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Access to VDL Mode 3 Broadcast Services

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SUMMARY

Broadcast services within the VDL Mode 3 system cannot be accessed via the presently defined ATN mobile Subnetwork Dependent Convergence Facility (SNDCF). An additional SNDCF has been defined which allows access to Mode 3 broadcast services by any user and meets all provisions of the ATN. It is requested that the ATN Panel be informed of this new SNDCF so that related work of the ATN Panel can be compatible with this SNDCF. This paper forms the basis for such a request.

References
1. ATN SARPs, Version 2.3
2. Appendix 1 - Draft SNDCF Technical Standards for VDL Mode 3

The VDL Mode 3 system provides both voice and data link capability. For data operation, a centralized ground station provides reservation access to a channel on a priority basis. Multiple aircraft belong to a common group for the purposes of channel access. A single data unit transmitted on a channel is available to the entire group. As such broadcast operations within the VDL Mode 3 system are very efficient. VDL Mode 3 is designed so that reception of broadcast data does not require a transmitter, only a receiver is needed. This configuration is attractive because of its simplicity and low cost.

The VDL Mode 3 data link is intended for Air Traffic Control (ATC) use, in which the prioritization of data for tactical use is essential and the transfer of common data to multiple aircraft is prevalent. Thus, it is critical that these two features prioritization and broadcasting be available to users of VDL Mode 3 in a cost effective and efficient manner.

The use of ISO8208 as the basis for the ATN mobile SNDCF (Reference 1, Section 5.7.6), while supported in its entirety within the VDL Mode 3 SARPs, is problematic with respect to the desired support for priority and broadcast operations. There are two areas of concern. First, the ISO8208 SNDCF presently does not support any form of broadcast operation; and even if it did, could not support the VDL Mode 3 receiver only configuration because of the duplex requirement of ISO8208 operation. Second, the need to reorganize queues at the link level, to support priority, requires the VDL Mode 3 system to track the state of all ISO8208 connections generated by the attached ATN routers. This is because priority information is only available in an ISO8208 call request and not on a per packet occurrence.

The added complexity of ISO8208 state information and the lack of broadcast support influence the cost and efficiency of operation of VDL Mode 3. This may detract from its acceptance, particularly for low-end avionics users. It is for this reason that a second mobile SNDCF was developed for the VDL Mode 3 data link. This SNDCF meets all ATN SARPs requirements. For convenience it is denoted the frame-based SNDCF and consists of a "raw" CLNP interface between ATN router and VDL Mode 3 equipment with compression of CLNP headers transmitted between air and ground. The compression supports broadcast operation (including the receiver only configuration) and point-to-point operation. The compression technique preserves the priority information for each network data unit, making link level reorganization of queues possible. Reference 2 documents the frame-based SNDCF.

The frame-based SNDCF operation is very similar to that used today when attaching, via a modem, a home PC to an Internet service provider. The modem device receives IP packets for transmittal to the remote end and performs compression of the data. The modem can be viewed as the equivalent of VDL Mode 3 equipment compressing CLNP packets.

Using the frame-based SNDCF, broadcast operations are supported in the same way as broadcast/multicast operations are supported in the Internet. There are three possibilities. First, the ATN router (and resident applications) can choose to send network data units as broadcast or point-to-point. An example of this operation is the ability to broadcast ISH packets to all aircraft, while IDRP routing updates are sent as point-to-point data to particular aircraft. Second, the VDL Mode 3 equipment can recognizes the NSAP address as a multicast address, representing a particular user group. In which case, aircraft registered for these user groups receive a broadcast packet. This assumes that the VDL Mode 3 system acts as a multicast server. Finally, the ATN router can act as the multicast server and direct multicast CLNP packets delivered to the VDL system, to be broadcast.

The AMCP requests that any future ATN provisions should be consistent with the operation of the frame-based SNDCF (as the present ATN provisions have allowed). In particular, insofar as the ATNP is considering the expansion of ATN services to include broadcast and multicast capabilities, it is requested that any future ATN broadcast/multicast provisions be compatible with the frame-based SNDCF.

Appendix 1 to **Access to VDL Mode 3 Broadcast Services**

Draft SNDCF Technical Standards for VDL Mode 3

6.7 THE VDL MOBILE
SUBNETWORK DEPENDENT
CONVERGENCE FUNCTION (SNDCF)

6.7.1 Introduction

The VDL Mode 3 mobile shall support one or more of the two defined SNDCFs. The first is an ISO 8208 based SNDCF and corresponds to that described in the ATN SARPs for mobile SNDCF. Procedures for this SNDCF are defined in Section 6.7.2. The second type of SNDCF, denoted frame-based SNDCF, shall use the procedures defined in Section 6.7.3.

   Note.— The SNDCF is termed frame-based because it uses the VDL Mode 3 frames without the need for an additional protocol (viz. ISO 8208 SNDCF) to transfer network packets. The frame-based SNDCF achieves independence from the network protocol by identifying the payload of each frame. Upon receipt of a frame, the payload field is examined and control is passed to the protocol identified.

6.7.2 The ISO 8208 SNDCF Interface

The VDL Mode 3 shall support the ISO 8208 SNDCF for mobile subnetworks as defined in the ATN SARPs, Sub-Volume V, Section 5.7.6.

6.7.3 The Frame-Based SNDCF Interface

The interface used between the network layer and the VDL Mode 3 frame-based SNDCF shall be a local issue. The interface shall be capable of indicating (1) the network protocol being used to transfer data to the remote peer and (2) whether the network packet presented to the VDL system is to be transferred as a broadcast frame or as a unicast (point-to-point) frame. In the case of a unicast frame, the address of the destination shall be provided as part of the SNDCF interface procedures. When the destination is an aircraft, the address provided must be specific enough to allow a one-to-one conversion to the 24 bit ICAO aircraft station address used internally by VDL Mode 3.

6.7.3.1. Frame-Based SNDCF Support for Broadcast and Unicast Network Packets

The frame-based SNDCF shall be capable of transferring to its remote peer both broadcast and unicast network data. Network data identified as broadcast shall be sent using the frame broadcast address. In the case of uplink traffic, network data identified as unicast shall be sent with the frame destination address set to the aircraft identifier specified by the frame-based SNDCF interface protocol. Downlink traffic will use the ground station identifier of record as the frame address for unicast data.

6.7.3.2. ATN Router Support

6.7.3.2.1   Join/Leave Events. An aircraft shall indicate that it requires ATN connectivity during net entry using the DLS Control frame as defined in the VDL Technical Manual, Section

3.7.3.3.4.1.3. The GNI, upon notification from an aircraft that ATN router connectivity is required, shall perform a join event for that aircraft with the local ATN router. When an aircraft leaves the jurisdiction of a GNI, a leave event shall occur both in the avionics and ground VDL Mode 3 equipment.

6.7.3.2.2   *Payload Identification*. When ATN connectivity is in effect the VDL Mode 3 frame-based SNDCF shall be capable of transferring all types of CLNP packets. When transferring CLNP packets the procedures of the VDL Technical Manual, Section 4.7.1 shall be used to identify each frame payload as a CLNP packet.

6.7.3.2.3   *Disposition of CLNP Packets*. When ATN connectivity has been specified during the net entry procedures, all CLNP network packets received by the SNDCF from its remote peer(s) shall be transferred to the local ATN router.

6.7.3.2.4   *ISH Packets.* ES-IS or IS-IS packets presented to the VDL Mode 3 system shall be transferred as broadcast or unicast packets as signaled by the ATN router.

6.7.3.2.5   *CLNP Compression*. Compression of CLNP packets within the frame-based SNDCF shall be supported. Compression of CLNP packets shall be performed whenever ATN connectivity is specified and shall be performed according to the procedures defined in Appendix J of the VDL Technical Manual. Compression shall be performed on both broadcast and unicast packets. The use of compression shall be signaled during net entry, using the procedures described in the VDL Technical Manual, Section 3.7.3.3.4.1.3. The compression status of each CLNP packet shall be indicated according to the procedures defined in the VDL Technical Manual Section 4.7.1.