International Civil Aviation Organization
North American, Central American and Caribbean Office (NACC)
GREPECAS CAR Project D – ATN infrastructure in the CAR Region and its ground-ground and ground-air applications
Santo Domingo, Dominican Republic, 27 September 2013

Agenda Item 2:   **ATN Infrastructure in the CAR Region and its Ground - Ground and Ground – Air applications**
2.2   Initiate Plan for an IP ATN CAR backbone network configuration

REVISION OF CAR IPv4 ADDRESSING SCHEME

(Presented by Dominican Republic)

SUMMARY
This paper presents for your information of the D Project and the AMHS Task Force, the results and recommendations for updating the existing CAR IPv4 Addressing scheme.

References:
• First NAM/CAR Air Navigation Implementation Working Group Meeting (ANI/WG/1), Mexico City, Mexico, 29 July to 1 August 2013

Strategic Objectives	*This working paper is related to Strategic Objectives:* *A. Safety – Enhance global civil aviation safety* *C. Environmental Protection and Sustainable Development of Air Transport*

1.   Introduction

1.1   During the First Meeting of the Air Navigation Implementation Working Group (ANI/WG/1), Dominican Republic presented a review of the IPV4 addressing scheme for the inter/intra-regional ground-ground links of the CAR/SAM Regions, and pointed out some errors detected in this scheme, as well as some inconsistencies that impede its correct implementation. Also Dominican Republic presented a draft scheme where only the permitted addresses are used, without the network and broadcast addresses, and the redundant links were eliminated and it proposed that the current network be studied to know how many additional links are required, if the network is to remain the same, so as to reserve the necessary address blocks.

2.   Discussion

2.1   In view of the above-mentioned, the ANI/WG Meeting agreed that the ANI/WG Task Force on the implementation of ATS Messages Handling Systems (AMHS) should analyze the IPV4 addressing scheme and the observations presented by the Dominican Republic and inform the ANI/WG of actions taken in this regard.

2.2   Attached to this paper is the WP/26 presented in the ANI/WG/01 Meeting.

3.   Suggested Actions

3.1   The Meeting is invited to review the results and proposal shown in WP/26 as **Appendix** to this paper, and present the corresponding update proposal for the IPv4 addressing scheme.

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ANI/WG/1 — WP/26
15/07/13

International Civil Aviation Organization
North American, Central American and Caribbean Office (NACC)
First NAM/CAR Air Navigation Implementation Working Group Meeting (ANI/WG/1)
Mexico City, Mexico, 29 July to 1 August 2013

Agenda Item 4:   **Air Navigation Matters**
                  4.2   Follow-up on the Implementation of the NAM/CAR Regional Performance Based Air Navigation Plan (RPBANIP):
                  • **Progress reports of the former Sub-regional Working Groups on AIM, ATM and CNS areas.**

REVIEW OF THE IPV4 ADDRESSING SCHEME FOR THE INTER/INTRA-REGIONAL G-G LINKS OF THE CAR/SAM

(Presented by Dominican Republic)

SUMMARY
This working paper points out some errors detected in the proposed IPv4 addressing scheme for the ground-ground links between the different States of the CAR Region. This scheme was constructed and presented for the purpose of planning the use of IP addresses among the different States. Each State has an IP address block for internal use, and another block for communication with the rest of the States. In the scheme for the latter, there were inconsistencies detected that would impede its correct implementation

References:
• IPv4 Addressing Scheme — Inter/ Intra Regional G-G Links For Nam/Car Regions (http://www.mexico.icao.int/fasid/NAMCAR-IPv4AddressingScheme.pdf)

Strategic Objectives	*This working paper is related to Strategic Objectives:* *A. Safety – Enhance global civil aviation safety* *C. Environmental Protection and Sustainable Development of Air Transport*

1.   Introduction

1.1   The implementation of AMHS in the CAR region will be done mostly on the existing MEVA network. To this end one or more circuits will be enabled using IPS (Internet Protocol Suite, referring to what is commonly named TCP/IP).

1.2　　　　　To accomplish the materialization of this network in an orderly manner, an IP Plan has been developed, where it is specified which addresses will be used by each State in the said network. In this IP Plan address blocks are reserved for each State for use in the AMHS stations, and also other address blocks for the routers that will communicate each State with the rest.

1.3　　　　　In the first meeting of the CNS/ATM subgroup in May, 2010, an IPv4 IP plan was presented for the CAR region, which was adopted by GREPECAS as a reference for the when determining which IP addresses to use in the implementation of AMHS.

2.　　　　　Analysis

2.1　　　　　The scheme has two parts: Part I specifies address blocks for the host stations of each State. Part II specifies address blocks for the routers that communicate one State with the other.

2.2　　　　　In Part II, the address blocks (or subnets) are specified in the following manner: 10.31.224.x/30, where x = {0,4,8,12,16,…, 168}, in multiples of 4. The "/30" part indicates the subnet mask is 30 bits, which among other things determines that each block has four possible addresses.

2.3　　　　　Each State appears with as many subnets so as to accommodate addresses for each of its adjacent States: for example, Dominican Republic appears with addresses for the links with United States, Haiti, Curaçao and Puerto Rico.

2.4　　　　　Part II has some fundamental flaws. The first one is that, in a subnet, the first address and the last address are always reserved, because they have a special meaning for the subnet. The first address of a subnet is the network address, which identifies the whole subnet. The last address of a subnet is the broadcast address, used for simultaneous communication with all the clients of the subnet. Therefore, neither the first address nor the last address can be assigned to any device in the network. In the scheme these reserved addresses are used for the routers, which would be rejected by the devices, and even if not, there wouldn't be a correct communication with these devices.

2.5　　　　　The second flaw is that the links repeat themselves. If, for example, in the section for Dominican Republic are specified the addresses for the routers between that State and Curaçao, it is not necessary in the section for Curaçao to specify the link with Dominican Republic. In the scheme presented these types of anomalies occur.

2.6　　　　　The third observation, done by Joe Knecht during the discussion between United States and the Dominican Republic in the implementation of AMHS, is that currently the network used for ground-ground communications does not take into account all the possible links between each country and its adjacent ones. For example, many MEVA States communicate with the rest by means of the United States, and not directly with each of those States. In practice, the amount of links is much less than the ones in the scheme.

3. **Proposals**

3.1 To correct the first two observations in the scheme of Part II, the **Appendix** of this working paper presents a scheme where only the permitted addresses are used, without the network and broadcast addresses, and the redundant links are eliminated. There has been the intent of maintaining similarity with the previous list, so the variation has the less impact possible.

3.2 As for the third observation, the proposal is in the sense that this scheme can be kept as a reference of a future network, more oriented to a "mesh". As links become necessary, the corresponding addresses would be looked up in this table. For those links that currently exist and are not indicated in this table, the vacant blocks can be used. It is proposed that the network be studied to know how many additional links are required, if the network is to remain the same, so as to reserve the necessary address blocks.

3. **Conclusion**

3.1 The enabling of the link is an important activity in the implementation of AMHS, which has a significant impact on the continuity of these projects. It is necessary that when connecting the systems, the network present no unanticipated hindrances that produce lost time troubleshooting connectivity problems. Good planning of the addresses will avoid confusions and conflicts, something very important as the network gets larger and more populated.

4. **Suggested actions**

4.1 The meeting is invited to:

a) Take note of this information;
b) Revise and update the IPv4 address plan for the CAR region, taking into account the proposal of the Appendix and the observations detailed in section 2 of this working paper; and
c) Take other actions as necessary.

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APPENDIX

Proposal for the Update of the IPv4 Address Plan for G-G routers between States in the CAR region

Network: 10.31.224.0/19

No.	Subnet	Admin & local host	Via	Links	IPv4 Address
1	10.31.224.0/30	Anguila	E/CAR	**Network Address**	10.31.224.0/30
				Trinidad & Tobago (Piarco)	10.31.224.1/30
				Anguila	10.31.224.2/30
				Broadcast Address	10.31.224.3/30
2	10.31.224.4/30	Antigua	E/CAR	**Network Address**	10.31.224.4/30
				Trinidad & Tobago (Piarco)	10.31.224.5/30
				Antigua	10.31.224.6/30
				Broadcast Address	10.31.224.7/30
3	10.31.224.8/30	Aruba	MEVA	**Network Address**	10.31.224.8/30
				Jamaica (Kingston)	10.31.224.9/30
				Aruba	10.31.224.10/30
				Broadcast Address	10.31.224.11/30
4	10.31.224.12/30	Bahamas / Nassau	MEVA	**Network Address**	10.31.224.12/30
				Haiti (Port-au-Prince)	10.31.224.13/30
				Bahamas / Nassau	10.31.224.14/30
				Broadcast Address	10.31.224.15/30
5	10.31.224.16/30	Barbados	E/CAR	**Network Address**	10.31.224.16/30
				Barbados	10.31.224.17/30
				Trinidad & Tobago (Piarco)	10.31.224.18/30
				Broadcast Address	10.31.224.19/30
6	10.31.224.20/30	Belice / Belice	CAMSAT	**Network Address**	10.31.224.20/30
				Belice / Belice	10.31.224.21/30
				Honduras (COCESNA) Tegucigalpa	10.31.224.22/30
				Broadcast Address	10.31.224.23/30
7	10.31.224.24/30	British Virgin Islands / Tortola	MEVA	**Network Address**	10.31.224.24/30
				British Virgin Islands / Tortola	10.31.224.25/30
				United States of America (Miami)	10.31.224.26/30
				Broadcast Address	10.31.224.27/30
8	10.31.224.28/30	Cayman I.	MEVA	**Network Address**	10.31.224.28/30
				Cayman I.	10.31.224.29/30
				Jamaica (Kingston)	10.31.224.30/30
				Broadcast Address	10.31.224.31/30

No.	Subnet	Admin & local host	Via	Links	IPv4 Address
9	10.31.224.32/30	Costa Rica (San José)	CAMSAT	**Network Address**	10.31.224.32/30
				Costa Rica (San José)	10.31.224.33/30
				Honduras (COCESNA) Tegucigalpa	10.31.224.34/30
				Broadcast Address	10.31.224.35/30
10	10.31.224.36/30	Cuba / La Habana	MEVA	**Network Address**	10.31.224.36/30
				Cuba (La Habana)	10.31.224.37/30
				Haiti (Port-au-Prince)	10.31.224.38/30
				Broadcast Address	10.31.224.39/30
11	10.31.224.40/30	Cuba / La Habana	MEVA	**Network Address**	10.31.224.40/30
				Cuba (La Habana)	10.31.224.41/30
				Jamaica (Kingston)	10.31.224.42/30
				Broadcast Address	10.31.224.43/30
12	10.31.224.44/30	Cuba / La Habana	MEVA	**Network Address**	10.31.224.44/30
				Cuba (La Habana)	10.31.224.45/30
				Honduras (COCESNA) Tegucigalpa	10.31.224.46/30
				Broadcast Address	10.31.224.47/30
13	10.31.224.48/30	Cuba / La Habana	TBD	**Network Address**	10.31.224.48/30
				Cuba (La Habana)	10.31.224.49/30
				México (Mérida)	10.31.224.50/30
				Broadcast Address	10.31.224.51/30
14	10.31.224.52/30	Curaçao	MEVA	**Network Address**	10.31.224.52/30
				Curaçao	10.31.224.53/30
				Dominican Republic	10.31.224.54/30
				Broadcast Address	10.31.224.55/30
15	10.31.224.56/30	Curaçao	MEVA	**Network Address**	10.31.224.56/30
				Curaçao	10.31.224.57/30
				Haiti (Port-au-Prince)	10.31.224.58/30
				Broadcast Address	10.31.224.59/30
16	10.31.224.60/30	Curaçao	MEVA	**Network Address**	10.31.224.60/30
				Curaçao	10.31.224.61/30
				Puerto Rico (San Juan)	10.31.224.62/30
				Broadcast Address	10.31.224.63/30
17	10.31.224.64/30	Dominican Republic / Santo Domingo	MEVA	**Network Address**	10.31.224.64/30
				Dominican Republic (Santo Domingo)	10.31.224.65/30
				Haiti (Port-au-Prince)	10.31.224.66/30
				Broadcast Address	10.31.224.67/30

No.	Subnet	Admin & local host	Via	Links	IPv4 Address
18	10.31.224.68/30	Dominican Republic / Santo Domingo	MEVA	**Network Address**	10.31.224.68/30
				United States of America (Miami)	10.31.224.69/30
				Dominican Republic (Santo Domingo)	10.31.224.70/30
				Broadcast Address	10.31.224.71/30
19	10.31.224.72/30	Dominica	E/CAR	**Network Address**	10.31.224.72/30
				Dominica	10.31.224.73/30
				Trinidad & Tobago (Piarco)	10.31.224.74/30
				Broadcast Address	10.31.224.75/30
20	10.31.224.76/30	El Salvador / San Salvador	CAMSAT	**Network Address**	10.31.224.76/30
				El Salvador	10.31.224.77/30
				Honduras (COCESNA) Tegucigalpa	10.31.224.78/30
				Broadcast Address	10.31.224.79/30
21	10.31.224.80/30	French Antilles (Guadeloupe) / Point-a-Pitre	E/CAR	**Network Address**	10.31.224.80/30
				French Antilles (Martinique) / Fort-de-France	10.31.224.81/30
				Trinidad & Tobago (Piarco)	10.31.224.82/30
				Broadcast Address	10.31.224.83/30
22	10.31.224.84/30	French Antilles (Guadeloupe) / Point-a-Pitre	E/CAR	**Network Address**	10.31.224.84/30
				French Antilles (Guadeloupe) / Point-a-Pitre	10.31.224.85/30
				Trinidad & Tobago (Piarco)	10.31.224.86/30
				Broadcast Address	10.31.224.87/30
23	10.31.224.88/30	Grenada	E/CAR	**Network Address**	10.31.224.88/30
				Grenada	10.31.224.89/30
				Trinidad & Tobago (Piarco)	10.31.224.90/30
				Broadcast Address	10.31.224.91/30
24	10.31.224.92/30	Guatemala (La Aurora)	CAMSAT	**Network Address**	10.31.224.92/30
				Guatemala (La Aurora)	10.31.224.93/30
				Honduras (COCESNA) Tegucigalpa	10.31.224.94/30
				Broadcast Address	10.31.224.95/30
25	10.31.224.96/30	Haiti / Port-au-Prince	MEVA	**Network Address**	10.31.224.96/30
				Haiti (Port-au-Prince)	10.31.224.97/30
				Jamaica (Kingston)	10.31.224.98/30
				Broadcast Address	10.31.224.99/30
26	10.31.224.100/30	Honduras / Tegucigalpa (COCESNA)	CAMSAT	**Network Address**	10.31.224.100/30
				Honduras (COCESNA) Tegucigalpa	10.31.224.101/30
				Honduras (San Pedro Sula)	10.31.224.102/30
				Broadcast Address	10.31.224.103/30

No.	Subnet	Admin & local host	Via	Links	IPv4 Address
27	10.31.224.104/30	Honduras / Tegucigalpa (COCESNA)	CAMSAT	**Network Address**	10.31.224.104/30
				Honduras (COCESNA) Tegucigalpa	10.31.224.105/30
				Panamá	10.31.224.106/30
				Broadcast Address	10.31.224.107/30
28	10.31.224.108/30	Honduras / Tegucigalpa (COCESNA)	CAMSAT	**Network Address**	10.31.224.108/30
				Honduras (COCESNA) Tegucigalpa	10.31.224.109/30
				United States of America (Miami)	10.31.224.110/30
				Broadcast Address	10.31.224.111/30
29	10.31.224.112/30	Honduras / Tegucigalpa (COCESNA)	MEVA	**Network Address**	10.31.224.112/30
				Honduras (COCESNA) Tegucigalpa	10.31.224.113/30
				México (Mérida)	10.31.224.114/30
				Broadcast Address	10.31.224.115/30
30	10.31.224.116/30	Honduras / Tegucigalpa (COCESNA)	CAMSAT	**Network Address**	10.31.224.116/30
				Honduras (COCESNA) Tegucigalpa	10.31.224.117/30
				NAM (Atlanta)	10.31.224.118/30
				Broadcast Address	10.31.224.119/30
31	10.31.224.120/30	México / Mérida	TBD	**Network Address**	10.31.224.120/30
				México (Mérida)	10.31.224.121/30
				NAM (Atlanta)	10.31.224.122/30
				Broadcast Address	10.31.224.123/30
32	10.31.224.124/30	Montserrat	E/CAR	**Network Address**	10.31.224.124/30
				Montserrat	10.31.224.125/30
				Trinidad & Tobago (Piarco)	10.31.224.126/30
				Broadcast Address	10.31.224.127/30
33	10.31.224.128/30	Puerto Rico / San Juan	E/CAR	**Network Address**	10.31.224.128/30
				Puerto Rico (San Juan)	10.31.224.129/30
				United States of America (Miami)	10.31.224.130/30
				Broadcast Address	10.31.224.131/30
34	10.31.224.132/30	Puerto Rico / San Juan	MEVA / REDDIG	**Network Address**	10.31.224.132/30
				Puerto Rico (San Juan)	10.31.224.133/30
				SAM (Caracas)	10.31.224.134/30
				Broadcast Address	10.31.224.135/30
35	10.31.224.136/30	Saint Kitts & Nevis / Saint Kitts	E/CAR	**Network Address**	10.31.224.136/30
				Saint Kitts & Nevis / Saint Kitts	10.31.224.137/30
				Trinidad & Tobago (Piarco)	10.31.224.138/30
				Broadcast Address	10.31.224.139/30
36	10.31.224.140/30	Saint Kitts & Nevis / Nevis	E/CAR	**Network Address**	10.31.224.140/30

No.	Subnet	Admin & local host	Via	Links	IPv4 Address
				Saint Kitts & Nevis / Nevis	10.31.224.141/30
				Trinidad & Tobago (Piarco)	10.31.224.142/30
				Broadcast Address	10.31.224.143/30
37	10.31.224.144/30	Saint Lucia	E/CAR	**Network Address**	10.31.224.144/30
				Saint Lucia	10.31.224.145/30
				Trinidad & Tobago (Piarco)	10.31.224.146/30
				Broadcast Address	10.31.224.147/30
38	10.31.224.148/30	Sint Marteen	MEVA	**Network Address**	10.31.224.148/30
				Sint Marteen	10.31.224.149/30
				United States of America (Miami)	10.31.224.150/30
				Broadcast Address	10.31.224.151/30
39	10.31.224.152/30	Sint Marteen	E/CAR	**Network Address**	10.31.224.152/30
				Sint Marteen	10.31.224.153/30
				Trinidad & Tobago (Piarco)	10.31.224.154/30
				Broadcast Address	10.31.224.155/30
40	10.31.224.156/30	Saint Vicent & the Grenadines	E/CAR	**Network Address**	10.31.224.156/30
				Saint Vicent & the Grenadines	10.31.224.157/30
				Trinidad & Tobago (Piarco)	10.31.224.158/30
				Broadcast Address	10.31.224.159/30
41	10.31.224.160/30	Turks & Caicos / Grand Turk	MEVA	**Network Address**	10.31.224.160/30
				Turks & Caicos / Grand Turk	10.31.224.161/30
				United States of America (Miami)	10.31.224.162/30
				Broadcast Address	10.31.224.163/30
42	10.31.224.164/30	Trinidad & Tobago / SAM (Venezuela)	E/CAR	**Network Address**	10.31.224.164/30
				Trinidad & Tobago (Piarco)	10.31.224.165/30
				SAM (Caracas)	10.31.224.166/30
				Broadcast Address	10.31.224.167/30
43	10.31.224.168/30	CAR/SAM (TBD)	E/CAR	**Network Address**	10.31.224.168/30
				CAR	10.31.224.169/30
				SAM (Caracas)	10.31.224.170/30
				Broadcast Address	10.31.224.171/30
44	10.31.224.172/30	Aruba	MEVA	**Network Address**	10.31.224.172/30
				Aruba	10.31.224.173/30
				Curaçao	10.31.224.174/30
				Broadcast Address	10.31.224.175/30
45	10.31.224.176/30	Bahamas / Nassau	MEVA	**Network Address**	10.31.224.176/30

No.	Subnet	Admin & local host	Via	Links	IPv4 Address
				Bahamas / Nassau	10.31.224.177/30
				United States of America (Miami)	10.31.224.178/30
				Broadcast Address	10.31.224.179/30
46	10.31.224.180/30	Cayman I.	MEVA	**Network Address**	10.31.224.180/30
				Cayman I.	10.31.224.181/30
				Cuba (La Habana)	10.31.224.182/30
				Broadcast Address	10.31.224.183/30
47	10.31.224.184/30	Cuba / La Habana	MEVA	**Network Address**	10.31.224.184/30
				Cuba (La Habana)	10.31.224.185/30
				United States of America (Miami)	10.31.224.186/30
				Broadcast Address	10.31.224.187/30
48	10.31.224.188/30	Curaçao	MEVA	**Network Address**	10.31.224.188/30
				Curaçao	10.31.224.189/30
				Jamaica (Kingston)	10.31.224.190/30
				Broadcast Address	10.31.224.191/30
49	10.31.224.192/30	Dominican Republic / Santo Domingo	MEVA	**Network Address**	10.31.224.192/30
				Dominican Republic (Santo Domingo)	10.31.224.193/30
				Puerto Rico (San Juan)	10.31.224.194/30
				Broadcast Address	10.31.224.195/30
50	10.31.224.196/30	Honduras / Tegucigalpa (COCESNA)	CAMSAT	**Network Address**	10.31.224.196/30
				Honduras (COCESNA) Tegucigalpa	10.31.224.197/30
				Nicaragua (Managua)	10.31.224.198/30
				Broadcast Address	10.31.224.199/30
51	10.31.224.200/30	Puerto Rico / San Juan	E/CAR	**Network Address**	10.31.224.200/30
				Puerto Rico (San Juan)	10.31.224.201/30
				Trinidad & Tobago (Piarco)	10.31.224.202/30
				Broadcast Address	10.31.224.203/30
52	10.31.224.204/30	Vacant		**Network Address**	10.31.224.204/30
				Vacant	10.31.224.205/30
				Vacant	10.31.224.206/30
				Broadcast Address	10.31.224.207/30
53	10.31.224.208/30	Vacant		**Network Address**	10.31.224.208/30
				Vacant	10.31.224.209/30
				Vacant	10.31.224.210/30
				Broadcast Address	10.31.224.211/30
…	…	…		**…**	…
				…	…

No.	Subnet	Admin & local host	Via	Links	IPv4 Address
				…	…
				…	…
2048	10.31.255.252/30	Vacant		**Network Address**	10.31.255.252/30
				Vacant	10.31.255.253/30
				Vacant	10.31.255.254/30
				Broadcast Address	10.31.255.255/30

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