



**MEMORANDUM OF UNDERSTANDING FOR THE  
INTERCONNECTION OF THE AUTOMATED SYSTEMS  
OF AAA AND BBB**

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### ***Preface***

This document defines the Memorandum of Understanding that will allow **AAA** and **BBB** to interconnect their air traffic control automation systems. It is based on the documents prepared by ICAO experts on automation.

The two States can revise this document as necessary.

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*Approval*

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OF AAA AND BBB**

For **AAA**

For **BBB**

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*Revisions*

<b>Revision / Date</b>	<b>Description</b>	<b>Revised pages</b>
Rev. 0		

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## 1. Section 1 - Introduction and Purpose

### 1.1. Introduction

GREPECAS/15, taking into account the impact that operational errors of the ATC loop between adjacent ACCs have on the safety of air operations, considered, in Conclusion 15/36, that “CAR/SAM States, Territories, and International Organisations should gradually implement the interface for ATC interfacility data communication (AIDC);” and that “ICAO should coordinate, provide assistance for, and do the follow-up on, the implementation of such corrective measures.”

The analysis of the problem led to the conclusion that the solution involved an intense use of CNS/ATM technologies, in keeping with ICAO recommendations, especially those concerning the interconnection of automated systems, as described in Document 4444-PANS/ATM, in Section 8.1.6: “States should, on the basis of regional air navigation agreements, provide for the automated exchange of coordination data relevant to aircraft being provided with ATS surveillance services, and establish automated coordination procedures”.

In this regard, studies were conducted under Projects RLA/98/003 and RLA /06/901 with a view to having an overview of this issue, including obstacles and required action, as well as of the implementation strategy.

The resulting documents are described in Annexes 1, 2 and 3 to the Appendix to this Memorandum.

The main body of this document consists of ten (10) sections and one (1) appendix. The contents of the sections and appendix are summarised below:

- a) Section 1 - Presents a brief overview and a statement of purpose;
- b) Section 2 – Describes the basic principles guiding the development of this document;
- c) Section 3 – Considers the cases in which this Memorandum applies;
- d) Section 4 – Describes the version control process;
- e) Section 5 – Lists the relevant legislation;

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- f) Section 6 – Establishes criteria and restrictions for the use of the information shared by two countries;
- g) Section 7 – Presents the operational aspects that must be considered for the interconnection of the automated systems;
- h) Section 8 - Presents the technical aspects that must be taken into account for the interconnection of the automated systems;
- i) Section 9 - Presents the administrative aspects that must be taken into account for the interconnection of the automated systems;
- j) Section 10 - Presents the financial aspects that must be taken into account for the interconnection of the automated systems;
- k) Appendix 1 – Technical-Operational Agreement

## 1.2. Purpose

The goal of this MoU is to provide the planning for the interconnection of the automated systems of the **XXXXX ACC in AAA, and the YYYY ACC in BBB**, establishing standard procedures covering the respective operational, technical, administrative, and financial aspects.

## 2. Section 2 - Principles

The following aspects have been taken into account when preparing this document:

1. This Memorandum is a guide for States to enter into bilateral agreements; and
2. This document takes into account the aspects contained in the automated system interconnection documents prepared by Projects RLA/98/003 and RLA 06/901, as well as GREPECAS recommendations.

## 3. Section 3 - Application

This document applies only to the interconnection of the automated systems of **AAA and BBB**.

## 4. Section – Organisation

This is a document through which the participating States will agree, as necessary, to revise or modify its details.

The revision to this Memorandum, or changes to its paragraphs will be coordinated by the participating States.

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## 5. Section 5 - References

This Memorandum follows ICAO recommendations contained in the following documents:

- a) Annex 11 to the Convention on International Civil Aviation
- b) Doc 4444
- c) Doc 7030
- d) Doc 9426
- e) Doc 9694
- f) Doc 9880 part IIa (AIDC)
- g) RLA/98/003 project document
- h) RLA/06/901 project document
- i) Final reports of the SAM/IG/1 and SAM/IG/2 meetings

## 6. Section 6 - Confidentiality

Each participating State must take all the necessary measures to ensure the safety, integrity, and confidentiality of the information.

Disclosure of these data to organisations other than those contemplated in this Memorandum may proceed only if previously authorised by the participating States.

## 7. Section 7 - Operational Aspects

The implementation of this Memorandum may require adjustments to the Operational Agreements that exist between the States.

The Administrations undertake to instruct the staff of the ACCs involved, on the appropriate sections of this MoU.

Priority will be given to automatic hand-off, through the transmission of the required data between automated systems, according to the specifications contained in the Appendix to this MoU.

However, other means of communication can be used for the transfer when automatic hand-off is not possible.

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**8. Section 8 - Technical Aspects**

The technical aspects to be taken into account by States for the establishment of the interconnection scenarios, the implementation strategy, the implementation of the solution, the supervision of the operation, and the personnel training aspects that will best meet their requirements are shown in Section 6 of the Appendix to this Memorandum.

**9. Section 9 - Administrative Aspects**

For the orderly implementation of the interconnection solution adopted, the participating States agree to the creation of an administrative structure based on an Interconnection Management Committee, whose functions, detailed composition, and activities are described in Section 7 of the Appendix to this Memorandum.

The States must designate their representatives, members of their respective groups, to make up the basic structure of the aforementioned Committee.

The States must select a forum for discussing cases of non-compliance and for resolving conflicts.

This is an ongoing Memorandum that can be interrupted at any time by common agreement of the parties involved.

**10. Section 10 - Financial Aspects**

The participating States, as individual administrations, will be responsible for any financial obligation to cover direct or indirect expenditures related to the implementation of this Memorandum, including those associated with the acquisition of equipment, spare parts, training of technical and operational personnel, lines of communication, and others.

Each State will be responsible for its respective portion of expenditures concerning upgrades to the REDDIG to address traffic increases, according to the guidance provided by the REDDIG Administration.

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The parties to this Memorandum understand that they will not commit to any action that could result in a financial obligation for the other parties, without first obtaining the written consent by all the other parties involved.

The States can establish financial mechanisms to carry out the interconnection, for example, through ICAO Technical Cooperation Projects.

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**APPENDIX TO THE MEMORANDUM OF UNDERSTANDING  
TECHNICAL-OPERATIONAL AGREEMENT FOR THE INTERCONNECTION OF THE  
AUTOMATED SYSTEMS OF **AAA** AND **BBB****

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## 11. Purpose

To provide a detailed description of the technical, operational, and administrative aspects of the Memorandum of Understanding required for the interconnection of the automated systems of **AAA** and **BBB**.

## 12. Summary

ICAO Projects RLA/98/003 and RLA/06/901 identified resources for the conduction of studies, in order to have a full vision of the interconnection of automated systems, including obstacles, required action, and implementation strategy.

The work carried out included:

- Drafting of the Initial Action Plan – July 2006;
- Concept Test – BBB Trial -Venezuela – September 2006;
- Data collection – Phase 1 – survey of countries – current interfaces;
- Data collection – Phase 2 – missions to the States – details of the interfaces – 2007
  - ✓ 1<sup>st</sup> mission: Peru, Ecuador, and Venezuela – September 2007;
  - ✓ 2<sup>nd</sup> mission: Colombia, Panama, and COCESNA – October 2007;
  - ✓ 3<sup>rd</sup> mission: Chile, AAA, and Uruguay - November 2007
- Drafting of the Interconnection Plan – February 2008;
- Drafting of the SICD document (System Interface Control Document) – March 2008;
- Drafting of the SSS document (System Subsystem Specification) – September 2008

The generated products cover, in summary, the following aspects:

1. SICD: contains all the data collected from the SAM States that have automated systems, as well as a description of their interfaces, providing an overview of the current situation and recommendations for the adoption of the necessary measures for their interconnection.

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2. Interconnection plan: contains the objectives, concepts, strategies, and the action required to meet the operational requirements for the hand-off between adjacent ACCs in the SAM Region.
3. SSS: contains the requirements--especially those that are mandatory--for ACC automation systems, to be used as a reference for future implementations of new air traffic control automated systems and their upgrades, as necessary.

The SICD, the Interconnection Plan, and the SSS documents were submitted for analysis and approval at the following events:

- Interconnection Plan and SICD:
  - ✓ Project RLA 06/901 - First meeting of the SAM Implementation Group (SAM/IG/1),
  - ✓ Sixth meeting of the GREPECAS ATM/CNS Subgroup; and
  - ✓ Seminar/Workshop on ATM Automation – Rio – BBB;
- SSS:
  - ✓ Project RLA/06/901 - Second meeting of the SAM Implementation Group (SAM/IG/2)

### 13. Reference

This Agreement follows ICAO recommendations contained in the following documents:

- a) Annex 11 to the Convention on International Civil Aviation
- b) Doc 4444
- c) Doc 7030
- d) Doc 9426
- e) Doc 9694
- f) Doc 9880 part IIa (AIDC)
- g) RLA/98/003 project document
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- i) Final reports of the SAM/IG/1 and SAM/IG/2 meetings

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#### 14. Security

Each State must ensure that its communication networks involved in the interconnection have the protection required for this type of service, taking into account, at least, the following aspects:

- Protection from invasion by unauthorised individuals and/or systems;
- Protection from the attack of computer viruses; and
- Use of the equipment exclusively for the interconnection of the automated systems.

#### 15. Operational Aspects

The Administrations undertake, within their respective jurisdiction, to directly inform the staff of the ACCs involved about the contents of this Memorandum of Understanding.

Priority will be given to automatic hand-off and the provision of radar control service through the transmission of the required data between the automated systems, as specified in this Agreement.

However, other means of communication can be used for the transfer when automatic hand-off is not possible.

Likewise, through the respective operational agreements, the provision of non-radar control services should be coordinated for hand-off between adjacent ACCs when the signals of the radars involved in this Agreement are not available.

The interconnection option chosen implies that the States will have to establish specific operational procedures, taking into account the functionalities available in each automated system, selecting the message set to be used, but complying with the specifications and requirements contained in the documents associated to the solution adopted.

The States agree to jointly define the transition area for the exchange of surveillance data between adjacent ACCs, **considering a distance of 55 NM** from the boundary of the FIRs involved, for both States.

Special attention must be given to the training of controllers in the use of the tools available in the automated systems concerning automatic hand-off between adjacent FIRs.

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## 16. Technical Aspects

The interconnection must meet the following requirements:

- It should allow for the automatic transfer of flight plans between adjacent ACCs;
- It should allow for surveillance data sharing in areas of common interest.

The main aspects are:

### 1) Analysis of the current scenario

According to the information contained in the reference documents, the current status in **BBB** and **AAA** is as follows:

#### 1) AAA

##### a) Automated System

The XXXXXX ACC uses an extension of the XXXX system, installed in XXX, which has the functionality required for the provision of radar surveillance services throughout the XXX FIR, and for the automated processing of flight plans, as described in the SICD.

The XXXX system has automatic flight plan “hand-off” capability, using the messages of ICAO Doc 4444, and can process OLDI and AIDC protocols. It is expected to have Asterix 62/63 capability by XXXX.

##### b) Radar Display

Radar coverage is currently available in the XXX FIR.

##### c) Data Network

The XXXXXX ACC has access to the REDDIG for oral communication with adjacent ACCs.

Radars will transmit data through the Ethernet and the domestic network, using the Asterix protocol.

The AMHS system has been/will be installed at domestic level and has been operating since/will operate starting in 20xx.

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**2) BBB**

**a) Automated System**

The XXXXXX ACC uses an extension of the XXXX system, installed in XXX, which has the functionalities required for the provision of radar surveillance services throughout the XXX FIR, and for automated processing of flight plans, as described in the SICD.

The XXXX system has the automatic flight plan hand-off capability, using the messages of ICAO Doc 4444, and can process the OLDI and AIDC protocols. It is expected to have Asterix 62/63 capability by XXXX.

**b) Radar Display**

Radar coverage is currently available in the XXX FIR.

**c) Data Network**

The XXXXX ACC has access to the REDDIG for oral communication with adjacent ACCs.

Radars will transmit data through the Ethernet and the domestic network, using the Asterix protocol.

The AMHS system has been/will be installed at domestic level and has been operating since/will operate starting in 20xx.

**2) Selection of the exchange scenario**

Based on the interconnection levels that exist in the XXXX ACC and XXXX ACC facilities, AAA and BBB agree to adopt the following interconnection possibilities in the short and medium term:

1) Short term: Automatic exchange of surveillance data only;

2) Medium term: Automatic exchange of surveillance data and flight plan data.

The States agree to adopt flight plan transfer based on the ICAO OLDI/AIDC, as foreseen in Section 5 (Concepts for Automated ATC Systems Interconnection) of Annex 2 to this Appendix.

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The States also agree to adopt the exchange of surveillance data based on the Asterix protocol, according to Section 5 (Concepts for Automated ATC Systems Interconnection) of Annex 2 to this Appendix.

### 3) **Implementation Strategy**

The interconnection will be carried out in (two) phases:

- Short term: Exchange of radar data using the Asterix protocol, around XXX; and
- Medium term: Automatic flight plan hand-off using the AIDC protocol, and exchange of radar data using the Asterix protocol, around XXXX.

The implementation strategy adopted by the 2 (two) States must take into account the following aspects:

- 1.1. Analysis of the impact on existing systems;
- 1.2. Definition of interfaces and means of communication;
- 1.3. Configuration of logical and physical connections;
- 1.4. Hardware and software adjustments; and
- 1.5. Interconnection tests

These aspects will be analysed by the technicians of the Interconnection Management Committee, as established in this Memorandum, and will be described in the corresponding document.

For the short-term phase, the following radars will be used:

- XXXX secondary radar, as described in paragraph 6.1.1.b of this document; and
- Secondary radars of XXXX.

The radar data contained in the transition area described in Appendix “A” to this document will be transmitted.

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The States undertake to provide the necessary technical details for the transmission and reception of the radar signals in each automated system.

Communication between the States will be through the REDDIG.

The medium-term phase will be established by XXX, once the States have the operational capability of using AIDC for automatic hand-off of flight plans.

4) Implementation

The Interconnection Management Committee will carry out the implementation, based on the guidelines issued by common agreement by the States, defining implementation dates, the outsourcing of services, and the distribution of responsibilities, among other relevant matters.

5) Supervision of the Operation

Each State must supervise the operation of its systems, including the maintenance of its equipment and systems, ensuring the required availability, performance, safety, and efficiency.

All the problems of uncertain origin will be jointly analysed by the States through the Interconnection Management Committee, which will coordinate the actions required for their resolution.

However, each State must take all possible steps to implement the actions for which it is responsible, reporting their implementation to the Interconnection Management Committee.

In all cases, the Interconnection Management Committee must be informed at all times about anomalies, regardless of their origin.

6) Training

The participating States must draft training plans for the technical teams responsible for system maintenance, taking into account length, frequency, and technological evolution.

7) Maintenance

Teams must be prepared to face contingencies and be technically capable of analysing anomalies.

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Each State must draft its Action Plan that defines the technical information required for the interconnection with adjacent ACCs, covering, at least, the following:

- the topology of the networks involved, with the technical details about the required bandwidth, availability, latency, and redundancy;
- the specification of the equipment used;
- the maintenance requirements;
- the maintenance procedures--preventive, predictive, and corrective---; and
- all of the related technical documents;

The States agree that the means of communication for the implementation of the interconnection will be the REDDIG.

## 17. Administrative Aspects

This Agreement is a dynamic document that can be revised at any moment, based on the technological evolution of the automated systems and of the communication networks of the participating States.

The Interconnection Management Committee created by the two (2) States will manage the interconnection, based the following:

### 1. Organisational Structure

In order to carry out its activities, the Committee will be organised as follows:

#### 1. Coordinator

The names of the coordinators of the interconnection between the systems of **AAA and BBB** are shown in Annex A.

Coordinators will be responsible for the general coordination of all the activities of the technical and operational groups, as well as for the contacts with other organisations to address matters related to the interconnection.

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## 2. Technical Group

Made up by technicians designated by the two States, with proven skills in their respective areas, especially in communication networks and computer automation systems.

It will be responsible for the implementation and/or coordination, in their respective countries, of the technical activities required for the implementation, maintenance, and support of automated systems, communication networks, and interconnection equipment.

## 3. Operational Group

Made up by personnel specialised in air traffic control, designated by the two States, with proven skills in their respective areas, especially in the automated systems used in the ACCs.

## **2. Faculties**

The Committee is responsible for coordinating the planning, implementation, maintenance, and support of the operation of the systems and equipment involved in the interconnection of the automated systems.

It must guarantee the safety of the information exchanged between the automated systems involved in the interconnection.

Its faculties include the control and updating of all the technical and operational documentation.

It is also responsible for proposing the network topology to be used in the interconnection, which shall be approved by the two (2) States.

The implementation of the interconnection shall be coordinated and controlled by the Committee, based on action plans previously approved by the two (2) States.

The Committee must advise the States about the need for the technological evolution of the equipment and systems involved in the interconnection, taking into account, *inter alia*, the technical requirements contained in Annex 3 – SSS, to this Appendix.

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Its teams must monitor the performance, stability, reliability, and integrity parameters of the equipment and systems involved in the interconnection, and propose and supervise the corrective action. To this end, it must use tools for analysing anomalies, such as radar protocol and communication line analysers.

The Committee shall establish the necessary procedures for correcting failures.

It shall also provide, together with the participating States, for the resolution of the problems encountered.

### **3. Management Process**

In order to carry out its activities, the Interconnection Management Committee will apply the following system:

1. Periodical meetings and discussions to identify requirements and preferred technical solution(s), alternatives, and options for the interconnection of the automated systems;
2. The exchange of technical reports and documents, plans and programmes to ensure the successful and timely culmination of these efforts.
3. Joint planning, technical coordination, and development of activities between the two (2) States.

### **18. Financial Aspects**

With respect to financial aspects, the States agree to the following:

1. Acquisition of equipment, components and systems

The equipment required for the interconnection will be acquired by each State, in keeping with the technical specifications approved by the Interconnection Management Committee;

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2. Acquisition of spare parts

Spare parts for the equipment used in the interconnection will be acquired by each State, according to its specific needs, but in keeping with the maintenance guidelines issued by the Interconnection Management Committee.

3. Acquisition of services from third parties

Each State agrees to cover the expenditures involved in the hiring of third-party services, such as software adaptations, projects, and implementation of communication networks.

Each State will be responsible for its respective portion of any expenditure concerning upgrades to the REDDIG to support traffic growth, according to the guidelines of the REDDIG Administration.

**19. Attachments**

1. Preliminary System Interface Control Document for the Interconnection of ACC Centres of the CAR/SAM Regions – SICD;
2. CAR/SAM Automated ACC Interconnection Plan;
3. Preliminary Reference System/Subsystem Specification SSS for the Air Traffic Control Automation System.

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**ANNEX A**

**AUTOMATED SYSTEM INTERCONNECTION MANAGEMENT COMMITTEE**

**AAA**

**BBB**

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**ANNEX B**

**RADAR DATA TRANSITION AREA BETWEEN THE XXX AND THE YYY ACCs**