**Agenda Item 5: Assessment of operational requirements to decide on the implementation of improvements to communication, navigation and surveillance (CNS) capabilities for en-route and terminal area operations**

# FOLLOW-UP ON TESTS FOR THE INTERCONNECTION OF AMHS SYSTEMS

(Presented by Peru)

**Summary**

This working paper presents information on the progress made regarding AMHS system interconnection tests and the revision of the "Guide for the Operational Interconnection of AMHS Systems in the SAM Region".

**References**

• Report of the Tenth Workshop/Meeting of the SAM Implementation Group (SAM/IG/10) (Lima, Peru, 1-5 October 2012);
• Report of the Sixteenth Meeting of the REDDIG Coordination Committee (RCC/16) (Lima, Peru, 18-20 March 2013).

| | |
|---|---|
| **ICAO strategic objectives:** | *A – Safety*<br>*B - Security*<br>*C – Environmental protection and sustainable development of air transport* |

## 1. Background

1.1 The SAMIG/10 addressed, *inter alia,* aspects related to Project D2 – *ATN ground-ground and air-ground applications in the SAM Region.* The goals taken under consideration are:

a) Complete all AMHS interconnections by December 2015.
b) Complete the drafting of MoUs for the interconnection of AMHS systems by mid 2013
c) Complete the migration to AMHS interconnections using the IP protocol by December 2015

1.2 The meeting also addressed the *Operational integration of AMHS connections.* The meeting took note that the AMHS interconnection between Ecuador and Peru had been implemented in July 2012, the first interconnection between two AMHS systems from different manufacturers. Peru is the State in the Region with the largest number of implemented AMHS interconnections, and this provided the experience required to complete other interconnections. In this regard, the meeting felt that Peru could provide technical advice (consultancy) to those States that might require it.

1.3 In order to support the States of the Region in the implementation of AMHS interconnections, the following events were carried out in 2012 through technical cooperation projects RLA/06/901 and RLA/03/901: the *Course on the ATS (COM-AMHS) message handling system and interconnection aspects* (Lima, Peru, July 2012) was conducted by the Instilux-Eurocontrol institute, with an expert with broad experience in AMHS systems and communication networks; and the *ICAO Seminar/workshop on the implementation of ground-ground and ground-air data links in the SAM Region* (Lima, Peru, September 2012).

1.4 These events helped the States of the Region in the implementation of AMHS systems (as was the case of the Ecuador-Peru AMHS interconnection). In this regard, another AMHS course has been scheduled for June 2013.

1.5 The meeting updated the AMHS interconnection action plan, as well as the information on AMHS systems implemented in the Region.

1.6 Teleconferences are a tool to support States in the drafting of MoUs, together with the testing and commissioning of AMHS system interconnection.

1.7 The meeting felt the need to review the Guide for the operational interconnection of AMHS systems in the SAM Region, taking into account the updated Eurocontrol document. The Aeronautical Administration of Peru would conduct this revision, to be presented at the SAM/IG/11 meeting.

2. **Discussion**

2.1 The current situation of the AMHS Interconnection Action Plan in the SAM Region is as follows:

2.1.1 The signing of *Memoranda of Understanding* (MoU) for the interconnection of AMHS systems between States that already have such systems in place is still pending:

a) Chile-Peru
b) Colombia-Panama
c) Colombia-Venezuela
d) Brazil-Suriname
e) Guyana-Venezuela
f) Suriname-Venezuela
g) Brazil-Guyana
h) Brazil-Venezuela
i) Bolivia-Peru
j) Bolivia-Brazil
k) Bolivia-Argentina
l) Ecuador-Colombia
m) Ecuador-Venezuela
n) Bolivia Paraguay

It should be noted that, to date, Uruguay has not yet implemented its AMHS system.

2.1.1 The following MTAs are undergoing operational implementation of the interconnection:

a) Argentina-Brazil
b) Argentina-Chile
c) Argentina-Peru
d) Brazil-Paraguay
e) Brazil-Peru
f) Brazil-Colombia
g) Peru-Venezuela

2.1.2 To date, the following operational interconnections between MTAs have been implemented using the P1 protocol:

a) Argentina-Paraguay, in March 2012
b) Colombia-Peru, in November 2010
c) Guyana-Suriname, in July 2011
d) Ecuador-Peru, in July 2012

2.1.3 It should be noted that only AMHS system interconnections between States that have implemented and signed the MoU have been included.

2.2 Regarding the status of implementation of AMHS systems in the SAM Region, Panama (estimated for late 2013) and Uruguay are in the process of implementation and acquisition, respectively.

2.3 Upon analysing the operational interconnections implemented in the SAM Region, the following has been noted:

2.3.1 Three (3) interconnections between AMHS systems of the same manufacturer--Argentina-Paraguay (Radiocom), Colombia-Peru (Comsoft), Guyana-Suriname (Skycom)—and one (1) interconnection between systems of different manufacturers--Ecuador (Thales)-Peru (Comsoft)—have been completed, based on document “Guide for the Operational Interconnection of AMHS Systems in the SAM Region”.

2.3.2 In this sense, as part of the revision of the cited Guide based on the updated version of the Eurocontrol document (Chapter 1.2.4, EUR AMHS Manual, currently in Version 4), according to Chapter 2.3 of that Guide, the transport layer is TCP.

2.3.3 In this regard, according to RFC standard 1006: "ISO transport service in the upper part of the TCP", the OSI/TCP adaptation in the transport layer must be done using the TP0 protocol.

2.3.4 Accordingly, it may be concluded that:

MTAs (AMHS systems) in the SAM Region must support and be compatible with the TP0 protocol and operate using TCP / IP as transport layer, with TPDU sizes during the connection request (CR): 2048, 1024, 512, 256, 128 bytes. It should be noted that, according to Chapter 13.3.4 of ISO 8073/ITU X.224, TPDU mesh sizes of 8192 and 4096 are not permitted for the TP0 protocol but they are permitted for the TP4/CLNP protocol, which is typically used in the ASIAPAC Region.

2.4 Based on our revision of the aforementioned AMHS Guide and our experience, the technical details of the interconnection tests conducted by the Administration of Peru to date are summarised below:

2.4.1 Together with its counterparts of Colombia and Ecuador, Peru has used the 2048-byte TP0 protocol to operationally interconnect AMHS systems.

2.4.2 Similarly, with the Administrations of Argentina, Brazil and Venezuela (whose AMHS systems use the TP4 protocol), progress has been made with the interconnection; however, to date, it has not been possible to achieve the operational interconnection between our AMHS systems due to the incompatibility of TP0 and TP4 protocols (transport layer).

2.5 In this order of ideas, it may be concluded that:

a) For purposes of interconnection, the OSI or TCP/IP model may be used, but NOT both.
b) Based this assumption, AMHS systems should be able to operate in a mixed environment, that is, some links (P1 LA) using TCP/IP and other links (P1 LA) using the OSI model. The Peruvian system can operate in a mixed environment to be configured as TP0 or TP4.
c) ICAO recommends TCP/IP as the transport layer for the SAM Region rather than the TP4/CLNP protocol, which uses NSAP addresses instead of IP addresses as indicated in the AMHS Guide.
d) When TP4 is used, CLNP must be used as the protocol in layer 3. In this case, AMHS systems require a link that supports OSI protocols, and an ATN router that permits TP4-TP0 conversion would be needed to interconnect two networks. This should be possible through the REDDIG.
e) It is suggested that, if possible, a working group be established in coordination with the manufacturers for the implementation of the interconnections still pending and to meet the goals of Project D2.

## 3. Suggested action

3.1 The Meeting is invited to:

a) Take note of the information provided in this working paper;
b) Analyse the aspects contemplated in section 2 of this working paper;
c) Address other aspects related to this agenda item that it may deem appropriate.

- END -