND condition. Therefore the table on pg. 37 is misleading, since you really need to be < 50 feet to prevent the override table from determining you are AIRBORNE. | Change tables to be compatible with each other, and re-address in ADS-B MASPS. Although DO-242A ADS-B MASPS says 100 feet, I think this value might be on the high side. Is it operationally OK, if an a/c has no weight-on-wheels (WOW) switch to consider them on the ground when they are floating to a touchdown, or doing a missed approach that dips below 100 feet AGL? This provides more reasons for AND'ing the conditions to determine if an aircraft without WOW switch is on the ground.<br><br>**WG-5 Response:** ADS-B MASPS Issue – WG-5 asks that WG-6 be asked to review this comment for DO-242B.<br>**ADS-B MASPS Referral** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 12 | UPS AT<br>James<br>Maynard | §2.2.4.5.2.7.2 | 44 | There is no description of the position offset that is to be applied when the "Position Offset Applied" bit is set to ONE. | Add a *Note* referring to §2.1.2.5 of DO-242A, the ADS-B MASPS, where a description of the ADS-B position reference point can be found.<br><br>**WG-5 Response:** Text added to the paragraph in 2.2.4.5.2.7.2 to clarify POA.<br>**Done** |
| 13 | UPS AT<br>S Horvath | 2.2.4.5.3.1 | 46 | Since a TIS-B site ID of 0000 defines a ground uplink site that does not have TIS-B service, then a state vector that is received with this field set to 0 should be discarded. | Add Note: that only non-zero TIS-B site Ids are valid, and are required to be non-zero to validate the state vector.<br><br>**WG-5 Response:** The ground station with a TIS-B Site ID of zero should not provide TIS-B messages. The application that uses TIS-B reports is an additional point where this can be checked. WG-5 added a 2nd note to 2.2.4.5.3.1 as follows: "*The application that uses TIS-B reports is assumed to make appropriate checks for a TIS-B Site ID of value ZERO.*"<br>**Done** |
| 14 | UPS AT<br>T Mosher | 2.2.4.5.4 | 46 | In reference to Chris Moody's comment #3, adding additional text for denoting the MSB and LSB is not feasible for some of the fields, due to space limitations in the table. | Add the following sentence below par. 1 of §2.2.4.5.4:<br>"When not specifically stated, the MSB of each field occupies the leftmost bit position, in Table 2.2.4.5.4 and in the subparagraphs that describe those fields."<br><br>**WG-5 Response:** WG-5 added a note below Table 2.2.4.5.4 indicating that "*In the above table, where MSB and LSB are not specifically noted, the MSB is the leftmost bit and the LSB is the rightmost bit.*"<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 15 | UPS AT<br>T Mosher | 2.2.4.5.6.1.5 | 59 | In the 2nd paragraph, the word "indication" doesn't seem the appropriate term for a target heading/track source. Also, if the subfield is not available, the "Target Source Indicator (Horizontal)" subfield should be set to the "0" encoding. | Modify text as follows:<br>"If this indication is present…" becomes<br>"If a source for this subfield is present…"<br>and to the end of the paragraph, add<br>", and the Target Source Indicator (Horizontal) shall be set to the "0" encoding."<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 16 | UPS AT<br>T Mosher | 2.2.4.5.6.2.4 | 61 | If the Target Altitude Capability subfield is not available, is defaulting to the ZEROS value the proper action ("altitude hold only")? | Elaborate<br><br>**WG-5 Response:** WG-5 agreed to switch the values in Table 2.2.4.5.6.2.4 for ZERO and THREE and adjust the test procedure appropriately.<br>**Done** |
| 17 | UPS AT<br>T Mosher | 2.2.4.5.6.2.5 | 61 | If the Target Altitude is unavailable for the Data Lifetime value, should it cause the Target Source Indicator (Vertical) to assume the "0" encoding? | Elaborate.<br><br>**WG-5 Response:** WG-5 agreed to add text to 2.2.4.5.6.2.5 so that the requirements would match the already correctly posted test procedures.<br>**Done** |
| 18 | UPS AT<br>T Mosher | 2.2.6.1.3 | 66 | Antenna selection cycle doesn't specifically address a one-antenna installation when Airborne. | Add the phrase "(if so equipped)" after the word "antennas" in the first sentence.<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 19 | UPS AT<br>T Mosher | 2.2.7.2.1 | 71 | Why is Velocity not listed in subparagraph a. as applying to the current 1 second UTC epoch? | Elaborate. Note 2 to this subparagraph does not seem to fully address the issue.<br><br>**WG-5 Response:** Agreed – WG-5 added to Note 2 in 2.2.7.2.1.<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 20 | UPS AT<br>S Horvath | 2.2.13.1 | 84 | Current requirement does not limit length of time that a test message can be transmitted. Since the Self test also allows this to occur at a rate of up to one self test broadcast every ten seconds, the maximum time length of the self-test broadcast should be specified to minimize potential system interference. | Determine reasonable test message length and specify maximum length of self test message.<br><br>**WG-5 Response:** Agreed – WG-5 modified subparagraph "c."<br>**Done** |
| 21 | UPS AT<br>T Mosher | 2.3.2.19 | 96 | The Note seems to make more sense if the word "Receiving" is replaced with "Transmitting". | Do so.<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 22 | UPS AT<br>T Mosher | 2.4.13.5.1 | 268 | Step 1 and 2 of the procedure calls for Transmitting Subsystem to send messages at rates that are faster or slower than the requirements. Creating a test mode that deliberately causes a violation of a requirement is troubling. Test procedure does not cover requirements for monitoring function, or momentary power interruption. Address verification is tested in a different procedure, but no reference is made to it. | • Remove requirement for testing at faster rate.<br>• Insert the following text:<br>"Address validation is performed in §2.4.4.5.1.3.1."<br><br>• A test procedure to verify no failure annunciations during a momentary power interruption can be easily added to the existing procedure in §2.4.16.1 and .2.<br><br>**WG-5 Response:** Agreed – WG-5 made changes to the test procedures in 2.4.13.5.1<br>**Done** |
| 23 | UPS AT<br>T Mosher | App. B | B-24 | Verify whether Final DO-242A R3.65 is quoted correctly (NACp = 10, vs. = 9 ?).<br>This MASPS requirement addresses resolution, not update time, so the existing note in the Compliance column is not appropriate.<br>The most stringent VEPU requirement in MASPS Table 2-3 is 4 meters. Since VEPU is a 2-sigma measurement (95%), an altitude resolution of 4 meters / 2 * SQRT(12) = 6.9 meters = 22.7 feet would be required. The UAT MOPS supports 25 foot resolution. | 1. Delete the existing Compliance/Note.<br>2. Add the following note:<br>"25 foot altitude resolution yields a 2-sigma value of 4.4 meters. This exceeds the VEPU requirement of < 4 meters for NACp = 11".<br><br>**WG-5 Response:** WG-5 agrees to add the note 2 to the Compliance Notes for Requirement R3.65.<br><br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 24 | UPS AT<br>T Mosher | General<br>Comment | | Draft TIS-B MASPS defines requirements for Service Status messages. UAT MOPS does not presently define a method for supporting these Uplink messages. Uplink Message capability must be partitioned so that multiple uplink services can be supported. | Address this issue in MOPS Rev A. Create an Issue Papers archive to track this issue and others as they arise. See UAT-WP-14-01 for one method of partitioning of uplink services.<br><br>**WG-5 Response:** WG-5 agrees that it should develop an "Issues Archive" to facilitate, when appropriate, a revision to this document, particularly in the light of developments in TIS-B, FIS-B, and other ADS-B standards. This will be tracked by maintaining the "UAT-Orphans" file used during the development of the UAT MOPS.<br>**Done** |
| 25 | UPS AT<br>S Horvath | 1.4.1 | 9 | Editorial: Did you mean "plan-view" rather than "plain-view"? | Change to "plan view."<br><br>**WG-5 Response:** Agreed – changed<br>**Done** |
| 26 | UPS AT<br>T Mosher | 2.1.11 | 14 | Editorial: Verify that text of paragraph 4 (regarding Class 'B' equipment) is consistent with final wording of DO-242A. | Review DO-242A final text for consistency.<br><br>**WG-5 Response:** It is consistent.<br>**No action required.** |
| 27 | UPS AT<br>T Mosher | Table 2-1 | 15 | Editorial: Table references "Fixed Obstructions", but text refers to "fixed or moveable". | Delete the word "Fixed" from the table text, so the row is labeled simply "Obstructions".<br><br>**WG-5 Response:** WG-5 agrees that the proper change is to change the word "Obstructions" to "Obstacle" in Table 2-1.<br>**Done** |
| 28 | UPS AT<br>T Mosher | 2.2.3.1.3.1 | 21 | Editorial: Subparagraphs a. and b. should have similar descriptions. | In subparagraph b, change "This" to "Parity".<br><br>**WG-5 Response:** Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 29 | UPS AT<br>S Horvath | 2.2.3.2.1 | 22 | Editorial: Add phrase "used for ground uplink messages" following 'sequence', so the sentence clearly states what is used for rather than the opposite of use for ADS-B. Corrected sentence (with added phrase underlined) would read:<br>"The polarity of the bits of the synchronization sequence used for ground uplink messages is inverted from that used for the ADS-B message, that is the ONEs and ZEROs are interchanged." | Add suggested phrase to clarify.<br><br>**WG-5 Response:** Agreed<br><br>**Done** |
| 30 | UPS AT<br>T Mosher | Table 2.2.4.2 | 27 | Editorial: In the AUX SV row of the table, the phrase "Air Reference Vector" in column 3 is in error. | Modify the term "Air Reference Vector" to read "Air Reference Velocity".<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 31 | UPS AT<br>T Mosher | 2.2.4.5.1.2<br>2.2.4.5.1.3.2 | 28<br>29 | Editorial: There is no stated requirement for the ADS-B Transmitting Subsystem to utilize the Address Selection Input in determining the values for the ADDRESS and ADDRESS QUALIFIER fields, although the appropriate Test Procedures specifically use the Address Selection Input. | Resolve whether an additional requirement needs to be inserted.<br><br>**WG-5 Response:** Agreed – WG-5 has amended the requirement in 2.2.4.5.1.2 to clarify the use of the Address Selection Input, in conformance with the already correct Test Procedure.<br>**Done** |
| 32 | UPS AT<br>T Mosher | 2.2.4.5.1.3 | 29 | Editorial: In first sentence, the description of the use of ADDRESS and ADDRESS QUALIFIER fields is incomplete. | Replace the following text:<br>"… to provide a convenient way to correlate various ADS-B Messages from the same A/V."<br>with<br>"…to identify the participant."<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 33 | UPS AT<br>T Mosher | 2.2.4.5.1.3.1<br>2.2.4.5.1.3.2 | 29 | Editorial: In the first sentence, "…from an aircraft" is incorrect, as the message could be from any participant.<br>In the second paragraph, all three words "Address selection input" should be capitalized. | Delete the phrase "from an aircraft" (two places). Capitalize the words "Selection" and "Input".<br><br>**WG-5 Response:** After discussion, WG-5 agrees to leave "from an aircraft" in both places, and agrees to capitalize Address Selection Input.<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 34 | UPS AT<br>T Mosher | 2.2.4.5.1.3.3<br>2.2.4.5.1.3.4 | 30 | Editorial: Word "transmission" as used is confusing in the context of a received TIS-B message (two places). | Replace text in both subparagraphs;<br>"…is a TIS-B transmission…" with<br>"…is from a TIS-B Target…"<br><br>**WG-5 Response:** Agreed, except that it is "for a TIS-B target."<br>**Done** |
| 35 | UPS AT<br>T Mosher | Figure<br>2.2.4.5.2.1 | 33 | Editorial: Latitude Encoding graphic is confusing. Latitudes are not generally considered to have "quadrants". | Replace labels for 1st and 2nd quadrants with "N. Hemisphere". Replace labels for 3rd and 4th quadrants with "S Hemisphere".<br><br>**WG-5 Response:** Comment withdrawn |
| 36 | UPS AT<br>T Mosher | Tables<br>2.2.4.5.2.5.1<br>2.2.4.5.2.5.2 | 37<br>38 | Editorial: The column labeled "speed" should refer to "airspeed", per DO-242A. | Change "speed" to "airspeed".<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 37 | UPS AT<br>S Horvath | 2.2.4.5.2.5.1<br>Notes 2. | 37 | Editorial: I believe that the word 'an' was intended in the 2nd note, so the sentence would read: "Because of the unique operational capabilities of "Lighter-than-Air" vehicles, i.e. balloons, an operational "Lighter-than-Air vehicle will always report AIRBORNE . . ." | Replace 'and' with 'an'<br><br>**WG-5 Response:** Agreed, and the previous i.e, was changed to e.g.<br>**Done** |
| 38 | UPS AT<br>T Mosher | 2.2.4.5.2.7.1.3 | 43<br>44 | Editorial: In Notes 1 and 3, the terms "Vertical Rate Sign Bit" and "sign" are used. The defined name of this field is "VV Sign Subfield". | Replace these terms.<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 39 | UPS AT<br>T Mosher | 2.2.4.5.8 | 62 | Editorial: The range of reserved bits for the TC element is not identified. | Add "(bytes 18 through 29)" to the description of the 96 reserved bits.<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 40 | UPS AT<br>T Mosher | 2.2.8.1 | 73 | Editorial: The subparagraphs a. and c. of the text are describing the subsections a. and b. of Figure 2.2.8.1. This is a little confusing. | Modify subparagraph b. into a Note, so that subparagraph c. becomes the new b. and matches the graphics in the figure.<br><br>**WG-5 Response:** WG-5 clarified subparagraph b.<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 41 | UPS AT<br>T Mosher | 2.2.8.2.4 | 76 | Editorial: Clarify that subparagraph d. applies to all equipment classes. | Add text "For all equipment classes:" similarly as for subparagraph a.<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 42 | UPS AT<br>T Mosher | 2.2.13.5.1<br>2.2.13.5.2 | 84 | Editorial: "enunciated" should be "annunciated". | Make the change (2 places).<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 43 | UPS AT<br>T Mosher | Appendix A | | Editorial: "Trigger" is not defined in the glossary. | Add to glossary:<br>Trigger: Detection of ADS-B or Ground Uplink synchronization sequence.<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 1 | FAATC<br>ACB-410 | 2.2.2.3 | 18 | Note 1 refers to the wrong paragraph number. | Change the reference from 2.2.2.5 to 2.2.2.6<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 2 | FAATC<br>ACB-410 | 2.2.3.2.2.1.4 | 24 | The field name is incorrect in the title and in the first sentence. | Change title to "UTC Coupled" Field Encoding.<br>Change beginning of the first sentence from "The "UTC" field" to "The "UTC Coupled" field".<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 3 | FAATC<br>ACB-410 | 2.2.4.5.2.1 | 32 | A Data Lifetime requirement needs to be included in this section in order to make it consistent with other sections of this document, which already have the requirement included. | Add the following paragraph prior to Table 2.2.4.5.2.1:<br>"If either the Latitude or the Longitude Input is "unavailable" for the "Data Lifetime" value listed for this input in Table 2.2.7.1, then the LATITUDE, LONGITUDE and NIC fields **shall** default to a value of ALL ZEROs."<br><br>**WG-5 Response:** Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 4 | FAATC ACB-410 | 2.2.4.5.2.2 | 34 | A Data Lifetime requirement needs to be included in this section in order to make it consistent with other sections of this document, which already have the requirement included. | Add the following paragraph after the last paragraph and just prior to the Note:<br>"If the Altitude Input is "unavailable" for the "Data Lifetime" value listed for this input in Table 2.2.7.1, then that Altitude **shall** be deemed unavailable for the purposes of encoding the "Altitude Type" Field."<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 5 | FAATC ACB-410 | 2.2.4.5.2.6.1 | 39 | A Data Lifetime requirement needs to be included in this section in order to make it consistent with other sections of this document, which already have the requirement included. | Add the following paragraph after the Notes and before §2.2.4.5.2.6.2:<br>"If the North Velocity Magnitude Input is "unavailable" for the "Data Lifetime" value listed for this input in Table 2.2.7.1, then the "North Velocity Magnitude" subfield **shall** default to a value of ALL ZEROs."<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 6 | FAATC ACB-410 | 2.2.4.5.2.6.2 | 40 | A Data Lifetime requirement needs to be included in this section in order to make it consistent with other sections of this document, which already have the requirement included. | Add the following paragraph after the Note and before §2.2.4.5.2.6.3:<br>"If the Ground Speed Input is "unavailable" for the "Data Lifetime" value listed for this input in Table 2.2.7.1, then the "Ground Speed" subfield **shall** default to a value of ALL ZEROs."<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 7 | FAATC ACB-410 | 2.2.4.5.2.6.3 | 41 | A Data Lifetime requirement needs to be included in this section in order to make it consistent with other sections of this document, which already have the requirement included. | Add the following paragraph after the Notes and before §2.2.4.5.2.6.4:<br>"If the East Velocity Magnitude Input is "unavailable" for the "Data Lifetime" value listed for this input in Table 2.2.7.1, then the "East Velocity Magnitude" subfield **shall** default to a value of ALL ZEROs."<br><br>**WG-5 Response:** Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 8 | FAATC ACB-410 | 2.2.4.5.2.6.4 | 42 | A Data Lifetime requirement needs to be included in this section in order to make it consistent with other sections of this document, which already have the requirement included. | Add the following paragraph after the Note and before §2.2.4.5.2.7:<br>"If either the Track Angle/Heading Type or the Track Angle/Heading Inputs are "unavailable" for the "Data Lifetime" value listed for these inputs in Table 2.2.7.1, then the "Track Angle/Heading Type" and the "Track Angle/Heading" subfields **shall** default to values of ALL ZEROs."<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 9 | FAATC ACB-410 | 2.2.4.5.2.7.1.3 | 44 | A Data Lifetime requirement needs to be included in this section in order to make it consistent with other sections of this document, which already have the requirement included. | Add the following paragraph after the Notes and before §2.2.4.5.2.7.2:<br>"If the Vertical Rate Input is "unavailable" for the "Data Lifetime" value listed for this input in Table 2.2.7.1, then the "Vertical Rate" subfield **shall** default to a value of ALL ZEROs."<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 10 | FAATC ACB-410 | 2.2.4.5.6.1.2 | 58 | A Data Lifetime requirement needs to be included in this section in order to make it consistent with other sections of this document, which already have the requirement included. | Add the following paragraph after Table 2.2.4.5.6.1.2 and before §2.2.4.5.6.1.3:<br>"If the Target Source Indicator (Horizontal) Input is "unavailable" for the "Data Lifetime" value listed for this input in Table 2.2.7.1, then the "Target Source Indicator (Horizontal)" subfield **shall** default to a value of ALL ZEROs."<br><br>**WG-5 Response:** Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 11 | FAATC ACB-410 | 2.2.4.5.6.2.2 | 60 | A Data Lifetime requirement needs to be included in this section in order to make it consistent with other sections of this document, which already have the requirement included. | Add the following paragraph after Table 2.2.4.5.6.2.2 and before §2.2.4.5.6.2.3:<br>"If the Target Source Indicator (Vertical) Input is "unavailable" for the "Data Lifetime" value listed for this input in Table 2.2.7.1, then the "Target Source Indicator (Vertical)" subfield **shall** default to a value of ALL ZEROs."<br><br>**WG-5 Response:** Agreed<br>**Done** |
| 12 | FAATC ACB-410 | Table 2.2.7.1 | 70 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #32 from: 2.2.4.5.6.1.2 to 2.2.4.5.6.1.1<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 13 | FAATC ACB-410 | Table 2.2.7.1 | 70 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #33 from: 2.2.4.5.6.1.4 to 2.2.4.5.6.1.2<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 14 | FAATC ACB-410 | Table 2.2.7.1 | 70 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #34 from: 2.2.4.5.6.1.5 to 2.2.4.5.6.1.3<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 15 | FAATC ACB-410 | Table 2.2.7.1 | 70 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #35 from: 2.2.4.5.6.1.7 to 2.2.4.5.6.1.5<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 16 | FAATC ACB-410 | Table 2.2.7.1 | 70 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #36 from: 2.2.4.5.6.2.2 to 2.2.4.5.6.2.1<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 17 | FAATC ACB-410 | Table 2.2.7.1 | 70 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #37 from: 2.2.4.5.6.2.4 to 2.2.4.5.6.2.2<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 18 | FAATC ACB-410 | Table 2.2.7.1 | 70 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #38 from: 2.2.4.5.6.2.5 to 2.2.4.5.6.2.3<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 19 | FAATC ACB-410 | Table 2.2.7.1 | 70 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #39 from: 2.2.4.5.6.2.6 to 2.2.4.5.6.2.4<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 20 | FAATC ACB-410 | Table 2.2.7.1 | 70 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #40 from: 2.2.4.5.6.2.7 to 2.2.4.5.6.2.5<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 21 | FAATC ACB-410 | Table 2.4.7.1 | 203 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #32 from: 2.4.4.5.6.1.2 to 2.4.4.5.6.1.1<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 22 | FAATC ACB-410 | Table 2.4.7.1 | 203 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #33 from: 2.4.4.5.6.1.4 to 2.4.4.5.6.1.2<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 23 | FAATC ACB-410 | Table 2.4.7.1 | 203 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #34 from: 2.4.4.5.6.1.5 to 2.4.4.5.6.1.3<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 24 | FAATC ACB-410 | Table 2.4.7.1 | 203 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #35 from: 2.4.4.5.6.1.7 to 2.4.4.5.6.1.5<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 25 | FAATC ACB-410 | Table 2.4.7.1 | 203 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #36 from: 2.4.4.5.6.2.2 to 2.4.4.5.6.2.1<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 26 | FAATC ACB-410 | Table 2.4.7.1 | 203 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #37 from: 2.4.4.5.6.2.4 to 2.4.4.5.6.2.2<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 27 | FAATC ACB-410 | Table 2.4.7.1 | 203 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #38 from: 2.4.4.5.6.2.5 to 2.4.4.5.6.2.3<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 28 | FAATC ACB-410 | Table 2.4.7.1 | 203 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #39 from: 2.4.4.5.6.2.6 to 2.4.4.5.6.2.4<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 29 | FAATC ACB-410 | Table 2.4.7.1 | 203 | The Relevant Paragraph listing needs to be corrected here. | Change the listing for Element #40 from: 2.4.4.5.6.2.7 to 2.4.4.5.6.2.5<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 30 | FAATC ACB-410 | 2.2.10.1 | 81 | The Note in list element “b” has inappropriate wording for MOPS. | Change the first sentence of the Note to the following: “It is important to note that the specification of requirements within this document describes the Report Assembly Function to the point where the Reports are structured and delivered to the Report Output Storage Buffer.”<br><br>**WG-5 Response:** Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 31 | FAATC ACB-410 | 2.4.2.5 | 103 | The letters heading the bullets need to be corrected here. | Change the letters 'g' through 'l' to 'a' through 'f'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 32 | FAATC ACB-410 | 2.4.3.1.3.1 | 108 | The letters heading the bullets need to be corrected here. | Change the letters 'c' through 'd' to 'a' through 'b'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 33 | FAATC ACB-410 | 2.4.4.5.1.3.2 | 119 | The letters heading the bullets need to be corrected here. | Change the letters 'c' through 'd' to 'a' through 'b'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 34 | FAATC ACB-410 | 2.4.4.5.2.1 | 121 | The letters heading the bullets need to be corrected here. | Change the *italics 'a'* to a standard 'a'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 35 | FAATC ACB-410 | 2.4.4.5.2.5 | 131 | The numbers heading the bullets need to be corrected here. | Change the '3' and the '4' to a '1' and a '2'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 36 | FAATC ACB-410 | 2.4.4.5.2.5.1 | 133 | The letters heading the bullets need to be corrected here. | Change the letters 'b' through 'c' to 'a' through 'b'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 37 | FAATC ACB-410 | 2.4.4.5.2.7.1.1 | 156 | The letters heading the bullets need to be corrected here. | Change the letters 'c' through 'd' to 'a' through 'b'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 38 | FAATC ACB-410 | 2.4.5.2 | 192 | The numbers and the letters heading the bullets need to be corrected here. | Change the letters 'g' through 'l' to 'a' through 'f' and change the numbers '5' through '8' to '1' through '4'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 39 | FAATC ACB-410 | 2.4.6.2.1 | 197 | The numbers heading the bullets need to be corrected here. | Change the '3' and the '4' to a '1' and a '2'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 40 | FAATC ACB-410 | 2.4.6.2.2 | 200 | The numbers and the letters heading the bullets need to be corrected here. | Change the letters 'c' through 'd' to 'a' through 'b' and change the numbers '4' through '6' to '1' through '3'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 41 | FAATC ACB-410 | 2.4.6.3 | 201 | The numbers heading the bullets need to be corrected here. | Change the '3' and the '4' to a '1' and a '2'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 42 | FAATC ACB-410 | 2.4.7.2.1.1 | 204 | The numbers and the letters heading the bullets need to be corrected here. | Change the letters 'c' through 'd' to 'a' through 'b' and change the numbers '3' through '4' to '1' through '2'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 43 | FAATC ACB-410 | 2.4.7.2.2.1 | 208 | The numbers and the letters heading the bullets need to be corrected here. | Change the letters 'c' through 'd' to 'a' through 'b' and change the numbers '3' through '4' to '1' through '2'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 44 | FAATC ACB-410 | 2.4.7.2.3 | 211 | The letters heading the bullets need to be corrected here. | Change the letters 'c' through 'd' to 'a' through 'b'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 45 | FAATC ACB-410 | 2.4.8.1.2 | 214 | The numbers and the letters heading the bullets need to be corrected here. | Change the letters 'c' to 'a' and change the numbers '5' through '8' to '1' through '4'<br><br>**WG-5 Response:** Editorial – Agreed on the 5 through 8, but the "c" should stay since this is identical to the same requirement paragraph in 2.2.8.1.2.<br>**Done** |
| 46 | FAATC ACB-410 | 2.4.8.2.1.1 | 217 | The letters heading the bullets need to be corrected here. | Change the letters 'c' through 'd' to 'a' through 'b'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 47 | FAATC ACB-410 | 2.4.8.2.1.2 | 218 | The letters heading the bullets need to be corrected here. | Change the letters 'c' through 'd' to 'a' through 'b'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 48 | FAATC ACB-410 | 2.4.8.2.2 | 220 | The numbers heading the bullets need to be corrected here. | Change the *italics '1'* to a standard '1'<br><br>**WG-5 Response:** Editorial – Actually the *italics 1* is correct. The "2" needs to also be *italics* since it is in a Note.<br>**Done** |
| 49 | FAATC ACB-410 | 2.4.8.2.4 | 226 | The letters heading the bullets need to be corrected here. | Change the first letter 'b' to an 'a'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 50 | FAATC ACB-410 | 2.4.8.2.5 | 231 | The numbers heading the bullets need to be corrected here. | Change the '3' and the '4' to a '1' and a '2'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 51 | FAATC ACB-410 | 2.4.8.2.5 | 232 | The numbers heading the bullets need to be corrected here. | Change the '1' and the '2' to a '3' and a '4'<br><br>**WG-5 Response:** WG-5 decided that both sets of bullets should be numbered 1 and 2.<br>**No Document Change** |
| 52 | FAATC ACB-410 | 2.4.8.3.1.1 | 233 | The numbers and the letters heading the bullets need to be corrected here. | Change the letters 'd' through 'f' to 'a' through 'c' and change the numbers '3' through '4' to '1' through '2'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 53 | FAATC ACB-410 | 2.4.8.3.1.2 | 242 | The letters heading the bullets need to be corrected here. | Change the letters 'c' through 'd' to 'a' through 'b'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 54 | FAATC ACB-410 | 2.4.8.3.3 | 253 | The letters heading the bullets need to be corrected here. | Change the letters 'd' through 'f' to 'a' through 'c'<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 55 | FAATC ACB-410 | 2.4.8.3.4 | 256 | The numbers and the letters heading the bullets need to be corrected here. | Change the letters ‘c’ through ‘d’ to ‘a’ through ‘b’ and change the numbers ‘4’ through ‘6’ to ‘1’ through ‘3’<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 56 | FAATC ACB-410 | 2.4.8.3.5 | 258 | The numbers and the letters heading the bullets need to be corrected here. | Change the letters ‘d’ through ‘h’ to ‘a’ through ‘d’ and change the numbers ‘4’ through ‘6’ to ‘1’ through ‘3’<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 57 | FAATC ACB-410 | 2.4.9.1 | 259 | The letters heading the bullets need to be corrected here. | Change the letters ‘c’ through ‘d’ to ‘a’ through ‘b’<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 58 | FAATC ACB-410 | 2.4.9.2 | 260 | The letters heading the bullets need to be corrected here. | Change the letters ‘d’ through ‘e’ to ‘a’ through ‘b’<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 59 | FAATC ACB-410 | 2.4.10.3 | 262 | The numbers and the letters heading the bullets need to be corrected here. | Change the letters ‘c’ through ‘d’ to ‘a’ through ‘b’ and change the numbers ‘3’ through ‘4’ to ‘1’ through ‘2’ both in bullet ‘a’ and in bullet ‘b’<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |
| 60 | FAATC ACB-410 | Appendix G | G-3 | The word ‘use’ at end of the forth sentence of G.2 in incorrect. | Change the word ‘use’ to ‘usage’<br><br>**WG-5 Response:** Editorial – Agreed<br>**Done** |

| # | Author | Section | Page | Comment | Suggested Resolution |
|---|---|---|---|---|---|
| 1 | Steve Creamer, ATC Alaska Region | UAT MOPS | -- | In order to foster implementation of ADS-B with the existing ground ATC infrastructure, a means needs to be provided to communicate in ADS-B Messages a unique identification to correlate with a specific Flight Plan. Today this communication is effected through use of the ATC-assigned 4096 code. | **WG-5 Response:** In section 2.2.4.5.4, page 47, Table 2.2.4.5.4, reserve byte 27, bit 7 of the Mode Status Element for "Call Sign ID." Rename section 2.2.4.5.4.15 to "Call Sign ID" and bump the paragraph for "Reserved Bits up to 2.2.4.5.4.16. In Section 2.2.4.5.4.15 have MOPS compliant units set the value to ONE (1). Create section 2.4 paragraphs for the revised 2.2 paragraphs and create a test procedure.<br>**Done**<br><br>It is intended to use this bit to implement, initially in Alaska, an alternation of Call Sign and ATC-assigned 4096 code to facilitate compatibility of ADS-B with existing ATC ground infrastructure programs. In parallel, the impact of such alternation on acquisition probability will be studied and a Issue Paper for DO-242B will be submitted so that, presuming that acceptable ADS-B System performance is maintained, the Alaska implementation can be standardized in DO-242B. It must be noted that a related problem to that discussed in the comment, is currently being addressed in Europe (i.e., the use of both 4096 code and Flight ID for identification purposes).<br><br>**ADS-B MASPS Referral** |

# Proposed Addendum to Appendix M

**Prepared by**

**Warren J. Wilson, The MITRE Corp.**

**31 May 2002**

---

Instructions:

Insert this material at the end of the text of the current version of Appendix M, but before the reference.

---

Up to this point the discussion has dealt with the performance of the RS codes in the presence of noise that generates random bit errors. However, in addition to protecting against errors created by stationary and nonstationary interference (see Appendix K), the RS codes are also used as the sole means to differentiate between Long and Basic ADS-B messages. It is of interest to investigate the performance of this identification process.

In order to analyze this issue, it is useful to have a clear picture of the ADS-B reception process as defined in this document. The logical flow of the process is as shown in Figure M-6.

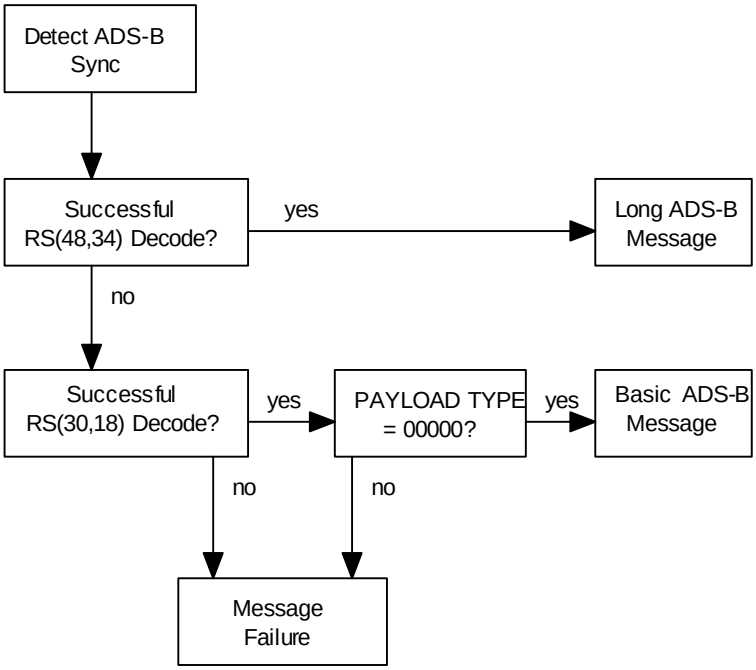


Figure M-6: Logical Flow of ADS-B Reception

After each successful detection of an ADS-B synchronization pattern, the receiver will first check if the RS(48,34) decoding process is successful. If so, the receiver will determine that a Long ADS-B message was actually sent. However, if this decoding process fails, the receiver will check if the RS(30,18) decoding process is successful. If it is, the message is a candidate Basic ADS-B message. As a final safeguard, the receiver will check if the 5 bits of the PAYLOAD TYPE field are all zeros. If this test is successful, the receiver will determine that a Basic ADS-B message was actually sent. If the PAYLOAD TYPE test fails or if the RS(30,18) decoding process fails, the entire message is discarded. (Note that this is a *logical* flow only. It is possible, for example, for the two RS decodes to be done in any time order.)

For this investigation there are two possible failure modes of interest. First, an actual Basic ADS-B message could be perceived as a Long ADS-B message. Second, a Long ADS-B message could be perceived as a Basic ADS-B message. These two will be discussed separately.

When a Basic message is received, it is first subjected to the RS(48,34) decoding process. The input to the decoder will be the 30 bytes of the Basic message (assumed to have no bit errors) plus 18 bytes of random data. Because the random part of the input to the decoder includes the entire parity check sequence, the probability of a successful decode is the same as the maximum undetected error rate reported in Table M-1, i.e., $9.95 \times 10^{-10}$. Thus, there is about one chance in one billion that a particular Basic message will appear to be a Long Message.

Note that in the case above a RS(30,18) decoding attempt would have been successful if carried out, since there are assumed to be no bit errors. However, the decoding rules give precedence to a successful Long ADS-B decision.

When a Long ADS-B message is received, it also is subjected initially to the RS(48,34) decoding process. If there are no bit errors, then the decoding will succeed, and the message will correctly be determined to be a Long ADS-B message. However, the process will not succeed if there are more than 7 incorrect bytes. In that case the decoder may (with probability no greater than $9.95 \times 10^{-10}$) produce an undetected error, i.e., it will produce a Long ADS-B message different from the one that was sent. It is far more likely that the decoder will fail to produce any result, and the RS(30,18) decoding process will be attempted next.

From the point of view of the RS(30,18) decoder, the first 30 bytes of the Long ADS-B message are equivalent to a random sequence of 240 bits, except that the first five bits (the location of the PAYLOAD TYPE field) are not 00000. Thus, the decoding process must change the first byte to include 00000 in order to succeed. The probability of this occurring is given by the following equation:

$$p = \frac{8}{256^{12}} \cdot \sum_{k=0}^{5} \binom{29}{k} 255^{k} = 1.29x10^{-11}.$$

Checking for the correct PAYLOAD TYPE lowers the false decode probability from $2.06 \times 10^{-9}$ to $1.29 \times 10^{-11}$.

During the development of UAT there was some concern that there might be an abnormally high probability of misinterpreting a Long ADS-B message as a Basic ADS-B message if there were a preponderance of zeros in the payload. This might happen if many of the fields were "stuffed" with zeros due to the unavailability of data. Since "all-zeros" is a valid RS code word and the RS(30,18) code can correct up to 6 erroneous bytes, the first 30 bytes of a Long ADS-B message will "successfully" decode to the all-zero Basic ADS-B message whenever 6 or less of the 30 bytes are nonzero. Because the RS(48,34) decoding process has precedence, this scenario requires that the Long decoding process must fail and the Basic decoding process must succeed. Normally, a BER high enough to cause the RS(48,34) decoding process to fail would turn enough of the zero bytes into nonzero bytes so that the RS(30,18) decoding process would also fail. However, it is possible that interference (e.g., another ADS-B message) could overlap only the tail end of a Long ADS-B message, leaving the first 30 bytes essentially intact. It is difficult to assess the likelihood that such a situation will arise since it depends on the number of potential interference sources and their relative signal strengths.

Whatever their probability might be, if the conditions described in the previous paragraph should prevail, the decoding process will incorrectly result in an all-zero Basic ADS-B message. This decoded message will pass the PAYLOAD TYPE test; however, this should *not* generate an operational problem because such a message will necessarily contain the all-zero ICAO address, which is invalid. Thus, in order to cope with this (very unlikely) situation, **any application that uses a decoded ADS-B message should check the validity of the ICAO address before processing the remainder of the information.**

As a final note it should be pointed out that the receiver could, as an option, check the PAYLOAD TYPE field of candidate Long ADS-B messages as well as of candidate Basic ADS-B messages. Checking that the PAYLOAD TYPE field is *not* 00000 will lower very slightly (by a factor of 31/32) the probability of undetected error in the presence of random bit errors. It will also lower the probability of interpreting a

Basic ADS-B message as a Long ADS-B message by a factor of about 7; this probability is given by the following formula:

$$p = \frac{248}{256^{14}} \cdot \sum_{k=0}^{6} \binom{47}{k} 255^{k} = 1.41x10^{-10}.$$

This check is not a requirement since the improvement it provides is rather modest.

The information contained in this Appendix is summarized in Table M-2. The numbers presented are upper limits on the likelihood of potential ADS-B messages being misinterpreted. The first two rows assume that the input bit stream is corrupted by strong interference, and the entries are upper bounds on the probabilities of interpreting a Long (Basic) ADS-B message as an incorrect Long (Basic) ADS-B message. The other rows provide upper limits on the probabilities of incorrectly interchanging Long and Basic. The shaded cells represent the results obtained by using the optional check of the PAYLOAD TYPE field for Long ADS-B message candidates. This table does not address the likelihood of a successful synchronization being followed by a very high BER for all or part of the remaining message; the probability of encountering the interference conditions necessary for misinterpreting message length is certainly much less than 1.

Table M-2: Upper Bounds on Undetected Message Error Probabilities

| Transmission | Perceived Reception | Raw Probability of Undetected Error | Probability with PAYLOAD TYPE Check |
|---|---|---|---|
| Long | Long | 9.95e-10 | 9.64e-10 |
| Basic | Basic | 2.06e-9 | 6.45e-11 |
| Basic | Long | 9.95e-10 | 1.41e-10 |
| Long | Basic | 2.06e-9 | 1.29e-11 |

# Proposed Change to Appendix K
# File "surface.doc"

**Prepared by**

**Larry Bachman and Michael Castle**
**Johns Hopkins University Applied Physics Lab**

**12 June 2002**

---

Instructions:

Replace text after first three paragraphs of K.4.5 with this document, which updates Figures 110-125 and conclusions

---

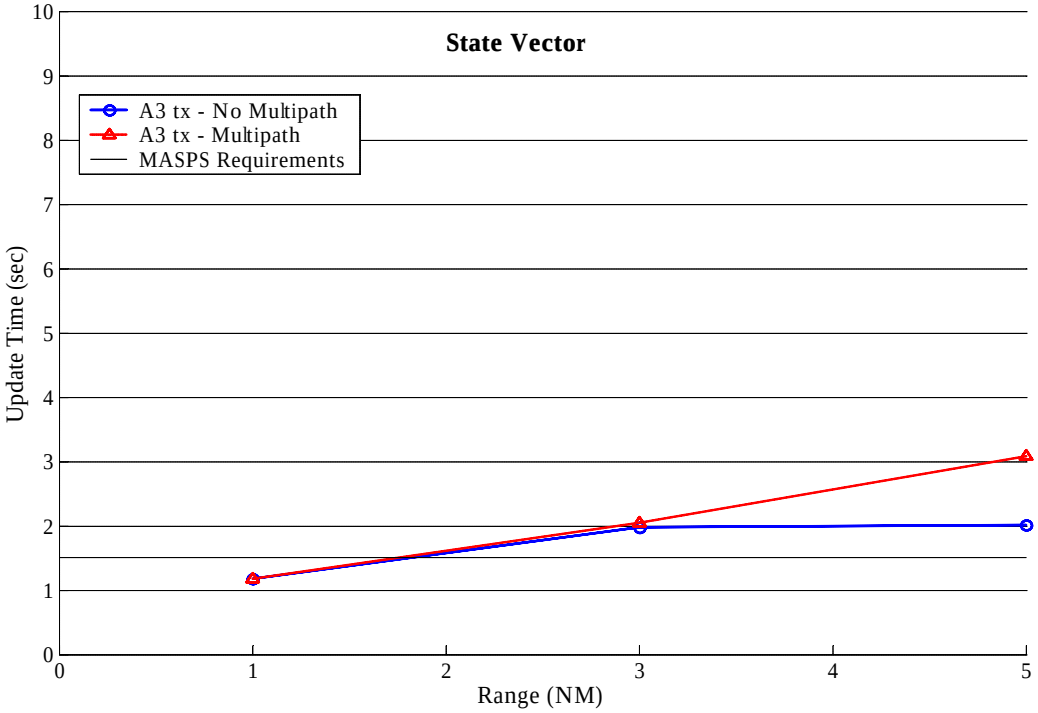


**Figure K-110: A3 Receiver on the Surface in LA2020 Scenario Receiving A3 Transmitters**

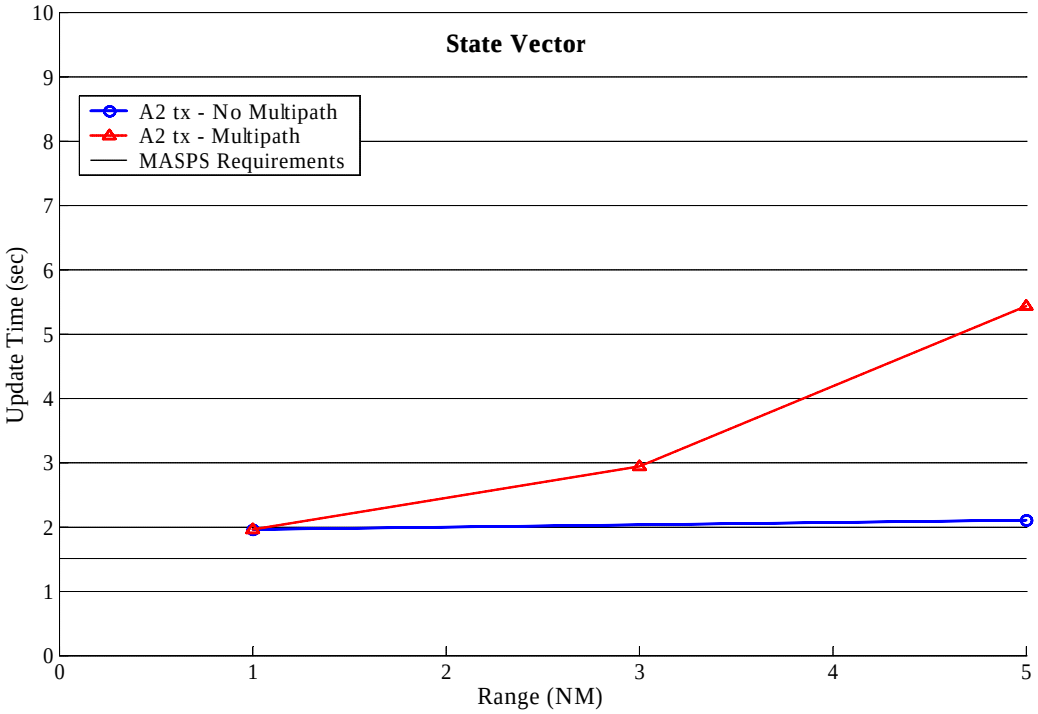


**Figure K-111: A3 Receiver on the Surface in LA2020 Scenario Receiving A2 Transmitters**

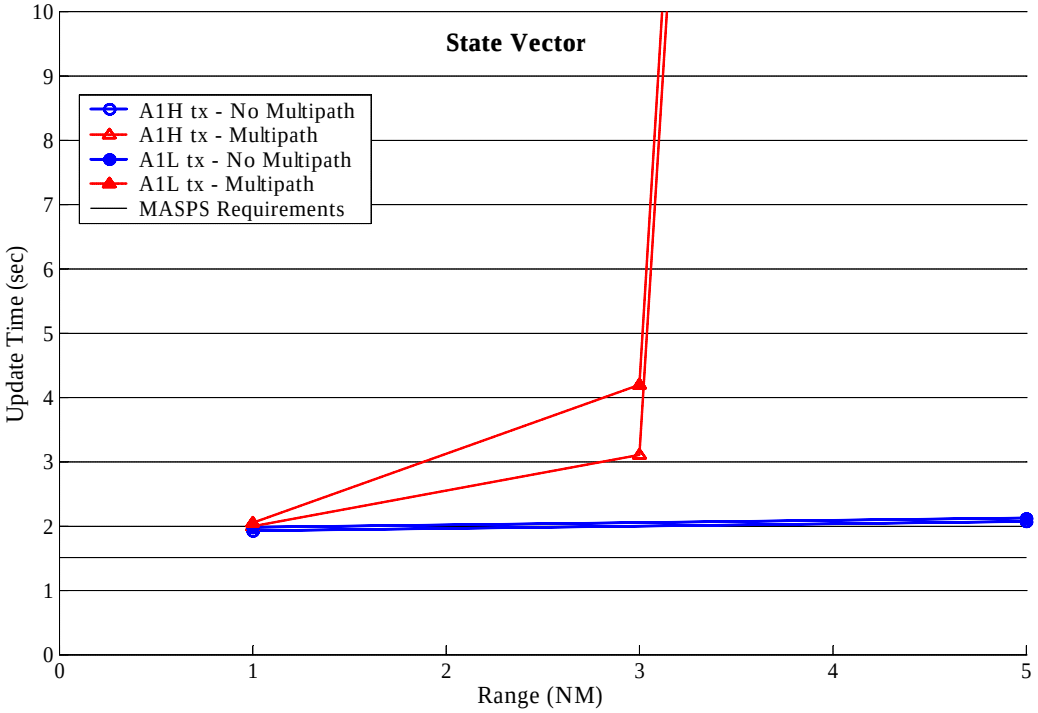


**Figure K-112: A3 Receiver on the Surface in LA2020 Scenario Receiving A1 Transmitters**

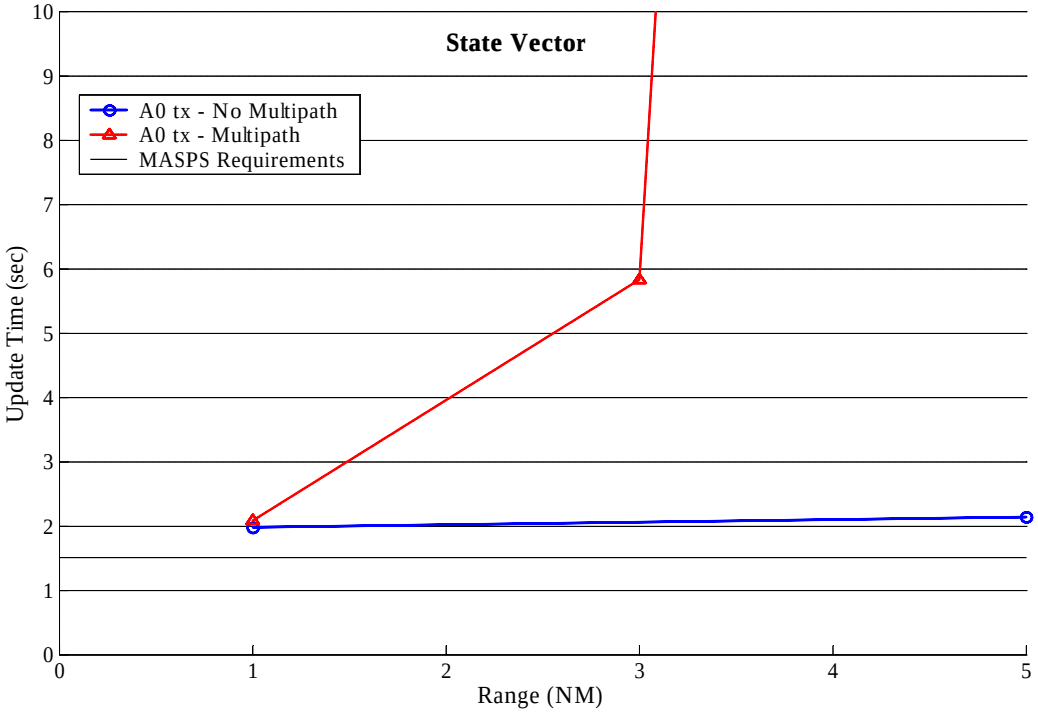


**Figure K-113: A3 Receiver on the Surface in LA2020 Scenario Receiving A0 Transmitters**

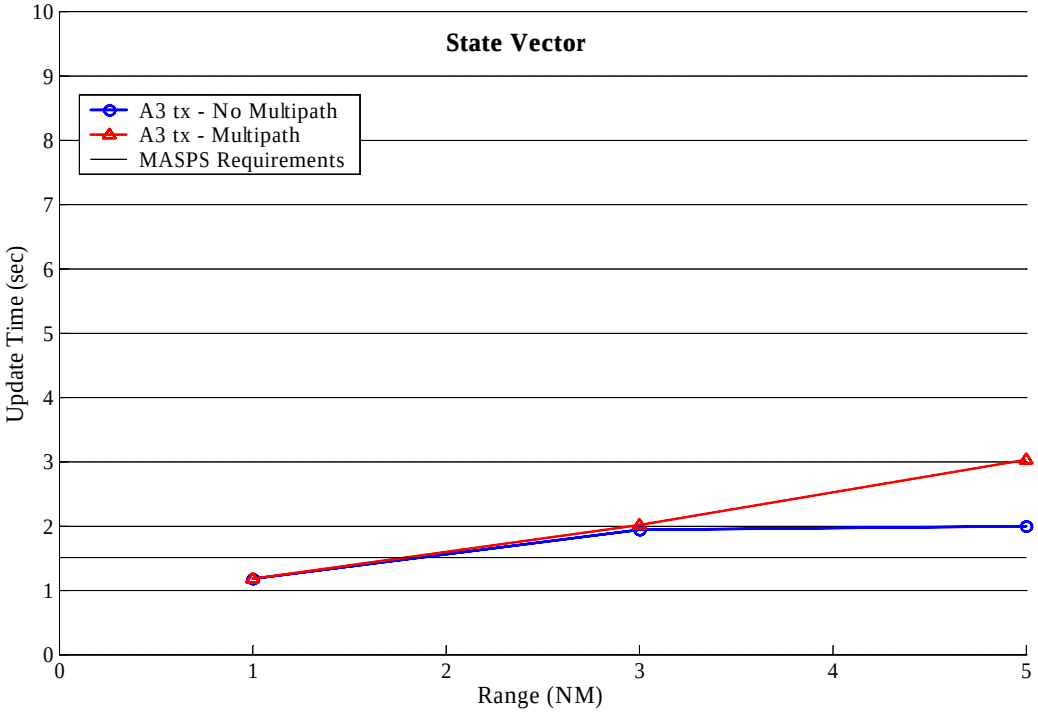


**Figure K-114: A2 Receiver on the Surface in LA2020 Scenario Receiving A3 Transmitters**

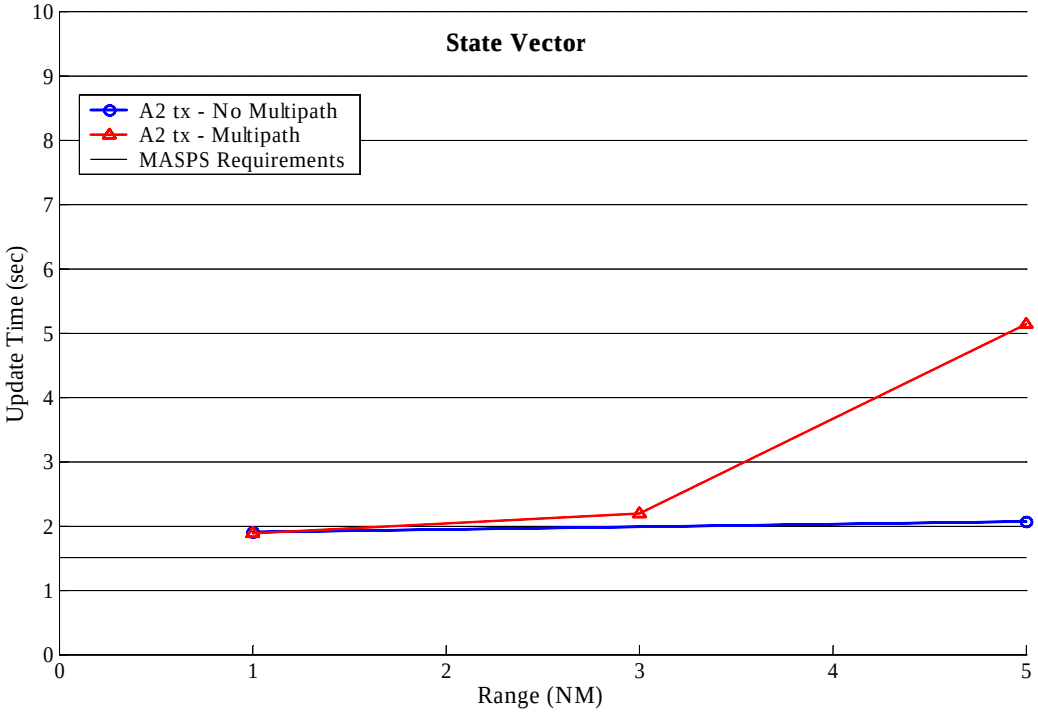


**Figure K-115: A2 Receiver on the Surface in LA2020 Scenario Receiving A2 Transmitters**

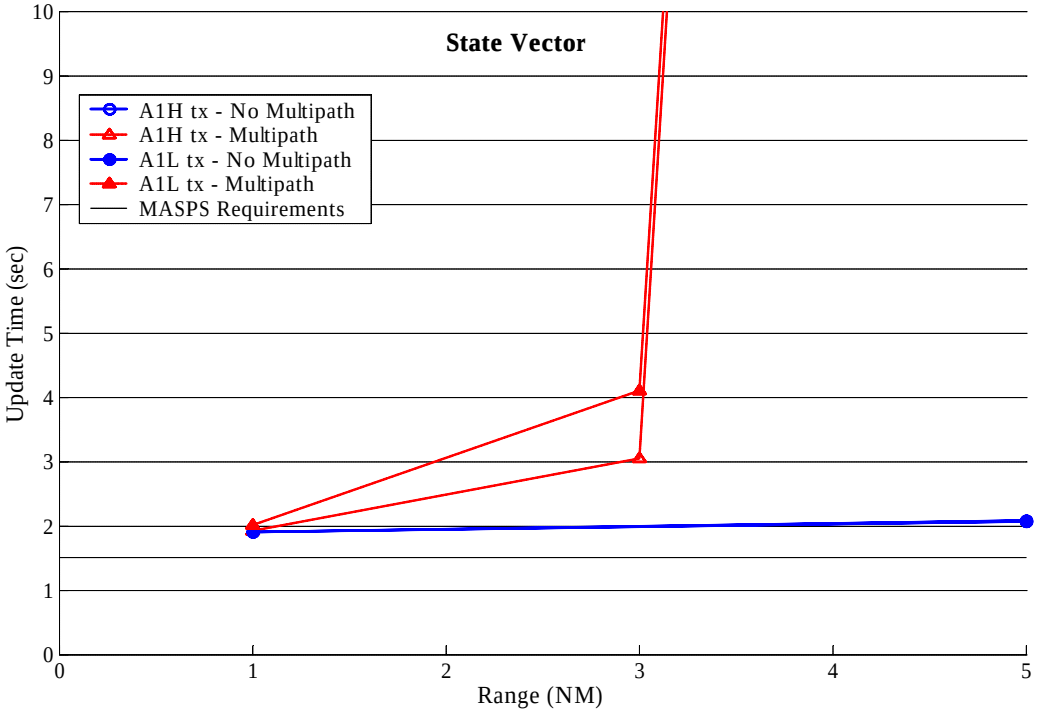


**Figure K-116: A2 Receiver on the Surface in LA2020 Scenario Receiving A1 Transmitters**

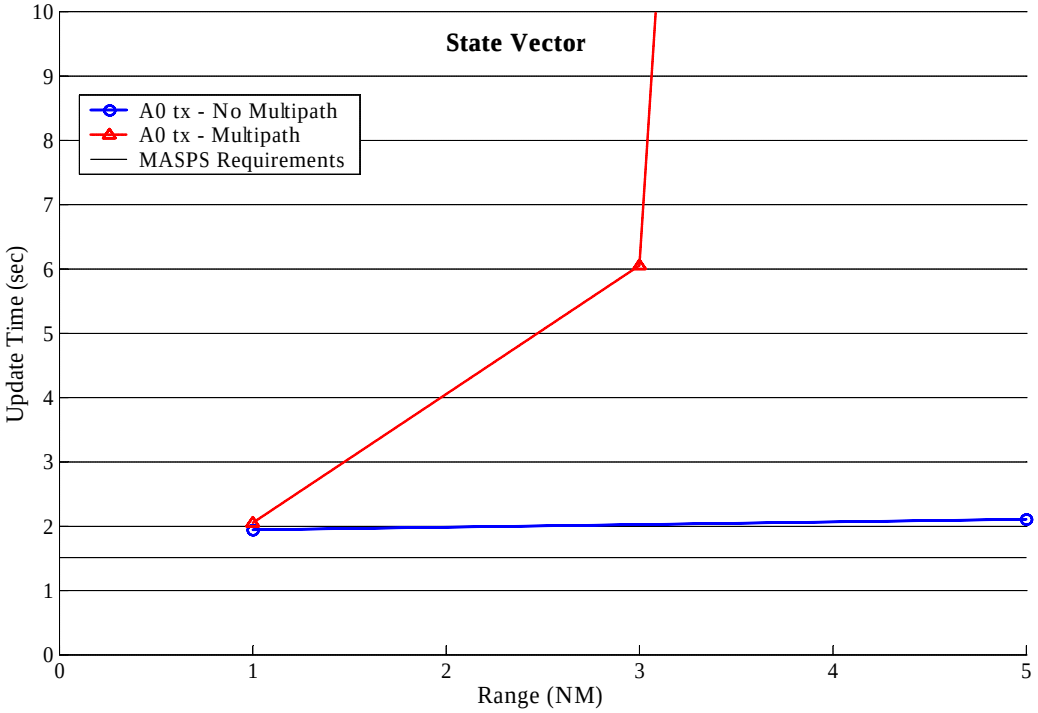


**Figure K-117: A2 Receiver on the Surface in LA2020 Scenario Receiving A0 Transmitters**

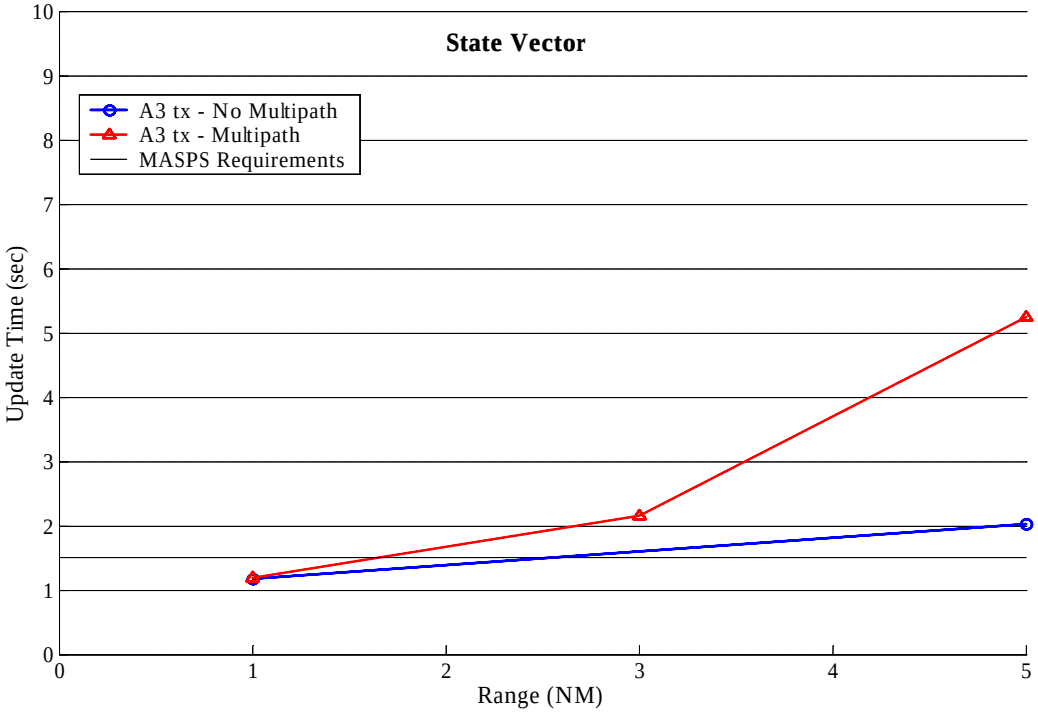


**Figure K-118: A1 Receiver on the Surface in LA2020 Scenario Receiving A3 Transmitters**

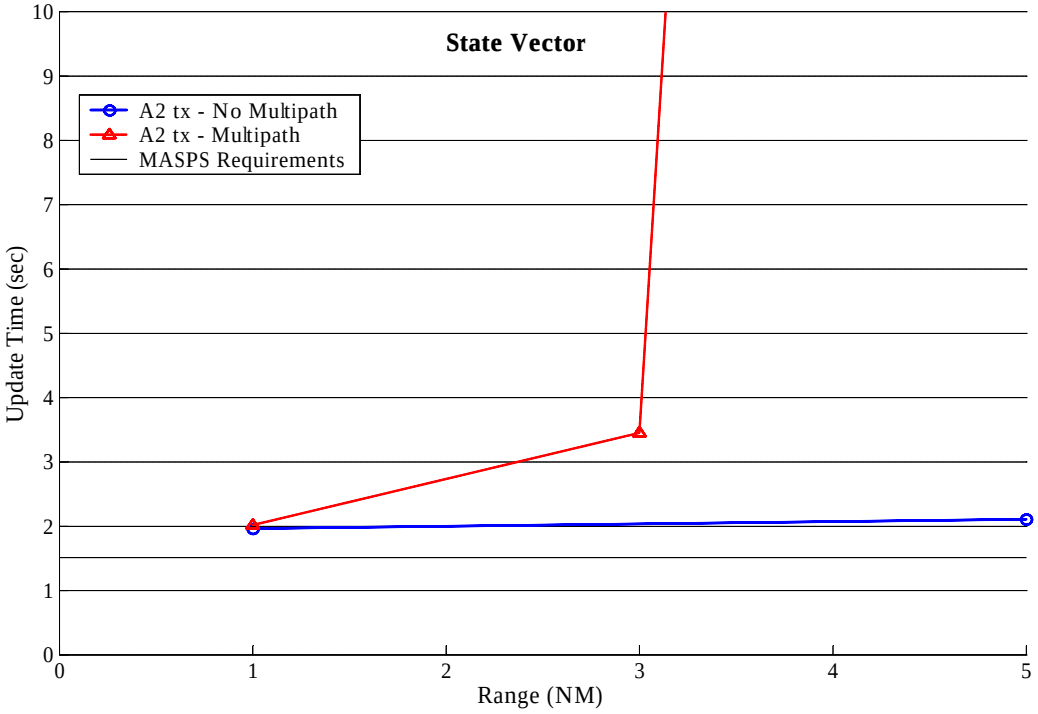


**Figure K-119: A1 Receiver on the Surface in LA2020 Scenario Receiving A2 Transmitters**

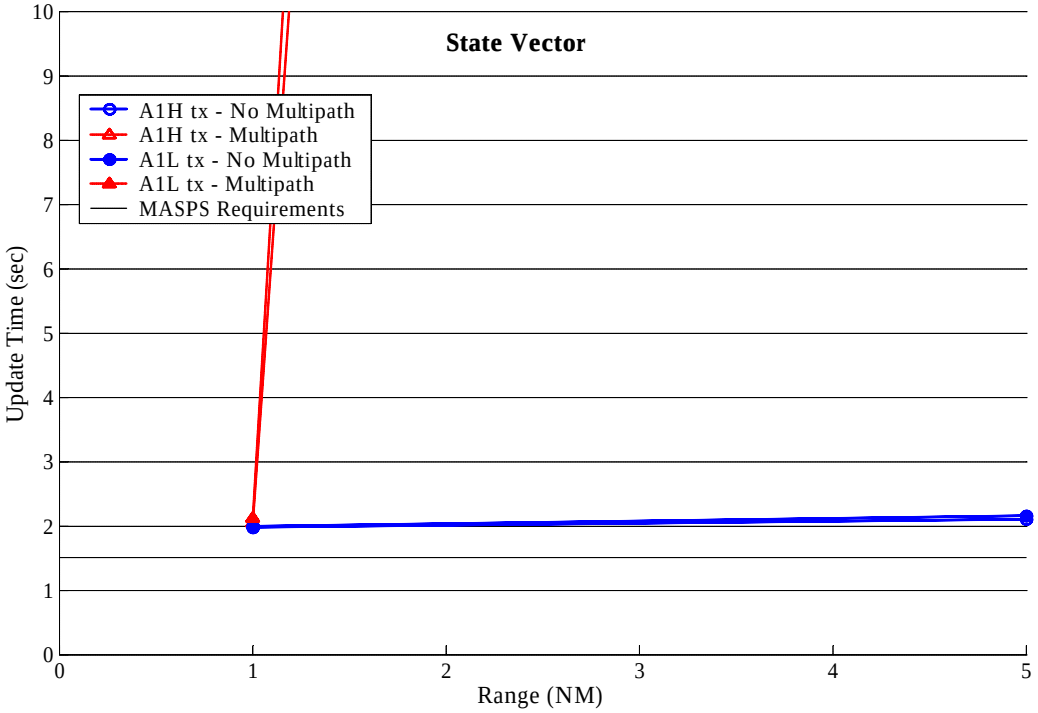


**Figure K-120: A1 Receiver on the Surface in LA2020 Scenario Receiving A1 Transmitters**

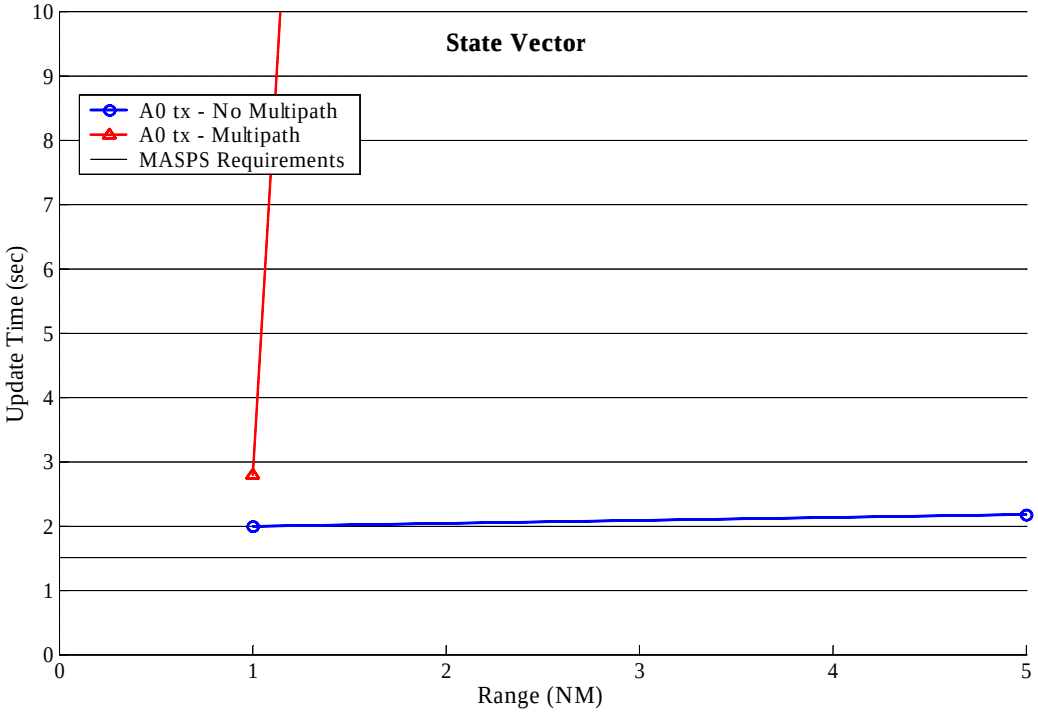


**Figure K-121: A1 Receiver on the Surface in LA2020 Scenario Receiving A0 Transmitters**

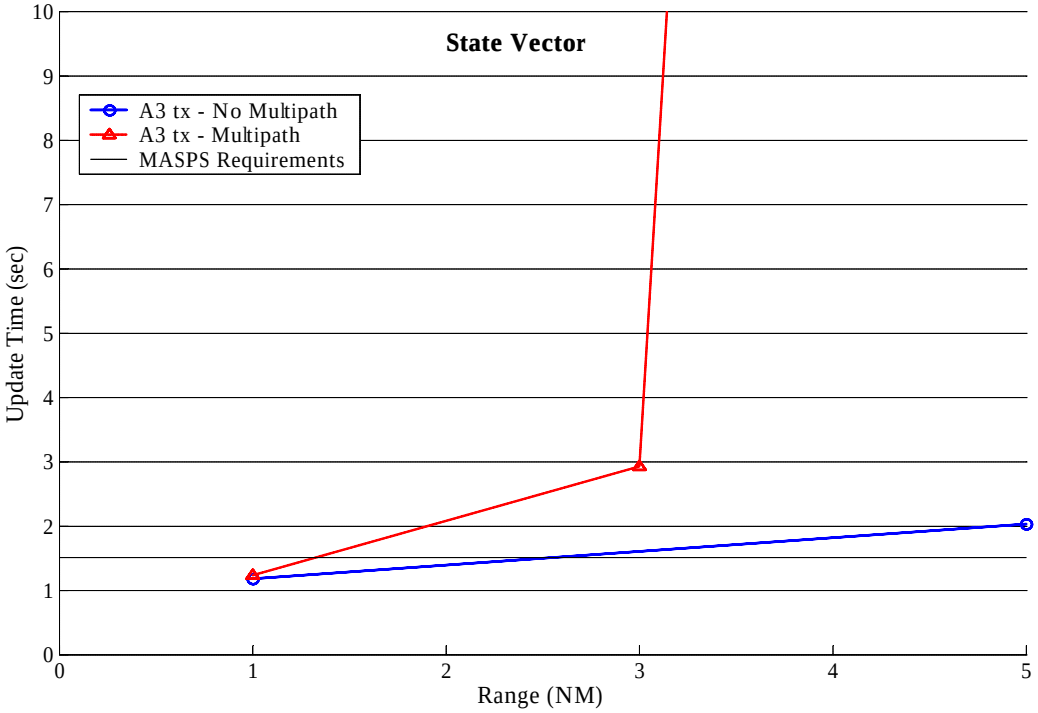


**Figure K-122: A0 Receiver on the Surface in LA2020 Scenario Receiving A3 Transmitters**

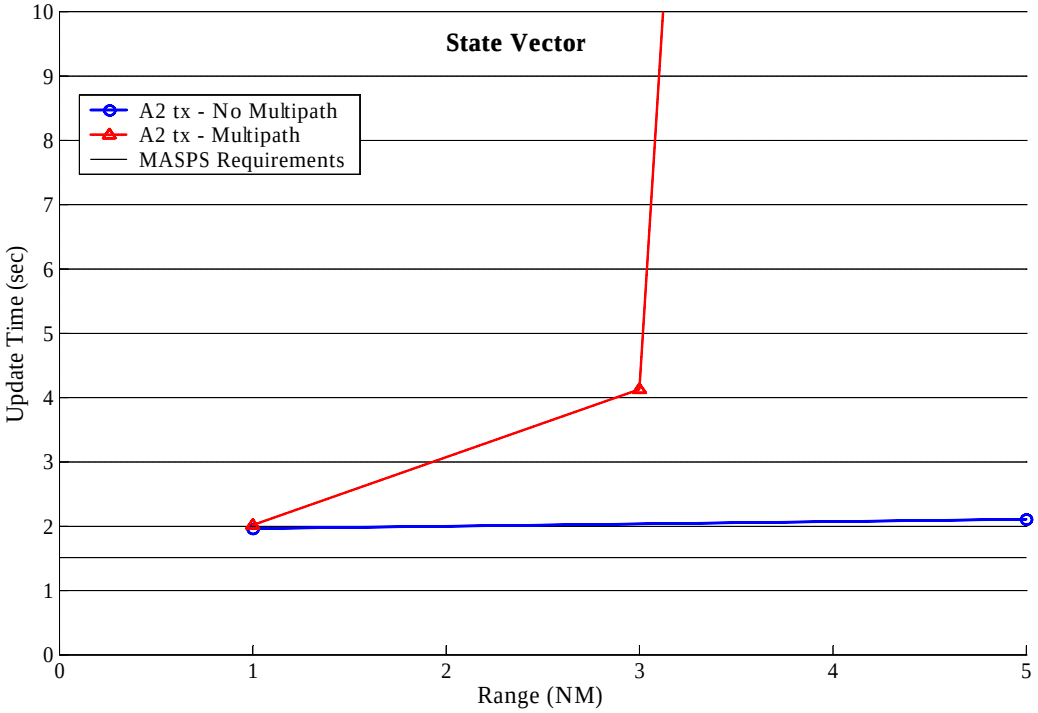


**Figure K-123: A0 Receiver on the Surface in LA2020 Scenario Receiving A2 Transmitters**

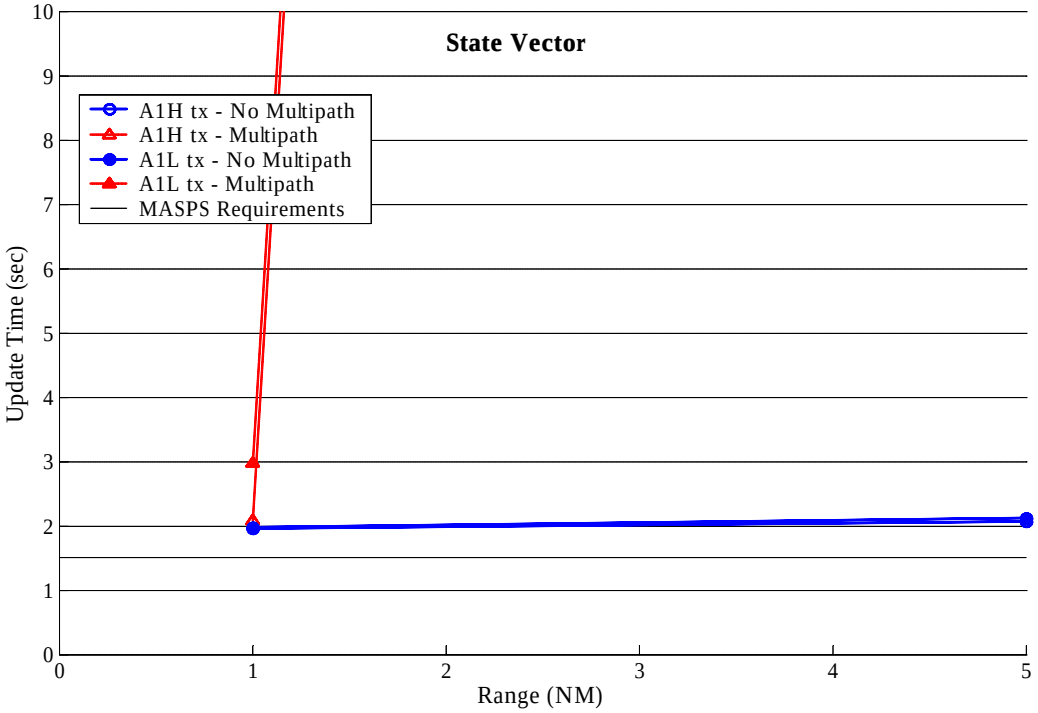


**Figure K-124: A0 Receiver on the Surface in LA2020 Scenario Receiving A1 Transmitters**

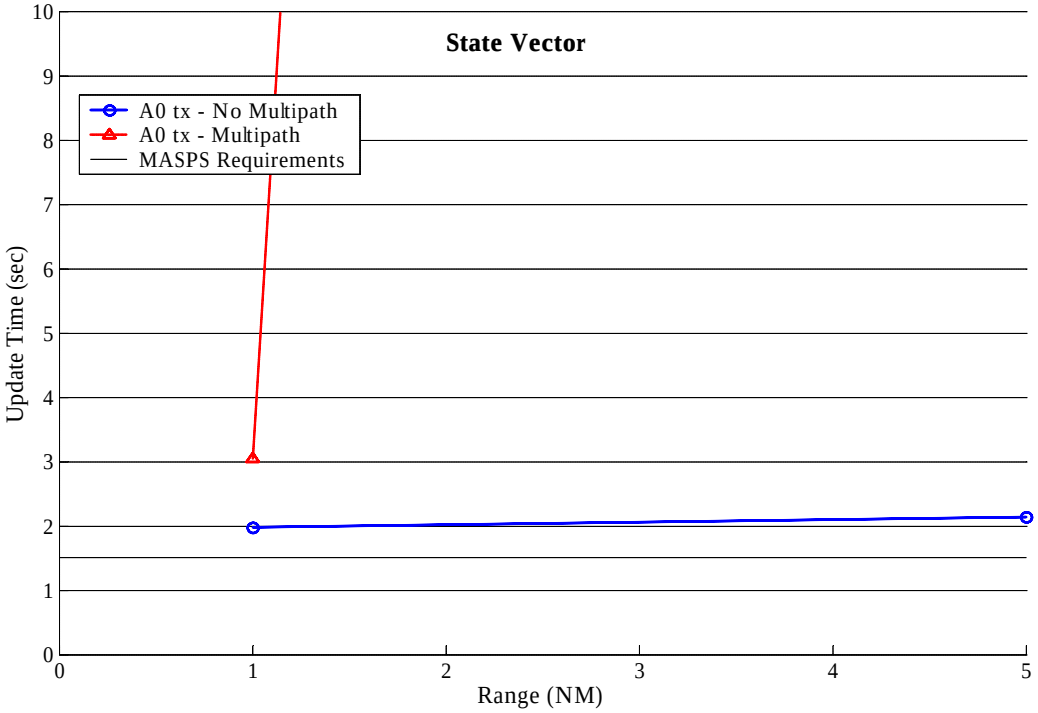


**Figure K-125: A0 Receiver on the Surface in LA2020 Scenario Receiving A0 Transmitters**

Recall that the LA2020 scenario, in addition to a total of 2694 aircraft (75 on the ground at LAX) transmitting UAT, includes 100 transmitting ground vehicles at LAX as well.

The results for the aircraft-to-aircraft surface-to-surface performance from Figures K-110 through K-125 may be summarized as follows:

- For the bounding cases with no multipath and with worst-case elevation plane multipath, the 95$^{th}$ percentile surface update requirement for the ADS-B MASPS (1.5 seconds out to 5 NM) are met for A3 transmitters up to 1-2 NM away.
- The 95$^{th}$ percentile surface update requirement for the ADS-B MASPS (1.5 seconds out to 5 NM) are not met for all other cases on the surface.
- The 95$^{th}$ percentile update time on the surface for all aircraft classes to 5 NM for the bounding case of no multipath is approximately 2 seconds. A3 transmitters can be seen by A2 and A3 receivers out to 5 NM with, approximately, a 3 second 95$^{th}$ percentile update time. A2 transmitters can be seen by A2 and A3 receivers out to 5 NM with, approximately, a 5 second 95$^{th}$ percentile update time.
- The 95$^{th}$ percentile update time on the surface for all aircraft classes for the bounding case of worst-case multipath is approximately 3 seconds at a range of 1 NM. The limiting factor at ranges greater than 1 NM is the transmit power and antenna placement for A0 and A1L class equipment, combined with the effect of 175 interferers at close range.

# Proposed Change to Appendix K

**Prepared by**

**Larry Bachman and Michael Castle**
**Johns Hopkins University Applied Physics Lab**

**12 June 2002**

---

Instructions:

e) Insert this document, which comprises a new section (K.4.6)
f) Change name of current Figure K-126 to Figure K-128 to reflect new figure numbering
g) Add the following sentence at the end of the 4th paragraph of K.1.1: "Section K.4.6 presents the results for a receiver on the surface receiving transmissions from aircraft on approach."

---

### K.4.6 A0 Reception on the Surface of Aircraft on Approach

An evaluation was performed of the performance of the UAT system for an aircraft on the surface receiving state vector transmissions from aircraft on landing approach in both the LA2020 and Core Europe 2015 scenarios. The aircraft on approach were modeled at an altitude of 2000 feet. The receiving aircraft on the ground is equipped as an A0 receiver. It was thought this would provide a worst case performance for aircraft on the surface receiving airborne transmitters due to the A0 receiver potentially only having antenna on the bottom of the aircraft. No multipath was included.

The evaluation was performed using the same co-site interference environment as for the airborne scenarios. In practice, the actual interference environment would be more benign, because of much lower instances of interrogations from TCAS/ACAS and radar ground systems when operating on the surface, and potentially from a lack of DME equipment on some portion of the A0 and A1L fleet. In addition, the Core Europe scenario had a 10 kW 979 MHz TACAN located 1000 feet away from the UAT receiving antenna.

Results of the MAUS runs for an A0 aircraft on the ground receiving UAT transmissions from aircraft on approach are shown in Figures K-126 and K-127 for the LA2020 and CE 2015 scenarios, and conclusions are presented below. We know of no specific ADS-B MASPS requirements for this situation.

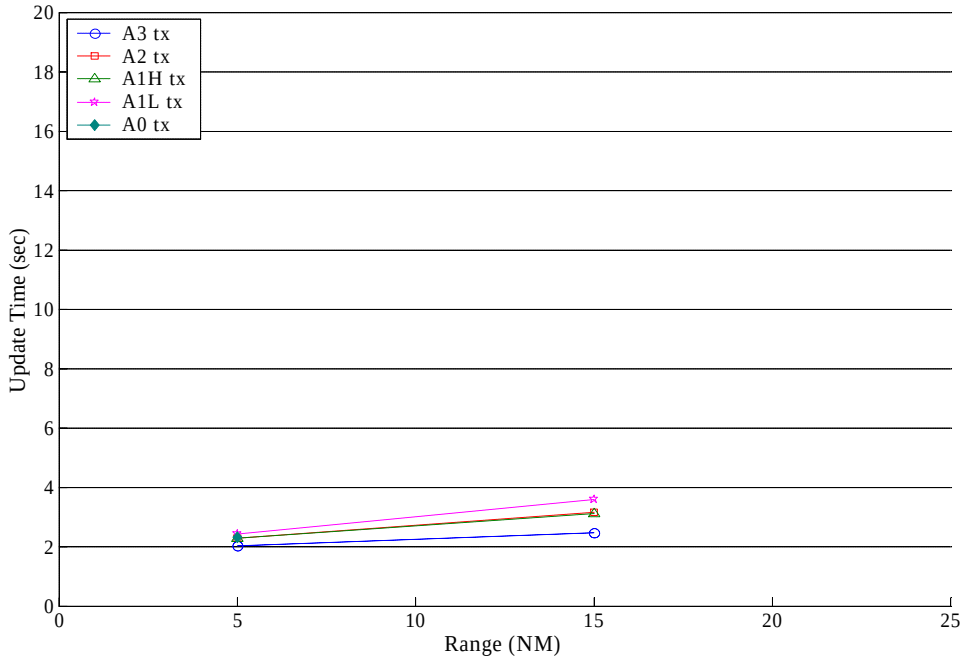


**Figure K-126: A0 Receivers on the Ground in LA2020 Receiving All Aircraft on Approach at an Altitude of 2000 feet**

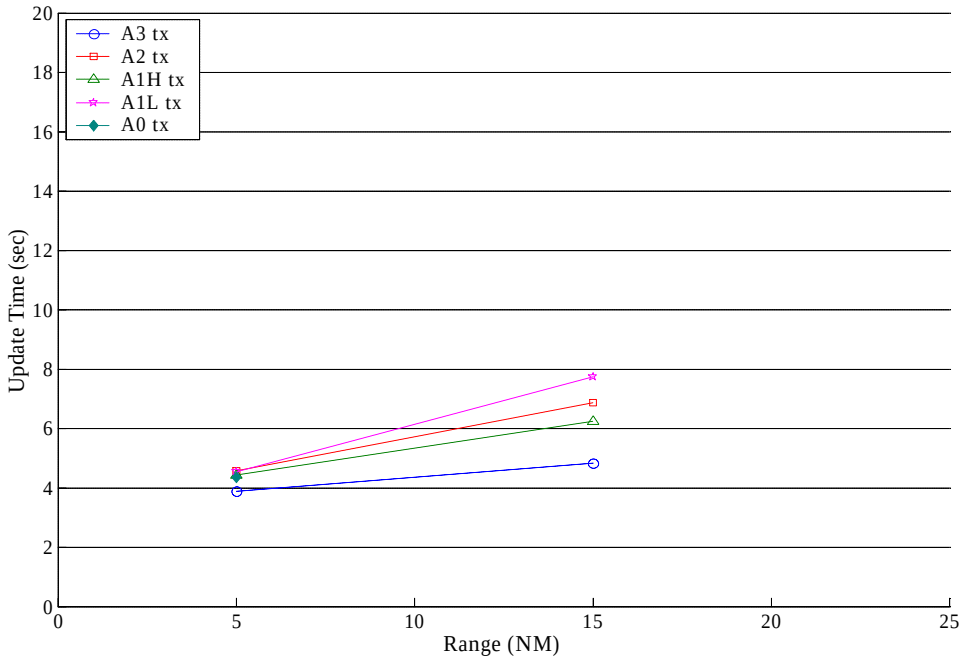


**Figure K-127: A0 Receivers on the Ground in CE2015 Receiving All Aircraft on Approach at an Altitude of 2000 ft to Brussels co-located with a 10 kW 979 MHz TACAN**

Recall that the LA2020 scenario, in addition to a total of 2694 aircraft (75 on the ground at LAX) transmitting UAT, also includes 100 transmitting ground vehicles at LAX as well. Furthermore, the CE2015 scenario has 2091 aircraft transmitting UAT, including 25 aircraft and 100 ground vehicles on the surface in Brussels.

The results for an aircraft on the surface receiving aircraft on approach are shown in Figures K-126 and K-127. We know of no specific ADS-B MASPS requirements for this situation.