INTERNATIONAL CIVIL AVIATION ORGANIZATION

CAR/SAM 01/01 CNS Informal Meeting

(Bogota, 9 to 11 October 2001)

Agenda Item 2 Status of implementation of CAR/SAM digital networks and their interconnection

INTEGRATION OF THE CAR/SAM NETWORKS

(Presented by the United States)

Summary

This paper present information on possible solutions to be taken into consideration while discussing the future integration of the CAR/SAM Networks

1. BACKGROUND

1.1 The CAR/SAM FASID and ATN Transition Plan identify Peru, Venezuela and USA (San Juan, PR and Miami, FL) as the nodes through which the REDDIG, MEVA, and E-CAR Regional Networks will interconnect. The CAMSAT network is connected to the MEVA network through a common node in Honduras. This paper presents several options to be taken into consideration while discussing the following items:

- The interconnection of the CAR/SAM sub-regional networks (CAMSAT, E-CAR, MEVA, REDDIG)
- The voice connectivity between Columbia (a REDDIG member State) and Panama, Jamaica, Curacao, and COCESNA (MEVA member States).

1.2 A color-coded map of all the networks in the CAR/SAM region can be found in the **Appendix A** of this document.

2. DISCUSSION

2.1 The interconnection of the CAR/SAM sub-regional networks

2.2 MEVA/REDDIG Interconnection

2.2.1 The United States and Peru are connected through a satellite circuit provided by Satellite Communications System, Inc (SCSI), which is also the service provider for the MEVA network. SCSI uses the satellite PANAMSAT PAS-1R to carry the Peru-USA and the MEVA AFTN links by using the Single Carrier Per Channel / Permanently Assigned Multiple Access (SCPC/PAMA) protocol. Please note that the MEVA network also utilizes SCPC / Dynamically Assigned Multiple Access (SCPC/DAMA) protocol for voice communication.

2.2.2 Once REDDIG is fully implemented, one might/could possibly assumed that traffic between REDDIG member States and US could be router through the Lima node. The US is integrated in the MEVA network via the Miami node; the AFTN traffic between MEVA member States and REDDIG member States could therefore transit through the Lima and Miami nodes.

2.2.3. The REDDIG network will be using the Time Division Multiple Access and Frame Relay (TDMA/FR) protocol combination while MEVA is using Single Carrier Per Channel and X.25 (SCPC/X.25). **These protocols are not compatible**. However, in the event of REDDIG using the PANAMSAT PAS-1R satellite, a hybrid station could be built using the same antenna and RF equipment, able to process TDMA/FR and SCPC/X.25 in parallel. *Vsat vendors need to be contacted to validate the feasibility of this hybrid station.* If feasible, this hybrid Vsat station should be able to receive and send data from both networks. Once the data is processed, a router located at the node would direct the traffic accordingly. This feature could conceivably decrease the cost of the interconnection.

2.2.3.1. *Although this option seems particularly attractive it introduces a major single point of failure*. If the satellite suddenly fails both the MEVA and REDDIG will be unable to communicate at all, and the E-CAR network will be cut-off from MEVA and REDDIG. Such a failure would plunge the entire CAR/SAM region “in the dark”. Note, that the E-CAR network will still be able to exchange traffic with Venezuela and the USA through the triangular connection Piarco-Caracas-San Juan that uses underwater cables (copper and optical fiber). This satellite failure will have to be address through comprehensive Contingency Plans at the regional and network levels to re-establish connectivity as soon and as smoothly as possible.

2.3 E-CAR/REDDIG Interconnection

2.3.1 The E-CAR network architecture is a triangle with its fulcrums at Trinidad and Tobago, Antigua, and Puerto Rico. The San Juan node in Puerto Rico is part of MEVA and is also connected to Venezuela (an entry point to REDDIG); like Trinidad and Tobago. In the event of a Piarco-Caracas link failure, the data traffic between E-CAR and REDDIG member States could be routed to Lima through the USA via the San Juan and Miami nodes. The primary alternative route however would be to route the traffic through San Juan to Caracas. The bandwidth of these links should be wide enough to accommodate the sudden increase in traffic, however the link between Caracas and San Juan, although running on bandwidth manager, is still using Teletype protocols. To insure an efficient exchange of traffic through this critical link, the protocol should be upgraded to X.25.

2.4 **E-CAR / MEVA connection**

2.4.1 The E-CAR network, currently running on a fiber optic backbone augmented by microwave links, is connected to the US through the San Juan (PR) node. The San Juan node is also a node of the MEVA network. As seen on the map in Appendix A, San Juan is a critical node for the CAR/SAM region. It is the link between MEVA and E-CAR, and also one of the interconnection points of the REDDIG network. Its failure (due to a hurricane or other catastrophic event) could lead to a disruption of the regional traffic. In order to diversify the possible paths, connecting Trinidad and Tobago directly to Miami can be envisioned. Perhaps by installing a MEVA or MEVA compatible station in Piarco, or by an underwater link.

2.5 **CAMSAT/REDDIG Interconnection**

2.5.1 Currently the CAMSAT network is connected to the other regional networks through MEVA. This connection does not have redundancy; it would be wise to implement a connection to the REDDIG network to provide diversity.

3. Voice connectivity between Colombia, COCESNA, Curacao, Jamaica and Panama.

3.1 During the CAR/SAM CNS 00/01 meeting held in Mexico City in June 2000, the members recognized that the existing voice circuits between Colombia FIRs and the FIRs managed by COCESNA, Curaçao, Jamaica and Panama were expensive and outdated, and needed to be replaced.

3.2. Both MEVA and Colombia's National network are satellite networks that use different technology and service providers. This creates a technological hurdle because of the unacceptable delay introduced by a "double-hop" through both networks.

3.3 In a Working Paper, the MEVA Technical Management Group (MEVA TMG) proposed that a MEVA compatible Vsat station be installed in Colombia. This solution offers a lot of advantages (reduced costs for the MEVA Members, direct AFTN connection to all MEVA Members for Colombia, increased interconnectivity between regional networks). *However*, to avoid a "double-hop" (once through the MEVA network and one through the Colombian network) a MEVA compatible Vsat Stations would need to be installed in each of the Colombian FIRs. This would significantly increase the cost of the connection, probably past the present cost.

3.4 Colombia proposed that each of the 4 other States install a Vsat station compatible with its National network. This is a valid technical solution for the double-hop problem, but these stations would only be used for voice connectivity, and installation and recurring costs would probably be over the cost of the existing circuits.

3.5 Another solution could be to re-compete the existing circuits. Since these circuits were procured, private companies have significantly expanded and upgraded their communications links in the region. A lot of optical fiber trunks now crisscross the region, and, perhaps, a cheaper solution using commercial dedicated lines could be found.

4. CONCLUSION

4.1 During the brainstorming preceding the writing of this paper several complementary solutions were devised. Extending the REDDIG network to Panama, COCESNA, Jamaica and/or Curaçao to take advantage of the shared satellite (Panamsat PAS-1R), etc… All these solutions ran into the wall raised by the double-hop problem. Unless MEVA and/or Colombia change the architecture and/or technology of their networks the only solution is one of the 3 highlighted above.

4.2 The meeting is invited to review and take into consideration the information mentioned in this paper while discussing possible solutions for the integration of the CAR/SAM Networks.

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APPENDIX/APENDICE A