International Civil Aviation Organization
North American, Central American and Caribbean Office
Special Eastern Caribbean Communication, Navigation and Surveillance Meeting (S-E/CAR CNS)
(Port of Spain, Trinidad and Tobago, 20 to 22 October 2004)

Agenda Item 2: Communication Developments
2.1 Status and interoperability issues of the E/CAR AFS Digital Network

INTERCONNECTION AND INTEROPERABILITY OF THE EASTERN CARIBBEAN AFS DIGITAL NETWORK

(Presented by the Secretariat)

SUMMARY

This working paper proposes the need to study the recommendation to implement the E/CAR AFS Digital Network additional interconnection point with other neighbouring Regional networks.

References:

- Report of the E-CAR/SAM-NE ICG/2 Meeting, Caracas, 1 to 5 December 2003.
- Report of the GREPECAS/10 Meeting, Las Palmas, Canary Islands, Spain, 23 – 27 October 2001.
- Report of the GREPECAS/12 Meeting, Havana, Cuba, 7 – 11 June 2004.

1. Introduction

1.1 The Second Meeting of the Informal Coordination Group of the Eastern Caribbean and North Eastern South American, held in Caracas, Venezuela, from 1 to 5 December 2003, adopted Conclusion 2/10, urging Trinidad and Tobago to take the necessary steps for the implementation of a REDDIG VSAT node in Piarco ACC by the last quarter of 2004, in order to meet AFS service requirements between the Piarco ACC and the ACCS of Georgetown, Maiquetia, Paramaribo and Rochambeau.

1.2 The GREPECAS/12 Meeting, held in Havana, Cuba, on 7 – 11 June 2004, through Conclusion 12/39 - *Additional Inter-Connection points for Regional and Inter-regional digital networks*, with the aimed of achieving a digital platform that provides homogeneous inter-operability in the CAR/SAM Regions among Regional and Inter-Regional digital communications networks in the CAR/SAM Regions and with neighboring Regions. Taking into account the current and future voice and data communications requirements, it is urgent that States, Territories and International Organizations consider implementing other points of interconnection, including the need to study the implementation of another inter-connection points of the E/CAR AFS Digital Network with the neighboring networks.

2. Analysis

2.1 Actually, the E/CAR AFS digital network has only an inter-connection point with neighboring networks through the FAA optical fiber link between Piarco and San Juan, Puerto Rico. Taking into account that it is essential to meet the AFS requirements between Piarco ACC NAM, SAM and AFI regions, it would be recommended to implement a REDDIG VSAT node in Piarco ACC and study the need and the feasibility to implement another interconnection point of the E/CAR Digital Network with other neighboring networks.

2.2 To study the points of interconnection of the E/CAR Digital Network with other neighboring network, the following essential aspects should be kept in mind:

a) The requirements of voice and printed communications between Piarco ACC and external centers to the Eastern Caribbean. As well as the requirements entity the E/CAR APP centers with the centers of the neighboring regions. These requirements are contained in Tables CNS1A and CNS1C of the FASID and are shown as Appendices A and D of the WP/04 of this meeting.

b) The infrastructure and the available logistical support in the proposed site.

c) The "Guidance material to initiate the analysis of digital network interconnection in the CAR/SAM Regions" recommended by the Conclusion 10/27 of the GREPECAS. In the **Appendix** is shown the mentioned guidance material.

3. Suggested Action

3.1 The Meeting is invited to:

a) take note of the information contained in this paper;

b) support the recommendation of implementation for a REDDIG VSAT node in Piarco ACC;

c) study the need and the feasibility to implement another interconnection point of the E/CAR Digital Network with other neighboring networks; and

d) suggest other actions.

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APPENDIX A

GUIDANCE MATERIAL TO INITIATE THE ANALYSIS OF DIGITAL NETWORK INTERCONNECTION IN THE CAR/SAM REGIONS

1. Background

1.1 This material was elaborated to present proposals to discuss the interconnection of digital networks in the CAR/SAM regions, where digital networks for the aeronautical fixed service (AFS) have been established or are in implementation. As necessary, these networks could require an interconnection, in order that users of final or end systems, of different network environment, that have requirements to be connected by the aeronautical fixed service, can do it. The final user could be a person or a determined application programme operating a communications system terminal or is a resident.

Communications networks

2.1 When speaking about communications networks, this idea is immediately linked to means to communicate users and its end systems. In the past, this was related with specific services such as the telephone, telex, etc. Nowadays, the situation has evolved and the networks move towards multiprotocol/multiservice network concepts in which, in a same network, various services are offered using the same switching/multiplexed system in their nodes. This presents advantages with respect to the savings in exploitation and equipment costs.

2. We can distinguish three basic elements in a network: the final user with its end systems, the node with its network functions (switching and routing) and the physical means for the information transmission and connection of the nodes. Figure 1-1 below shows this subject taking into account the connection of any two nodes in a network.

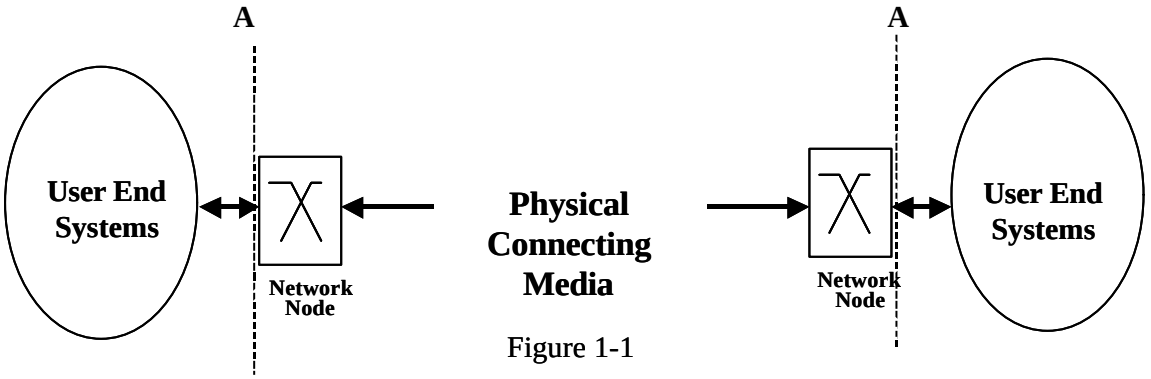

Figure 1-1

2.2.1 The user systems are all those final systems such as automatic switches or AFTN terminals, PABX, connections to LANs, routers, voice switching systems for air traffic consoles (VSCS), network management systems, etc.

2.2.2 The network nodes are composed of:

a) interphases for user systems (A-A dotted line in Figure 1-1)
b) interphases for connection to the physical media; and
c) network protocol (Frame Relay ISDN, ATM) for switching and routing functions.

Note: The network protocol should, as possible, provide support to voice and data to achieve an effective and efficient integration of the communications services.

2.2.2.1 The physical interphases are those necessary to connect the network nodes to the agreed physical media, such as: UHF, microwave, optic fibre, satellite, copper wires, etc.

2.2.3 A digital network is established within a community of users under an institutional agreement reflecting the interests of those users to implement the communications services. This institutional agreement establishes the framework for the technical development of the network and the manner of its exploitation, administration, operation and maintenance. On the other hand, the network, as a communications structure, uses routing procedures and schemes established by the user community to which it provides the communications services.

2.3 There are many network topologies for the electric connection of the nodes such as: mesh, star, ring, etc. In the CAR/SAM Regions, since they are extensive networks covering States/Territories, their nodes are normally connected with a mesh/star topology.

3. Digital network interconnection

3.1 One should start from the fact that the networks, upon being established as mentioned in paragraph 2.2.3, are normally different communications structures even though, from the functional point of view, the same objective is achieved. In this sense, we can have networks of different physical media and protocols, such as networks based on VSAT technology, Frame relay, ISDN, etc. Taking into consideration this matter, the network interconnection should start taking into account the fact of keeping the independence of the network environments and the need that an effective and efficient integration of services should exist at the interconnection points that could involve the connection of one or more nodes of the two networks in question. Upon observing Figure 1-1, it can be noted that if the interconnection is made at the network services level, advantages could be obtained in the use of the network protocols of both networks, while the independence of same are maintained. This would mean connecting the nodes to the same service level that the user interphases obtain at the A-A points in Figure 1-1. Figure 2-2 shows this matter.

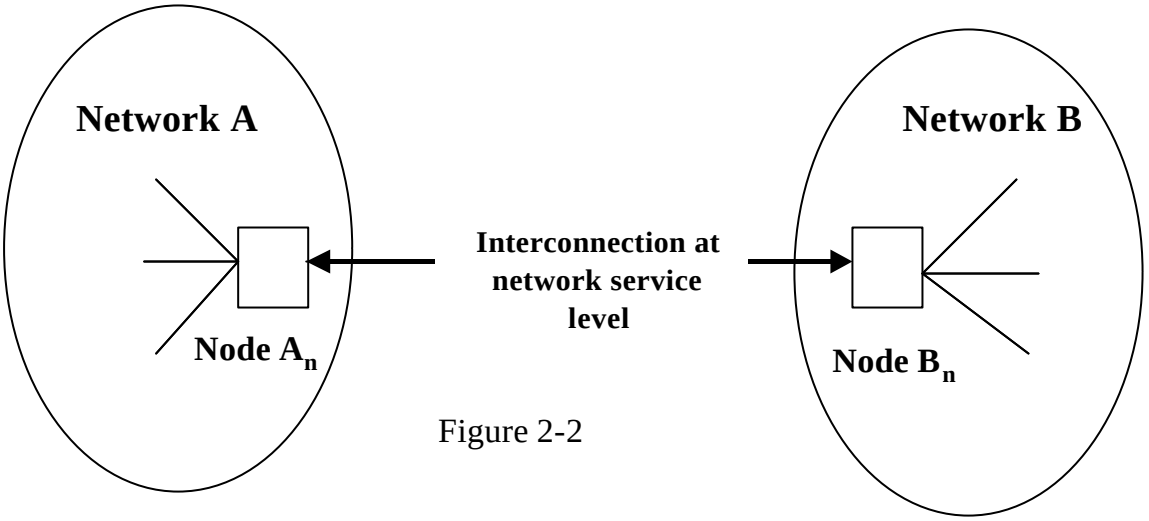

Figure 2-2

3.1.1 The interconnection advantages through the method shown in Figure 2-2 are the following:

a) Independence of the physical means used by the networks. A VSAT network can be interconnected with one of optic fibre or microwave, or two dissimilar VSAT networks can be interconnected without having to carry out the co-location of nodes to avoid problems with speech communications mentioned in 3.1.2;

b) institutional agreements with regard to management, maintenance, etc., and the routing method of the communications in each network is maintained;

c) The interconnection media can be independent and different to the means employed in the network environments to be interconnected;

d) The interconnection media can be established in a flexible and economical manner. Services offered by the public/private carriers could be used; and

e) If necessary, the inter-networking of the communications services would be possible.

3.1.2 The inter-connection of digital networks is greatly facilitated when the networks have an open architecture.

3.1.3 As a matter of importance for the interconnection of digital networks, it is necessary to note that data interconnection, be it for the AFTN and/or ATN inter-network, is guaranteed, since the communications ports of the user end systems can be connected to one or another network at the A-A interphases indicated in Figure 1-1. The most critical aspect to be taken into consideration and that can define how to make the networks interconnection, is the interconnection of voice channels. This interconnection must maintain the quality of the voice and the degree of the service, where the delay due to the use of geostationary satellites and the digital voice signalling process play an important role. In this respect, the one-way end-to-end delay should be less than 400 ms.

4. **Network interconnection in the CAR/SAM region**

4.1 In the CAR/SAM regions, there has been a development of digital networks that established clearly defined network environments. In this regard, note should be taken of the following:

MEVA SCPC/DAMA/PAMA VSAT network using PAS-5 satellite, that establishes point-to-point connections between its users for voice and data. The DAMA access is used for voice switching. It also has PAMA access for non-switched voice circuits and for data circuits. Its users are mainly located in the Central Caribbean. MEVA is currently being reconfigured and it is most likely that it can adopt an open network architecture. The network is exploited by a communications provider in charge of the technical support and the administration of the system.

E-CAR ATN compatible ground ISDN optic fibre network. The E-CAR network has its users located mostly in the Eastern Caribbean and one node in the SAM Region (CARACAS) that will facilitate its interconnection with the REDDIG. The network is exploited by a communications provider in charge of the technical support and the administration of the system.

REDDIG An open network design system, multiservice/multiprotocol, for voice, data and video communications, compatible with the ATN, based on Frame Relay and will use, as main physical media, VSAT technology with TDMA access method and ISDN ground backup to connect its nodes. Its users will be all SAM States with the exception of Panama. It is expected to be implemented by 2002. The network will be operated by the SAM States, with a system administration to be established by these States through a regional agreement. .

CAMSAT COCESNA's ATN compatible Frame Relay VSAT network. Its users are in Central America. It uses the Intelsat 805 satellite.

COLOMBIAN VSAT NETWORK Likewise, Colombia has operated for one year a SCPC/DAMA/PAMA network using the INTELSAT 805 satellite, servicing 36 nodes with two geographically redundant HUBs located in Bogota and Barranquilla. The CAR/SAM/3 RAN meeting recommended that a study be made on the benefits of the use of this network to improve voice/data communications with Jamaica, Netherlands Antilles, Panama and COCESNA (Conclusion 9/8).

4.2. As it can be observed, the CAR/SAM network environments were established with different institutional agreements for its exploitation, administration, operation and maintenance. It is necessary to note that currently VSAT networks interconnection solutions have been implemented through node co-location, such is the case of CAMSAT and MEVA. However, this trend is not always applicable since on one hand the solution could be very expensive and on the other, there would be a proliferation node co-location for the VSAT networks, practice that has been taken with certain reserve by some States. In this regard, it would be convenient, as it has been analyzed in Informal Meetings on interconnection of digital networks and in the RLA/98/019 Project (REDDIG), to develop a case by case interconnection approach based, as possible, on the network services of the nodes to be interconnected, as indicated in above paragraph 3.

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