

UAT-WP-5-19
19 June 2001

RTCA Special Committee 186, Working Group 5

ADS-B UAT MOPS

Meeting #5

19-22 June 2001

Lexington, MA

UAT discussions in AMCP WGC

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SUMMARY

This paper provides an extract of the report of the second meeting of the AMCP WGC held between the 7 and 11 of May 2001 in relation to the discussion of SARPs for UAT.

Agenda Item 6: New Systems to be considered

6.1. Universal Access Transceiver (UAT)

6.1.1 WP2, presented by the US member of the panel, invited the group to consider the need for the development of SARPs for the UAT. The group recalled that the AMCP/7 meeting had agreed that an element of the new work in Working Group C would be to consider the need for the developments of such SARPs. The paper also provided information on related activities, including the FAA "Capstone" program, a joint FAA/Eurocontrol ADS-B link alternatives assessment and the development of UAT MOPS. Additional information on those activities was provided in WP3, WP4, WP5, WP6 and WP18 (see below), also presented by the US member of the panel.

6.1.2 WP3 and WP18 contained a report on the outcome of the ADS-B/situational awareness links assessment conducted by the Technical Link Assessment Team (TLAT) and commissioned by both (1) the Safe Flight 21 (SF21) Steering Committee consistent with the recommendations of the RTCA Free Flight Select Committee and (2) the Eurocontrol ADS Programme Steering Group (PSG). The assessment had been conducted on three candidate ADS-B/situational awareness links: the SSR Mode S Extended Squitter, the VHF Digital Link (VDL) Mode 4 and the UAT.

6.1.3 The group was informed that the report was intended to serve as a primary technical input to FAA and Eurocontrol selections of ADS-B link technologies for implementation. It was emphasized that these selections of ADS-B link technologies would be based on a number of considerations (e.g., cost/benefit and institutional/transitional issues) in addition to the technical factors discussed in the report.

6.1.4 It was also clearly stressed that the report did not contain an ADS-B link recommendation.

6.1.5 A summary of the evaluation criteria adopted by the TLAT was provided to the group. The criteria included those originally developed by the Safe Flight 21 (SF21) Link Evaluation Team (LET), additional criteria proposed by Eurocontrol and other considerations specified in the TLAT Terms of Reference.

6.1.6 The findings of the group were also presented. The meeting noted with appreciation that all the findings had been unanimously agreed upon by the members of the TLAT. It was also noted that some of the criteria had not been addressed. This meant that the TLAT did not have time to address them. It did not imply that they could not be met.

6.1.7 The meeting was informed that detailed system descriptions of the candidate links and significant supporting information for the Technical Link Assessment Criteria, traffic scenarios, and TLAT simulations/analyses were available at the following websites:

www.eurocontrol.be/projects/eatchip/ads

www.faa.gov/safeflight21/

6.1.8 WP5 presented the areas (as derived by the FAA) in which the UAT had distinguished itself in the TLAT report. WP 4 presented the status and schedule for the development of RTCA MOPS for the UAT. The development is being conducted by SC-186 Working Group 5. The current target date for submission of the UAT MOPS to the RTCA Program Management Committee is February 2002. WP 6 presented the status of the FAA "Capstone" program, a safety improvement initiative in Alaska. It will include the installation of bundled avionics capability including UAT data link transceiver, cockpit display system, GPS navigator and terrain data base, at FAA expense. The initial program funding will equip 150 participating aircraft and establish 11 data link ground stations in Western Alaska. The meeting noted that three data link systems, Mode S, VDL-4 and UAT were candidates under consideration for ADS-B use in the US NAS (National Airspace System), and that a link decision, expected by June 2001, might provide

for one or more of the three systems. Instead of waiting on this decision, the leadership in Alaska's aviation community decided the safety benefits from early deployment of an ADS-B system far outweighed the risk associated with waiting for the link decision. Capstone "radar-like" services using UAT/ADS-B became operational in the Alaska region on 1 January 2001.

6.1.9 WP30, presented by the Swedish member of the panel presented concerns with the standardization of UAT. A list of issues to be addressed when considering the need for a UAT standard was included in the paper. While the meeting did not discuss the list in detail, a number of the issues were identified as rather controversial during the presentation of the paper. The Secretary reminded the group that, in the course of the process leading to the adoption or rejection of any proposed ICAO standard, there would be many situations in which the proposals would be closely scrutinized to identify any outstanding issues. Early identification and, where possible, resolution of potential issues, was an integral part of the group's work in considering the need for UAT SARPs and could be very useful for its progress. The group therefore decided that the list of issues contained in WP30 should be further discussed at the next meeting.

WP30 also contained comments, both general and detailed, on the TLAT report. Members of the TLAT attending the meeting expressed their disagreement with many of the comments, and their wish to have the meeting review the comments in detail. The Secretary pointed out that the current priority of WG-C was the planning of the work to be conducted by WG-C itself, rather than the discussion of details of the TLAT report with which most WG-C members were not familiar. It was therefore agreed that, at least for the time being, the issue would be pursued outside WG-C.

6.1.10 After introduction of the above-mentioned working papers, a subgroup was formed to develop a proposal for the future actions that the WG would need to undertake in order to assess the need for UAT SARPs. The proposal developed by the subgroup was then reviewed by the WG.

6.1.11 The WG agreed that it should conduct a comparative analysis in order to establish whether the need for UAT SARPs could be justified on the basis of any additional benefits that the UAT would be able to deliver over and above the existing ADS-B candidate links already included in Annex 10 (SSR Mode S extended squitter and VDL Mode 4), conditional on the resolution of any associated substantive issues.

6.1.12 The meeting agreed to a proposal that the comparative analysis should make use of the considerable amount of technical data collected by the TLAT (which included experts on all three candidate technologies). However, the meeting also recognized that the TLAT report had not been aimed to support the work of WG-C and that, as stated in WP3 and WP18 and reiterated in the meeting's discussion, the TLAT report itself did not contain an ADS-B link recommendation. Hence, any conclusions drawn by WG-C using the information contained in the TLAT report were the WG-C responsibility and did not imply an agreement by the TLAT to the group's conclusions.

6.1.13 The meeting also agreed that, in addition to considering additional benefits that could derive from the UAT, all substantive issues with the UAT that would be identified during the course of the comparative analysis and which might prevent the development of SARPs, such as availability of spectrum, should be investigated and resolved.

6.1.14 The meeting discussed the way in which it should perform the comparative analysis. It was noted that the full TLAT report material, comprising several voluminous detailed technical appendices, had not been submitted to the group. Also, the group itself did not have the expertise to fully assess the validity of the detailed technical descriptions used as the basis of the simulation models for the three candidate systems, and of the assumptions made with regard to the ADS-B operational requirements. It was therefore decided that the group should seek the help of other ICAO technical groups in their respective area of expertise.

6.1.15 In particular, the group agreed that OPLINKP should be requested to confirm that the ADS-B operational requirements used by the TLAT were representative of and broadly consistent with the ICAO ADS-B requirements under development by OPLINKP itself. In this regard, the group was informed that within OPLINKP it was WG-A, which was responsible for developing a concept of use and operational requirements for the application of ADS-B. A proposed liaison statement to OPLINKP WGA was drafted.

Action Item WGC/2-5: Further develop the a liaison statement to OPLINKP WG-A contained in **Attachment D**

6.1.16 The group also agreed that SCRSP and AMCP WG-M should be requested to review the detailed technical descriptions, respectively, of the SSR Mode-S Extended Squitter and of VDL Mode 4 in order to confirm their consistency with the relevant ICAO provisions. Drafts of Liaison statements to SCRSP and to AMCP WG-M are in **Attachments E and F**.

Action Item WGC/2-6: Finalise the draft liaison statements to SCRSP and AMCP WG M as contained in Attachment D and E Appendix

6.1.17 Finally, the group agreed that AMCP WG-F should be requested to review the spectrum availability issues and provide advice as to their resolution. A liaison statement to AMCP WG-F is at **Attachment G**.

Action Item WGC/2-7 Expand Attachment G with the necessary details

6.1.18 The group noted that there are no SARPs for UAT and therefore it was not necessary to confirm the consistence with ICAO SARPs of the detailed UAT technical description as used by the TLAT. However the meeting noted that, should the Air Navigation Commission decide on the basis of a recommendation by AMCP that ICAO provisions should be developed, it was likely that AMCP WGC would be tasked with the development. It was therefore decided that the detailed technical description of the UAT as presented at WG-C1 should be made available to the group for information.

6.1.19 With regard to the final outcome of the comparative analysis, the Secretary informed the group that, should the comparative analysis support the need for UAT SARPs, a recommendation to develop SARPs should be produced by WG-C and conveyed to AMCP. Should AMCP support the recommendation from WG-C, the Secretary would then undertake to submit the recommendation to the Air Navigation Commission and request that the work programme of the panel be amended accordingly.

Attachment D to AMCP WGC2 Report (7-11 May 2001)

Draft Liaison statement from AMCP WG-C to OPLINKP WG-A

AMCP (WGC) is currently conducting a comparative assessment of ADS-B links. Background information is provided at Appendix A. In its assessment, AMCP is making use of information gathered by the joint FAA/Eurocontrol ADS-B Technical Link Assessment Team.

AMCP would like to request OPLINKP WGA to review the assumptions used by the TLAT with regard to ADS-B operational requirements and report to AMCP on the extent to which the assumptions are consistent with the ICAO ADS-B operational requirements currently under the development by OPLINKP. It would be much appreciated if OPLINKP WGA could report back to AMCP (ideally in time for the next meeting of WGC, to be held from 15 to 19 October 2001). The assumptions used by TLAT are at Appendix B. They have been extracted from Appendix G of the TLAT report. The full report is available at the following websites:

www.eurocontrol.be/projects/eatchip/ads

www.faa.gov/safeflight21/

AMCP understands that the development of ICAO operational requirements has not been completed yet. However, it should be noted that the assumptions are not intended to replace the ICAO operational requirements, but only to be used to provide a representative benchmark for the comparative performance analysis of ADS-B links. Hence, OPLINKP is not requested to provide a detailed statement of consistency, but only a general indication as to whether the assumptions could be considered broadly representative of the expected ADS-B operational environment would be very useful to AMCP.

Appendix A Background information
Appendix B Extract from Appendix G of TLAT

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Attachment E to AMCP WGC2 Report (7-11 May 2001)

Liaison statement from AMCP WG-C to SCRSP

AMCP (WGC) is currently conducting a comparative assessment of ADS-B links. Background information is provided at Appendix A. In its assessment, AMCP is making use of information gathered by the joint FAA/Eurocontrol ADS-B Technical Link Assessment Team..

AMCP would like to request SCRSP to review the assumptions used by the TLAT with regard to the applicable technical description for the SSR Mode S Extended squitter, and report back to AMCP (ideally in time for the next meeting of WGC, to be held from 15 to 19 October 2001). The assumptions used by TLAT are at Appendix B. They have been extracted from Appendix F of the TLAT report. The full report is available at the following websites:

www.eurocontrol.be/projects/eatchip/ads

www.faa.gov/safeflight21/

It should be noted that the technical description is not intended to replace the relevant ICAO provisions, but only to be used to provide a representative benchmark for the comparative performance analysis of ADS-B links. Hence, AMCP is not seeking a detailed statement of compliance with ICAO provisions, but only an indication as to whether the assumptions could be considered generally acceptable for such use. Should SCRSP identify elements of the description that could be expected to bias a comparative analysis, AMCP would be grateful if an indication of the likely direction and impact of the bias was provided.

Appendix A Background information
Appendix B Appendix F of TLAT Report

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Attachment F to AMCP WGC2 Report (7-11 May 2001)

Liaison statement from AMCP WG-C to AMCP WG -M

AMCP WGC is currently conducting a comparative assessment of ADS-B links. Background information is provided at Appendix A. In its assessment, WGC is making use of information gathered by the joint FAA/Eurocontrol ADS-B Technical Link Assessment Team..

WGC would like to request WGM to review the assumptions used by the TLAT with regard to the applicable technical description for VDL Mode 4, and report back to WGC (ideally in time for the next meeting of WGC, to be held from 15 to 19 October 2001). The assumptions used by TLAT are at Appendix B. They have been extracted from Appendix E of the TLAT report. The full report is available at the following websites:

www.eurocontrol.be/projects/eatchip/ads

www.faa.gov/safeflight21/

It should be noted that the technical description is not intended to replace the relevant ICAO provisions, but only to be used to provide a representative benchmark for the comparative performance analysis of ADS-B links. Hence, WGC is not seeking a detailed statement of compliance with ICAO provisions, but only an indication as to whether the assumptions could be considered generally acceptable for such use. Should WGM identify elements of the description that could be expected to bias a comparative analysis, WGC would be grateful if an indication of the likely direction and impact of the bias was provided.

Appendix A Background information
Appendix B Appendix E of TLAT Report

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Appendix A – Background information

1. Introduction

This appendix contains background information on the Universal Access Transceiver (UAT) and on the ADS-B/situational awareness links assessment conducted by the joint FAA/Eurocontrol Technical Link Assessment Team (TLAT) and commissioned by both (1) the Safe Flight 21 (SF21) Steering Committee consistent with the recommendations of the RTCA Free Flight Select Committee and (2) the Eurocontrol ADS Programme Steering Group (PSG).

2. TLAT Report

The US Safe Flight 21 Steering Committee and Eurocontrol ADS PSG requested continued technical evaluation of three ADS-B and situational awareness link candidates, 1090 MHz Extended Squitter, VHF Digital Link (VDL) Mode 4, and Universal Access Transceiver (UAT). The candidate links were to be technically characterized in a common manner and evaluated, in a reference set of traffic scenarios, to a common set of technical link assessment criteria derived from the need to support both the Free Flight Operational Enhancements specified in August 1998 by the RTCA Free Flight Select Committee and further applications as designated by the Eurocontrol ADS PSG.

The TLAT began its activities in May 2000. Subject matter experts for each of the three ADS-B link candidates have participated, as have key technical personnel from several organizations within the FAA, Eurocontrol, and from Johns Hopkins University, the Mitre Corporation, and the industry.

3. AMCP activities

The AMCP/7 meeting (March 2000) tasked WG-C to consider the need for the development of SARPs for the UAT system. Development of SARPs would take place after relevant instructions from the Air Navigation Commission have been received. The second meeting of WGC (WGC2, May 2001)

decided that WGC should conduct a comparative analysis in order to establish whether the need for UAT SARPs could be justified on the basis of any additional benefits that the UAT would be able to deliver over and above the existing ADS-B candidate links already included in Annex 10 (SSR Mode S extended squitter and VDL Mode 4), conditional on the resolution of any associated substantive issues. WGC2 also decided that the comparative analysis should make use of the considerable amount of technical data collected by the TLAT. However, the meeting also recognized that the TLAT report had not been aimed to support the work of WGC and that the TLAT report itself did not contain an ADS-B link recommendation. Hence, it was understood that any conclusions drawn by WGC using the information contained in TLAT report were the group's only responsibility and did not imply an agreement by the TLAT to the group's conclusions.

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Attachment G to AMCP WGC2 Report (7-11 May 2001) – Rev.2 (18.5.2001)

Liaison statement from AMCP WGC to AMCP WGF

AMCP WGC is currently considering the need for Universal Access Transceiver (UAT) SARPs. As stated in the AMCP/7 Report, section 7.2.3.3, this activity should also, in coordination with WGF, consider the radio regulatory aspects connected to the use of the band 960 – 1215 MHz for this system.

UAT is optimized toward the support of broadcast applications, both air- and ground-based, to support surveillance and situational awareness. The UAT data rate is approximately 1 megabit/second within a message. Access to the UAT medium is time-multiplexed within a 1 second frame between ground-based broadcast services (the first 188 milliseconds of the frame) and an ADS-B segment. While the design presumes time synchronization between ground-based broadcasts to reduce/eliminate message overlap, medium access within the ADS-B segment is randomized. Initial UAT operations have been conducted using the experimental frequency of 966 MHz. Operational demonstrations in Alaska are using 981 MHz as the UAT frequency. The “mask” specifying the bandwidth occupied by the signal is currently TBD. A detailed description of the UAT, produced within the framework of the joint FAA/Eurocontrol ADS-B Technical Link Assessment Team (TLAT), is attached. It should also be noted that the UAT is currently undergoing standardization within the RTCA Inc. Minimum Operational Performance Standards (MOPS) process. That effort has already identified modifications to the UAT (compared to the version considered by the TLAT), that should make it less susceptible to interference, and more compatible with existing systems. Further information on these activities can be found at:

<http://adsb.tc.faa.gov/ADS-B/186-subf.htm>

WGC would like to request WGF to consider the following question and provide advice to WGC (ideally in time for the next meeting of WGC, to be held from 15 to 19 October 2001):

Are the radio regulatory provisions applicable to the band in which the UAT is expected to operate appropriate to accommodate the operation of UAT, or would they need to be modified?

WGF is also requested to note that WGC analyses of UAT compatibility with DME are ongoing, and will be forwarded to WGF at a later time, with a view to obtaining WGF's view on the likelihood that operating frequencies for UAT could be identified and coordinated internationally within the above mentioned band.