



Agenda Item 2: Analysis of performance indicators and metrics for the implementation of air navigation and safety efficiency and capacity improvements

IMPROVEMENTS TO THE COMMUNICATIONS, NAVIGATIONS AND SURVEILLANCE SYSTEMS

SUMMARY

This working paper presents the current situation on the interconnection of the ATS Message Handling System (AMHS), the interconnection of automated systems between adjacent ACCs, the implementation of national IPS networks, and the goals expected in the short term regarding associated indicators and metrics.

References

- Air Navigation System Performance-Based Air Navigation System Implementation Plan for the SAM Region (PBIP) (Version 1.3, May 2013);
- Eleventh Workshop/Meeting of the SAM Implementation Group (SAM/IG/11) RLA/06/901 Project (Lima, Peru, 13-17 May 2013);
- Annual Safety Report - Pan America (RASGA-PA) (fourth edition, July 2013; and
- Mission reports on automation, August 2013.

ICAO Strategic Objectives:

*A - Safety
C - Environmental Protection and Sustainable Development of Air Transport*

1. Background

1.1 In the SAM Region, the interconnection of AMHS, of automated systems (radar data and flight plans) and the implementation of national IPS (Internet Protocol Suite) networks are the short-term (2013-2018) priorities taken under consideration within the CNS system improvements specified in the *Air Navigation System Performance-Based Air Navigation System Implementation Plan for the SAM Region (PBIP)*.

AMHS interconnection

1.2 Since 2005, the SAM Region started a plan to migrate the Aeronautical Fixed Service Network (AFTN) to AMHS. To date, practically all SAM States count with an AMHS implemented, with the exception of French Guiana (France) and Uruguay. Uruguay expects to have its AMHS operational by the end of the first quarter of 2014.

1.3 The objective of AMHS interconnection is to replace the current AFTN circuits by new ones that permit the transmission of a greater number of information (ATS data) at a higher speed, through REDDIG.

1.4 The final objective is the migration of all AFTN circuits through AMHS links. Follow-up to AMHS interconnection is being conducted through the SAM implementation group meetings (SAM/IG), with the support of RLA/06/901 project and through which guidelines in support of regional AMHS implementation have been drafted, and can be found in the ICAO SAM website, under the electronic documents section.

Interconnection of automated systems

1.5 The interconnection of automated systems between adjacent ACCs has the objective of reducing the aeronautical incident risks generated by coordination activities between centres and, at the same time, improve the planning phases for a more efficient flight control from/to the corresponding Flight Information Regions (FIR).

1.6 Follow-up to the interconnection of automated systems is being carried out at the SAM/IG meetings, through which guidelines have been drafted in support of this implementation, as well as missions to States, to be found in the ICAO SAM website, under the electronic documents section.

1.7 The desired automated systems interconnection consisted in the exchange of radar data through the use of the ASTERIX (*All Purpose Structured Eurocontrol Surveillance Information Exchange*) format and IP (Internet protocol) communications, as well as the automated flight plan transfer between centres, through the ATS interfacility data communications (AIDC).

Implementation of national IPS networks

1.8 The implementation of national IPS networks will enable an increase in the aeronautical information (voice and data) transport capacity, as well as a better management of same.

1.9 The basic recommendation that every State should meet is that the IPS (Internet Protocol Suite) should exclusively be private. Each State can select the provider of the IPS elements it deems convenient; nevertheless, it should take under consideration that this choice should be practically definitive, since it is highly un-recommendable to have equipment with identical aim, but of different makes, as this will force unnecessary multiplication regarding training, spare parts, human resources and remote management.

1.10 In addition, it is the decision of each State (on the basis of its technical and economical policies) to choose whether the IPS network should be supported by ground or satellite networks (or a mix of both), self-owned network links or leased to communications services providers, transported over dedicated lines or switched connections. The switched connections, in turn, can be switched circuits or switched packets/cells. The network should be installed to permit the remote visualization and management of all and each of its components.

1.11 Each State can use the addresses and addressing scheme it prefers, but it is recommended that the network addresses be assigned in continuous blocks, that the address distribution block be carried out hierarchically, so as to permit routing scalability and that the sub-networks can be configured, in order to take maximum advantage of the network assigned.

1.12 Other important considerations are found in the *Guidance for the implementation of national digital networks that use the IP protocol, to support current and future aeronautical applications*, drafted in the SAM Region through the support of RLA/06/901 project. Refer to the SAM Regional Office website, under the CNS electronic documents section.

2. Analysis

2.1 Hereunder is an analysis of the current situation and short-term goals for AMHS and automated systems interconnection.

AMHS interconnection

2.2 AMHS interconnection started in 2010, date when many of the SAM States had implemented their AMHS. To date, four are the number of AMHS interconnected. The connections were carried out through REDDIG, using IP protocol.

2.3 With the aim of establishing technical, operational and administrative commitments when interconnecting automated systems, a model Memorandum of Understanding (MoU) was drafted for its application in the SAM Region. In this manner, States starting the interconnection describe the activities and dates required for the interconnection, as well as the technical and operational staff responsible for the coordination of the activities.

2.4 The total AMHS interconnections required within the SAM Region, the interconnections completed, the MoU established, as well as those scheduled, are presented in **Appendix A** to this working paper.

2.5 The total AMHS interconnections required are 26. **The goal is to have 100% of the AMHS interconnected by the end of 2016**, four of these are already implemented, the remainder would be implemented as follows: one for 2013, 11 for 2014, 5 for 2015 and 5 for 2016. The State implementation distribution is shown in **Appendix B** to this working paper.

2.6 The difficulty to date to complete AMHS interconnection, is software incompatibility between the AMHS installed in Argentina, Brazil, Paraguay and Venezuela (same manufacturer) with the AMHS installed in the rest of the countries of the Region (different manufacturers). In this respect, Brazil is currently updating its AMHS software. This updating will permit interconnection of the Brazil AMHS (Brasilia and Manaus) with the other AMHS in the Region of different makes. The software updating is scheduled to finish at the end of 2013; therefore, implementations would start in 2014. The results of the activities carried out by Brazil would aid in the interconnection of the remaining systems.

2.7 Other activities to be taken into account once the interconnections are finished, is to complete each AMHS directory data base with all addresses.

2.8 The pending activities could require intervention from the equipment manufacturer, this would represent an extra cost.

Interconnection of automated systems

2.9 Practically all SAM States have automated systems installed at their ACCs. These automated systems have the capacity to process surveillance and flight plan data.

2.10 For the interconnection of automated systems in the SAM Region, the first activity taken under consideration beforehand, was the drafting of MoU between involved States. In the MoU, States involved establish the technical and operational requirements to complete the interconnection.

2.11 **Appendix C** to this working paper shows a chart containing SAM interconnection requirements, where it can be observed that **by the end of 2015, the goal is 15 interconnections**. Per year (2013-2015) implementation distribution is the following: 1 in 2013, 8 in 2014 and 6 in 2015.

2.12 To date, 6 MoU have been signed. Of the six, even though most have started implementation and trial coordinations, none have completed any interconnection.

2.13 In 2012, Argentina-Uruguay interconnected new radar data using IP protocol through REDDIG, but they are being partially used for operational purposes. Successful tests have been conducted regarding radar data and flight plan exchanges between Brazil and Venezuela, through REDDIG. It is expected that before the end of 2013, the interconnection will become completely operational.

2.14 With the aim of analyzing the causes for the delay in implementing automated systems at the States which have signed MoUs (some MoU are of 2009), the SAM/IG Automation Group developed a survey which was submitted to all SAM States, and also, missions to States were conducted by a group of automation experts, from 5 to 16 August 2013, with the support of project RLA/06/901.

2.15 As a result of the automation mission, actions have been established for the completion of their interconnection, such as the naming of focal points for the coordination of technical and operational aspects required, establishing chronogrammes for the conduct of radar data exchange tests using the ASTERIX format, and flight data through AIDC, purchasing of equipment to complete the interconnection (converters, filters, new automated systems), holding of courses and updating of estimated dates for their interconnection in the regional action plan for the implementation of automated systems. Many of the afore indicated actions require the participation of the manufacturer and the purchasing of equipment, which represents a cost to be taken under account within the States' budget.

2.16 States who have no automated systems implemented at their ACCs (La Paz, Bolivia) have no estimated implementation date for their interconnection. There are countries in the Region that should analyze the automated systems implementation requirements and examine the operational requirements.

Operational benefits in AMHS and automated systems (radar data and AIDC exchange) interconnection

2.17 Successful AMHS and automated systems interconnection, through AIDC and radar data exchange, will permit a greater supporting data integrity for the application of reduced separation, which directly translates into an increase in flow capacity between sectors or through the FIR limits.

2.18 Reduced separation can also be used to offer, with greater frequency, flight levels closer to the optimum; in certain cases, this also translates into a lesser wait en-route and, as a consequence, a greater efficiency. From it, controller workload is reduced. In addition, safety will be increased through the mitigation of incidents caused in operational errors related with flight reporting, coordination and transfer between adjacent FIRs.

2.19 Another benefit obtained by the implementation of automated systems is the reduction of *Mid Air Collision* (MAC) events, one of the top category safety improvements in the Region, as per the RASG-PA Annual Safety Report – Pan America (fourth edition, July 2013).

Implementation of national IPS networks

2.20 With AMHS implementation, most of the States of the Region have improved their links through the use of IPS protocol, but very few have implemented national IP networks with the afore indicated characteristics.

2.21 Only one SAM State has implemented a national IPS network with these characteristics. The services that the State has over the IPS network is AMHS and radar data, and has plans to use other data services through the network, such as AIS and/or MET applications and voice operational services (direct or switched ATS communications).

2.22 Other States of the Region have AMHS, radar data and voice IPS applications installed in various networks, difficulting their integration and management. Some States of the Region have short-term plans for self-owned IPS networks, and others, improve the networks leased to communications services providers.

2.23 By the end of the **2014-2016 period, it is expected that 80% of the SAM States** will have national IPS networks implemented with the above indicated characteristics. The 2014-2016 implementation distribution will be: 2 for 2014, 3 for 2015 and 5 for 2016. For 2018, 100% implementation is foreseen. State IPS network implementation is shown in **Appendix D** to this working paper.

3. **Action suggested**

3.1 The Meeting is invited to:

- a) Take note of the information presented; and
- b) Analyze and comment upon the implementation goals for AMHS, automated interconnection and national IP network implementation indicated in Section 2 and Appendices A, B, C, and D.

APPENDIX A

ACTION PLAN FOR THE INTERCONNECTION OF AMHS SYSTEMS IN THE SAM REGION

ITEM	ACTIVITY	RESPONSIBLE	EXPECTED RESULT	STATUS	FINALIZATION DATE
1	<p>MoU for the interconnection of AMHS currently implemented in the SAM Region:</p> <ul style="list-style-type: none"> a) Argentina-Brazil b) Argentina-Chile c) Argentina-Peru d) Argentina-Paraguay e) Brazil-Colombia f) Brazil-Paraguay g) Brazil-Peru h) Chile-Peru i) Colombia-Peru j) Colombia-Panama k) Colombia-Venezuela l) Peru-Venezuela m) Brazil-Suriname n) Guyana-Venezuela o) Suriname-Venezuela p) Brazil-Guyana q) Guyana-Suriname r) Brazil-Venezuela s) Bolivia-Peru t) Bolivia-Brazil u) Bolivia-Argentina v) Ecuador-Peru w) Ecuador-Colombia x) Ecuador-Venezuela y) Uruguay-Argentina z) Uruguay-Brazil <p>The AMHS interconnection MoU in French Guiana (France) and Uruguay should be drafted once AMHS installation is completed at national level.</p>	SAM States involved	MoU for interconnection of AMHS systems between SAM States having AMHS implemented	a), b) c), d), f), g), i), l), q) & v) completed	<p>Date estimates for pending MoU</p> <ul style="list-style-type: none"> b) May 2014 h) May 2014 j) May.2014 k) May.2014 m) Oct 2015 n) Oct 2014 o) Oct 2015 p) Oct 2014 r) May 2014 s) Oct 2015 t) Oct 2015 u) Oct 2015 w) May 2014 x) Oct 2014 y) May 2015 z) May 2015

ITEM	ACTIVITY	RESPONSIBLE	EXPECTED RESULT	STATUS	FINALIZATION DATE
2	<p>Phase I Interconnection trials between MTAs of:</p> <p>a) Argentina-Brazil b) Argentina-Paraguay c) Brazil-Paraguay d) Colombia-Peru e) Argentina-Chile f) Argentina-Peru g) Brazil-Peru h) Guyana-Suriname i) Ecuador-Peru j) Brazil-Colombia k) Perú-Venezuela</p> <p>Types of tests to carry out: Network transportation; Network connectivity; Message exchange; Preparatory phase.</p> <p>Note: Inclusion has been made of only the AMHS interconnected between States having implemented and signed the MoU.</p>	Argentina, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Venezuela and REDDIG Administration	Interconnection trials between Argentina, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname and Venezuela MTAs	<p>a), f), g) message exchange trials were held between CIPE (Argentina)-Brasilia (Brazil) MTAs; the Manaus (Brazil)-Lima (Peru) MTAs, and the CIPE (Argentina)-Lima (Peru) MTAs.</p> <p>c) MoU was updated, as entrance node to Brazil will be Curitiba, and the network connectivity, and transport and exchange of messages tests will be carried out.</p> <p>b), d), h) and i) Operational interconnection trials completed</p> <p>c), e), j) No tests carried out</p> <p>k) network connectivity trials held</p>	<p>a) Jun 2012 Completed b) Mar 2012 Completed c) Mar 2014 d) Oct 2010 Completed e) Jun 2014 f) Mar 2014 g) May 2014 h) Jun 2011 Completed i) Jul 2012 Completed j) Jul 2014 k) Jul 2014</p>
3	<p>Operational interconnection implementation at the following MTA:</p> <p>a) Argentina-Brasil b) Argentina-Paraguay c) Brasil-Paraguay d) Colombia-Perú e) Argentina-Chile f) Argentina-Perú g) Brasil-Perú h) Guyana- Surinam i) Ecuador- Perú j) Brasil- Colombia k) Perú-Venezuela</p> <p>Note: Inclusion has been made of only the AMHS interconnected between States having implemented and signed the MoU.</p>	Argentina, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, and Venezuela	Operational implementation of AMHS systems	AMHS interconnection completed between following MTA, using P1 protocol and operational in b), d) h), i)	<p>a) Dec 2013 b) Mar 2012 operational c) Jul 2014 d) Nov 2010 operational e) Dec 2014 f) Jul 2014 g) Jul 2014 h) Jul 2011 Operational i) Jul 2012 Operational j) Dec 2014 k) Dec 2014</p>

APPENDIX B / APENDICE B

**AMHS INTERCONNECTION REQUIREMENTS AND DATES OF IMPLEMENTATION
2013-2016 IMPLEMENTATION GOALS /
REQUERIMIENTOS DE INTERCONEXIÓN AMHS Y FECHAS DE IMPLANTACION
METAS DE IMPLANTACION 2013-2016**

STATE/ESTADO	AMHS INTERCONNECTION REQUIREMENT/ REQUERIMIENTO DE INTERCONEXIÓN AMHS	IMPLEMENTATION DATE/ FECHA IMPLANTACION	REMARKS/ OBSERVACIONES
Argentina	Bolivia	Mar 2016	
	Brasil	Dec 2013	
	Chile	Dec 2014	
	Paraguay	Mar 2012	Implemented/ Implantado
	Perú	Jul 2014	
	Uruguay	Dic 2015	
Bolivia	Argentina	Mar 2016	
	Brasil	Abr 2016	
	Perú	May 2016	
Brazil	Argentina	Dic 2013	
	Bolivia	Abr 2016	
	Colombia	Dic 2014	
	Guyana	Mar 2015	
	Guyana Francesa	TBD	AMHS implementation pending/ Falta implantación AMHS
	Paraguay	Jul 2014	
	Perú	Jul 2014	
	Surinam	Mar 2016	
	Uruguay	Dic 2015	
	Venezuela	Dic 2014	
Chile	Argentina	Dic 2014	
	Peru	Dic 2014	
Colombia	Brazil	Dic 2014	
	Ecuador	Dic 2014	
	Panamá	Dic 2014	
	Peru	Sep.2010	Implemented/ Implantado
	Venezuela	Mar 2015	

STATE/ESTADO	AMHS INTERCONNECTION REQUIREMENT/ REQUERIMIENTO DE INTERCONEXIÓN AMHS	IMPLEMENTATION DATE/ FECHA IMPLANTACION	REMARKS/ OBSERVACIONES
Ecuador	Colombia	Dic 2014	
	Perú	Julio 2012	Implemented/ Implantado
	Venezuela	May 2015	
French Guiana (France) Guyana Francesa (Francia)	Brazil	TBD	AMHS implementation pending/ Falta implantación AMHS
	Venezuela	TBD	AMHS implementation pending/ Falta implantación AMHS
Guyana	Brazil	Mar 2015	
	Surinam	Jun 2011	Implemented/ Implantado
	Venezuela	Dic.2014	
Panamá	Colombia	Dic.2014	
Paraguay	Argentina	Mar 2012	Implemented/ Implantado
	Brazil	Jul.2014	
Perú	Argentina	Jul 2014	
	Bolivia	May 2016	
	Brasil	Jul.2014	
	Chile	Dic 2014	
	Colombia	Sep.2010	Implemented/ Implantado
	Ecuador	Julio 2012	Implantado
	Venezuela	Dic 2014	
Suriname, Paramaribo	Brazil	Mar 2016	
	Guyana	Jun 2011	Implemented/ Implantado
	Venezuela	Mar.2016	
Uruguay, Montevideo	Argentina	Dic 2015	
	Brazil	Dic 2015	

STATE/ESTADO	AMHS INTERCONNECTION REQUIREMENT/ REQUERIMIENTO DE INTERCONEXIÓN AMHS	IMPLEMENTATION DATE/ FECHA IMPLANTACION	REMARKS/ OBSERVACIONES
Venezuela	Brazil	Dic 2014	
	Colombia	Mar 2015	
	Ecuador	May 2015	
	Guyana	Dic.2014	
	Guyana Francesa	TBD	AMHS implementation pending/ Falta implantación AMHS
	Perú	Dic.2014	
	Surinam	Mar.2016	

APPENDIX C / APENDICE C

INTERCONNECTION OF AUTOMATED SYSTEMS /
INTERCONEXIÓN SISTEMAS AUTOMATIZADOS

State/ Estado	AIDC and Radar Data Interconnection Requirements/ Requerimientos de Interconexión AIDC y Datos Radar	MoU Date of Implementation/ Fecha Implantación MoU	AIDC and Radar Data Interconnection Date/ Fecha Interconexión AIDC y Datos Radar	Remarks/ Observaciones
Argentina	Bolivia	TBD	TBD	Bolivia has no automated systems/ Bolivia no cuenta con sistemas automatizados
	Brasil	2009	Aug 2014	MoU implemented/ MoU implantado
	Chile	2010	Jul 2014	MoU implemented/ MoU implantado
	Paraguay	May 2014	Dec 2014	
	Uruguay	2009	Jun 2014	MoU implemented/ MoU implantado
Bolivia	Argentina	TBD	TBD	Bolivia has no automated systems/ Bolivia no cuenta con sistemas automatizados
	Brasil	TBD	TBD	
	Chile	TBD	TBD	
	Paraguay	TBD	TBD	
	Peru	TBD	TBD	
Brazil/Brasil	Argentina	2009	Aug 2014	MoU implemented/ MoU implantado
	Bolivia	TBD	TBD	Bolivia has no automated systems/ Bolivia no cuenta con sistemas automatizados
	Colombia	Oct 2014	Jul 2015	
	Guyana	TBD	TBD	Define requirement/ Definir requerimiento
	French Guiana (France)	TBD	TBD	Define requirement/ Definir requerimiento
	Paraguay	Oct 2014	Mar 2015	
	Peru	2012	Sep 2014	MoU implemented/ MoU implantado
	Suriname	TBD	TBD	Definir requerimiento
	Uruguay	2009	Aug 2014	MoU implemented/ MoU implantado
	Venezuela	2011	Dic 2013	MoU implemented/ MoU implantado
Chile	Argentina	2010	Jul 2014	MoU implemented/ MoU implantado
	Peru	Jun 2014	Mar 2015	

State/ Estado	AIDC and Radar Data Interconnection Requirements/ Requerimientos de Interconexión AIDC y Datos Radar	MoU Date of Implementation/ Fecha Implantación MoU	AIDC and Radar Data Interconnection Date/ Fecha Interconexión AIDC y Datos Radar	Remarks/ Observaciones
Colombia	Brazil	Oct 2014	Jul 2015	
	Ecuador	May 2014	Dic 2014	
	Panamá	May 2014	Dic 2014	
	Peru	Oct 2014	Jul 2015	
	Venezuela	Dec 2014	Dic 2015	
Ecuador	Colombia	May 2014	Dic 2014	
	Peru	Oct 2013	Jun 2014	
French Guiana (France)/ Guyana Francesa (Francia)	Brasil	TBD	TBD	Define requirement/ Definir requerimiento
	Surinam	TBD	TBD	Define requirement/ Definir requerimiento
Guyana	Brazil	TBD	TBD	Define requirement/ Definir requerimiento
	Surinam	TBD	TBD	Define requirement/ Definir requerimiento
	Venezuela	TBD	TBD	Define requirement/ Definir requerimiento
Panama	Colombia	May 2014	Dec 2014	
Paraguay	Argentina	May 2014	Dec 2014	
	Bolivia	TBD	TBD	Bolivia has no automated systems/ Bolivia no cuenta con sistemas automatizados
	Brasil	Oct 2014	Mar 2015	
Peru	Bolivia	TBD	TBD	Bolivia has no automated systems/ Bolivia no cuenta con sistemas automatizados
	Colombia	Oct 2014	Jul 2015	
	Chile	Jun 2014	Mar 2015	
	Ecuador	Oct 2013	Jun 2014	
Surinam	Brasil	TBD	TBD	
	French Guiana (France)	TBD	TBD	
	Guyana	TBD	TBD	
Uruguay	Argentina	2009	Jun 2014	
	Brasil	2009	Aug 2014	MoU implemented/ MoU implantado
Venezuela	Brasil	2011	Dec 2013	MoU implemented/ MoU implantado
	Colombia	Dec 2014	Dec 2015	

APPENDIX D / APENDICE D

IMPLEMENTATION OF NATIONAL IP NETWORKS /
IMPLANTACION DE REDES IP NACIONALES

STATE/ESTADO	IP APPLICATIONS IMPLEMENTED/ APLICACIONES IP IMPLANTADAS	DATE IMPLEMENTATION NATIONAL IP NETWORK FOR ALL IP APPLICATIONS/ FECHA IMPLANTACION RED IP NACIONAL PARA TODAS LAS APLICACIONES EN IP
Argentina	AMHS, DATA RADAR, IP VOICE/VOZ IP	2005
Bolivia	AMHS	2016
Brazil/Brasil	AMHS, DATA RADAR, IP VOICE/VOZ IP	2015
Chile	AMHS	2015
Colombia	AMHS, RADAR	2016
Ecuador	AMHS, RADAR	2014
French Guiana (France) / Guyana Francesa (Francia)	No	2018
Guyana	AMHS	2018
Panamá	AMHS, RADAR	2016
Paraguay	AMHS	2014
Perú	AMHS, RADAR	2016
Surinam	AMHS	2018
Uruguay	IP VOICE / VOZ IP	2016
Venezuela	AMHS	2015

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