

Review of Draft VHF Digital Link (VDL) Mode 3 Design Guidelines

Working Paper

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Summary

This document summarizes the results of a review and evaluation of the draft VDL design guidelines in response to an action defined by the Air Navigation Commission when reviewing the material produced at AMCP/4.

1. Introduction

The ATNP was invited by the Air Navigation Commission to review the draft VHF digital link (VDL) Mode 3 design guidelines which were produced at the fourth meeting of AMCP. This paper presents the results of a review and evaluation of the draft VDL Mode 3 design guidelines which was conducted by German ATN and VDL experts.

2. Comments on Draft VDL Mode 3 Design Guidelines

The review has been performed on the basis of the material contained in Appendix C of the Report on Agenda Item 4 as documented in the yellow cover report of AMCP/4.

The results of the review are presented in a tabular form comprising a clear reference to the relevant sections of the draft VDL Mode 3 design guidelines, a review comment and a proposed amendment to the guidelines where appropriate. The review comments are grouped into three categories including technical comments, editorial comments and typographical comments.

2.1 Technical Comments

| VDL Design Guideline Reference | Review Comment | Proposed Amendment |
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| Section 2.2, bullet a) 1st sentence | i) The Draft ATN SARPs contain sub-network service requirements rather than interface requirements. ii) These are assumed to be met by the VDL Mode 3 through the use of the SNDCF for ISO/IEC 8208 mobile subnetworks. iii) This SNDCF is only applicable when providing service to the ISO/IEC 8473, ISO/IEC 9542, ISO/IEC 10589 and ISO/IEC 11577 network layer protocols. | Rephrase the first sentence to read: „The VDL Mode 3 shall provide subnetwork services to the ATN Internet satisfying the requirements for ATN (mobile) subnetworks as specified in the Draft ATN SARPs (Section 5 - Internet Communications Service). If necessary, this will be achieved through the use of a subnetwork dependent convergence facility (SNDCF)“. |
| Section 3.1 | i) According to the Draft ATN SARPs the SNDCF for ISO/IEC 8208 Mobile Sub-networks has to be used for access to the VDL Mode 3. ii) This SNDCF is only applicable when providing service to the ISO/IEC 8473, ISO/IEC 9542, ISO/IEC 10589 and ISO/IEC 11577 network layer protocols; unpredictable behaviour may result if used to support other higher layer entities iii) Furthermore, it is assumed that the requirement statement does not hold for | The requirement may be rephrased to read: „ATN Internet access to the VDL Mode 3 shall be made via the subnetwork dependent convergence function (SNDCF) for ISO/IEC mobile subnetworks and an ISO/IEC 8208-compatible DTE.“ However, this statement may not meet the intended rationale. |

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| | VDL sub-system specific services. | |
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| Section 3.5, 1st sentence | This design objective may be rapidly outdated when vocoder technology evolves. Then it may unduly impact spectrum efficiency. | Rephrase the design objective |
| Section 3.5, Design objective | The design objective should be expanded to the end that the VDL voice quality should not be worse than that of the current DSB-AM system | Add the following sentence to the existing text: „The VDL Mode 3 digital voice quality should at least provide the same intelligibility and acceptability as the current 25 kHz Double Sideband-Amplitude Modulation (DSB-AM) system.“ |
| Section 3.8, Rationale | The requirement is more to unambiguously identify the entry and exit points of the VDL subnetwork when routing ATN data through this subnetwork. | Rephrase the sentence to read: „This is required to unambiguously identify the entry and exit points of the VDL subnetwork in the process of routing ATN network protocol data units (NPDU) through this subnetwork.“ |
| Section 4.8, Requirement | According to the Draft ATN SARPs, ATN subnetworks are required to support a minimum SNSDU size of 1100 octets (see Draft ATN SARPs Section 5.2.5.1.6) | Delete „large“ and add „of at least 1100 octets“ after „subnetwork service data units“ |
| Section 4.9, Requirement | The Draft ATN SARPs (Section 5.2.5.2.2) require ATN mobile subnetworks to provide a SNACp mechanism for invocation of subnetwork priority when priority is implemented in the subnetwork | Renumber the existing requirement to a) and add the following new text after the existing requirement: „b) The VDL Mode 3 subnetwork shall provide a mechanism for invocation of subnetwork priority by the subnetwork user. <i>Note.-- The VDL subnetwork access protocol, i.e. ISO/IEC 8208 (see section 3.6), provides this capability.</i> “ |
| Section 8, Recommend., last sentence | The subnetwork priority mechanism will not be in a position to provide short-term congestion control. It queues packets which have already entered the network but cannot prevent packets from entering the network in an overload condition. Moreover the priority mechanism may even contribute to increase the congestion: if the queued low-priority packets can not be forwarded (due to heavy overall traffic load), they will be retransmitted by the sender following a given timeout period. These packets will be queued again or canceled if the queue runs out of space resulting in further retransmissions. Thus the congestion will further increase instead | Revisit congestion control concept of the VDL Mode 3 subnetwork |

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| | of decreasing. | |
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| Section 10, Requirement | <p>i) This requirement statement is not consistent with the definition of the system recovery time given in the previous sentence and the rationale given in the next sentence. The definition defines the system recovery time as the time between a system becoming disabled and being re-enabled whereas the requirement only considers the time from the end of the interference.</p> <p>ii) Such a measure has only limited value without an associated specification of the maximum tolerable downtime of the system.</p> | Revisit the requirement statement |
| ----- | <p>According to the Draft ATN SARPs (Section 5.2.5.2.3), ATN mobile subnetworks should provide a mechanism for invocation of subnetwork QoS, including transit delay, protection against unauthorized access, cost determination and residual error probability, in order to support the internetwork routing decision process. In the case that the VDL subnetwork intends to make available QoS parameters to the subnetwork user, a corresponding design objective should be added to the VDL Design Guidelines.</p> | Add design objective on the provision of VDL subnetwork QoS, if appropriate. |

2.2 Editorial Comments

| VDL Design Guideline Reference | Review Comment | Proposed Amendment |
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| Section 2.2, bullet a) 1st sentence | This sentence is much more related to ATN conformance than to OSI/ISO conformance | Add „ATN and ...“ to the title of section 2.2 |
| Section 2.2, bullet a) 1st sentence | It is recommended to base the design of the VDL Mode 3 on the Draft ATN SARPs as prepared by ATNP/2 instead of the ICAO Manual of the ATN (Doc 9578) which contains partly outdated material. ¹ | Replace „ICAO Manual of the Aeronautical Telecommunication Network (ATN) (Doc 9578)“ by „Draft ATN SARPs Section 5 (Internet Communications Service)“ |
| Section 2.2, bullet a) 2nd sentence | <p>i) There is a syntactical disconnect from the first sentence of this section</p> <p>ii) Section 2.2 starts with requirement a) but</p> | Rearrange the second sentence to read: „b) The VDL Mode 3 architecture shall be based ...“ |

¹ It is recognised that the ICAO Manual of the ATN (Doc. 9578) is currently the only officially published ICAO document on the ATN. However, given the technical maturity and the status of the Draft ATN SARPs (approved by ANC as of ??) it is deemed appropriate to reference the Draft ATN SARPs.

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| | is not followed by requirement b) | |
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| Section 2.2, Rationale, bullet b) | It is recommended to base the design of the VDL Mode 3 on the Draft ATN SARPs as prepared by ATNP/2 instead on the ICAO Manual of the ATN (Doc 9578) which contains partly outdated material. | Replace „ICAO Manual of the Aeronautical Telecommunication Network (ATN) (Doc 9578) and subsequent draft versions“ by „Draft ATN SARPs Section 5 (Internet Communications Service)“ |
| Section 3.2, Rationale, 2nd sentence | Meanwhile a number of OSI protocols have been revised or are currently under revision respectively to include broadcast features | Replace „is not supported by OSI“ by „is not supported by the ATN“ |
| Section 3.2, Rationale, 3rd sentence | The term „throughput delay requirement“ is not understood. | Replace „throughput delay“ by „transit delay“ |
| Section 3.4, 1st sentence | As this statement is grouped under the category design objective, the term „should“ may be more appropriate | Replace „shall“ by „should“ |
| Section 3.4, Rationale | „Civil Aviation Authorities“ seems to be a more familiar term in the ICAO terminology | Replace „Civil Aeronautics Authorities“ by „Civil Aviation Authorities“ |
| Section 3.5, 1st sentence | It should be indicated that the stated bitrate includes channel coding | Add „including channel coding“ at the end of the sentence |
| Section 3.6, 1st sentence | The requirement formulation does not read well. | Rephrase sentence to read: „The ISO 8208 packet level protocol shall be used as access protocol to the VDL Mode 3 subnetwork.“ |
| Section 3.6, Rationale | The simplification of the implementation and validation is a result of the fact that the <u>same</u> SNAcP is used for all air-ground subnetworks | Rephrase the sentence to read: „This requirement greatly simplifies the implementation and validation of the internetwork process since the same SNAcP is used as for the other air-ground subnetworks (i.e. AMSS and Mode S). Furthermore, it meets the ATN requirement for a SNAcP mechanism that provides for the invocation of subnetwork priority. <i>Note. --- See Draft ATN SARPs Section 5.2.5.2“</i> |
| Section 3.7, Requirement Reference | An appropriate requirement reference would be section 5.2.5.2.5 and 5.3.5.2 of the Draft ATN SARPs | Replace the text in brackets by: „Draft ATN SARPs Sections 5.2.5.2.5 and 5.3.5.2“ |
| Section 3.8, 1st sentence | The statement mixes the general definition of an SNPA address with ATN specifics in an inappropriate manner | Rephrase the sentence to read: „The subnetwork point of attachment (SNPA) address of an ATN network entity attached to the VDL Mode 3 subnetwork is an assigned unique address within the context of this subnetwork and has only meaning within this particular VDL |

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| | | subnetwork.“ |
| Section 3.8, Requirement | Section 3.5.2 does not exist in this document | Delete text in brackets including the brackets |

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| Section 3.8, Requirement Reference | The requirement reference is missing. An appropriate requirement reference would be section 5.2.5.1.4 of the Draft ATN SARPs | Add at the end of this section: „ Requirement Reference: Draft ATN SARPs Section 5.2.5.1.4“ |
| Section 4.3, Requirement Reference | An appropriate requirement reference would be section 5.2.5.1.2 of the Draft ATN SARPs | Add to the requirement reference list: „Draft ATN SARPs Section 5.2.5.1.2“ |
| Section 4.4, Requirement Reference | An appropriate requirement reference would be section 5.2.5.2.4 of the Draft ATN SARPs | Add to the requirement reference list: „Draft ATN SARPs Section 5.2.5.2.4“ |
| Section 4.5, 1st sentence | The requirement statement is an almost complete duplication of the requirement statement in section 3.8 | Remove duplication |
| Section 4.5, Note 2 | A requirement with reference 3.5.3 does not exist | Correct reference number or delete note |
| Section 4.5, Rationale | i) The term „standard SNDCF“ is unclear. It may refer to the SNDCF for ISO/IEC 8208 mobile subnetworks as defined in the Draft ATN SARPs. This SNDCF assumes a unique and unambiguous identification of each SNPA, but the rationale for the requirement is more or less in the support for routing ATN data through the VDL subnetwork as explained in the technical comment to section 3.8 above. ii) No functional system requirement should exist which is based on the software used to implement the VDL subnetwork | A more appropriate formulation of the rationale is offered in the comment to section 3.8 in the table above. |
| Section 4.5, Requirement Reference | An appropriate requirement reference would be section 5.2.5.1.4 of the Draft ATN SARPs | Add to the requirement reference list: „Draft ATN SARPs Section 5.2.5.1.4“ |
| Section 4.6, Note | A requirement with reference 3.5.2 does not exist | Correct reference number or delete note |
| Section 4.6, Rationale | Procedures for initiating routing information exchange in a mobile data link environment are defined in the ATN SARPs; mobile subnetworks have to support these procedures | Replace „define“ by „support“ |
| Section 4.6, Requirement Reference | An appropriate requirement reference would be section 5.2.5.2.5 of the Draft ATN SARPs | Add to the requirement reference list: „Draft ATN SARPs Section 5.2.5.2.5“ |
| Section 4.7, 1st sentence | i) This design objective is not understood ii) As this statement is grouped under the category design objective, the term „should“ may be more appropriate | Reformulate design objective Replace „shall“ by „should“ |
| Section 4.8, Requirement Reference | The requirement reference is missing. An appropriate requirement reference would be sections 5.2.5.1.6 and 5.2.5.2.6 of the Draft | Add at the end of this section: „ Requirement Reference: Draft ATN SARPs Sections 5.2.5.1.6 and |

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| | ATN SARPs | 5.2.5.2.6“ |
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| Section 4.9, Requirement Reference | An appropriate requirement reference would be section 5.2.5.2.2 of the Draft ATN SARPs | Add to the requirement reference list: „Draft ATN SARPs Section 5.2.5.2.2“ |
| Section 5.1, 1st sentence | This definition is not understood | Improve formulation |
| Section 6, Title | The term „Throughput Delay Requirements“ is unclear | Rephrase section title to „Throughput and Delay Requirements“ |
| Section 6 through section 10 | These sections contain subnetwork performance characteristics and should be arranged under the heading of section 5 | Renumber section 6 to 5.2 and so forth |
| Section 9, Rationale | There is no service availability requirement contained in this document | Add appropriate service availability requirement statement |

2.3 Typographical Comments

| VDL Design Guideline Reference | Review Comment | Proposed Amendment |
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| Section 1.2, 1st line | Typo | Delete „s“ from „aids“ |
| Section 2.1, bullet a) | Typo | Change „MHZ“ to „MHz“ |
| Section 3.7 | Typo | Replace „address(s)“ by „address(es)“ |
| Section 6, Traffic Model, 6th line | Typo | Replace „subnetwork“ by „subnetwork“ |

3. Recommendation

The working group is invited to review and consider the above comments in the process of preparing its communique to the AMCP in response to the ANC action.