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CAR/SAM REGIONAL PLANNING IMPLEMENTATION GROUP (GREPECAS)
Fifth Meeting of the CNS Committee of the GREPECAS ATM/CNS Subgroup (CNS/COMM/5)
Lima, Peru, 13 to 17 November 2006

Agenda Item 1: Communication systems developments
1.1 Review of the integration/interconnection and development status of the regional digital networks

DEVELOPMENT AND INTERCONNECTION/INTEGRATION OF THE VSAT MEVA II AND REDDIG DIGITAL NETWORKS

(Presented by the Secretariat)

SUMMARY

This working paper makes a review of the progress made in the implementation, development, and interconnection/integration of the MEVA II and REDDIG digital networks.

References:

- Report of the CAR/SAM RAN 3 Meeting, Doc. 9749.
- CAR/SAM Air Navigation Plan (FASID).
- Final report of the GREPECAS/10 and GREPECAS/12 Meetings.
- Report of the Second MEVA II REDDIG Coordination Meeting, (Lima Peru, 20-22 March 2006).
- Report of the Third MEVA II REDDIG Coordination Meeting (Mexico City, Mexico, 26-28 July 2006).
- Report of the First Meeting of the MEVA II REDDIG Interconnection Task Force (Mexico City, 3-5 May 2006).
- Report of the Second Meeting of the MEVA II REDDIG Interconnection Task Force (Lima Peru, 2-3 October 2006).

1. Introduction

1.1 The implementation and interconnection of digital networks have been based on Recommendation 9/1 – *Implementation of digital networks to improve the current AFS (Aeronautical Fixed Service) and facilitate the introduction of the ATN* formulated by the Third CAR/SAM Regional Air Navigation Conference (CAR/SAM RAN 3) (Buenos Aires, 5-15 October 1999). This recommendation urged States to continue with the coordinated implementation of modern digital communication networks, and asked GREPECAS to develop the relevant criteria and guidelines for the interconnection of available and emerging digital networks, and to use ICAO technical co-operation mechanisms to implement these networks and interconnect them.

1.2 The GREPECAS/10 Meeting (Las Palmas, Spain, 23-27 October 2001) adopted preliminary material concerning the interconnection of digital aeronautical communication networks (Conclusion 10/27), as well as general principles for the design of digital networks (Conclusion 10/26) and capacity building for the exchange of large amounts of information through digital aeronautical communication networks (Conclusion 10/28).

1.3 The GREPECAS/12 Meeting (Havana, Cuba, 7-11 June 2004) stressed that it was important to continue with the efforts to achieve a homogeneous interconnection of digital communication networks within the CAR/SAM Regions and inter-regionally with neighbouring regions, taking into account current and future voice and data communication requirements. To this end, it formulated Conclusion 12/39 – *Additional interconnection points for regional and inter-regional digital networks*. The additional points of interconnection recommended were Merida (Mexico), Barranquilla or Bogota (Colombia) and Buenos Aires (Argentina). The points of interconnection considered previously were: Maiquetia (Venezuela), Miami (United States), San Juan (Puerto Rico), Piarco (Trinidad and Tobago), and Tegucigalpa, Honduras (COCESNA).

1.4 In order to develop a homogeneous network between the MEVA II and the REDDIG networks, the GREPECAS/13 Meeting (Santiago, Chile, 14-18 November 2005) formulated Conclusion13/70 - *Establishment of agreements to achieve the MEVA II - REDDIG interconnection/interoperation*.

1.5 As a follow-up on GREPECAS Conclusion 13/70, two MEVA II / REDDIG Coordination Meetings were held with the participation of the States/International Organisations that are members of these networks, as well as two Meetings of the MEVA II / REDDIG Interconnection Task Force. The MEVA II / REDDIG Coordination Meetings were held in Lima Peru, 20-22 March 2006, and in Mexico City, Mexico, on 26-28 July 2006. The Meetings of the Task Force were held in Mexico City, 3-5 July 2006, and in Lima, Peru, 2-3 October 2006.

1.6 **Appendices A** and **B** to this working paper illustrate the status of the REDDIG and MEVA II digital networks, respectively.

2. Analysis

2.1 Taking into account current and future SARPs and the communication requirements in the CAR and SAM Regions, there is a need for an integration/interconnection between the MEVA II and REDDIG digital networks. To this end, implementation studies were conducted through the MEVA II / REDDIG coordination Meetings and the Meetings of the MEVA II/REDDIG interconnection Task Force. **Appendix C** to this paper shows the requirements for voice and data service among CAR/SAM States.

2.2 Studies on the interoperation of the MEVA II/REDDIG digital networks were started with an analysis of three implementation options:

1) Total homogeneous integration
2) Partial homogeneous integration between the nodes that need it.
3) Non-homogeneous interconnection.

Total homogeneous integration

2.3 Total homogeneous integration represents the merging of the MEVA II and REDDIG networks into a single VSAT network that does not require the implementation of additional means of communication for their integration. This option would be eased by the fact that the MEVA II and the REDDIG are VSAT networks with similar characteristics (full mesh configuration, using TDMA/Frame Relay-type satellite access, use of the PAS 1R satellite with beam directed over the United States/Latin America, C-band operating frequencies and vertical linear polarisation, use of similar equipment for FRAD and MODEM). For the synchronisation of the integrated network, a single reference carrier (MRT) and an AMRT (alternate MRT) would be used. **Appendix D** to this working paper contains two diagrams for this configuration. Under this configuration, any MEVA II nodescould communicate with any REDDIG Nodes, and vice versa.

Partial homogeneous interconnection between the Nodes requiring it

2.4 This option contemplates the implementation of an additional terminal MODEM (Linkway 2100) and other devices, such as dividers/combiners, in the MEVA II or REDDIG Nodes that require inter-network communications, a study of the possible need of increasing power, a study of the bandwidth associated to the interconnection, the number of carriers and their associated cost, which would enable it to operate on the "other" network. According to this configuration, every Node of the REDDIG that has a MEVA II MODEM installed, may communicate with another node of the MEVA II.

Non-homogeneous interconnection

2.5 For this MEVA II – REDDIG interconnection alternative, the following aspects have been considered:

a) installation of a REDDIG Node in Tegucigalpa, Honduras (COCESNA). The implementation of a REDDIG Node in Honduras would permit the establishment of ATS speech communication requirements between the Guayaquil and Bogota ACCs. With a MEVA Node in Honduras, the MEVA II – REDDIG interconnection would be made easier. In this way, other circuits required for ATS speech communications as well as current AFTN circuits would be implemented in the MEVA II and REDDIG nodes.

b) interconnection between the MEVA II and REDDIG networks through the establishment of a dedicated ground circuit between a REDDIG Node (for example, Bogota or Maiquetia) and a MEVA II Node (for example, Tegucigalpa or San Juan, Puerto Rico). The selected REDDIG Node would receive all the information from the other REDDIG Nodes that need to communicate with MEVA II. Likewise, the selected MEVA II node would receive all the information from the MEVA II Nodes that need to communicate with the REDDIG.

c) implementation of a MEVA II Node in Maiquetía, which would facilitate voice and data communications between Caracas and Curaçao, between Aruba and Josefa Camejo; would provide redundancy to voice and data communications between Maiquetia and San Juan, Puerto Rico. Furthermore, through this Node, other telecommunication services would be implemented between the MEVA II and REDDIG Nodes.

2.6 The second MEVA II / REDDIG Coordination Meeting, held in Lima, Peru, 20-22 March 2006, after analysing the three aforementioned options, considered that options 1 and 2, described in paragraph 2.2, were the most appropriate, since they offered advantages such as the use of a single satellite hop, keeping voice and data communication delays to a minimum, a seamless and independent operation for group users (REDDIG, MEVA II and MEVA II/REDDIG), no significant additional investment on major equipment or stations, flexibility to incorporate new interconnection users into any of the networks, compliance with the principles of regional digital network interoperation and easy implementation of existing inter-network AFS services, as well as ATN router interconnections, new radar data exchange services, and other communication services.

2.7 In order to analyse options 1 and 2, the Second MEVA II / REDDIG Coordination Meeting created the MEVA II and REDDIG interconnection Task Force, made up by a small group of people, with the task of analysing more in depth the aspects mentioned in the previous paragraph. The group was formed by the following States, International Organizations and company: Argentina, Brazil, Colombia, United States, Venezuela, COCESNA, Americom Government Services (AGS) and the REDDIG Administrator, under the coordination of ICAO. See Conclusion 2/2 (Study of Options Nº 1 and Nº 2 on integration/interconnection solutions.

2.8 The Task Force met from 3-5 May 2006 at the ICAO NACC Regional Office, in Mexico, and reviewed the technical and administrative aspects, as well as the cost-benefit ratio of the aforementioned options.

2.9 Upon analysing the two options, the Task Force formulated three Draft Conclusions: Draft Conclusion 1/1 (Technical, operational and cost-benefit feasibility of the solution involving a total homogeneous integration/interoperability of the VSAT MEVA II and REDDIG networks); Draft Conclusion 1/2 (Proposal for the partial homogeneous interconnection/interoperation of the VSAT MEVA II and REDDIG networks); and Draft Conclusion 1/3 (Proposed action for the adoption of the MEVA II / REDDIG integration/interconnection modality).

2.10 Conclusion 1/1 stated that the solution involving a total homogeneous integration between the VSAT MEVA II and REDDIG networks is, from the technical and operational point of view, and according to the results of the cost-benefit analysis, a viable solution and would generate significant benefits.

2.11 Conclusion 1/2 stated that, based on the results of the technical/operational feasibility studies and the cost-benefit analysis, a partially homogeneous solution could be temporary and would be implemented in order to attain the goal of the consolidation of the MEVA II and REDDIG networks. This would require the adoption of administrative and operational arrangements that meet the premises of this type of solution.

2.12 Conclusion 1/3 stated that, since the two options are feasible from the technical, operational, and cost-benefit points of view, they should be further analysed.

2.13 The Third MEVA II REDDIG Coordination Meeting was held in Mexico City, Mexico, on 26-28 July 2006. This Meeting took note that the members of both REDDIG and MEVA II were satisfied with the existing arrangements in their networks. Consequently, the Meeting considered that the implementation of the homogeneous integration solution would not be possible in the initial stage, and that the interconnection solution should be analysed.

2.14 The Meeting considered that the interconnection solution to be analysed involved the installation of MEVA II MODEMS in the REDDIG Nodes of Colombia and Venezuela, as well as the installation of a REDDIG MODEM in Tegucigalpa, COCESNA. **Appendix E** shows the interconnection diagram.

2.15 The Meeting formulated Conclusion 3/1 (Technical and operational feasibility analysis of the MEVA II / REDDIG interconnection solution), which stated that the best option, based on the technical and operational analysis, would be the integration, but that the most feasible option during the initial stage would be the interconnection, seeking network integration after a period of five years; to this end, it would be necessary to make a more in-depth analysis of the interconnection solution, which would consist of the implementation of the MEVA II MODEM in Venezuela and Colombia, and a REDDIG MODEM in COCESNA.

2.16 The Meeting assigned the MEVA II/ REDDIG Task Force with the preparation of a more in-depth analysis of the interconnection solution, in terms of the technical and administrative aspects, and with the drafting of a Memorandum of Understanding (MoU) for its implementation.

2.17 The MEVA II REDDIG Interconnection Task Force made a more thorough analysis of the technical and administrative aspects of the interconnection solution, and prepared a Memorandum of Understanding (MoU) for the implementation of the interconnection, containing mainly information on the cooperative technical process of the agreement, the technical terms of reference, and the financial responsibility of the parties.

3 Conclusions

3.1 As a result of the activities carried out for the MEVA II / REDDIG integration/interconnection described in section 2 of this working paper, it is concluded that the integration of the MEVA II and REDDIG networks into a single consolidated network under a single network control unit, represents the best option; but, due to the operational management systems of the two VSAT networks, it would be difficult to change them at the present time. Therefore, it was felt that this option would be implemented five years from now.

3.2 During this five-year period, an interconnection between the VSAT MEVA II / REDDIG networks will be established, and they will continue to operate independently, managed through their respective management centres. The administrative arrangements related to supervision and control aspects, space segment, the acquisition of spare parts and equipment installation, maintenance and security and control have been defined and included in the Memorandum of Understanding, to be implemented by the parties involved.

3.3 Likewise, in view of the technical and administrative difficulties that arise at the time of interconnecting/integrating VSAT networks, in order to facilitate the implementation of current and future services, the proliferation of independent VSAT networks at the regional level or between adjacent regions should be avoided, and consideration should be given to the expansion of existing VSAT networks. In this respect, the Fifth Meeting of the ALLPIRG Advisory Group (ALLPIRG/5), held at ICAO Headquarters, Montreal, Canada, on 23-24 March 2006, in relation to the implementation of VSAT networks, formulated Conclusion 5/16 (Implementation of very small aperture terminals (VSATs) discouraging the proliferation of VSAT networks in places where VSAT networks can be expanded to serve new areas of interest.

4. Suggested action

4.1 The Meeting is invited to:

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

b) take note of the operation and status of implementation of the MEVA II and REDDIG networks presented in Appendices A and B to this working paper;

c) analyse and issue recommendations on the technical and administrative configurations for the integration and interconnection of the VSAT MEVA II and REDDIG networks described in section 2 ; and

d) recommend other actions that the Meeting may deem appropriate.

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APPENDIX A

DESCRIPTION AND STATUS OF THE REDDIG

1. GENERAL DESCRIPTION OF A REDDIG NODE

1.1 Each REDDIG Node is mainly composed of the following equipment:

a) Base band CX950
b) Satellite Linkway Modem 2100
c) 40W Power Amplifier and LNB Receptor
d) 3.7M Parabolic Antenna

1.2 Each node has redundancy (duplicated equipment) for items a), b) and c). For the selection of "on line / standby" equipment (chain), there is:

- 1 Base band switcher
- 1 wave guidance switcher for transmission
- 1 wave guidance switcher for reception

1.3 Also, for monitoring and control purposes (M&C) of the Node both local and remote, each Node has a Linux PC with their respective inter-phases to act on each equipment of the Node and also for the selection of the "on line / standby" equipment (chain).

CX950 Base Band Equipment

1.4 There are two groups of equipment employed (as regards configuration and amount), depending on the interphase (analogue or digital) of the voice channels of each Node:

a) *Nodes with digital interphase of voice channel:*
SPIM, SEGU and SKED

b) *Nodes with voice channel analogue interphase***:**
SAEZ, SLLP, SBCT, SBMN, SBRF, SCEL, SGAS, SOCA, SMPM, SYGC, SUMU and SVMI

Satellite Linkway 2100 equipment Modem

1.5 All the Nodes have for each operation chain:

(1) Linkway 2100 satellite Modem, with entry and exit in L Band, which has also installed:
(1) Serial Frame Relay Module (slot 1)

40W Power amplifier equipment and LNB Receptor

1.6 All the Nodes have for each operation chain:

(1) 40W power amplifier with "Block Up Converter" (BUC) internally installed in the amplifier.
L Banda entry (with external reference provided by the linkway modem and C Band exit
(1) LNB Receptor
C Band Entry and L Band exit (with reference and external DC feeding entry provided by the Linkway Modem).

3.7M Antenna Equipment

1.7 All the Nodes have:

(1) One parabolic antenna for transmission and signal with co-linear polarization feeder. This antenna has an adjustment mechanism for azimuth the elevation, azimuth and polarization.

2. OPERATION THEORY

2.1 The users' services are connected to the REDDIG through FRAD devices in dual configuration. The FRAD supports interphases and protocols required by the user, which uses voice and equipment service and data-transmitting equipment.

2.2 The FRAD equipment used by the REDDIG is the CX 950. For serial entry and exit interconnection with users' services, the FRAD uses interphases cards.

2.3 The FRAD equipment provides voice and data switching functions having operations on permanent and switched circuits. All the users are multiplexed in one WAN interphase using Frame Relay protocol. Each FRAD defines an only permanent virtual circuit (PVC) for each possible destination.

2.4 The analogue and digital entry user information to the FRAD exits as a frame relay permanent virtual circuit for each destination. The Frame Relay PVC are configured in the "full mesh" modality This means, that in each site a PVC two-ways circuit is connected to each one of the nodes of the network .

2.5 Currently, REDDIG is composed of 15 nodes, which implies that ll the possible frame relay permanent virtual circuits in a full mesh configuration are 105 ((N* (N-1)/ 2) N = number of Nodes of the REDDIG).

2.6 The exit of the FRAD is connected to the satellite Modem (2100 Via Sat linkway). The Modem works under the multi-carrier mode, TDMA (Time Division Multiple Access). A VSAT network using this Modem may bear up to 256 carriers. The number of carriers depends on the network traffic. All the carriers in a satellite transponder are shared on demand by all users of the same.

2.7 The assignment of the carrier to the terminal is carried out in a dynamic manner by the NCC (Network Control Center). The Modem supports five modulation rates 312Ksps, 625Ksps, 1.25Msps, 2.5Msps and 5Msps.

2.8 The exit of the Modem in L band is connected to the external amplifier (40 watts SSPA) which also converts the signal in C band. The REDDIG uses three carrier frequencies, two of them modulated with an 1.25M symbols/sec index and one to 0.625M symbols/sec.. Therefore, the REDDIG is a TDMA network operating in C band, using PAS-1R satellite with a beam over Untied States and Latin America, located at 45° W. The transponder used is 3C/4C.

NCC Network Control Centre

2.9 The NCC is the most important element of the REDDIG, and is composed by two SUN working stations with UNIX Solaris operational system. Its function is to handle and control the TDM network of the Linkway 2100 Modems. It monitors the network traffic and dynamically assigns bandwidth to the sites according to the traffic demand and availability of bandwidth.

2.10 Due to the importance of the NCC, it has to have a backup station. The backup station automatically takes control of the network in case the main NCC has total failure problems, or when changes to operate from auxiliary to main are programmed.

2.11 The NCC presents a dual configuration in each station. Currently, the NCC are located in Manaus (Brazil) and Ezeiza (Argentina). From the beginning of the REDDIG operations, in September 2003, up to 15 December 2005, the NCC operated in Lima, Peru. The NCC of Lima has been transferred to Manaus and became operative on 15 December 2005. Between the Manaus NCC and the Ezeiza NCC there is a dedicated link circuit for the transference of operations of the NCC.

2.12 The NCC links with all the satellite Modems (Linkway 2100) located in each Node of the REDDIG through the master reference terminal (MRT). The MRT is a Linkway 2100 terminal but loaded with a special configuration. The MRT provides synchronization for the entire network and is the core of the network. If the MRT fails, the entire network collapses. Due to the importance of the MRT, it has a backup. If the MRT fails, the NCC shall use the backup to maintain synchronization in the network. This change is automatic and normally the network is not aware on this respect.

2.13 In the REDDIG the main MRT is physically separated from the backup MRT. Modem A from SBMN and Modem A from SAEZ are the main backup couple of the REDDIG. This geographical separation was determined, based on the sun outage period. The active NCC has an Ethernet connection with the main and backup MRT through a 64Kbits/sec dedicated line. This line is the same as described in paragraph 2.11.

2.14 In each NCC a working station is installed which carried out the network management. Its main function is to provide graphical information of the network Nodes (monitoring) and the necessary network commands. The working station with operative system Windows 2000 has several programmes of application for monitoring and control installed, such as Memotec Cx Tool, Memotec Cx Access, Netscape 4.77, HP Open View, telnet y ftp. The monitoring and control is made on the same satellite network but also has a Modem connected to the public telephone network.

2.15 The monitoring and control on the network is carried out on permanent virtual circuits on Internet Protocol (IP) unlike those services as described, which use permanent virtual circuits in Frame Relay. The total number of PVC in IP on the network for each NCC is 14. The total number of PVC in IP is 27 (2*(N-1)-1) where N = number of Nodes of the REDDIG.

Local Control and monitoring

2.16 For the monitoring and control in each Node, there is a PC with operative system SuSE Linux 7.3. The computer is connected to the outdoor unit, the base band switch, the wave guide switches, the Linkway Modems and the FRAD multiplexers. Firstly this PC acts as a redundancy controller. Secondly this PC is the main local user interface. The site personnel can use the PC to connect, monitor and configure local equipment. The NCC through the network accesses local equipment of the node through the Linux PC. If there is any failure it may be made through the modem through the public telephone network. Finally, the PC is used to store the configuration files.

CURRENT STATUS OF THE REDDIG

2.17 As of 15 December 2005, the NCC operations were initiated in Manaus, Brazil. The operations of moving the NCC from Lima to Manaus were initiated in October 2005. Moving operations were carried out by the staff in charge of the REDDIG administration.

2.18 With the implementation of the NCC in Manaus Conclusion RCC3/3 (*Designation of nodes for management of the REDDIG*) formulated during the Third Coordination Meeting of the REDDIG (Lima, Peru, 6-7 November 2002) is complied with.

2.19 The backup network was implemented in the REDDIG Nodes that have installed ISDN connections with the local telephone providers. In the following Nodes, the backup network SAEZ, SKED, SPIM, SBMN, SBCT, and SUMU is operating.

2.21 From the last week of September 2006 the REDDIG VSAT node of Piarco, Trinidad &Tobago started its operation.

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APPENDIX B

SUMMARY ON THE IMPLEMENTATION STATUS OF THE MEVA II VSAT NETWORK IN THE CENTRAL CARIBBEAN

1. The MEVA VSAT network was developed and implemented since 1996 mainly in the Central Caribbean, providing voice and data communications of the Aeronautical Fixed Services (AFS) between fifteen VSAT-equipped nodes in the Central Caribbean and neighbouring zones. MEVA operates in the 4-6 GHz C-band on the PAS-1R satellite and uses SCPC/DAMA technology for bandwidth-on-demand communications and circuit management. This network has made possible to implement and improve the AFTN and ATS speech circuits required for this area in the Air Navigation Plan.

2. The States, Territories and International Organizations Members MEVA[1], considering the SARPs contained in Annex 10, Vol. III, Chapter 3, as well as the ICAO guidance related to the need, not only to satisfy the AFS communications requirements, but also aimed at supporting the communications, navigation, surveillance and air traffic management services; that is, to facilitate the introduction of aeronautical telecommunications network (ATN), recognized the need to update the MEVA Network, to facilitate the adoption of protocols and services with common interfaces equipment based on the reference model for the open systems interconnection (OSI) of the International Standardization Organization (ISO), and the MEVA Network interconnection/interoperability achievement with other regional and sub-regional digital networks, Such as the South American Digital Network (REDDIG). This initiative is called “MEVA II Network”.

3. The MEVA Technical Management Group, integrated by experts from States, Territories and an International Organization, studied in detail the MEVA update aspects toward the MEVA II Network implementation, such work represented the basis for the Request for Information (RFI) and subsequently the Request for Proposals (RFP) for the MEVA II and so the evaluation and selection of the best proposal. This stage process culminated with the MEVA/10 Meeting, held in Mexico City, 13 – 15 December 2004, in which the level of Civil Aviation Directors approved the Service Provider for the MEVA II Network, as well as the updated Document of Agreement (DOA) for the MEVA II Network, which has been approved through the signatures of Directors of Civil Aviation.

4. The MEVA II Network has been conceived with a satellite technology access VSAT/TDMA/Frame Relay type, through a “Full Mesh” network topology, the use of PAS 1R satellite with beam directed over United States / Latin America, operation frequencies in the C band, and vertical linear polarization. All of this contributes with the objectives to satisfied the AFS communications required at present, contribute and ease the ATN subnetworks implementation and to achieve interoperability between the MEVA II network and the REDDIG and other CAR Region subregional networks, contributing with the implementation of the new CNS/ATM systems, including the new ATM integrated global system.

5. During the first months of 2005, the MEVA II TMG finalized Annex I of the MEVA II Document of Agreement, which is a technical document describing the network. Likewise, the transition plan of MEVA to MEVA II was developed. Based on these documents and in accordance with the corresponding national laws, the MEVA II Members arranged their contracts with the MEVA II Service Provider. Cuba and Panama established their MEVA contracts through the ICAO Technical Co-operation Bureau.

6. Regarding the implementation and activation of the MEVA II network, the initial implementation of some parts of the network were carried out in the United States and Bahamas. Subsequent to this action, the next MEVA II implementation programme has been executed with a high rate of success.

MEVA II Network Implementation Programme – 2006	
Date	**MEVA II nodes implementation**
Before 16 October	United States and Bahamas
16 – 21 October	Havana, Cuba Kingston, Jamaica
21 – 26 October	San Juan Santo Domingo Curacao Port-au-Prince
26 October to 1 November	Grand Cayman Panama City Aruba COCESNA – Honduras
5 – 12 November	St Maarten

***Note**: The MEVA I network will continue its functions during the transition stage.*

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APPENDIX C

REQUIREMENTS FOR ATS ORAL VOICE AND DATA SERVICE AMONG CAR/SAM STATES/TERRITORIES AND ORGANIZATIONS

Summary of CAR/SAM interoperability requirements																	
No.	**State/Station**	**ARUBA,** Aruba	**COLOMBIA**	Barranquilla	Bogota	Cali	Medellín	San Andrés	**ECUADOR**, Guayaquil	**JAMAICA**, Kingston	**NETHERLANDS A.** Curacao	**PANAMÁ**, Panamá	**PUERTO RICO**, San Juan	**VENEZUELA**	Caracas	Josefa Camejo	**COCESNA**, Tegucigalpa	**Total per State**
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	**ARUBA**, Aruba															V		**1 Voice**
2	**COLOMBIA**																	**8 Voice + 1 Data**
2.1	Barranquilla									V	V	V						
2.2	Bogotá											D,V					V	
2.3	Cali											V						
2.4	Medellín											V						
2.5	San Andrés											V						
3	**ECUADOR**, Guayaquil																V	**1 Voice**
4	**JAMAICA**, Kingston			V														**1 Voice**
5	**NETHERLANDS A.** Curacao			V											D,V			**2 Voice + 1 Data**
6	**PANAMA**, Panamá			V	D,V	V	V	V										**5 Voice + 1 Data**
7	**PUERTO RICO**, San Juan														D,V			**1 Voice + 1 Data**
8	**VENEZUELA**																	**3 Voice + 2 Data**
8.1	Caracas										D,V		D,V					
8.2	Josefa Camejo	V																
9	**COCESNA**, Tegucigalpa				V				V									**2 Voice**
	Total per Station	1 Voice		3 Voice	2 Voice + 1 Data	1 Voice	1 Voice	1 Voice	1 Voice	1 Voice	2 Voice + 1 Data	5 Voice + 1 Data	1 Voice + 1 Data		2 Voice + 2 Data	1 Voice	2 Voice	

***Note**: Additionally to the requirements shown on the Table, ATN router interconnections, new services for the exchange of radar data and other communications services should be added, all of which still remains under review and definition process.*

Summary of NAM/SAM interoperability requirements		
Communication service	**Type**	
2	3	
AFTN **BRAZIL**, Brasilia – UNITED STATES main circuit	Data	
AFTN **PERÚ**, Lima – UNITED STATES main circuit	Data	
AFTN **VENEZUELA**, Caracas – UNITED STATES main circuit	Data	
ATN router Interconnection No. 1 (Plan under review)	Data	
ATN router Interconnection No. 2 (Plan under review)	Data	
Other future services	Data	

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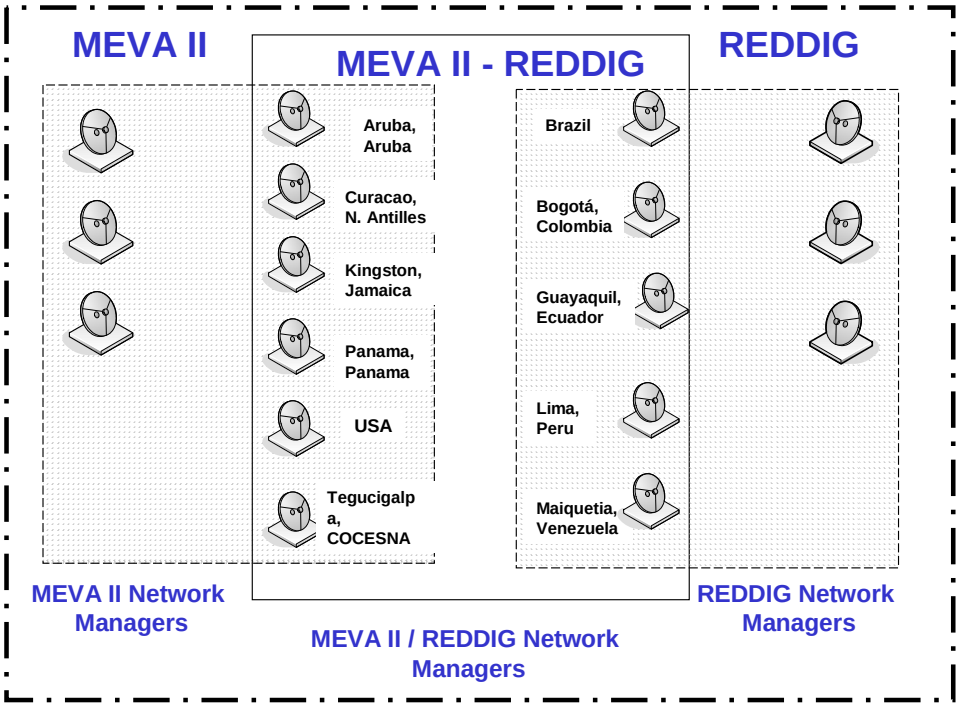
APPENDIX D

MEVA II REDDIG INTEGRATION

Diagram 1 – MEVA II / REDDIG Integration

PAS 1R @ 45° W



<u>Note</u> : The dashed dark line represent a total network operator

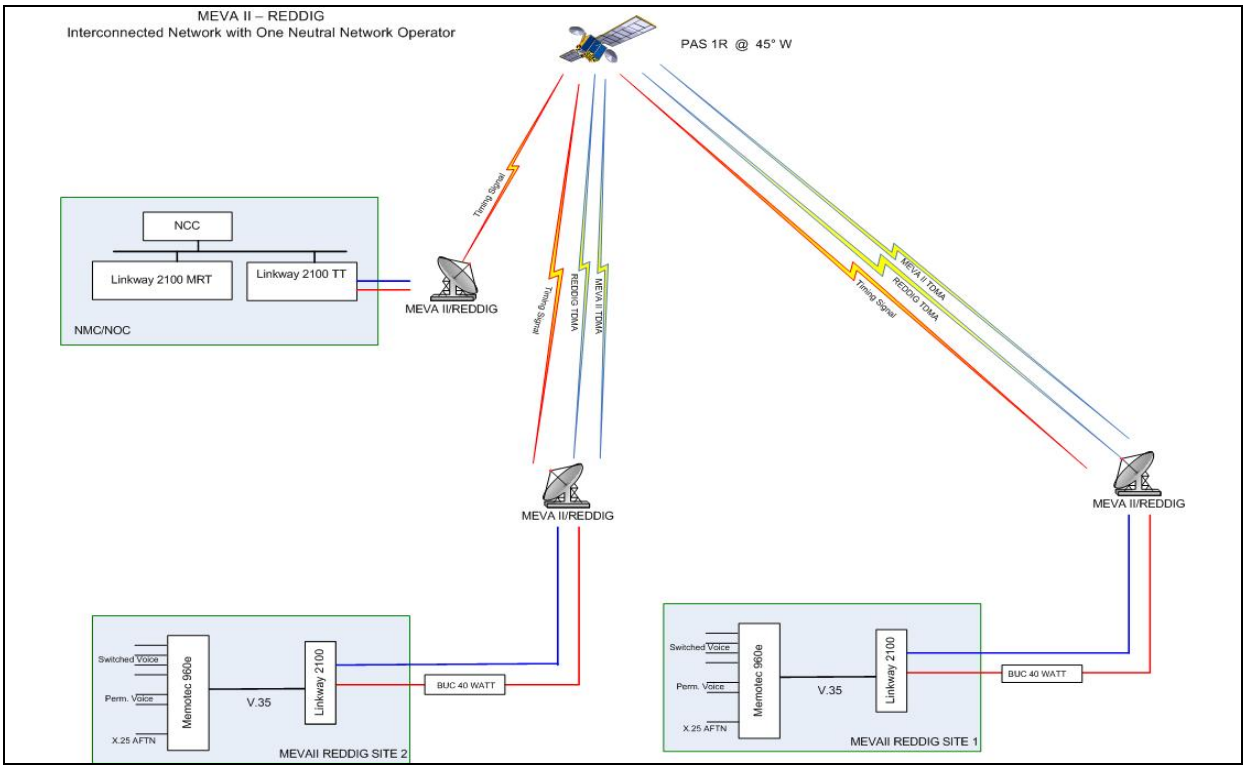


Diagram 2 –MEVA II – REDDIG network integration with one network operator

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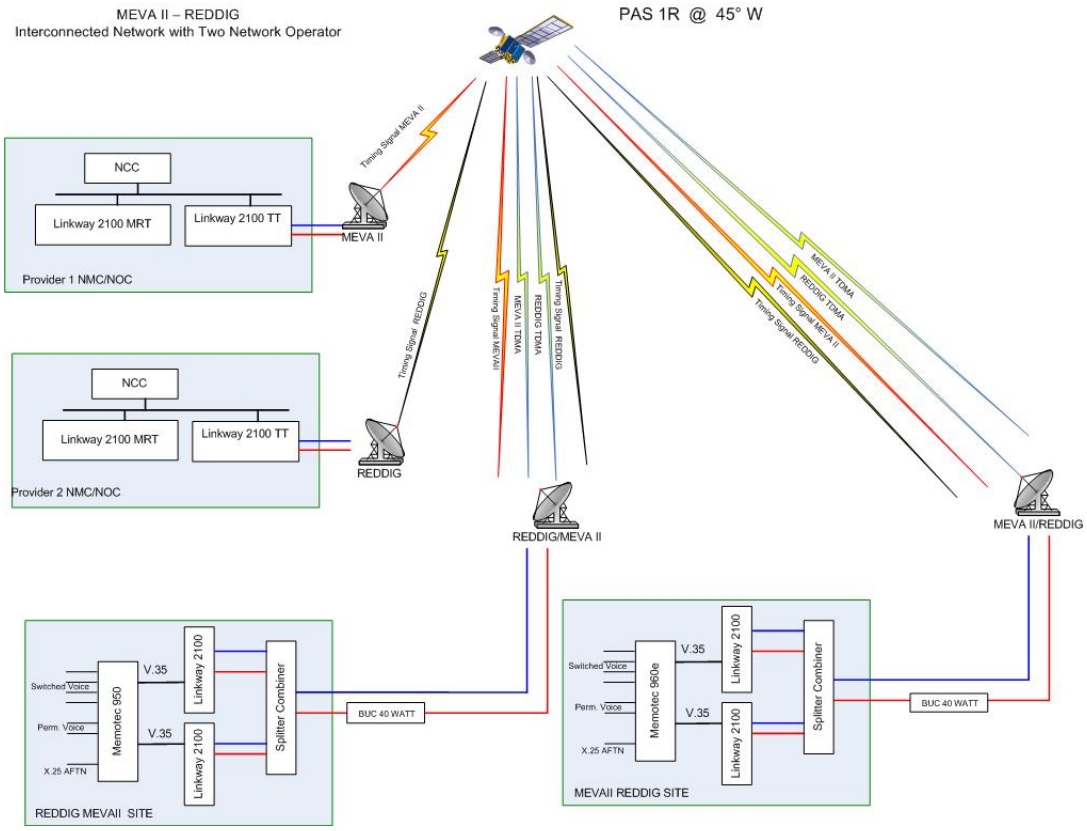
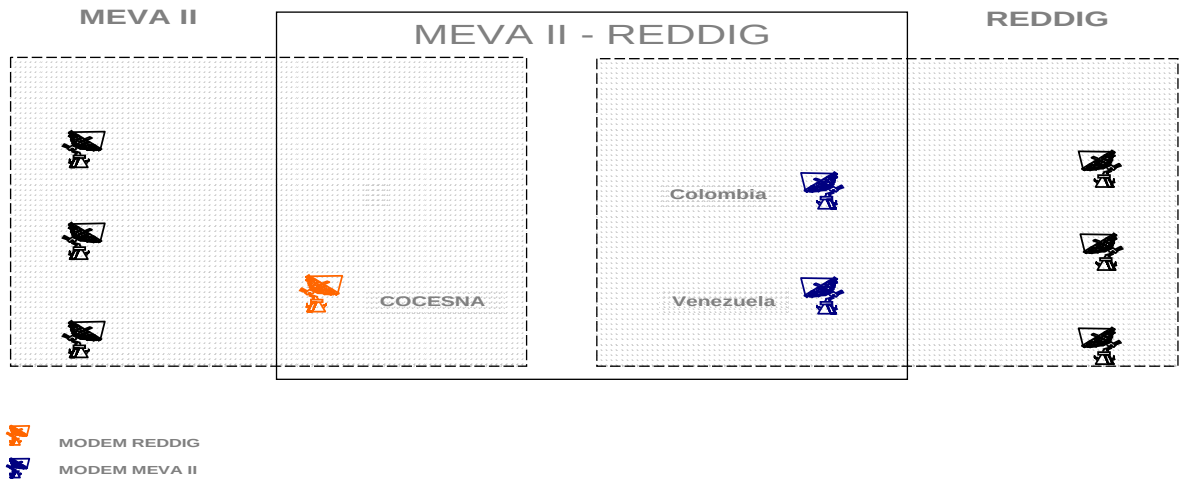
APPENDIX E

MEVA II REDDIG Interconnection diagrams

MEVA II – REDDIG interconnection with two independent network operators





MEVA II and REDDIG Nodes involved in the interconnection