



Agenda Item 6: Any other business

**STUDY FOR THE IMPLEMENTATION OF A NEW DIGITAL NETWORK IN THE SAM
REGION (REDDIG II)**

(Presented by the Secretariat)

SUMMARY

This information paper presents information related to the study that SAM Region is developing for the implementation of the new digital network (REDDIG II).

References

- Report of the thirteenth REDDIG Coordination Committee meeting (RCC/13, Lima, Peru, 9-10 March 2010); and
- Report of SAM/IG/6 meeting (Lima, Peru, 19-22 October 2010).

**ICAO strategic
objectives:**

A – *Safety*
C – *Environmental protection and sustainable
development of air transport*

1. Introduction

1.1 The REDDIG Network was designed and implemented at the early 2000 to provide for the support of the operational Aeronautical Fixed Service within SAM (AFTN, GTS) and Administrative coordination data driving between ACCs.

1.2 It aims to also providing for network resources to the implementation of CNS/ATM components in particular the implementation of data exchange.

1.3 The equipment technology of the current REDDIG network is from 2002, and some of its equipment is no longer manufactured, such as the Memotec FRAD CX 950 /CX950e and the VIASAT MODEM Linkway 2100.

2. Discussion

2.1 For the near and medium term, new services are required to implement in the REDDIG, as the interconnection of AMHS system, the interconnection of radar and AIDC systems and other services to support the SAM air navigation services. The implementation of these new services will require more satellite bandwidth.

2.2 Taking in consideration the above considered aspects, the REDDIG coordination meeting (group that manages the REDDIG network) considered the necessity to initiate the study for a new digital network, and an action plan was made in this respect.

2.3 The action plan for the implementation of a new REDDIG II digital network was presented to the fifth workshop/meeting of the SAM Implementation Group (SAM/IG/5), held in Lima, Peru, from 10 to 14 May 2010.

2.4 The study for the implementation of a new digital network (REDDIG II) was presented to the sixth workshop/meeting of the SAM Implementation Group (SAM/IG/6), held in Lima, Peru, from 18 to 22 October 2010. The meeting reviewed the study and considered to distribute the same to all REDDIG members for their comments. The next step will be the elaboration of technical specifications and initiate the bidding process. These activities will be supported by the ICAO Technical Cooperation Bureau.

2.5 The study contains the analysis of the current fixed aeronautical services, the bandwidth required to support the specified requirements, the definition and cost of a satellite REDDIG II structure model; definition and cost of a ground REDDIG II structure model; comparative study of the REDDIG II satellite and ground models and costs; analysis of the mixed model (ground and satellite network) and proposal of a final network infrastructure.

2.6 The SAM ATN will be based on IP networks, its core structure will be made up by routers linking the domestic services (either current or future) to the backbone access; that is, to the new digital network.

2.7 The summary of study of digital network REDDIG II is presented in **Appendix** to this Information Paper.

3. **Action suggested**

3.1 The Meeting is invited to:

- a) take note of the contents of this information paper and;
- b) examine the best way to ensure in the future projects the compatibility and interoperability between REDDIG II and CAFSAT networks.

APPENDIX

Summary of the study of digital network REDDIG II

Analysis of the SAM – REDDIG communications network current situation and application requirements in the long term in the SAM Region

The current services transmitted by REDDIG, arising from the Air Navigation Plan for the Caribbean and South American Regions are almost fully operational to date, and are described in Table CNS1A (AFTN Plan) and Table CNS1C (ATS direct speech circuit plan).

There are a number of future services, for the short, medium and long term that should be supported by REDDIG, namely:

- c) Those emerging from the MEVA II – REDDIG interconnection.
- d) The teleconference service for flow management units (FMU) or flow management positions (FMP) to be provided on a daily basis between all units in the Region, initially for twenty users.
- e) The exchange of flight plans and/or radar information, using conventional methods, according to the respective MoUs (Memoranda of Understanding) already signed or to be signed.
- f) AMHS interconnection requirements, gradually replacing the AFTN service, according to the respective MoUs signed or to be signed.
- g) AIDC interconnection requirements, gradually replacing the ATS speech service.
- h) ADS-B data exchange and multilateration between all the ACCs of adjacent FIRs.
- i) AIM requirements: to date, there are no concrete requirements.

3.2 With the above, it was determined that Table 1 describes a summary of interfaces necessary for the REDDIG telecommunications equipment supporting all current and future requirements:

State	Location	Minimum interfaces					
		Universal I/O	Ethernet	Digital	E&M	FXO	FXS
Argentina	Ezeiza	11	1	0	11	0	1
Bolivia	La Paz	4	1	0	4	0	4
Brazil	Curitiba	4	1	0	6	2	1
	Manaus	6	1	0	7	0	5
	Recife	1	1	0	7	0	1
Chile	Santiago	2	1	0	8	0	0
Colombia	Bogota	7	1	1	0	0	0
Ecuador	Guayaquil	3	1	1	0	0	0
French Guiana	Rochambeau	2	1	0	0	0	5
Guyana	Georgetown	4	1	0	0	0	5

State	Location	Minimum interfaces					
		Universal I/O	Ethernet	Digital	E&M	FXO	FXS
Paraguay	Asunción	3	1	0	3	0	3
Peru	Lima	9	1	1	0	0	0
Suriname	Paramaribo	3	1	0	0	0	4
Trinidad and Tobago	Piarco	2	1	0	0	0	6
Uruguay	Montevideo	2	1	0	0	4	5
Venezuela	Maiquetía	10	1	0	7	0	4

Table 1: Interfaces of the Future Routers

With regard to the bandwidth for the current and future applications, the needs for REDDIG are reflected in Table 2.

State	Site	Service (each in Kbps)		
		Radar	AMHS	ADS-B
Argentina	Ezeiza	76.8	28.8	19.2
Bolivia	La Paz	115.2	14.4	19.2
Brazil	Curitiba	76.8	19.2	19.2
	Manaos	134.4	33.6	19.2
	Recife	0	4.8	19.2
Chile	Santiago	57.6	9.6	19.2
Colombia	Bogotá	76.8	38.4	19.2
Ecuador	Guayaquil	38.4	14.4	19.2
French Guiana	Rochambeau	38.4	9.6	19.2
Guyana	Georgetown	57.6	19.2	19.2
Paraguay	Asunción	57.6	9.6	19.2
Perú	Lima	96	43.2	19.2
Suriname	Panamaribo	76.8	14.4	19.2
Trinidad & Tobago	Piarco	19.2	9.6	19.2
Uruguay	Montevideo	19.2	9.6	19.2
Venezuela	Maiquetía	76.8	38.4	19.2
Partial (Kbps)		1017.6	316.8	307.2
Partial global (Kbps)		1641.6		
Difference AFTN		-103.2		
Net bandwidth increase		1538.4		

Table 2: Additional bandwidth estimate

3.3 An analysis to Tables 1 and 2 leads to the following observations:

3.3.1 It should be noted that what is not used in the AFTN shall be deducted from the cited increases, since the service is either AFTN or AMHS, never in parallel. Therefore, the value obtained from Table 2 is inserted, providing the net value of the required increase in bandwidth.

3.3.2 **No bandwidth increase is required for the ATS speech circuits** as there are no additional operational requirements in Table CNSIC for direct or switched circuits.

3.3.3 The additional bandwidth requirement due to radar data exchange will be for the exclusive function of the MoU (memoranda of understanding) signed or to be signed by States. Therefore, in order to count with an initial calculation, it is estimated that, at least, each State will transmit or receive, either data from a radar or summarized information from their neighbouring States, **for which the total bandwidth for radar applications amount to approximately 1 Mbps.**

3.3.4 For the teleconference service for ATFM purposes, it has been estimated that the interfaces and bandwidth capacity remaining in REDDIG is enough to absorb the demand, even at peak voice and data traffic, **for which no additional bandwidth is required.**

3.3.5 For the AMHS application, the initial conclusions to the trials carried out between Manaus and Ezeiza have been adopted to calculate the additional bandwidth. **It has been estimated that an addition 320 kps bandwidth would be required for this application.**

3.3.6 For the AIDC application, it has been estimated that the message traffic increase to be generated, will be compensated by the decrease in the ATS speech circuit. Only during the transition period, while AIDC is implemented is that the bandwidth may suffer an increase. Once this phase ends, and upon progressively deactivating speech communications will the bandwidth consumption start to diminish, until the time when the need to continue using voice circuits will completely disappear. **Therefore, no additional bandwidth will be required for AIDC.**

3.3.7 For the automated systems in the exchange of radar data using Asterix 62 y 63, the bandwidth increase will be the same as for AIDC. The moment of greater bandwidth need will occur when this service is completely disseminated throughout the Region, while the temporary mandatory transmission in radar form to the automated centre is kept. **Therefore, there will be no additional bandwidth requirement for the application.**

Trials to determine the bandwidth necessary for AMHS application

3.4 With the aim of determining the minimum bandwidth necessary for the operation between MTAs of the AMHS application, trials were carried out between the Ezeiza (CIPE) and Manaus MTAs. The scenario used, including the IP addressing plan, is described in Figure 1.

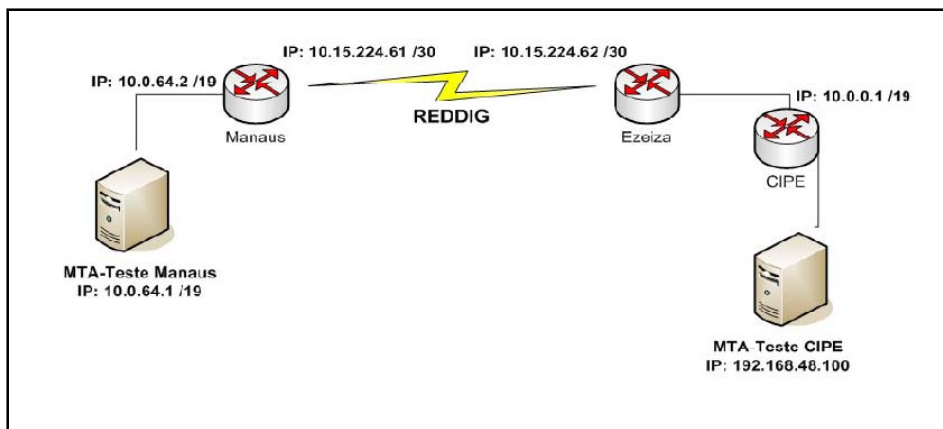


Figure 1: Connectivity scheme

3.5 With regard to the trials, Table 3 presents a part of the trials that used 1KB message sizes and 64, 32 and 4.8 kbps transmission speeds configured in REDDIG.

Trial No.	Description	Speed Link (Kbits/s)	total time (hh/mm/ss)	Message Time / Hour	Message Exchange / Second	Message Transit Time (seconds)
1	Remittance 5000 1KB messages	64	0:59:21	5000	1.39	0.72
2	Remittance 5000 1KB messages	32	2:18:00	2174	0.6	1.66
3	Remittance 25 1KB messages	4.8	11:42:00 (*)	427	0.12	8.43

(*): if the test had been with 5000 messages

Table 3: Trials and results obtained

The conclusion arrived at was that a 4.8 kbps bandwidth is enough for the peak hour message exchange between Argentina and Brazil, which has the greater traffic in South America. Therefore, in terms of bandwidth estimating for the future REDDIG, the referred speed is to be considered between all South American MTAs. With regard to the messages between Brazil and United States, a 9.6 or 16 kbps speed may be enough for the application.

Comparative study among the satellite, ground and mixed (satellite and mixed) IP based network models for the SAM Region

Hereunder is a summary of the studies carried out for the selection of an IP platform for the SAM Region:

- a) The studies conducted in the SAM Region deemed a mixed structure most appropriate for the future REDDIG.

- b) The costs comparison between a satellite and a ground network produced an advantage of the first option, as can be noted in Figure 2.

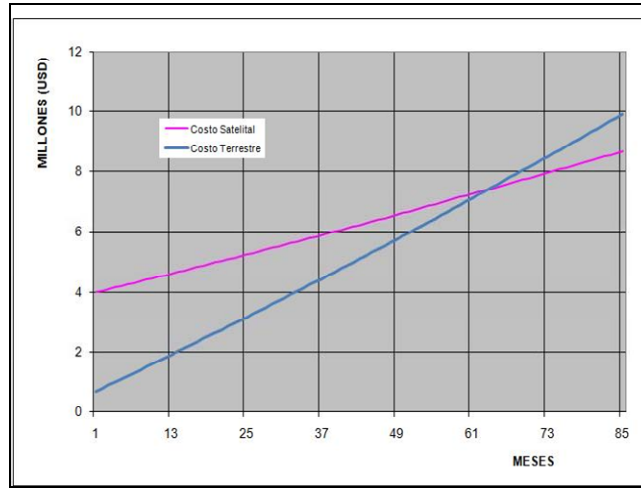


Figure 2: Satellite and ground costs comparison

- c) From the economical and technical-operational point of view, the satellite structure is an advantage for the South American States versus a ground network, but the hiring of a parallel ground network will ensure availability (first of all) and, also, dispose of a natural increase of same, presenting a mixed network configuration.
- d) This infrastructure is based on the scheme presented as Figure 3.

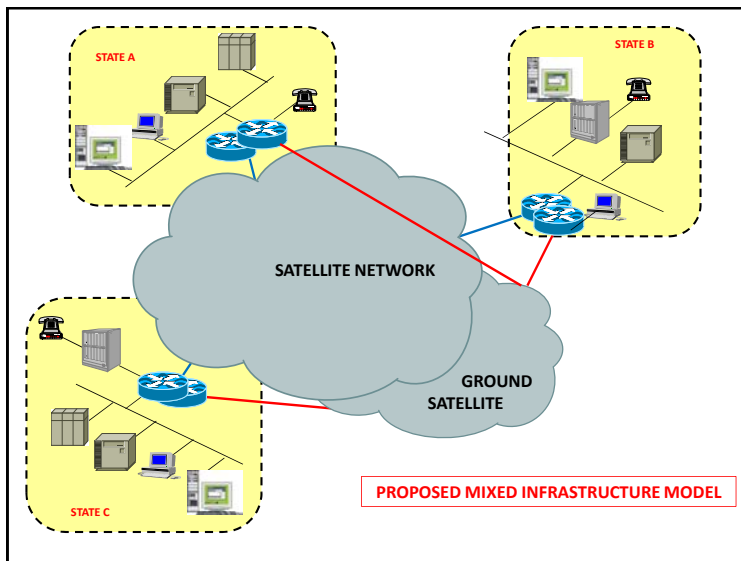


Figure 3: Proposed infrastructure scheme

- e) The referred network would be a mixture of a *main satellite network* and a *ground one*, to serve for the increase in network capability, for the transit of new ATN applications and, also, as extensively indicated, for the increase in the availability of the system.

- f) To that end, the satellite segment would count with duplicate chains to guarantee a high availability; the ground segment would have a practical availability chain provided by the majority of the ground networks.

- END -