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**International Civil Aviation Organization
South American Regional Office**

**THIRD WORKSHOP/MEETING OF THE SAM IMPLEMENTATION GROUP (SAM/IG/3)
REGIONAL PROJECT RLA/06/901**

Lima, Peru, 20-24 April 2009

**Agenda Item 7: Operational implementation of new ATM automated systems and integration
of the existing ones**

PLAN FOR THE IMPLEMENTATION OF AUTOMATED SYSTEM INTERCONNECTION

(Presented by the Secretariat)

SUMMARY

This working paper presents the documentation developed to date on the interconnection of automated systems, including the memorandum of understanding prepared following the SAM/IG/2 meeting, so that the SAM/IG CNS Task Force may begin drafting flight and radar surveillance plans on a bilateral basis between SAM States that have automated systems.

References:

- Report of the GREPECAS/12 meeting (Havana, Cuba, 7-11 June 2004);
- Report of the GREPECAS/14 meeting (San Jose, Costa Rica, 16-20 April 2007);
- System interface control document (SICD);
- Initial plan for regional interconnection of ACC automated systems; and
- Preliminary document containing automated system requirements (SSS).

ICAO Strategic Objectives:

D: Efficiency — *Enhance the efficiency of aeronautical operations*

1. Introduction

1.1 Operational errors in the ATC coordination loop between adjacent ACCs directly affect the safety of operations. The States, Territories, and International Organisations were invited to reduce the occurrence of said errors at various GREPECAS meetings.

1.2 The implementation of automated systems at the ACCs and the establishment of automated coordination procedures between adjacent ACCs constitute the solution to the reduction of operational errors.

1.3 Document 4444, Section 8.1.6, Procedures for Air Navigation Services - Air Traffic Management (PANS-ATM), considers that States should foresee the automatic exchange of relevant coordination data concerning the aircraft receiving ATS surveillance services, based on regional air navigation agreements, and should establish automated coordination procedures.

1.4 The Global Air Navigation Plan for the implementation of the global ATM considers the need to implement a series of initiatives that includes GPI-17, on the implementation of data link applications, and GPI-22, on the implementation of efficient communication networks to support data link applications.

1.5 The GREPECAS/12 meeting, with a view to harmonising the integration of ATM automated systems, formulated Conclusion 12/31 - *Regional strategy for the integration of automated systems*, urging CAR/SAM States, in coordination with ICAO Regional Offices, to define action plans for the integration, taking into account the guidelines for an ATM automated system integration strategy.

1.6 In order to assist the States/Territories and International Organisations in the development of action plans for the integration of automated systems, the Automation Task Force of the ATM/CNS Subgroup drafted an *Interface Control Document (ICD) for Data Communications between ATS Units in the Caribbean and South American Regions (CAR/SAM ICD)*, as well as a *Table on ATS Operational Requirements for Automated Systems*.

1.7 In this regard, the GREPECAS/14 meeting formulated Conclusion 14/43 - *Automated systems interface agreements* and Conclusion 14/44 - *Establishment of an action plan for the interface of ATM automated systems*, with a view that the States, Territories and International Organisations use the interface control document (ICD) and establish the action plan for the interconnection of automated systems.

1.8 ICAO technical cooperation project RLA 98/003 - *Transition to CNS/ATM systems in the CAR/SAM Regions*, with a view to supporting CAR/SAM States/Territories/International organisations, and taking into account GREPECAS conclusions formulated in this respect, drafted a system interface control document (SICD) and a regional interconnection plan for ACC automated systems to support the States in the Region in the drafting of action plans for the implementation of automated system interconnection.

1.9 Project RLA/06/901, in order to support SAM States with the implementation of the global ATM in this Region, contemplates activities related to the implementation of automated systems in the ACCs and their interconnection, as a follow-up to the activities carried out under RLA/98/003, which has already completed its activities. In this regard, the project drafted a document containing the requirements for an automated ACC centre (SSS), reviewed the action plan for the interconnection of automated systems, and drafted a memorandum of understanding containing technical, operational, administrative, and financial elements for the interconnection of automated systems between two States having adjacent ACCs in the SAM Region, which is presented to this SAM/IG/3 Meeting.

2. Analysis

2.1 For the interconnection of automated systems, SAM States currently have the following documentation available:

- a) Guidelines for an integration strategy for ATM automated systems in the CAR/SAM Regions;
- b) Interface Control Document (ICD) for data communications between ATS units in the Caribbean and South American Regions (CAR/SAM ICD);
- c) System interface control document (SICD);
- d) Initial plan for regional interconnection of ACC automated systems;
- e) Preliminary document containing automated system (SSS) requirements; and
- f) Memorandum of understanding for the implementation of the interconnection of automated systems between two States having adjacent ACCs.

Guidelines for a strategy of integration of ATM automated systems in the CAR/SAM Regions

2.2 The guidelines for a strategy of integration of ATM automated systems was submitted to, and approved by GREPECAS through Conclusion 12/31 (Appendix K to Agenda Item 3). The objective of these guidelines is to provide States, users, and ATS service providers with a safe, gradual, evolutionary, and interoperable vision towards a seamless, flexible, optimum, and dynamic management of airspace.

2.3 The guidelines for a strategy of integration of automated systems list a number of activities required for the integration of automated systems, to be implemented in different stages. **Appendix A** to this working paper contains the guidelines for a strategy of integration of ATM automated systems in the CAR/SAM Regions.

Interface Control Document (ICD) for data communications between ATS facilities in the Caribbean and South American Regions (CAR/SAM ICD)

2.4 The purpose of the ICD is to serve as guidance material for the exchange of specific messages (FPL, CPL, CNL, etc.) between ATM automated systems in the short term, pursuant to Annex 10 - Vol. II, Annex 11, Doc 4444 and other ICAO and State documents, as appropriate, and, in some cases, containing supplementary information to meet the additional requirements of modern automation systems.

2.5 This document describes the units of measure and conventions for data; the flight plan fields; message types to be used for pre-flight coordination, active flights, general information, interface management, radar transfer and acknowledgment; communications and support mechanisms. The ICD is shown in **Appendix B** to this working paper.

System interface control document (SICD)

2.6 The system interface control document (SICD) supplements the ICD document with the interface technical information required for implementing the interconnection of automated systems.

2.7 The system interface control document (SICD) contains detailed information about the interface between the radar sensor (primary/secondary radar) and the ATCS (ATC control system), the interface between the aeronautical message switching centre (AFTN) and the ATCS, the OLDI interface between ATCS, the AIDC interface between ATCS, the interface between flight plan processors, the interface between the radar sensor monitoring and control systems and the monitoring and control central unit, the interface between the clock timing server and the ATCS.

2.8 For each of the aforementioned interfaces, the SCID document specifies the type (serial, synchronous, etc.), description (simple HDLC, duplex, etc.), type of data (radar, flight plan, OLDI, etc.), format (Asterix, TVT2, etc.), message definition (Asterix message types 001, 002, etc.), speed (9.6Kbits/seg, 2.4Kbits/seg, etc.), electric characteristics (RS 232, V24/V28, etc.), physical connection (type of connector) and reference (manufacturer manual).

2.9 The SICD is a reference document that will facilitate the interconnection between radar sensors, flight plans and the corresponding ATCS, as well as the interconnection between ATCS systems. The document, although it describes only the interfaces of automated systems in the States visited by the project (Argentina, Brazil, Chile, Ecuador, Panama, Peru, Uruguay, and Venezuela), also serves as a reference for those States having automated ATC systems and wish to interconnect with other automated systems or radar sensors in other States, since the document describes the technical information.

2.10 The SICD contains information obtained from the data collected in 2007. The document should be updated if new automated systems have been replaced or implemented from the indicated date. Likewise, the SICD document should include the interfaces implemented in the States that were not initially included in the ICD. The SICD document shown as **Appendix C** should be updated during the Meeting.

2.11 To this end, the following draft conclusion is formulated:

DRAFT CONCLUSION SAM/IG/3-X**UPDATING OF THE SCID**

In order to update the SICD drafted in 2007:

- a) SAM States included in the ICD are urged to review and update the information contained in the document, in case they have implemented new automated systems in the ACC after 2007;
- b) SAM States having automated systems and are not included in the SICD are urged to send the information to the ICAO Regional South American Office; and
- c) SAM States are urged to send the information required in sections a) and b) to the ICAO South American Regional Office by **29 May 2009**.

Initial regional interconnection plan for ACC automated systems

2.12 The regional interconnection plan for automated systems describes a recommended strategy for implementing the interconnection of automated systems between adjacent ACCs, taking into account the current and foreseen situation of automated systems, based on the automation systems currently installed in the ACCs of the Region.

2.13 The interconnection of automated systems contemplated in the plan indicates that the interconnection between automated systems located in adjacent ACCs in the SAM Region can be done in terms of the exchange of flight plans, the exchange of radar data, or the exchange of flight plans and radar data together, depending on the facilities installed where the automatic data transfer is required.

2.14 The interconnection plan classifies flight plan and radar data exchange levels according to the systems installed in the Region. In this respect, as specified in Document 4444, flight plans can be exchanged through OLDI messages and AIDC messages. Regarding the exchange of radar data, use can be made of proprietary protocols, the Asterix protocol at radar sensor level, and the Asterix protocol at system level.

2.15 The interconnection plan, according to data exchange classification in the Region as described in the previous paragraph, presents a table with the interconnection levels that can be currently implemented in the Region.

2.16 The Meeting should review and update the interconnection document contained in **Appendix D** in case a new level of radar data or flight plan exchange is implemented.

Preliminary document of automated system requirements (SSS)

2.17 The document presents the minimum requirements for an automated centre. It is addressed to the States of the Region that have automated systems in the ACCs so that they can verify that they have the appropriate systems, and to the States that have not yet implemented automated systems in their ACCs. The document was presented at the SAM/IG/2 meeting and is contained in **Appendix E** to this working paper.

Memorandum of understanding for the implementation of the interconnection between automated systems of two States having adjacent ACCs

2.18 The SAM/IG/2 meeting considered that the Project should develop a memorandum of understanding model to guide States in the identification of technical, operational, administrative, institutional, and financial considerations needed for bilateral implementation of automated systems interconnection between adjacent States of the Region that have automated systems installed in their ACCs.

2.19 In this regard, project RLA /06/901, following the recommendations of the SAM/IG/2 meeting, hired an expert for one week for drafting the memorandum of understanding model that is contained in **Appendix F** to this working paper.

2.20 The memorandum of understanding represents a guide for SAM States to be able to enter into bilateral agreements. It takes into account the aspects contained in the documents on automated system interconnection developed by projects RLA/98/003 and RLA/06/901, as well as GREPECAS recommendations.

2.21 The document applies to all SAM States having automated air traffic control systems that they wish to interconnect. This document only applies to the interconnection of automated systems between two (2) States.

3. Summary

3.1 The SAM States and Territory that have automated systems installed already have the necessary documentation, as described in section 2 of this working paper, allowing them to draft specific plans for the interconnection of automated systems between adjacent ACCs.

3.2 The preliminary regional action plan for the interconnection of automated systems in the ACCs of the Region was developed at the SAM/IG/1 meeting and reviewed at the SAM/IG/2 meeting, and is presented as **Appendix G** to this working paper.

3.3 The regional action plan, from line 33 to line 78, contemplates the interconnection of flight plans and radar data, in keeping with the systems installed in the SAM States that have implemented automated systems.

3.4 The SAMIG Working Group on CNS Capacity Improvement should review the regional action plan and begin drafting specific implementation plans for the interconnection of the systems between States.

3.5 As an example, a specific implementation plan would involve the interconnection of flight plans between the Santiago and Ezeiza ACCs, using OLDI (line 36), and the interconnection of radar surveillance systems between the Santiago and Ezeiza ACCs using the Asterix radar protocol.

3.6 A specific implementation plan would contain specific information to carry out the interconnection work. The specific implementation plan would draw on the documents developed in this respect, such as the memorandum of understanding presented in Appendix F to this paper, the technical information on interface systems (SICD) contained in Appendix C to this paper, the types of flight plan messages to be exchanged, the ICD document shown in Appendix B to this paper, the initial plan for regional interconnection of ACC automated systems contained in Appendix D, and the preliminary document with the automated system requirements (SSS), contained in Appendix G to this paper.

3.7 The specific implementation plans initially drafted at this SAM/IG/3 meeting will be completed by the members of the CNS Working Group involved, and sent to the ICAO Regional Office by **30 June 2009**.

3.8 Once the specific implementation plans have been drafted, the States should begin the corresponding implementation. To this end, the following draft conclusion is proposed to the Meeting:

DRAFT

CONCLUSION SAM/IG/3-X

DRAFTING OF SPECIFIC IMPLEMENTATION PLANS FOR THE INTERCONNECTION OF AUTOMATED SYSTEMS

That, taking into account the memorandum of understanding for the interconnection of automated systems between States having adjacent ACCs, the interface control document (ICD) for data communications between ATS units in the Caribbean and South American Regions (CAR/SAM ICD), the system interface control document (SICD), the initial plan for regional interconnection of

ACC automated systems, and the preliminary document on automated system requirements (SSS), that:

- a) the CNS Working Group begin drafting specific implementation plans for the interconnection of automated systems between two States at the SAM/IG/3 meeting;
- b) the definitive specific implementation plans for the interconnection of automated systems be sent to the ICAO South American Regional Office by 30 June 2009; and
- c) once the specific implementation plans are completed, the States involved set dates for starting the implementation of the interconnection.

4. **Suggested action**

4.1 The Meeting is invited to:

- a) take note of the information contained in this paper;
- b) analyse the aspects contemplated in Section 2 of this working paper;
- c) review and approve the draft conclusion contained in paragraph 2.11;
- d) review the memorandum of understanding document contained in Appendix F to this working paper; and
- e) review and approve the draft conclusion contained in paragraph 3.8 of this working paper.

APPENDIX A

GUIDELINES FOR STRATEGY OPERATIONAL INTEGRATION OF THE ATM AUTOMATED SYSTEMS OF THE CAR/SAM REGIONS

Objective: Through a committed participation of the States, users and ATS providers of the CAR/SAM Regions,

- 1) to cooperate jointly in the integration of technologies for ATM automation, in accordance with ICAO guidelines available, considering the best regional and global alternatives;
- 2) develop a strategy for the integration of ATM automated systems with a safe, gradual, evolutionary and interoperable vision that facilitates the information exchange and the collaborative decision-making of all the components of the ATM system for a seamless, flexible, optimum and dynamic management of airspace and international aerodromes, and at the same time that it increases the required operational safety levels.
- 3) take into account the data processing and network environment, taking into consideration the use of ground and space segments for an interactive ATS information process, under the criteria of integrity, quality and real time.

FRAMEWORK

- a) identify homogeneous areas on the basis of traffic flows operating in the different airspace and international aerodromes;
- b) analyze the operational environment scenarios of the air traffic services currently provided and those that are planned;
- c) determine the scope, architecture design, characteristics and attributes of the operational requirements for the short-term integration of the current automated systems of the ATS units depending on the current provided service levels, as well as other operational requirements that respond to future expectations of the components of the ATM system, considering:
 - i) arranging the requirements in logical sequence, through the following stages.

Stage	Function
Stage I	- Flight plan processing (FDPS/Flight Data Processing System)
Stage II	- Radar data processing and ATS surveillance (RDPS/Radar Data Processing System, ADS and exchange of radar information); - Monoradar ; - Multiradar ; - Radar data sharing .
Stage III	- Automated digital communications (radar control transfer/automated traffic hand off, AIDC/CPDLC, etc.).
Stage IV	- Implementation of CDM (Collaborative Decision Making) for other ATM requirements (AOM [Airspace Organization and Management], CM [conflict management], DCB [Demand/Capacity Balancing], AO [Aerodrome Operation], TS [Traffic Synchronization], AUO [Airspace User Operation], ASDM [ATM Service Demand Management], AIS, Meteorology, Statistics, etc.);

NOTE: SAR should be taken into consideration in all the lower airspace stages.

- ii) identify the automation level required according to ATS functions defined in States' classification of airspace and international aerodromes, as follows:

ATS Operational functions required in the automated systems (ATC, FIS, SAR)							
APPLICABLE ATS FUNCTIONS	ATS Airspace						
	A	B	C	D	E	F	G
Identification							
Separation							
Navigation guide							
Surveillance							
Transfer							
Coordination							
Information of flight plans in real time							
Visualization of the geographical position of the aircraft (longitude, latitude, history)							
Statistical data of flight plans (past and forecasted information).							
Radar data processing system (RDPS)							
Flight data processing system (FDPS)							
ATS inter-facility data communications (AIDC)							
Controller-pilot data link communications (CPDLC)							
Flight profile information (altitude, vertical speed, offset speed, predictive							

ATS Operational functions required in the automated systems (ATC, FIS, SAR)							
APPLICABLE ATS FUNCTIONS	ATS Airspace						
	A	B	C	D	E	F	G
vector, turn angle, etc.)							
Automatic alerts (STCA, MSAW, DIAW, emergency, communication failure, unlawful interference, etc.)							
AIS Interface							
Meteorological information							

- iii) define the incoming and outgoing data, and functional interfaces data applicable to functions and sub-functions of the service;
 - iv) define from the highest to lowest level the functional decompositions for all the ATM components;
 - v) successively determine the different operational applications from the functional level or lowest interface to the upper interface;
 - vi) define the current and future operational applications needs;
 - vii) determine the short-term operational requirements; and
 - viii) determine the future operational requirements.
- d) determine the existing facilities and technological equipments in the CAR/SAM Regions, especially in adjacent States/Territories/Organizations, as well as the inter-operability technical requirements, data bases, equipped aircraft, software tools, etc., required that ease the integration of automated systems;
- e) develop a cost-benefit analysis for the integrated implementation of ATM automated systems;
- f) establish bilateral and multilateral agreements as appropriate, among States/Territories/International Organizations of adjacent airspace and regions for trials and the operational implementation/integration of ATS automated systems;
- g) develop standards, procedures and guidance material required (as *the Interphase Control Document (ICD) for data communications and common coordination between ATM centres, based on ICAO SARPS*) for the functional operation of ATS automated systems, including critical contingency cases, so as to serve as an aid to users;

- h) take the necessary measures for human resources training on a national and regional basis and allowing the facilitation of the implementation/integration of ATS automated systems;
- i) identify other potential benefits for the ATM community that may be obtained in the long-term; and
- j) document an action plan permitting the interoperable implementation of ATS automated systems.

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APPENDIX B / APENDICE B



INTERNATIONAL CIVIL AVIATION ORGANIZATION

**INTERFACE CONTROL DOCUMENT
FOR
ATS INTER-FACILITY DATA COMMUNICATIONS
IN THE
CARIBBEAN AND SOUTH AMERICAN REGIONS
(CAR/SAM AIDC ICD)**

Version	Draft 0.2
Date	13 November 2006

FOREWORD

The *Interface Control Document (ICD) for ATS Inter-Facility Data Communications (AIDC) in the Caribbean and South American Regions (CAR/SAM AIDC ICD)* is published by the ATM/CNS Subgroup of the Caribbean/South American Regional Planning and Implementation Group (GREPECAS). It describes a process and protocols for exchanging data between multiple States/Territories/International Organizations within and across regions.

Copies of the *CAR/SAM AIDC ICD* can be obtained by contacting:

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The present edition (Draft Version 0.2) includes all revisions and modifications until November 2006. Subsequent amendments and corrigenda will be indicated in the Record of Amendment and Corrigenda Table.

Proposals for amendments to the document may be submitted to either of the ICAO Regional Offices for coordination and processing. The GREPECAS and its contributory bodies will issue revised editions of the Document as required.

The publication of amendments and corrigenda is regularly announced through correspondence with States, and the ICAO web site, which holders of this publication should consult. The space below is provided to keep a record of such amendments.

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INTRODUCTION

HISTORICAL

Air Traffic Services providers in several regions have identified the requirement to exchange flight plan and radar data information between adjacent ATC facilities utilizing ATS Inter-Facility Data Communications (AIDC). This requirement stems from the increasing traffic levels crossing FIR boundaries and the need to improve efficiency and accuracy for the ATC providers. Developing a harmonized process and protocols for exchanging data between multiple States/Territories/International Organizations within and across regions is critical to satisfying this requirement. As ATS providers develop their automation systems, consideration should be given to meeting the capabilities identified within this Interface Control Document (ICD).

The CAR/SAM AIDC ICD is based on the North American Common Coordination Interface Control Document used by Canada, the United States and Mexico. The NAM region has advanced to the level of initial implementation of flight plan data exchange. Experience gained by the NAM region during their development process is incorporated here.

The GREPECAS/12 meeting held in Cuba, 07 – 11 June 2004 concluded that the CAR/SAM States/Territories/International Organizations should define an action plan for the application of a regional strategy for the integration of ATM automated systems. This document provides the basis for interfacing those ATM automation systems in the CAR/SAM regions.

The Interface Control Document for ATS Inter-Facility Data Communications for the Caribbean and South American Regions (CAR/SAM AIDC ICD) content is as follows:

Part I- Purpose, Policy, and Units of Measurement

This section provides an overall philosophical view of the Interface Control Document (ICD) and general information concerning the measurement units that are used. It also describes the process by which changes to this document are to be managed.

Part II- ATS Coordination Messages

This section describes in detail all the messages that may be used to exchange ATS data between Air Traffic Services (ATS) Units. In this version of the document, flight plan and radar handover messages have been defined.

Part III- Communications and Support Mechanisms

This section describes the technical and other requirements needed to support ATS message exchange.

Appendices

Appendix A includes a list of error messages.

Appendix B contains Implementation Guidance Material for the message sets.

Appendix C is a model describing a specific Common Boundary Agreement to be followed by ATS providers, noting the level of the interface that is supported and any deviations from the core message definitions.

GLOSSARY

Active Flight	A flight that has departed but has not yet landed. Note: This ICD assumes any flight with an entered actual departure time in the flight plan is active.
Adapted Route	A route whose significant points are defined in an automation system and associated with a name for reference purposes. Adapted routes normally include all ATS routes, plus non-published routes applied to flights by the system or by controllers.
Adapted Route Segment	Two significant points and the name of the adapted route connecting them.
Aircraft ID	A group of letters, numerics or combination thereof which is either identical to, or the coded equivalent of, aircraft callsign to be used in air-ground communication, and which is used to identify the aircraft in a ground-ground ATS communication..
Air Traffic Services Provider	For the purposes of this ICD means the responsible to provide air traffic services in the jurisdiction of State/Territory, such as own State, Agency or International Organization.
Airway	A route that is defined and published for purposes of air navigation.
Altitude	The vertical distance of a level measured from mean sea level (MSL).
Area Control Center/ Centre	An Air Traffic Services unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction.
Assigned SSR Code	A SSR code that has been assigned by an ATC facility to a flight. The flight may or may not be squawking this code. See Established SSR Code.
ATS Route	A specified route designed for channeling the flow of traffic as necessary for the provision of air traffic services.
Boundary Crossing Point	An intersection point between a route of flight and a control boundary.
Boundary Crossing Time	The time at which a flight is predicted to reach its Boundary Crossing Point.
Boundary Point	An agreed point on or near the control boundary at which time and altitude information is provided for purposes of coordination.
Character	A letter from A-Z or number from 0-9.
Control Boundary	The boundary of the Area Control Center (ACC) as defined in the local automation system. This is typically close to, but not the same as, the FIR boundary.

Direct Route Segment	A route segment defined solely by two significant points. The path between the points is implied, and depends on the navigation system used.
Element	Within a numbered field of an ICAO message there may be several sub-fields, called elements. These are referred to by sequential letters a, b, c, etc. For example Field 03 has elements a, b, and c.
Established SSR Code	The SSR code that a flight is now squawking.
Field	A numbered logical portion of a message. All references to fields in this document are to message fields defined in ICAO Doc. 4444 unless otherwise specified.
Fix-radial-distance	A method of specifying a geographic point. It includes the name of a fix, followed by a direction from the fix in degrees and then a distance in nautical miles.
Flight ID	The combination of aircraft ID (from Field 07) and most recent message number (from ICAO Field 03(b)) which uniquely identify a flight.
Flight Level	A surface of constant atmospheric pressure which is related to a specific pressure datum of 1,013.2 hPa (29.92 inches of mercury), and is separated from other such surfaces by specific pressure intervals (see Annex 11). Each is stated in three digits that represent hundreds of feet. For example, flight level 250 represents a barometric altimeter indication of 25,000 feet with the altimeter set to 29.92.
Letter	A letter from A-Z.
Numeric	A number from 0-9.
Off-Block Time	The time at which an aircraft expects to push back or has pushed back from the gate.
Proposed Flight	A flight which has a flight plan but which has not departed.
Reject	When this term is used, it means that an incoming message is not to be processed further and should be output to a specified location (either the message source, or a local adapted device or position). The message must be re-entered in total (after correction) in order for it to be processed.
Reported Altitude	The latest valid Mode C altitude received from an aircraft, or the latest reported altitude received from a pilot.
Route	A defined path consisting of one or more ordered route segments with successive segments sharing a common end/start point. (See also Adapted Route, Direct Route, Flight Plan (or Filed) Route, Route Segment, Direct Route Segment, Adapted Route Segment).
Route Segment	Two significant points and the path between them, the order of the points indicating the direction of flight. (See adapted and direct route segments.)

Selective Calling System	Techniques, or procedures, applied to radio communications for calling only one of several receiving stations guarding the same frequency (SELCAL).
Service	In the context of this interface, a service refers to type of interface service provided: message transfer, file transfer, data base query, etc.
SSR Code	A transponder code consisting of four octal digits.
Standard Arrival Route	A published route from a designated significant point to an aerodrome.
Standard Departure Route	A published route from an aerodrome to the first significant point on a route.
Significant Point	A specified geographical location used in defining an ATS route or the flight path of an aircraft and for other navigation and ATS purposes.
Symbol	Any of the symbols used within messages, including space “ ” oblique stroke “/”, single hyphen “-”, plus “+”, open bracket “(” , closed bracket “)”.
Transaction	The exchange of a message and a response.

LIST OF ACRONYMS

ACC	Area Control Center/Centre
ACID	Aircraft ID - the three to seven character callsign or registration number of an aircraft (e.g. MEX123)
ACP	Acceptance Message
ADF	Automatic Direction Finder
AFTN	Aeronautical Fixed Telecommunications Network
AIFL	Air filed - substitutes for departure aerodrome in flight plan Field 13 when IFR clearance is granted to airborne VFR aircraft
ARTCC	Air Route Traffic Control Center (see Area Control Center)
ATM	Air Traffic Management
ATN	Aeronautical Telecommunications Network
ATS	Air Traffic Services
Bps	Bits Per Second
CAR	ICAO Caribbean Region
CHG	Modification message for Proposed Flight Plan
CNL	Flight Plan Cancellation message
CNS	Communications, Navigation and Surveillance
CPL	Current Flight Plan message
EST	Estimate message
FDP	Flight Data Processing
FIR	Flight Information Region
FPL	Filed Flight Plan message
FSAS	Flight Services Automation System
FSS	Flight Service Station
ICD	Interface Control Document
ICAO	International Civil Aviation Organization
ID	Identification
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IRQ	Initialization Request message
IRS	Initialization Response message
ISO	International Standards Organization
Kb	Kilobyte (= 1024 bytes)
LAM	Logical Acknowledgement message
LRM	Logical Rejection message
MIS	Miscellaneous Information message
MOD	Modification message for Active Flight Plan
MSN	Message Switched Network
NACC	ICAO North American, Central American and Caribbean Regional Office
NAM	ICAO North American Region (and Mexico)
NAT	ICAO North Atlantic Region

PAC	ICAO Pacific Region
PANS	Procedures for Air Navigation Services
PSN	Packet Switched Network (synonymous with PSDN)
PSDN	Packet Switched Data Network (synonymous with PSN)
RDP	Radar Data Processing
RLA	Radar Logical Acknowledgement
RNP	Required Navigation Performance
RTF	Radio Telephone
RTA	Radar Transfer Accept
RTI	Radar Transfer Initiate
RTU	Radar Track Update
RVSM	Reduced Vertical Separation Minimum
SAM	ICAO South American Region
SELCAL	Selective Calling System
SID	Standard Instrument Departure
SSR	Secondary Surveillance Radar
STAR	Standard Arrival Route
TBD	To Be Determined
TRQ	Termination Request message
TRS	Termination Response message
UTC	Universal Time Coordinated
VFR	Visual Flight Rules
VHF	Very High Frequency
VOR	VHF Omnidirectional Range
VSP	Variable System Parameter

REFERENCES

Document ID	Document Name	Date/ Version
ICAO Doc. 4444	Air Traffic Management, Doc. 4444 PANS-ATM/501	Always use latest version
ICAO Annex 10, Volume II	Aeronautical Telecommunications. Communication, Procedures including those with PANS status.	Always use latest version
ICAO Annex 11	Air Traffic Services	Always use latest version
ICAO Doc. 8643	Aircraft Type Designators	Always use latest version
ICAO Doc. 7910	Location Indicators	Always use latest version
ICAO Doc. 9705	Manual of Technical Provisions for Aeronautical Telecommunications Network	Always use latest version
ICAO Doc. 9426	ATS Planning Manual	Always use latest version

PART I – PURPOSE, POLICY, AND UNITS OF MEASUREMENT

PURPOSE

The purpose of this document is to ensure that data interchange between ATS units providing Air Traffic Services in the CAR and SAM Regions conforms to a common standard, and to provide a means to centrally coordinate changes to the standard.

POLICY

CONFIGURATION MANAGEMENT

The contents of this ICD must be approved by the GREPECAS. Proposed changes to this document will be submitted through the GREPECAS mechanism.

The ICAO secretariat will coordinate review through the GREPECAS mechanism. When all parties have agreed to a change, the document will be amended and distributed by the secretariat.

This document identifies the standards to be followed when the defined messages are implemented. A separate Common Boundary Agreement between each pair of ATS providers shall define which message sets are currently implemented.

SYSTEM PHILOSOPHY

The automation of flight data exchange between neighboring Air Traffic Services units will follow the standards set by ICAO Documents referenced above. In constructing the interface it is recognized that the ICAO standards address neither all required messages nor all required details of message content, and that existing ATS procedures and automation systems are not always fully compatible with parts of the ICAO standard. Therefore this document supplements ICAO Doc. 4444 as needed to meet the requirements of the ATS providers in the CAR/SAM Regions.

This document addresses messages exchanged between Area Control Centers (ACCs) and any other applicable facilities (e.g. Terminal or ATFM Units). Note that a message (e.g. FPL) from a user or operator to an ACC may have different requirements than those sent from ACC to ACC or ACC to ATFM Unit. This document defines the ATM messages that are needed for complete flight plan coordination.

Each pair of ATS providers planning to implement AIDC shall select the applicable message sets from those defined below. By implementing only those message sets necessary to meet the current needs and capabilities of the automation systems, the ATS providers can obtain benefits on an incremental basis.

1.1.1.1 **FLIGHT PLAN DATA COORDINATION**

The interface automates only the exchange of flight plan data agreed between the specific ATS providers involved. Additional to those messages contained in Doc 4444, the following messages defined in this document may be used:

- Active flight modification (MOD)
- Miscellaneous Information (MIS)
- Logical Rejection (LRM)
- Initialization Request (IRQ)
- Initialization Response (IRS)
- Termination Request (TRQ)
- Termination Response (TRS)

1.1.1.2 **ATFM COORDINATION MESSAGES**

As the requirement to coordinate ATFM information arises, specific messages may need to be developed and incorporated into this document.

1.1.1.3 **RADAR HANDOVER**

Transfer of Control includes the capability to perform a radar handover, using the messages defined in this ICD.

- Radar Transfer Initiate (RTI)
- Radar Track Update (RTU)
- Radar Transfer Accept (RTA)
- Radar Logical Acknowledgement (RLA)

The format of these messages is consistent with ICAO standards. The RLA message was introduced as a logical acknowledgement to an RTI, instead of LAM, because it needs to transmit information back to the sender.

1.1.1.4 **ADS HANDOVER**

As ADS surveillance is implemented and the requirement to perform ADS handovers arises, additional messages may need to be developed and incorporated into this document.

UNITS OF MEASUREMENT AND DATA CONVENTIONS

TIME AND DATE

All times shall normally be expressed in UTC as four digits, with midnight expressed as 0000. The first two digits must not exceed 23, and the last two digits must not exceed 59.

If higher precision is needed, then a field specification may designate additional digits representing seconds and then fractions of seconds (using decimal numbers) may be added.

For example, 092236 is 9 hours, 22 minutes, and 36 seconds.
11133678 is 11 hours, 13 minutes, and 36.78 seconds.

When used, dates shall be expressed in the form YYMMDD where YY are the last two digits of the year (e.g. 01 is 2001), MM is the month (e.g. 05 for May), and DD is the day of the month (e.g. 29).

GEOGRAPHIC POSITION INFORMATION

Geographic position information shall be expressed in one of the following forms.

- Items a) through d) are consistent with ICAO Doc. 4444 PANS-ATM/501 Appendix 3, section 1.6.3; and,
 - item e) was added because the standard ICAO definition of Latitude/Longitude did not provide enough precision for exchange of radar identification.
- a) A two to five character significant point designator.
- b) Four numerics describing latitude in degrees and minutes, followed by “N” (North) or “S” (South), followed by five numerics describing longitude in degrees and minutes, followed by “E” (East) or “W” (West). The correct number of numerics is to be made up, where necessary, by the insertion of zeros, e.g. “4620N07805W”.
- c) Two numerics describing latitude in degrees, followed by “N” (North) or “S” (South), followed by three numerics describing longitude in degrees, followed by “E” (East) or “W” (West). Again, the correct number of numerics is to be made up, where necessary, by the insertion of zeros, e.g. “46N078W”.
- d) Two to three characters being the coded identification of a navigation aid (normally a VOR), followed by three decimal numerics giving the bearing from the point in degrees magnetic followed by three decimal numerics giving the distance from the point in nautical miles. The correct number of numerics is to be made up, where necessary, by the insertion of zeros, e.g. a point at 180° magnetic at a distance of 40 nautical miles from VOR “FOJ” would be expressed as “FOJ180040”.

- e) When surveillance information with higher precision is necessary, use six numerics describing latitude in degrees, minutes, and seconds, followed by “N” (North) or “S” (South), followed by seven numerics describing longitude in degrees, minutes, and seconds followed by “E” (East) or “W” (West). The correct number of numerics is to be made up, where necessary, by the insertion of zeros, e.g. “462033N0780556W”.

ROUTE INFORMATION

All published ATS routes shall be expressed as two to seven characters, being the coded designator assigned to the route to be flown.

ALTITUDE/LEVEL INFORMATION

All altitude information shall be specified as flight level(s) or altitude(s) in one of the following formats (per ICAO Doc. 4444 PANS-ATM/501, Appendix 3, Section 1.6.2):

- F followed by three decimal numerics, indicating a Flight Level number.
- A followed by three decimal numerics, indicating altitude in hundreds of feet.

Each message description identifies which of these formats may be used.

Note: If adjacent FIRs have different transition altitudes, agreement may be reached between the ATS Units on specific use of F versus A with the agreed upon solution documented in their Common Boundary Agreement.

SPEED INFORMATION

Speed information shall be expressed as true airspeed or as a Mach number, in one of the following formats (ICAO Doc. 4444 PANS-ATM/501 Appendix 3):

- N followed by four numerics indicating the true airspeed in knots (e.g. N0485).
- M followed by three numerics giving the Mach Number to the nearest hundredth of unit Mach (e.g. M082).

HEADING INFORMATION

Heading information shall be expressed as degrees and hundredths of degrees relative to true north using five digits, and inserting zeros as necessary to make up five digits, e.g. “00534” is 5.34 degrees relative to true north.

FUNCTIONAL ADDRESSES

A functional address, which refers to a function or position (e.g. Supervisor position) within an ATS Unit, may be substituted in the MIS message for the aircraft identification found in Field 07. The functional address shall contain between one and six characters and shall be preceded by an oblique stroke (/), for a total length of two through seven characters (e.g. /S1) .

FACILITY DESIGNATORS

Facility designators shall consist of four letters. The ICAO Doc. 7910 location identifier for the facility shall be used. Any exceptions shall be incorporated into the Common Boundary Agreement between the two affected ATS Units.

PART II –ATS COORDINATION MESSAGES

INTRODUCTION

The following sections describe those messages used by ATS systems for exchange of information. Messages and fields conform generally to ICAO Doc. 4444, and differences are noted.

MESSAGE FIELDS

Table 1 provides a summary of all fields used in messages described by this document. The remainder of this section describes the format of each field element. Section 3 describes which elements are to be included in each ATS message type, and Appendix B describes rules for the semantic content of each field.

Table 1. Summary of Message Fields

Field	Element (a)	Element (b)	Element (c)	Element (d)	Element (e)
03	Message Type Designator	Message Number	Reference Data		
07	Aircraft Identification	SSR Mode	SSR Code		
08	Flight Rules	Type of Flight			
09	Number of Aircraft	Type of Aircraft	Wake Turbulence Category		
10	Radio, Comm., Nav., and Approach Aid Equipment	Surveillance Equipment			
13	Departure Aerodrome	Time			
14	Boundary Point	Time at Boundary Point	Cleared Level	Supplementary Crossing Data	Crossing Condition
15	Cruising Speed or Mach Number	Requested Cruising Level	Route		
16	Destination Aerodrome	Total Estimated Elapsed Time	Alternate Aerodrome(s)		
18	Other Information				
22	Field Indicator	Amended Data			
31	Facility Designator	Sector Designator			
32	Time of Day	Position	Track Ground Speed	Track Heading	Reported Altitude

FIELD 03, MESSAGE TYPE, NUMBER AND REFERENCE DATA

Field 03(a) format shall be per ICAO Doc. 4444 except that:

Only the message identifiers included in Table 2, Core Message Set, shall be permitted in element (a).

Field 03(b) and Field 03(c) format shall be per ICAO Doc. 4444 except that:

The ATS unit identifier in elements (b) and (c) shall be exactly 4 letters. The ATS unit identifier should correspond to the first four letters of the ICAO Doc. 7910 location identifier for the ATS unit, e.g. SKBO for the Bogota ACC.

FIELD 07, AIRCRAFT IDENTIFICATION AND TRANSPONDER CODE

Field 07(a) format shall be per ICAO Doc. 4444 except that:

The aircraft ID shall be at least two characters long.

Aircraft IDs that begin with “TEST” shall be used only for test flight plans.

In an MIS message, a functional address may be substituted for the flight ID.

Field 07(b) and Field 07(c) format shall be per ICAO Doc. 4444, with the clarification that each number in

Field 07(c) must be an octal digit (i.e. 0-7). Note that elements 07(b) and 07(c) are either both present or both absent.

FIELD 08, FLIGHT RULES AND TYPE OF FLIGHT

Field 08(a) format shall be per ICAO Doc. 4444.

Field 08(b) format shall be per ICAO Doc. 4444.

FIELD 09, NUMBER AND TYPE OF AIRCRAFT AND WAKE TURBULENCE CATEGORY

Field 09(a) format shall be per ICAO Doc. 4444.

Field 09(b) format shall be per ICAO Doc. 4444.

Field 09(c) format shall be per ICAO Doc. 4444.

FIELD 10, EQUIPMENT

Field 10(a) format shall be per ICAO Doc. 4444.

Field 10(b) format shall be per ICAO Doc. 4444.

FIELD 13, DEPARTURE AERODROME AND TIME

Field 13(a) format shall be per ICAO Doc. 4444.

Field 13(b) format shall be per ICAO Doc. 4444.

FIELD 14, ESTIMATE DATA

Field 14(a) format shall be per ICAO Doc. 4444.

Field 14(b) format shall be per ICAO Doc. 4444.

Field 14(c) format shall be per ICAO Doc. 4444.

Field 14(d) format shall be per ICAO Doc. 4444.

Field 14(e) format shall be per ICAO Doc. 4444.

FIELD 15, ROUTE

Field 15(a) format shall be per ICAO Doc. 4444 except that:

The designator “K” used for kilometers per hour will not be permitted.

Field 15(b) format shall be per ICAO Doc. 4444 except that:

The designators “S” and “M” used for metric altitude will not be permitted.

Field 15(c) format shall be per ICAO Doc. 4444.

(Note that even though metric speed and altitude information is not permitted in other fields, it is permissible in elements (c4) and (c6).

**FIELD 16, DESTINATION AERODROME AND TOTAL ESTIMATED ELAPSED TIME,
ALTERNATE AERODROME(S)**

Field 16(a) format shall be per ICAO Doc. 4444.

Field 16(b) format shall be per ICAO Doc. 4444.

Field 16(c) format shall be per ICAO Doc. 4444.

FIELD 18, OTHER INFORMATION

Field 18(a) format shall be per ICAO Doc. 4444, except that:

Indicators other than those shown in ICAO Doc. 4444 may be used; however these indicators may not be processed correctly by all ATS units and/or may cause flight plans to reject.

This reflects the reality that flight plans are filed with indicators other than those defined by ICAO (e.g. DOF/000112 to identify date of flight is commonly filed) some of which may be mandated by other ICAO regions.

Multiple instances of the indicator RMK/ may be used. ICAO Doc. 4444 does not address the validity/invalidity of this; however instances of filed plans which use the same indicator multiple times have been identified. For example, “RMK/AGCS EQUIPPED RMK/TCAS EQUIPPED RMK/RTE 506”. The same may be true for some other indicators (e.g. STS/, NAV/ or COM/).

It must be noted that certain other indicators, for example DEP/, must only be used once to ensure successful processing of the flight plan.

FIELD 22, AMENDMENT

Field 22(a) format shall be per ICAO Doc. 4444.

Field 22(b) format shall be per ICAO Doc. 4444.

FIELD 31—FACILITY AND SECTOR DESIGNATORS

Field 31(a) shall contain a four-letter designator of the destination facility that is to receive the handover.

Note that this facility ID can be for a terminal facility that the parent en route system provides routing for. The four-letter designator should be the location identifier for the facility (from ICAO Doc. 7910) if one exists. If a location identifier does not exist, one should be assigned by mutual agreement between the implementing ATS providers and submitted to ICAO for inclusion in ICAO Doc. 7910.

Field 31(b) shall contain a two-character designator of the sector that is to receive the handover.

If 00 is designated, or the field element is not included then the receiving system is to determine the appropriate sector.

Example: MDCS00

FIELD 32—AIRCRAFT POSITION AND VELOCITY VECTOR

Each element of field 32 is fixed length; there is no separator between elements.

Field 32(a) shall contain time of day that the position is valid for, expressed in eight digits: HHMMSSDD where HH is hours from 00 to 23; MM is minutes from 00 to 59; SS is seconds from 00 to 59 and DD is hundredths of seconds from 00 to 99.

Field 32(b) shall contain the position of the referent flight expressed in Latitude/Longitude to the nearest second, in ICAO Doc. 4444 format extended to include seconds (e.g. 462034N0780521W).

Field 32(c) shall contain the ground speed of the flight expressed in knots, per ICAO Doc. 4444 format (e.g. N0456).

Field 32(d) shall contain the heading of the flight expressed in degrees and hundredths of a degree using five digits, from 00000 to 35999 relative to true north.

Field 32(e) shall contain the reported altitude expressed in ICAO Doc. 4444 format (e.g. A040, F330).

CORE MESSAGE SET

The core message set is summarized in Table 2 below.

Table 2. Core Message Set

Category	Msg.	Message Name	Description	Pri- ority	Source
Coordination of pre-departure flights	FPL	Filed Flight Plan	Flight plan as stored by the sending ATS unit at the time of transmission. Used only for proposed flights.	FF	ICAO Doc. 4444
	CHG	Modification message for Proposed Flight Plan	Changes previously sent flight data (before estimate data has been sent).	FF	
	CNL	Cancellation	Cancels an FPL	FF	
Coordination of active flights	CPL	Current Flight Plan	Flight plan as stored by the sending ATS unit at the time of transmission, including boundary estimate data. Used only for active flights.	FF	ICAO Doc. 4444
	EST	Estimate	Identifies expected flight position, time and altitude at boundary.	FF	
	CNL	Cancellation	Cancels a CPL.	FF	
	MOD	Modification message for Active Flight Plan	Changes previously sent flight data (after estimate data has been sent).	FF	New message, format per CHG.
General Information	MIS	Miscellaneous	Free-format text message with addressing options.	FF	NAT ICD
Interface Management	IRQ	Initialization Request	Initiates activation of the interface.	FF	Based on existing Canadian protocols.
	IRS	Initialization Response	Response to an IRQ.	FF	
	TRQ	Termination Request	Initiates termination of the interface.	FF	
	TRS	Termination Response	Response to a TRQ.	FF	
Radar Handover	RTI	Radar Transfer Initiate	Initiates a radar handover.	FF	New messages based on existing U.S. protocols and ICAO Doc. 4444 format
	RTU	Radar Track Update	Provides periodic position updates for a track in handover status.	FF	
	RLA	Radar Logical Acknowledgement	Computer acceptance of an RTI message.	FF	
	RTA	Radar Transfer Accept	Accepts or retracts a handover.	FF	

Category	Msg.	Message Name	Description	Pri- ority	Source
Acknowledgements (included in each of the above services)	LAM	Logical Acknowledgement	Computer acceptance of a message.	FF	ICAO Doc. 4444
	LRM	Logical Rejection	Computer rejection of an invalid message.	FF	NAT ICD

COORDINATION OF PRE-DEPARTURE FLIGHTS

1.1.1.5 FPL (FILED FLIGHT PLAN)

FPL Purpose

An FPL shall be addressed to the appropriate ATS Units according to the requested route as prescribed in Doc 4444.

In the case of near-border departures, an FPL may be sent from ATS unit to ATS unit under agreed conditions (e.g. for departures when the flight time to the boundary is less than the normal advance time for sending a CPL). In this case the FPL sent contains the latest flight plan information as entered by Air Traffic Control, and is not always the same as the original FPL filed by the user. This FPL may be used as advanced notification at the receiving ATS facility for planning purposes.

FPL Format

FPL Field	Required Elements	Optional Elements	Comments
03	a, b		
07	a	b, c	SSR code is only sent if one is (already) assigned and the aircraft is so equipped.
08	a	b	Element (b) is included per requirements of the boundary agreement.
09	b, c	a	
10	a, b		
13	a, b		
15	a, b, c		
16	a, b	c	
18		a, other info.	Element (a) is included only if no other information is included. Either element (a) OR other information (but not both) must be included.

FPL Examples

This flight plan was sent from Bogota ACC (SKED) to Maiquetia ACC (SVZM). The flight is from La Mina Airport in Maicao, Colombia to La Chinita International Airport in Maracaibo, Venezuela. Because the departure airport is at the border between Colombia and Venezuela, a FPL needed to be sent before departure.

(FPLSKED/SVZM381-HK2Z5-IG-C172/L-S/C-SKLM1235-N0110A080 DCT CJN G445 MAR DCT-SVMC0036-EET/SVZM0007)

This flight plan was filed by TACA International Airlines for a flight from Toncontin International Airport in Tegucigalpa, Honduras to Boa Vista International Airport in Boa Vista, Brazil.

(FPL-TAI128-IS-B752/M-DGIJLORVW/S-MHTG1735-N0447F290 DCT TNT UA552 NOL UW27 RONER UL304 BVI DCT-SBBV0403-EET/MPZL0039 SKSP0044 MPZL0054 ALPON0122 SKEC0135 SVZM0157 SBMU0344 SEL/CDHQ DAT/S)

1.1.1.6 CHG (MODIFICATION MESSAGE FOR PROPOSED FLIGHT PLAN)

CHG Purpose

A CHG is used to transmit a change to one or more fields of previously sent flight data for a flight that has not had boundary estimate data sent. When boundary estimate data has been sent (via CPL or FPL followed by EST), a MOD message must be used for flight data changes.

CHG Format

CHG Field	Required Elements	Optional Elements	Comments
03	a, b, c		Element (c) shall contain the reference number of the first message sent for this flight.
07	a	b, c	If a SSR code has been assigned and sent in a previous CHG, it should be included. Fields 07, 13, and 16 must contain the values of these fields <u>before</u> the flight data was changed.
13	a		
16	a		
22	a, b		

CHG Examples

This amendment changes the equipment in Field 10 adding a DME equipment.

(CHGSKED/SVZM395SKED/SVZM381-HK2Z5-SKLM-SVMC-10/SD/C)

This amendment changes the ACID of a flight from HK2Z5 to HK2X5. Note that when Field 07(a) is changed, it is the only change allowed in the message.

(CHGSKED/SVZM412SKED/SVZM381-HK2Z5-SKLM-SVMC-07/HK2X5)

1.1.1.7 CNL (CANCELLATION)

CNL Purpose

A CNL is used to notify the receiving ATS unit that a flight, for which an FPL or CPL was sent earlier, is no longer relevant to that ATS unit.

CNL Format

CNL Field	Required Elements	Optional Elements	Comments
03	a, b, c		Element (c) shall contain the reference number of the first message sent for this flight.
07	a		Elements (b) and (c) are not used in this context.
13	a		
16	a		

CNL Example

This message was sent from Bogota ACC (SKED) to Maiquetia ACC (SVZM) to indicate that flight HK2X5 from La Mina Airport in Maicao, Colombia to La Chinita International Airport in Maracaibo, Venezuela will no longer be entering Maiquetia ACC airspace.

(CNL SKED/SVZM452SKED/SVZM381-HK2X5-SKLM-SVMC)

COORDINATION OF ACTIVE FLIGHTS

1.1.1.8 CPL (CURRENT FLIGHT PLAN)

CPL Purpose

A CPL is used to inform the receiving center of the cleared flight plan and boundary estimate information for coordination purposes. This message may only be sent as the initial transmission of an active flight plan (i.e. a flight that has departed and for which a boundary estimate based on the actual departure time is available).

CPL Format

CPL Field	Required Elements	Optional Elements	Comments
03	a, b		
07	a	b, c	SSR code is only sent if one is (already) assigned and the aircraft is so equipped.
08	a	a	Element (b) is included per requirements of the boundary agreement.
09	b, c	a	
10	a, b		
13	a		
14	a, b, c	d, e	
15	a, b, c		
16	a		
18		a, other info.	Element (a) is included only if no other information is included. Either element (a) OR other information (but not both) must be included.

CPL Example

This flight plan was sent from Bogota ACC (SKED) to Maiquetia ACC (SVZM). It indicates that the flight is expected to cross the coordination fix ORTIZ at 1932UTC, that the assigned beacon code is 2617, and that the flight has been cleared to flight level 290.

(CPLSKED/SVZM172-TAI128/A2617-IS-B752/M-DGIJLORVW/S-MHTG-ORTIZ/1932F290-N0447F290 ORTIZ UA552 NOL UW27 RONER UL304 BVI DCT-SBBV0403-EET/MPZL0039 SKSP0044 MPZL0054 ALPON0122 SKEC0135 SVZM0157 SBMU0344 SEL/CDHQ DAT/S)

1.1.1.9 **EST (ESTIMATE)***EST Purpose*

An EST is used to provide boundary estimate information for a flight when the basic flight plan information was previously transmitted via an FPL (instead of a CPL). Note that the EST is sent only when a flight becomes active.

EST Format

EST Field	Required Elements	Optional Elements	Comments
03	a, b, c		Element (c) shall contain the reference number of the last message sent for this flight.
07	a	b, c	SSR code is only sent if one is (already) assigned and the aircraft is so equipped. Aircraft ID and beacon code sent in an EST message <u>must</u> match the values previously sent in the FPL or the last CHG that modified the FPL.
13	a		Departure aerodrome <u>must</u> match the value previously sent in the FPL or the last CHG that modified the FPL.
14	a, b, c	d, e	
16	a		Destination aerodrome <u>must</u> match the value previously sent in the FPL or the last CHG that modified the FPL.

EST Example

This message was sent from Bogota ACC (SKED) to Maiquetia ACC (SVZM) upon departure of HK2X5. It indicates that the flight is expected to cross the coordination fix OSOKA at 1245UTC, that the assigned beacon code is 4322 and that the flight has been cleared to an altitude of 8,000 feet.

(ESTSKED/SVZM452SKED/SVZM381-HK2X5/A4322-SKLM-OSOKA/1245A080-SVMC)

1.1.1.10 **CNL (CANCELLATION)***CNL Purpose*

A CNL is used to notify the receiving ATS unit that a flight, for which an FPL or CPL was sent earlier, is no longer relevant to that ATS unit.

CNL Format

The CNL message is used for both active and proposed flights.

1.1.1.11 MOD (MODIFY MESSAGE FOR ACTIVE FLIGHT PLAN)

MOD Purpose

A MOD is used to transmit a change to one or more fields of previously sent flight data after boundary estimate data has been sent. The MOD is therefore used for any flight data changes after a CPL or an EST has been sent.

MOD Format

MOD Field	Required Elements	Optional Elements	Comments
03	a, b, c		Element (c) shall contain the reference number of the first message sent for this flight.
07	a	b, c	SSR code is only sent if one is (already) assigned or the aircraft is so equipped. Fields 07, 13, and 16 must contain the values of these fields <u>before</u> the flight data was changed.
13	a		
16	a		
22	a, b		

MOD Example

This amendment removes the RVSM capability from field 10 and changes the assigned altitude to flight level 240.

(MODSKED/SVZM218SKED/SVZM172-TAI128-MHTG-SBBV-10/DGIJLORV/S-15/N0447F240
UA552 NOL UW27 RONER UL304 BVI DCT)

GENERAL INFORMATION MESSAGES

1.1.1.12 MIS (MISCELLANEOUS)

MIS Purpose

A MIS is used to transmit a free text message to a specific functional position, or to the position responsible for a specific flight, at another facility.

MIS Format

MIS Field	Required Elements	Optional Elements	Comments
03	a, b		
07	a		Note that element (a) in the MIS may contain a flight ID <u>or</u> a functional address
18	RMK/ followed by free text		

MIS Example

In this example, Bogota ACC (SKED) informs Maiquetia ACC (SVZM) that TACA flight 128 has lost its RVSM capability.

(MISSKED/SVZM221-TAI128-RMK/TACA128 HAS LOST RVSM CAPABILITY)

INTERFACE MANAGEMENT MESSAGES**1.1.1.13 IRQ (INITIALIZATION REQUEST)***IRQ Purpose*

An IRQ is used to request transition of an interface from a non-operational to an operational state.

IRQ Format

IRQ Field	Required Elements	Optional Elements	Comments
03	a, b		

IRQ Example

In this example, Bogota ACC (SKED) has sent a request to Maiquetia ACC (SVZM) to initialize the interface.

(IRQSKED/SVZM266)

1.1.1.14 IRS (INITIALIZATION RESPONSE)*IRS Purpose*

An IRS is used as a response to an IRQ message.

IRS Format

IRS Field	Required Elements	Optional Elements	Comments
03	a, b, c		Element (c) should contain the reference number of the previously sent IRQ.

IRS Example

In this example, Maiquetia ACC (SVZM) has responded to Bogota ACC's (SKED) request to initialize the interface.

(IRSSVZM/SKED817SKED/SVZM266)

1.1.1.15 TRQ (TERMINATION REQUEST)

TRQ Purpose

A TRQ is used to request transition of an interface from an operational to a non-operational state.

TRQ Format

TRQ Field	Required Elements	Optional Elements	Comments
03	a, b		
18		a, other info.	Element (a) is included only if no other information is included. Either element (a) OR other information (but not both) must be included. Other information, if included, must include RMK/ followed by free text.

TRQ Example

In this example, Bogota ACC (SKED) has sent a request to Maiquetia ACC (SVZM) to terminate the interface.

(TRQSKED/SVZM348)

1.1.1.16 TRS (TERMINATION RESPONSE)

TRS Purpose

TRS is used as a response to an TRQ message.

TRS Format

TRS Field	Required Elements	Optional Elements	Comments
03	a, b, c		Element (c) should contain the reference number of the previously sent TRQ.
18		a, other info.	Element (a) is included only if no other information is included. Either element (a) OR other information (but not both) must be included. Other information, if included, must include RMK/ followed by free text.

TRS Example

In this example, Maiquetia ACC (SVZM) has responded to Bogota ACC's (SKED) request to initialize the interface.

(TRSSVZM/SKED912SKED/SVZM348)

ACKNOWLEDGEMENTS

1.1.1.17 LAM (LOGICAL ACKNOWLEDGEMENT)

LAM Purpose

An LAM is sent from ACC to ACC to indicate that a message has been received and found free of syntactic and semantic errors. It does not indicate operational acceptance by a controller. Element (c) contains the reference number (i.e. element 3(b)) of the message being responded to.

LAM Format

LAM Field	Required Elements	Optional Elements	Comments
03	a, b, c		

LAM Example

In this example, Maiquetia ACC (SVZM) has accepted message number 739 from Bogota ACC (SKED).

(LAMSVZM/SKED629SKED/SVZM739)

1.1.1.18 LRM (LOGICAL REJECTION)

LRM Purpose

An LRM is used to indicate that a message sent from ATS system to ATS system contained an error and has been rejected by the receiving system.

LRM Format

LRM Field	Required Elements	Optional Elements	Comments
03	a, b, c		
18	text as shown in Comments		Describes the error code and the error per Appendix A guidelines: after RMK/, include two digits comprising the error code; (note that error code 57 will be used for any error that is not field specific and that is not identified in Appendix A - Error Codes) two digits comprising the field in error (or 00 if the error is not field-specific); and the erroneous text, i.e. the contents of the message that caused the error when the error is field specific. When the error is non-field specific, a descriptive error message shall be included. Separate the above items by an oblique stroke (/).

LRM Example

In this example, Maiquetia ACC (SVZM) has rejected message number 392 from Bogota ACC (SKED) because the aircraft identification in field 7 of message 392 was too long.

(LRMSVZM/SKED519SKED/SVZM392-RMK/06/07/TACA1745)

RADAR HANDOVER MESSAGES

1.1.1.19 RTI MESSAGE (RADAR TRANSFER INITIATE)

RTI Purpose

An RTI message is sent from one ATS unit to another to initiate the transfer of radar identification for a flight. Logical acknowledgement of an RTI is an RLA or LRM.

RTI Format

RTI Field	Required Elements	Optional Elements	Comments
03	a, b, c		
07	a, b, c		Must include ACID and <u>established</u> SSR code
13	a		
16	a		
31	a	a	If no sector designated or sector 00 is designated, then receiving system determines
32	a, b, c, d, e		

RTI Examples

This is an example of a handover initiated by Merida ACC to Cenamer ACC. No sector is designated, so Cenamer will determine who should receive it.

(RTIMMMD/MHTG812MMMD/MHTG801-TAC210/A3407-MMMX-MPTO-MHTG-13242934162000N0912401WN043327629F349)

This is an example of a handover directed to sector 01 in Cenamer ACC, from Merida ACC.

(RTIMMMD/MHTG812MMMD/MHTG801-TAC210/A3407-MMMX-MPTO-MHTG01-13242934162000N0912401WN043327629F349)

1.1.1.20 RLA MESSAGE (RADAR LOGICAL ACKNOWLEDGEMENT)

RLA Purpose

The Radar Logical Acknowledgment message is used to acknowledge computer receipt of an RTI message. The facility sending this message is indicating that the referenced message has been received and has no format or logic errors, and to indicate which sector the handover was routed to. The RLA is an acknowledgement message in response to RTI and therefore is not responded to.

RLA Format

RLA Field	Required Elements	Optional Elements	Comments
03	a, b, c		
31	a, b		

RLA Examples

In this example Cenamer ACC has indicated to Merida ACC that it has received a handover and routed it to sector 01.

(RLAMHTG/MMMD202MHTG/MMMD445-MHTG01)

In this example Cenamer ACC has indicated to Merida ACC that it has received a handover and routed it to the Guatemala Radar Approach Control

(RLAMHTG/MMMD202MMMD/MHTG445-MGGT)

1.1.1.21 RTU MESSAGE (RADAR TRACK UPDATE)

RTU Purpose

An RTU message may be sent from one ATS unit to another to update the radar position of a flight during transfer of radar identification. RTU messages are sent periodically after an RTI, until an RTA is received or the handover is retracted. There is no logical acknowledgement of an RTU.

RTU Format

RTU Field	Required Elements	Optional Elements	Comments
03	a, b, c		Element (c) shall refer to the message number of the RTI message that initiated the handover.
07	a ,b ,c		Include <u>established</u> SSR code.
13	a		
16	a		
32	a, b, c, d, e		

RTU Examples

This is an example of an RTU message initiated by Cenamer ACC to Merida ACC. The message MHTG/MMMD801 was the RTI message that initiated the handover.

(RTUMHTG/MMMD000MHTG/MMMD801-TAC211/A3407-MPTO-MMMX
-13242934154412N0905100WN043327629F341)

1.1.1.22 RTA MESSAGE (RADAR TRANSFER ACCEPT)

RTA Purpose

An RTA message may be sent from one ATS unit to another as an application response to an RTI. This message signifies that a controller has accepted radar identification of a flight. An RTA is also sent by the facility that initiated a handover to retract the handover. Logical (computer) acknowledgement of an RTA is an LAM or LRM.

RTA Format

RTA Field	Required Elements	Optional Elements	Comments
03	a, b, c		Element (c) refers to the message number of the RTI that is being responded to.
07	a, b, c		Include <u>assigned</u> SSR code (i.e. code assigned by the accepting center).
13	a		
16	a		
31	a, b		Note accepting facility may be a Radar Approach Control serviced by the sending ACC.

RTA Examples

This is an example of a handover accepted by Merida ACC. Handover was initiated by Cenamer ACC.

(RTAMMMD/MHTG438MHTG/MMMD812-TAC211/A4222-MPTO-MMMX-MMMD01)

This is an example of a retraction by Cenamer ACC:

(RTAMHTG/MMMD222MHTG/MMMD812-TAC211/A4222-MPTO-MMMX-MHTG01)

PART III – COMMUNICATIONS AND SUPPORT MECHANISMS

INTRODUCTION

The communications protocols and physical path are not dictated by this ICD. This ICD addresses only the application message content.

TELECOMMUNICATIONS REQUIREMENTS AND CONSTRAINTS

USE OF AERONAUTICAL FIXED TELECOMMUNICATIONS NETWORK (AFTN)

AFTN may be used as a flight plan data interface, subject to verification of performance. Any interface exchanging radar position data, including radar handovers, shall not use AFTN.

When AFTN is used as the communications mechanism:

- a) The AFTN IA-5 Header as described in ICAO Annex 10, vol. 2 will be used for exchange of messages.
- b) ATS messages will be addressed to each ATS unit using an eight-character facility address where the first four characters are the appropriate location indicator from ICAO Doc. 7910, and the last four characters are routing indicators defined by the ATS unit in accordance with ICAO Annex 10, vol. 2.

Each message shall be sent with the priority indicated in Table 2 of Part II.

USE OF A WIDE-AREA NETWORK

Use of existing wide-area networks (e.g. X.25 or Frame Relay packet-switched network) may be used if the speed, capacity, and security characteristics are verified as adequate to support the interface.

USE OF DIRECT LINES

In cases where speed, capacity, and/or security require it, a direct line interface may be used between facilities.

CHARACTER SET

The IA-5 character set shall be used for all application message content. Certain characters have special meaning and must only be used as indicated below:

Open parenthesis “(” and close parenthesis “)” shall be used only to begin and terminate the application message.

A single hyphen “-” shall be used only as a field separator and shall not be used within any field.

ENGINEERING CONSIDERATIONS

ASSOCIATED AUTOMATION FUNCTIONALITY

Each ATS service provider participating in this interface must have a supporting automation system. The supporting automation shall:

- Error check all inbound messages for proper format and logical consistency.
- Ensure only messages from authorized senders are accepted and processed.
- As required, alert the responsible controller(s) of flight data that has been received.
- Notify the responsible personnel when any message sent is rejected or not acknowledged within a variable system parameter (VSP) period of time (see 4.5.1 Response time).

FAILURE AND RECOVERY SOLUTIONS

Automation systems may have different failure avoidance and failure recovery mechanisms. Each participating system shall have the following characteristics:

- If the recovery process preserves the current message number in the sequence with each facility, no notification is necessary.
- If the recovery process requires reset of the sequence number to 000, a means of notifying the receiving facility that the message numbers have been reset is required. This may be procedural rather than automated.

The recovery process shall not automatically re-send any CPL for which an LAM had been received. This is relevant if the system was able to recover state information about which flight plans have been coordinated, and did not need to reset the message sequence numbers.

DATA REQUIREMENTS

Certain data must be defined and maintained to support all features of the interface. Depending on the data, it should be coordinated on a Regional, National, or Local (facility) basis. Data requirements are identified in Table 3 below.

Table 3. Summary of Data Definitions Needed to Support the Interface

Field	Data	Purpose	Source	Coordination
03	Facility Identifiers	Identify the sending/receiving facility.	ICAO Doc. 7910 (first four characters) and local definition (second four characters)	Local
07	Functional Address	Agree on functional addresses to be used in MIS messages.	Local Data	Local
10	Equipment Codes	Identify ATS-specified equipment qualifiers that are not specified in ICAO Doc. 4444.	CAR and SAM 7030 Supplements	Regional
14	Boundary Point	Identify the coordination fixes to be sent for each airway.	Local Data	Local
15	Adapted Routes and Fixes	Identify airway and fix information that is adapted by both systems.	Local Data	Local
18	Requirements for other data to be included	Identify any requirements for data that must be included in Field 18.	CAR and SAM 7030 Supplements	Regional

SECURITY CONSIDERATIONS

PRIVACY

This ICD does not define mechanisms that guarantee privacy. It should be assumed that any data sent over this interface may be seen by unintended third parties either through interception of the message or through disclosure at the receiving facility.

Any communications requiring privacy must be identified and appropriate communications and procedures defined.

AUTHENTICATION

Each system shall authenticate that messages received are from the source that is identified in Field 03.

ACCESS CONTROL

Each system participating in the interface shall implement eligibility checks to ensure that the source of the message is eligible to send the message type and is the appropriate authority for the referenced flight.

TEST CONSIDERATIONS

Before an automated flight data interface becomes operational between any two facilities, the following set of tests shall be completed:

Test of the telecommunications system and addressing:

Off-line tests using development or test (i.e. non-operational) systems. These may include test systems at non-operational facilities, and/or operational systems that are in an off-line mode. Note: If off-line testing is not possible, extreme care should be used when conducting first round testing on operational systems.

Test of non-operational message sets:

Tests using the operational systems in off-line (recommended) or operational mode in which TEST messages are exchanged. (Note: If off-line testing is not possible, extreme care should be used when conducting second round testing on operational systems.)

Test of operational message sets:

Tests using the operational systems in operational mode in which manual coordination verifies each flight data message sent.

Before each test, a document specifying purpose, procedures and data to be collected, must be agreed to by both/all facilities. To ensure success/failure is clearly defined, specific criteria should be included in the document.

Data transmitted during test phases should include both correct and incorrect formats/data fields to verify that correct data is processed correctly and incorrect data is rejected.

For diagnostic purposes, each side of the interface should be able to isolate the source of interface problems.

PERFORMANCE CONSIDERATIONS

RESPONSE TIME

For flight planning messages, controllers require indication of an unsuccessful message transmission within 60 seconds of the message being sent. Therefore, the response time from the time a message is sent until an LAM (or LRM) is received shall be under 60 seconds at least 99% of the time under normal operations. A faster response time is desirable, and will result in operations that are more efficient.

For messages involving transfer of control and surveillance data (e.g. RTI, RTA, and RTU) the data must be transmitted in time for the receiving system to display the track position with acceptable accuracy. Communication across the interface shall be less than six seconds maximum.

AVAILABILITY / RELIABILITY

The hardware and software resources required for providing service on the CAR/SAM interfaces should be developed such that the inherent reliability will support interface availability which is at least equal to the end systems of that interface (e.g. 99.7% availability for end systems that both operate with 99.7% reliability).

CAPACITY AND GROWTH

Before implementing this interface between two ACCs, an analysis of the traffic expected between the centers shall be performed and the proposed communications links verified for appropriate capacity. Traffic estimates should consider current and future expected traffic levels.

For initial planning purposes the following estimates of message size and messages per flight are provided.

Table 4. Expected Message Rates and Sizes

Message	Avg. per Flight	Avg. Size	Max Size	Comments
Messages per near-border departure flight:				
FPL	1	275	2,000	
CHG	0.5	160	1,000	Assumed 1 of 2 flights amended after coordination, before departure.
EST	1	120	200	
MOD	2	120	1,000	Assumed each flight has an average of one change after coordination due to amendment and two time updates.
Messages per non near-border departure flight:				
CPL	1	275	2,000	
MOD	2	120	1,000	Assumed each flight has an average of one change after coordination due to amendment and two time updates.
Messages per every flight:				
CNL	0.01	100	150	Assumed 1 in 100 flight plans are cancelled.
RTI	1	150	200	
RTU	5	140	200	Assumed 1 RTU every 6 seconds for 30 seconds.
RTA	1	110	160	
MIS	0.1	130	625	
Responses (not per flight):				
LAM/RLA	Sum of all above except RTU	80	130	
LRM		100	230	

The hardware and software developed for the interfaces shall be capable of asynchronously exchanging the messages defined in Part III, Table 2 simultaneously with all adjacent automated systems.

APPENDIX A – ERROR CODES

The error codes for use with LRM messages are defined in Table A-1 below.

Table A-1. LRM Error Codes and Explanations

Error Code	Field Number	Supporting Text
1	Header	INVALID SENDING UNIT (e.g., AFTN address)
2	Header	INVALID RECEIVING UNIT (e.g., AFTN address)
3	Header	INVALID TIME STAMP
4	Header	INVALID MESSAGE ID
5	Header	INVALID REFERENCE ID
6	07	INVALID ACID
7	07	DUPLICATE ACID
8	07	UNKNOWN FUNCTIONAL ADDRESS
9	07	INVALID SSR MODE
10	07	INVALID SSR CODE
11	08	INVALID FLIGHT RULES
12	08	INVALID FLIGHT TYPE
13	09	INVALID AIRCRAFT MODEL
14	09	INVALID WAKE TURBULENCE CATEGORY
15	10	INVALID CNA EQUIPMENT DESIGNATOR
16	10	INVALID SSR EQUIPMENT DESIGNATOR
17	13, 16	INVALID AERODROME DESIGNATOR
18	13	INVALID DEPARTURE AERODROME
19	16	INVALID DESTINATION AERODROME
20	17	INVALID ARRIVAL AERODROME
21	13, 16	EXPECTED TIME DESIGNATOR NOT FOUND
22	13, 16	TIME DESIGNATOR PRESENT WHEN NOT EXPECTED
23	13, 14, 16	INVALID TIME DESIGNATOR
24	13, 14, 16	MISSING TIME DESIGNATOR
25	14	INVALID BOUNDARY POINT DESIGNATOR
26	14, 15	INVALID ENROUTE POINT
27	14, 15	INVALID LAT/LON DESIGNATOR
28	14, 15	INVALID NAVAID FIX
29	14, 15	INVALID LEVEL DESIGNATOR
30	14, 15	MISSING LEVEL DESIGNATOR
31	14	INVALID SUPPLEMENTARY CROSSING DATA
32	14	INVALID SUPPLEMENTARY CROSSING LEVEL
33	14	MISSING SUPPLEMENTARY CROSSING LEVEL
34	14	INVALID CROSSING CONDITION
35	14	MISSING CROSSING CONDITION
36	15	INVALID SPEED/LEVEL DESIGNATOR
37	15	MISSING SPEED/LEVEL DESIGNATOR
38	15	INVALID SPEED DESIGNATOR
39	15	MISSING SPEED DESIGNATOR
40	15	INVALID ROUTE ELEMENT DESIGNATOR

Error Code	Field Number	Supporting Text
41	15	INVALID ATS ROUTE/SIGNIFICANT POINT DESIGNATOR
42	15	INVALID ATS ROUTE DESIGNATOR
43	15	INVALID SIGNIFICANT POINT DESIGNATOR
44	15	FLIGHT RULES INDICATOR DOES NOT FOLLOW SIGNIFICANT POINT
45	15	ADDITIONAL DATA FOLLOWS TRUNCATION INDICATOR
46	15	INCORRECT CRUISE CLIMB FORMAT
47	15	CONFLICTING DIRECTION
48	18	INVALID OTHER INFORMATION ELEMENT
49	19	INVALID SUPPLEMENTARY INFORMATION ELEMENT
50	22	INVALID AMENDMENT FIELD DATA
51		MISSING FIELD nn
52		MORE THAN ONE FIELD MISSING
53		MESSAGE LOGICALLY TOO LONG
54		SYNTAX ERROR IN FIELD nn
55		INVALID MESSAGE LENGTH
56		NAT ERRORS
57		INVALID MESSAGE
58		MISSING PARENTHESIS
59		MESSAGE NOT APPLICABLE TO zzzz ACC
60		INVALID MESSAGE MNEMONIC (i.e., 3 LETTER IDENTIFIER)
61	Header	INVALID CRC
62		MESSAGE REJECTED, MANUAL COORDINATION REQUIRED
63-255		Reserved for future use.

Error Code 57 shall be used for any error that is not field-specific and is not identified in the table. Each ATS provider may propose additional error codes as needed and submit them through the GREPECAS mechanism for approval and inclusion in this Table.

APPENDIX B – IMPLEMENTATION GUIDANCE MATERIAL

B.1 USE OF THE CORE MESSAGE SET

B.1.1 FILED FLIGHT PLAN (FPL) MESSAGES

A user must file a filed flight plan message (FPL) with the initial ATS unit that will service the flight as well as with the ATS unit for each FIR that the flight will cross. The format and content of this FPL is subject to the rules of the receiving country and is not defined by this ICD.

It is expected that an FPL will be filed by an airspace user, and a subsequent CPL will be received from an adjacent ATS unit. It is the responsibility of each country to design their automation to ensure that an FPL or CPL from an adjacent ATS unit always takes precedence over a user-filed FPL for the flight so that second-order flight data messages are applied to the ATS unit-supplied flight plan and not the user-filed flight plan.

B.1.2 COORDINATION OF ACTIVE FLIGHTS (CPL)

Normally, an agreed upon number of minutes before a flight reaches a control boundary the sending ATS unit will send a CPL message to the receiving ATS unit.

The normal computer response to a CPL is an LAM sent by the receiving automation system to signify that the plan was found to be free of syntactic or semantic errors. Controller acceptance is implied (i.e. the ACP message defined in ICAO Doc. 4444 is not implemented). This is permitted per ICAO Doc. 4444, Part IX, section 4.2.3.5.1 and Part VIII, section 3.2.5. If the receiving computer cannot process a CPL then an LRM will be returned if that message has been implemented. Alternatively, no response will be generated.

ICAO Doc. 4444 states, in Part IX, section 4.2.3.2.5 “A CPL message shall include only information concerning the flight from the point of entry into the next control area or advisory airspace to the destination aerodrome”. However ICAO Doc. 4444 provides no guidelines for choosing the exact point at which the CPL should start.

The nature of ATC automation systems is that they have differing requirements for the starting point of a route relative to the facility boundary, necessitating some agreement on allowable route tailoring. The relationship between the start of the route in Field 15 and the coordination fix in Field 14 must also be established so that the receiving center can accurately process the route. Agreements on these points are provided in the attached boundary agreements for each ATS provider.

B.1.3 CHANGES AFTER COORDINATION

Any change to a flight plan after initial coordination requires a message that can be mapped to the correct flight plan. Every message sent after an initial CPL should have the same Aircraft ID, departure point, and destination point. The message reference data should point to the previous message in the sequence for this flight. For example, if the CPL is message number KZMP/CZWG035 then the reference data for the first MOD sent after the CPL should be KZMP/CZWG035. The second MOD sent for that flight should refer to the message number of the original CPL.. The messages that represent valid changes to the original flight plan include CHG, EST, MOD, RTI, and RTA (when used for retraction; see Section B.1.8).

If a flight for which a CPL has been sent will no longer enter the recipient's airspace, a CNL message should be sent.

After acceptance of a CNL message, the receiving system should not accept any changes regarding the subject flight.

Any change to flight data for a flight that has been coordinated (i.e. a CPL or EST has been sent) must be forwarded via a MOD message. The MOD message is identical to the ICAO CDN message in format and content, but does not require an ACP response (only LAM or LRM).

The expected computer response to a CNL, CHG, EST, or MOD is an LAM or LRM (if the latter has been implemented).

Each system should implement rules as to whether an amendment on a particular flight should be accepted from a neighboring ACC. For example, an amendment from the sending ACC typically is not accepted once transfer of control has been initiated.

It is expected that the content of a field sent in a flight data change message (e.g. CHG or MOD) will completely replace the content of the field currently stored in the receiving center. So, for example, if Field 18 is amended the entire contents of the field should be sent and not only the changed elements.

An aircraft placed into a hold should result in a MOD message being sent with new Field 14 Estimate Data (boundary time) based on the Expect Further Clearance (EFC) time. If no EFC time is established by ATC, an agreed upon default EFC time may be used (e.g. 2 hours) to ensure the flight plan data is maintained by the receiving facility. If necessary, a second MOD message should be sent with the revised Estimate Data time once it is known.

Upon acceptance of an RTI message the receiving system should accept only an RTA, RTU, or MIS message for the flight. If an RTA signifying retraction is accepted, then the system may once again accept a MOD message.

Upon receipt of a logical acknowledgement to an RTA message signifying handover acceptance, the sender of the RTA should not accept any messages regarding the subject flight.

B.1.4 NEAR-BORDER DEPARTURES

ATS units implementing automated coordination for near-border departures may also exchange FPLs to coordinate flights pre-departure when the flight time from the departure point to the boundary point is less than the normal CPL notification time.

ATS units will send an FPL message pre-departure followed by an EST message upon departure. Additional coordination procedures may be defined in an inter-facility Letter of Agreement.

If an FPL has been sent and changes are subsequently made, then a CHG message should be used to modify the changed fields. Only the ATS unit that sent an FPL message may send a CHG message (i.e. the receiving unit cannot send a CHG back to the sending unit). Once an EST message is sent, a MOD must be used instead of a CHG for transmission of flight data changes.

The expected computer response to an FPL is an LAM or LRM.

If a previously sent FPL is to be cancelled, a CNL message should be sent.

B.1.5 INTERFACE MANAGEMENT

ATS units implementing an AIDC interface will nominally be expected to accept messages at any time when the system is available. Each system is responsible for providing the capability of inhibiting received messages, if needed. Each system is expected to be able to inhibit outgoing messages. Manual coordination between facilities may be needed for one facility to request the other to inhibit messages.

ATS units which implement AIDC interfaces may exchange messages to request initialization or termination of the AIDC interface via automated messages. Only when an initialization request has been sent and responded to affirmatively will each system be expected to accept messages.

Any message received when the interface is not initialized shall be ignored (i.e. not processed and not responded to), except for IRQ.

To request initialization one system shall send an IRQ message to the other. The IRQ may be repeated a predetermined number of times if no response is received, with each repeated IRQ receiving the same message number.

If the receiving system is ready to communicate (i.e. it has already sent an IRQ) when it receives an IRQ, it shall send an IRS in response. There is no LAM or LRM response to an IRQ. The reference number in Field 03 should refer to the message number of the IRQ being responded to. Each system becomes active when it receives an IRS from the other system. There is no response to an IRS.

If no response to an IRQ is received and the maximum number of retries exceeded, the interface is considered failed by the initiating system.

A system requests orderly termination of the interface by sending a TRQ message. After sending a TRQ, a system shall accept only a TRS or TRQ message. There is no LAM or LRM response to a TRQ. Upon receipt of a TRS the interface shall be deactivated. There is no response to a TRS. Upon receipt of a TRQ the system shall respond with a TRS and deactivate the interface immediately (even if a TRQ is outstanding). When messages are exchanged between two ATS units that cause successful termination of the interface, the two systems shall not send or accept any messages on the interface until a successful initialization transaction has been completed.

B.1.7 ERROR CHECKING, RESPONSES, AND RESENDS

Upon receiving a message, the receiving system shall check that the format and content of each field are in accordance with this ICD. Other logic checks may be performed per the rules defined by the ATS provider.

Whenever a message is received and passes all syntactic and semantic checks an LAM (or RLA for handover initiation) shall be returned to the sender for those messages designated for LAM/LRM responses.

ATS units implementing only LAM acknowledgement messages will not send any response to the sender when a message fails a syntactic or semantic check. The sending ATS Unit must infer message rejection by failure to receive an LAM. Agreement on one minute as a maximum operationally acceptable timeout value (from the time a message is sent to receipt of an LAM) is recommended.

ATS units implementing only LAM acknowledgement messages cannot productively use message resend as a technique, since the lack of an LAM may infer a lost message or message rejection. Therefore use of message resends after timeout of an LAM receipt is not recommended.

ATS units implementing both LAM and LRM acknowledgement messages will send an LRM when a received message fails a syntactic or semantic check, using the error codes in Appendix A. In the case of a radar handover initiation (see B.1.8) an RLA is used instead of an LAM.

When no response to a message is received within a VSP period of time a unit may optionally choose to resend the original message—using the same message number—a VSP number of times before declaring failure. The same message number should be used so that the receiving station can easily distinguish exact duplicates should the same message be received more than once.

B.1.8 RADAR HANDOVERS

- RTI Message

An RTI shall be used to initiate a transfer of radar identification from a controller in one ACC to a controller in another ACC. An RLA or LRM shall be returned in response to an RTI, based on acceptance checks by the receiving computer.

If no logical response (RLA or LRM) to an RTI is received after a specified number of retries, the handover should be marked as failed to the initiating controller.

Upon acceptance of an RTI message the receiving system should not accept any flight data messages regarding the subject flight except for an RTA, RTU, or MIS.

- RTU Message

The transferring center shall begin sending RTU messages once an RLA is received for an RTI. RTU messages shall be sent once every tracking cycle. The expected track update rate must be coordinated between the implementing countries.

An RTU message should not be sent when current track data is not available for a flight, e.g. if the flight enters a coast mode.

Upon retraction of the transfer or receipt of an RTA from the receiving center the sending of RTUs shall stop. There will be no response to an RTU (i.e. no LAM, RLA, or LRM).

- RTA Message

An RTA message shall be sent by the receiving center in response to an RTI when the receiving controller has accepted the transfer. An RTA message shall be sent by the sending center when the initiating controller retracts a previously issued RTI. An LAM or LRM shall be returned in response to an RTA, based on acceptance checks by the receiving computer.

If no response is received within a VSP period of time (e.g. 6 seconds), the transfer shall be considered failed and the accepting controller notified.

If the sending center receives an RTA after retracting a handover, it shall reject the RTA by returning an LRM.

If the receiving center receives an RTA after accepting a handover, it shall reject the RTA by returning an LRM.

After an RTA is rejected, the controller that attempted to accept or retract control shall be notified that the handover failed. Note that it is possible for an accept and retract to be entered simultaneously, resulting in both RTA messages being rejected.

B.1.9 MIS MESSAGE

The MIS message can be addressed to either a functional address, or to an aircraft ID. The functional addresses to use will be exchanged between adjacent centers. Each functional address will map to a workstation or set of workstations, and the types of information that should be sent to each address should accompany the exchange of addresses.

When an MIS message is addressed to a flight ID, the receiving system shall route the message to the sector that currently controls the flight. If no sector controls the flight the message shall be rejected. The intent is that an MIS message does not modify the flight record for the subject flight (i.e. it is not treated as an amendment to Field 18 for that flight).

B.2 DEVELOPMENT OF FIELD CONTENT

The following sections provide implementation notes on the expected semantic content of each field, how to generate the fields and how to interpret the fields.

B.2.1 FIELD 03

Each message sent to each interface should receive an incrementally higher number. Thus, a system must maintain a separate sequence for each facility with which it interfaces.

The message following number 999 will be 000, and then the number sequence repeats.

The message number in Field 03 and the Aircraft ID in Field 07 combined, must be unique for any CPL or FPL. A flight plan received that has the same message number and ACID as a previously received plan shall be rejected. Note that it is possible to have duplicate message numbers if the sending computer system fails and is restarted in a cold start mode (i.e. no previous state data is retained). In this case the message numbers would restart and may repeat.

Implementers of the AIDC interface should consider a check for out-of-sequence messages (i.e. a message received has a message number that is not one greater than the previous message number). Since messages may be resent if a response is not received within a VSP period of time, it may also be possible to receive a message more than once. Therefore implementers should consider a check for duplicate messages based on the message number. Any such checks should also consider the behavior after a system failure/restart.

B.2.2 FIELD 07

If the aircraft does not have Mode A capability, omit elements (b) and (c) and the preceding oblique stroke. Also omit these elements if the aircraft has Mode A capability but the SSR code is unknown (or not assigned).

B.2.3 FIELD 09

When the aircraft type is “ZZZZ”, there may be no certificated maximum take-off weight. In this case the pilot and/or controller are expected to determine what the value should be per the ICAO guidelines and the estimated weight of the aircraft.

Allowable values for the aircraft type should include any type designator in ICAO Doc 8643.

Note that implementers may choose to validate the wake turbulence category based on the aircraft type, since these are published in ICAO Doc 8643.

B.2.4 FIELD 10

Agreement on ATS-prescribed indicators is to be specified in the CAR and SAM Doc 7030 Supplements.

B.2.5 FIELD 13

The aerodrome in Field 13 must match a location indicator in ICAO Doc 7910, or must match one that is agreed to per the relevant boundary agreement, or agreed to by the implementing facilities. (Note: Some States permit International flights to depart from other than international aerodromes. These aerodromes may not have location indicators in ICAO Doc 7910.)

If ZZZZ or AFIL is used, then additional information should be present in Field 18 per ICAO Doc 4444. This ICD imposes no specific requirements on the content of DEP/.

B.2.6 FIELD 14

Field 14(a) contains a Boundary Point, which is an agreed point on or near the control boundary. The boundary agreement between implementing ATS providers identifies any specific requirements governing the choice of boundary point.

B.2.7 FIELD 15

A CPL, per ICAO Doc. 4444 Part IX, Section 4.2.3.2.5 “shall include only information concerning the flight from the point of entry into the next control area or advisory airspace to the destination aerodrome”. In practical terms, each automation system generally has restrictions on the starting point of the route.

Each boundary agreement will define where the route of flight shall begin so as to meet the above requirement.

After the initial point, Field 15(c) should contain the remainder of the route of flight.

B.2.8 FIELD 18

In an FPL or CPL, all Field 18 content must be delimited by elements constructed as shown in ICAO Doc 4444, each of which is a three to four-letter identifier followed by an oblique stroke.

Field 18 shall not contain the character “-”, which is used to delineate fields in the message.

When used in an LRM, only the RMK/ element should be identified; only the text of the rejection message shall be included.

B.3 SUMMARY OF EXPECTED RESPONSES TO MESSAGES

Table B-1 identifies the expected responses to each message. The computer logical responses represent acceptance or rejection based on computer checks for message validity. An application response is a response that is initiated by a person or the application software to provide semantic response to a message. Note that an LRM can be sent in response to a message with no computer response identified if the message ID (e.g. RTU) cannot be determined by the receiving computer.

Table B-1. Summary of Expected Message Responses

Msg	Computer Logical Response		Application Response
	Accept	Reject	
FPL	LAM	LRM	None
CHG	LAM	LRM	None
EST	LAM	LRM	None
CPL	LAM	LRM	None
CNL	LAM	LRM	None
MOD	LAM	LRM	None
MIS	LAM	LRM	None
IRQ	None	None	IRS
IRS	None	None	None
TRQ	None	None	TRS
TRS	None	None	None

Msg	Computer Logical Response		Application Response
	Accept	Reject	
RTI	RLA	LRM	RTA
RTU	None	None	None
RLA	None	None	None
RTA	LAM	LRM	None
LAM	None	None	None
LRM	None	None	None

APPENDIX C – MODEL OF COMMON BOUNDARY AGREEMENT

C.1 INTRODUCTION

This section documents the AIDC interface planned between (...XXX and XXX...) automation systems. The initial interface may have limited message capability. Future evolutions may include additional messages.

C.2 MESSAGE IMPLEMENTATION AND USE

C.2.1 MESSAGES IMPLEMENTED

The AIDC interface between the (...XXX and XXX...) automation systems will include CPL and LAM. A CPL will be sent when a flight departs, or when it is within a VSP flying time from the boundary, whichever occurs later. Each CPL that is received and successfully checked for syntactic and semantic correctness will be responded to with an LAM.

C.2.2 ERROR HANDLING

An LAM will be sent in response to each CPL unless the receiving automation system detects an error. The automation system that sent the CPL will wait a VSP period of time for an LAM, and if none is received within the time parameter, it will notify the appropriate position that a failure occurred. Automatic retransmission of the message will not be attempted.

C.2.3 CHANGES TO A CPL

All changes to a previously sent CPL will be coordinated manually between the sending and receiving sectors.

C.2.4 FIELD 08, FLIGHT RULES AND TYPE OF FLIGHT

Regardless of the value in Field 08(a), all CPLs sent on this interface will be assumed to be IFR at the boundary between (...XXX and XXX...) airspace. Each center is only to send flight plans for flights that are IFR at the boundary.

C.2.5 FIELD 09, NUMBER AND TYPE OF AIRCRAFT AND WAKE TURBULENCE CATEGORY

When a specific aircraft type is used, the wake turbulence indicator sent to (XXX) must match the value stored for the aircraft type in the (XXX) database. When “ZZZZ” is used as the aircraft type, the wake turbulence category may be H, M, or L as appropriate.

C.2.6 FIELD 13, DEPARTURE AERODROME AND TIME

Field 13(b), normally only present in FPLs, will be allowed as an optional element for CPLs on this interface. (XXX) expects to include this element in messages; the (XXX) does not.

C.2.7 FIELD 14, ESTIMATE DATA

If a flight is on an adapted route segment when it crosses the control boundary, Field 14(a) will reference the last significant point in the sending center’s airspace.

If a flight is on a direct route segment when it crosses the control boundary Field 14(a) will reference the last significant point in the sending center’s airspace.

If there is no significant point between the departure aerodrome and the boundary, the departure aerodrome will appear in Field 14(a).

All flights are expected to cross the boundary in level flight, at the altitude in Field 14(c). Elements (d) and (e) will not be used, and manual coordination will be required for any flight not in level flight at the boundary.

For flights from to:

If a flight is on an adapted route segment when it crosses the control boundary, Field 14(a) will reference the first significant point in the receiving center’s airspace.

If a flight is on a non-adapted direct route segment when it crosses the control boundary Field 14(a) will reference the intersection of the route with the control boundary.

C.2.8 FIELD 15, ROUTE

Element type (c6) will not be used on this interface.

Element 15(c) will be constructed the same way whether the flight is from or from:

If a flight is on an adapted route segment when it crosses the control boundary then Field 15(c) will begin with the same significant point as is in Field 14(a).

If a flight is on a direct route segment when it crosses the control boundary then Field 15(c) will begin with the last significant point in the sending center’s airspace, if one exists.

If there is no significant point between the departure aerodrome and the boundary then Field 15(c) will begin with “DCT”.

After the initial point, Field 15(c) will contain the remainder of the route of flight.

C.2.9 FIELD 16, DESTINATION AERODROME AND TOTAL ESTIMATED ELAPSED TIME, ALTERNATE AERODROME(S)

Fields 16(b) and (c), normally only present in FPLs, will be allowed as optional elements on this interface.

C.3 PHYSICAL INTERFACE

Messages will be exchanged across this interface between the following facilities:

...Center to ...

...Center to

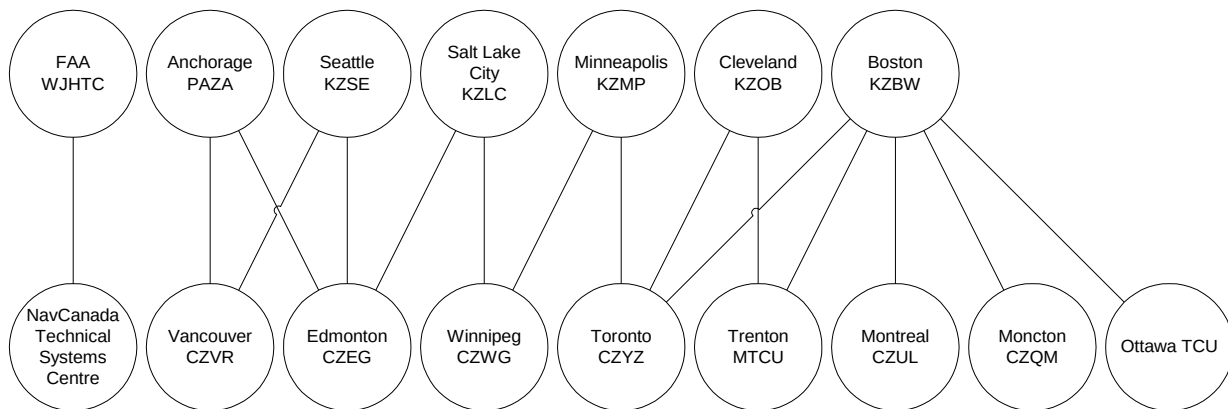


Figure 1. Expected FAA/NAV CANADA Interfaces Governed by this ICD

APPENDIX C

**PRELIMINARY SYSTEM INTERFACE CONTROL
DOCUMENT**

FOR THE

**INTERCONNECTION OF ACC CENTERS OF THE CARSAM
REGION**

PREFACE

This document defines the external interfaces and messages of the ATC Systems in the countries from the CARSAM Region. It includes those interfaces that are external to the ATC Automation System. It is based on source material obtained from a Survey coordinated by ICAO Office in Lima. This document was prepared for the purpose of registering the current interfaces between the ATC Automation Systems and the external sensors and Centers. This document is subject to change based on continuing review by ICAO Office and the countries members.

REVISION HISTORY

Revision/Date	Description of Change	Change Pages

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1.0 Scope

The purpose of this document is to provide details of the external interfaces existing in each ATC System installed on countries of the CARSAM Region. The Air Traffic Control Automation System (ATCS) is part of the ACC that is responsible for the FIR control.

1.1 Identification

This document is identified as the System Interface Control Document (SICD) for the ATC Systems in the CAR/SAM region. The following diagram shows the hierarchical structure of the documents and identifies the relative position of this document.

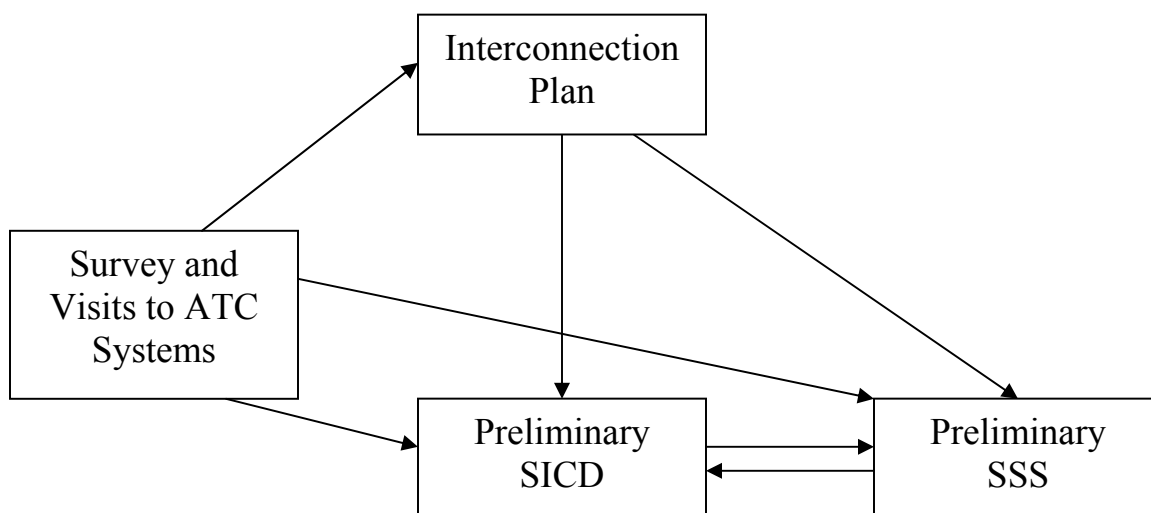


Figure 1.1-1 Document hierarchy

1.2 System Overview

The Interconnection Plan is a strategy to interconnect the ATC System in the CAR/SAM Region involving analysis of the infrastructure to provide the better flight coordination and flow control between adjacent control centers, promoting improvements in safety as well.

ATC Systems are composed of a great quantity of sensors and flight plan interfaces connected to Data Processing Servers by a telecommunications network (REDDIG). These data-processing centers are known variously as Data Treatment and Visualization centers (STVs) which include necessary local telecommunications equipments.

Various sensors provide the data concerned to the Air Traffic and meteorological information. The supporting subsystems include:

- Primary and secondary air traffic control radars,
- Weather radars,
- Air navigation aids,
- Radio and telephone communications.

These sensors collect data that are transmitted through one integrated telecommunications network to the STVs. A local network of computer workstations provides the necessary ambient for the processing, exploitation and analysis of collected data; the development and use of application software and program development tools; the management and use of databases from varied sources and for the training of system users.

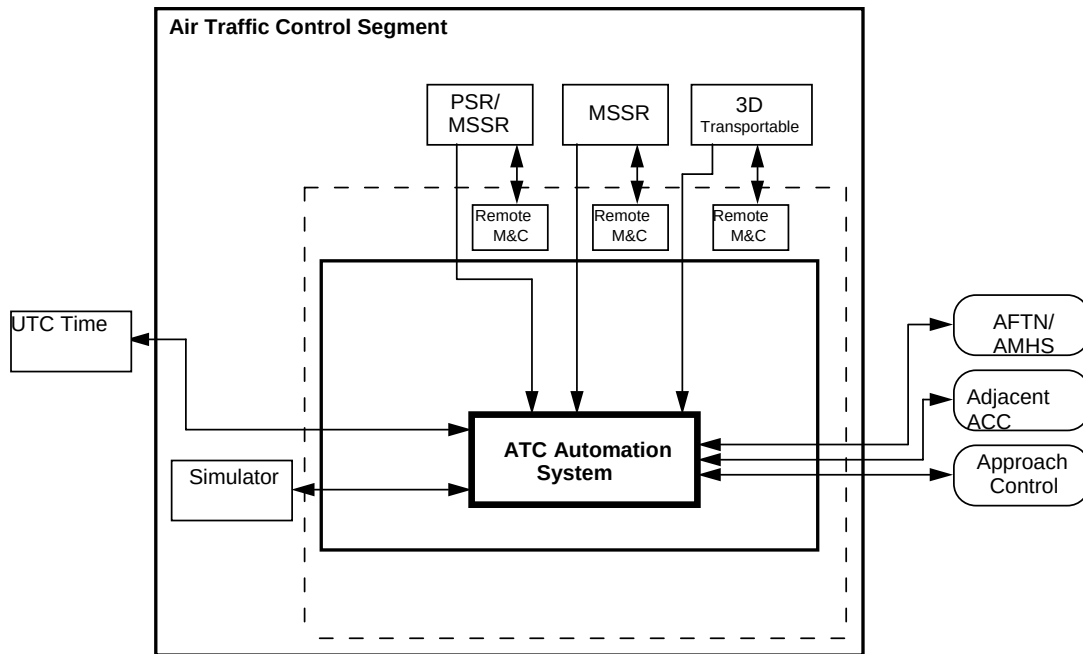


Figure 1.2-1 System Architecture

<u>SEGMENT</u>	<u>DESIGNATOR</u>	<u>SUBSYSTEM NAME</u>
Air Traffic Control	ATC System	
	RDP System	Radar Data Processor
	FDP	Flight Data Processor
	AIS	Aeronautical Information System
	AFTN	Aeronautical Fixed Telecommunication Network
	AMHS	Aeronautical Message Handling System

Table 1.2-1 ATC Systems

1.3 Document Overview

This document defines the external interfaces that connect to the Air Traffic Control Automation System. Messages that are internal to the ATCS should be detailed in the Interface Design Document (IDD) from each System Supplier.

The method of describing each of the external interfaces follows the same pattern. Each subsection addresses one interface. The objective is to identify all the parameters of the interface including the point of connection. This is defined as a point between two areas of responsibility. Each side of the interface will agree on this line of demarcation and the interface definition presented.

2.0 Referenced Documents

The documents listed below form a part of this System Interface Document (SICD) to the extent specified herein.

2.1 ICAO Documents

ICAO Annex 10	Aeronautical Communications
Doc 4444-RAC/501	Air Traffic Management - Procedures for Air Navigation Services ICAO 14th Edition 01/ 11/ 2001

2.2 EUROCONTROL Documents

Ref. 005-1-93 Eurocontrol Standard Document for Radar Data Exchange – All Purpose Structured Eurocontrol Radar Information Exchange (ASTERIX), 31 January 1995

DPS.ET1.ST06-STD-01-01 Eurocontrol Standard Document for On-Line Data Interchange (OLDI) Edition 2.3 December 2001

SUR.ET1.ST05.2000-STD-09-01 Eurocontrol Standard Document For Surveillance Data Exchange Part 9: Category 062 SDPS Track Messages Edition: 1.3 Edition Date : April 2005

SUR.ET1.ST05.2000-STD-10-01 Eurocontrol Standard Document For Surveillance Data
Exchange Part 10: Category 63 Sensor Status Messages

2.3 Other Documents

ISO 3309 Data Communications High-Level Data Link Control (HDLC) Procedures,
Frame Structure

WMO Manual on Codes

Publication #306 World Meteorological Organization Manual on Codes

Vol. I International Codes

Vol. II National and Regional Codes

G630621 INTERFACE CONTROL DOCUMENT BETWEEN THE SIVAM 3-D
TRANSPORTABLE RADAR AND THE AUTOMATION SYSTEM

G535530 INTERFACE CONTROL DOCUMENT BETWEEN THE ASR23SS AND
THE AUTOMATION SYSTEM INTERFACE CONTROL DOCUMENT

IC808466/801 FOR THE CONDOR MK2D ASTERIX RADAR DATA OUTPUT SIVAM
- FREE-STANDING INSTALLATIONS

E-277-01-2132 SSDD - USER APPLICATION PROFILE (UAP) FOR TRANSMISSION OF
MONORADAR TARGET REPORT (ASTERIX CATEGORY 34 & 48)
FROM ALENIA

CD2 FPS-117 Specification

TVT2 Inter-facility Radar Message Formats. "Procedure De Transmission TVT2"

C.A.006.13.D.TV.710.AT.T02.DK.001.03 - ESPECIFICAÇÃO DAS INTERFACES
EXTERNAS (SICD) – ACC CINDACTA I

Formato de Mensajes Radar ASTERIX con UAPs de Alenia. COCESNA

ESPECIFICACIÓN DEL INTERFACE DE SALIDA DE DATOS EN FORMATO DDE DEL
RADAR IRS-20MP/L, Ceselsa, 15/11/95

ESPECIFICACIÓN DEL INTERFACE DE SALIDA DE DATOS EN FORMATO ASTERIX
DEL RADAR IRS-20MP/L, Ceselsa, 15/11/95

ESPECIFICACIÓN DEL INTERFAZ SDC-2000/AIRCON2000 INDRA, 25/10/01

TymServe™ 2100L Network Time Server User's Guide Datum Inc, Rev B, May 1999

3.0 External Interfaces

Each external interface is identified and listed in Table 3.0-1 below. Where multiple instances of the same interface type occurs, they are indicated in the list by the letter ‘M’. Interfaces used with ATC Automation Systems are usually duplicated to provide increased availability, especially, where telecommunications channels used are maintained by a third party. Dual data links provide identical information simultaneously, when fully operational. These links are indicated in the list by the letter ‘D’.

Number	Name of External Interface	Dual Links/Multiple Occurrence
R001,R005 ,R011	3D PSR/MSSR	D, M
R002-R004 R006-R010 R012-R016	2D PSR/MSSR	D, M
R017-R024	MSSR	D, M
R025-R027	ATCS to ATCS (for Radar Track Updates)	M
F028-F032	ATCS to ATCS (for Flight Plan Data)	
F034	AFTN Server (to/from AIS)	
033	RCMS	M
032	AFTN Server (to/from FDPS)	
T035	Time Server to ATCS (for Time Synchronization)	

Table 3.0-1 List of External Interfaces

The following tables indicate the allocation of the various interfaces to the ATC Operational Centers. All ATCs have direct access to the international AFTN network via the AFTN Server, and hence links to all other AFTN Subscribers.

[illegible]

Radar Type	Radar	Interface ID	Argentina	Brazil	Chile	COCESNA	Colombia	Ecuador	Panamá	Peru	Uruguay	Venezuela
MSSR	RSMA INVAP	R017	√									
MSSR	CARDION	R018			√							
MSSR	SIR-7 Alenia	R019		√								
MSSR	SIR-S SELEX	R020										√
MSSR	CONDOR	R021		√								
MSSR	ISIR-M ALENIA	R022				√						
MSSR	IRS-20MP/L INDRA	R023				√		*				
MSSR	RSM 970 THALES	R024					√					

√* - Not installed yet

Table 3.0-2 Radar Types Allocation Table

Surveillance Interface to Adjacent Centers	Interface ID	Argentina	Brazil	Chile	COCESNA	Colombia	Ecuador	Panamá	Peru	Uruguay	Venezuela
AMS Interface	IR025					√	√				
Inter-CINDACTA	IR026		√								√*
INDRA Interface	IR027	√**								√**	

√* - With minor software changes used in the Essay Brazil-Venezuela

√**- As verified in the SSS, but this requirement was not tested yet

Table 3.0-3 Radar Interface to Adjacent Centers Allocation Table

Flight Plan Interface	Interface ID	Argentina	Brazil	Chile	COCESNA	Colombia	Ecuador	Panamá	Peru	Uruguay	Venezuela
ICAO 4444 & Hand-off Coordination	IF028 IF032		√								√*
ICAO 4444 without Hand-off Coordination	IF029			√	√	√	√	√	√	√	
OLDI	IF030	√*		√**	√*	√*	√*	√*		√*	
AIDC	IF031	√***									

√* - Not configured

√** - Only for APP and ACC interconnection

√*** - To be implemented

Table 3.0-4 Flight Plan interface with Adjacent Centers

ATCS Automation System Supplier	Version	Argentina	Brazil	Chile	COCESNA	Colombia	Ecuador	Panamá	Peru	Uruguay	Venezuela
ATECH	X-4000		√								√
ATECH/ RAYTHEON	SCO		√								
THOMSON	MITRA		√*								
THALES	EUROCAT1000			√							
INDRA	AIRCON2000				√	√		√			
INDRA	AIRCON2010									√	
INDRA	AIRCON2100	√									
ALENIA/ MARCONI	CMS					√	√				
NORTHROP GRUMMAN	AMS2000								√		

√* - To be changed to ATECH X-4000 this year

Table 3.0-5 ACC ATCS Automation Systems

3.1 3D-PSR/MSSR TPS-B34 3D Transportable Radar Interface

3.1.1 General

The 3D-PSR/MSSR sensor is a transportable primary radar (TPS-B34) system with a co-mounted secondary radar. Each system contains plot extraction facilities and remote control and monitoring capability. Each radar site provides radar plot and track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site and does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communication between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.1.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX
Message Definition:	ASTERIX messages types 001 Radar target report 002 Radar service message 008 Mono-radar derived weather information
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	D' type 25 pin at input to Radar Distribution Unit (RDU)
Reference	G630621 - INTERFACE CONTROL DOCUMENT BETWEEN THE SIVAM 3-D TRANSPORTABLE RADAR AND THE AUTOMATION SYSTEM

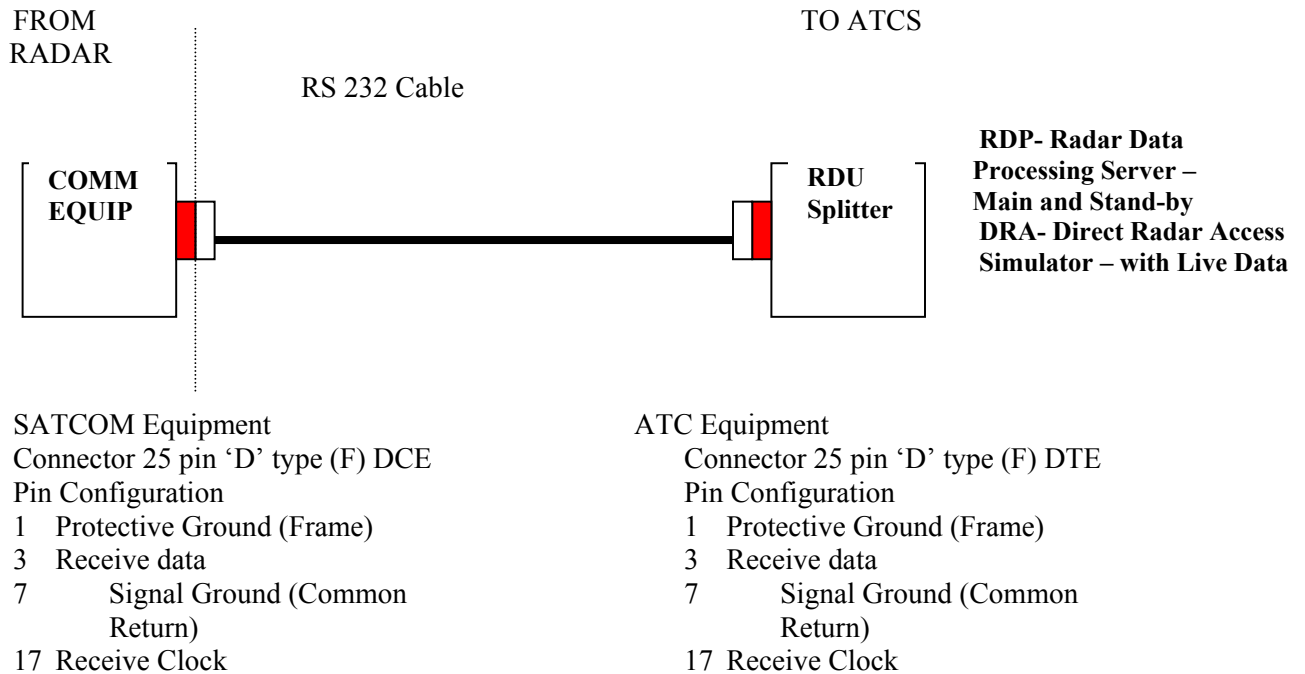
3.1.3 Special Features

Radar data links are organized as Simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

These radar systems are transportable and may be relocated to meet the needs for required radar coverage. In addition, the host radar (PSR) can operate in either of two turning modes (rpm of antenna) which needs a separate re-configuration for each radar (PSR and MSSR).

3.1.4 Typical Interface Connection for HDLC

The following diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.



3.1.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.1.5-1 HDLC Frame Structure

3.2 PSR/SSR LP23M + RSM870 Thomson Interface

3.2.1 General

The PSR/SSR sensor is a co-mounted primary (LP 23M) and secondary radar system with plot extraction facilities and remote control and monitoring capability. These radar sites are existing radar facilities. Each site provides radar track data in a standard format to the ATCS. Information provided by the radar supports ATC Operations. Communications is provided between the ATCS and the radar site by telephone channels, using landline and microwave links.

3.2.2 Interface Definition

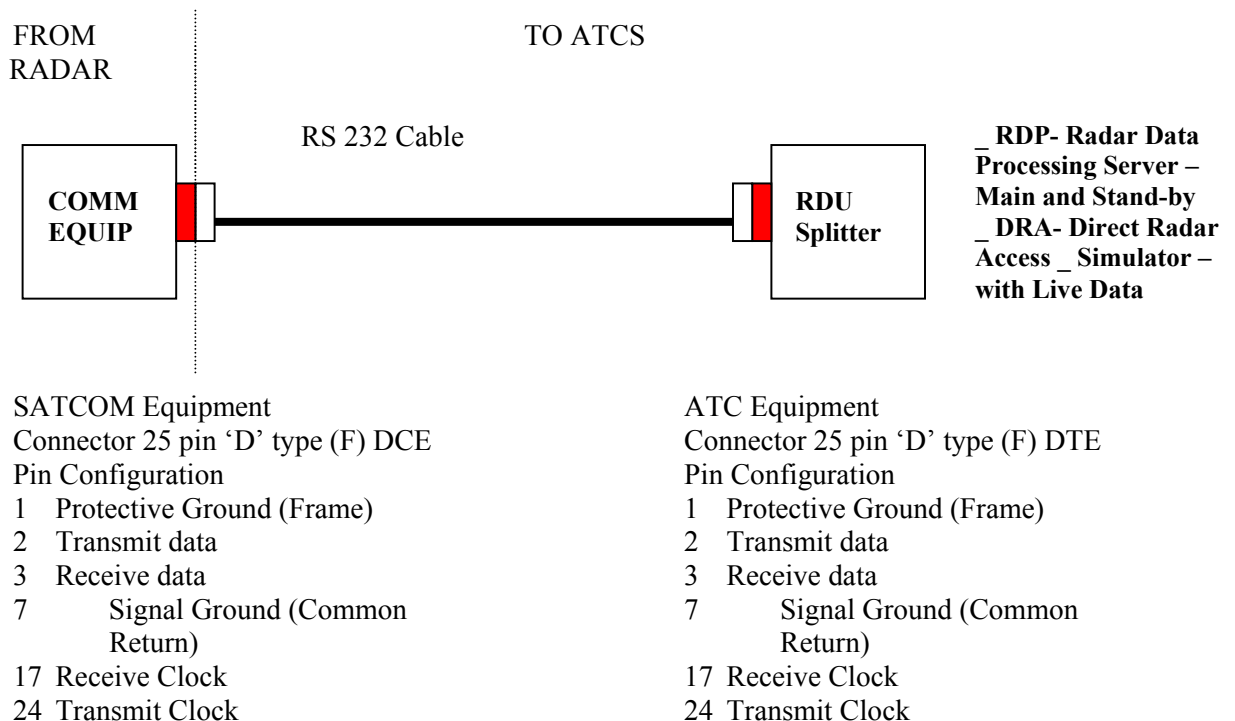
Type:	Serial – binary-synchronous
Description:	Simplex (TVT2)
Data Type:	Radar data
Format:	PR 800
Message Definition:	TVT2 messages types – Ref. ‘Procedure de Transmission TVT2’ Message ‘Status’ (Sector Message) Message ‘Piste’ (Track Report) Message ‘Correspondance Horloge’ (North Mark) Message ‘Suppression Piste’ (Track Drop)
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232
Physical Connection:	‘D’ type 25 pin at input to Radar Distribution Units
Reference	SICD ACC-BS

3.2.3 Special Features

These radars use a common format (TVT2) for data transmission between the radar site and the existing ATC centers.

3.2.4 Typical Interface Connection for BI-SYNC Protocol

The following diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.



3.2.5 Interface Connection

The data provided by the radar site is formatted into a BISYNC data block as shown below. Order of transmission is LSB sent first.

SYN	SYN	SOH	HEADER	STX	TEXT	ETX/ETB	BCC
-----	-----	-----	--------	-----	------	---------	-----

Table 3.2.5-1 Binary Synchronous Frame Structure

3.3 PSR/MSSR ASR-9 Interface

3.3.1 General

The PSR/MSSR sensor is a co-mounted dual primary (ASR 9) and dual secondary MMSSR radar system with plot extraction facilities and remote control and monitoring capability. Each site provides radar plot, track and weather data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site but does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communications between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.3.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX
Message Definition:	ASTERIX message types 001 Radar target report 002 Radar service message 008 Mono-radar derived weather information
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	‘D’ type 25 pin at input to Radar Distribution Unit (RDU)
Reference	TBD

3.3.3 Special Features

Radar data links are organized as simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.3.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.3.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown in below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.3.5-1 HDLC Frame Structure

3.4 PSR/SSR LP23M + RSM 970 Thomson Interface

3.4.1 General

The 3D-PSR/MSSR sensor is a primary radar system with a co-mounted secondary radar. Each system contains plot extraction facilities and remote control and monitoring capability. Each radar site provides radar plot and track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site and does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communication between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.4.2 Interface Definition

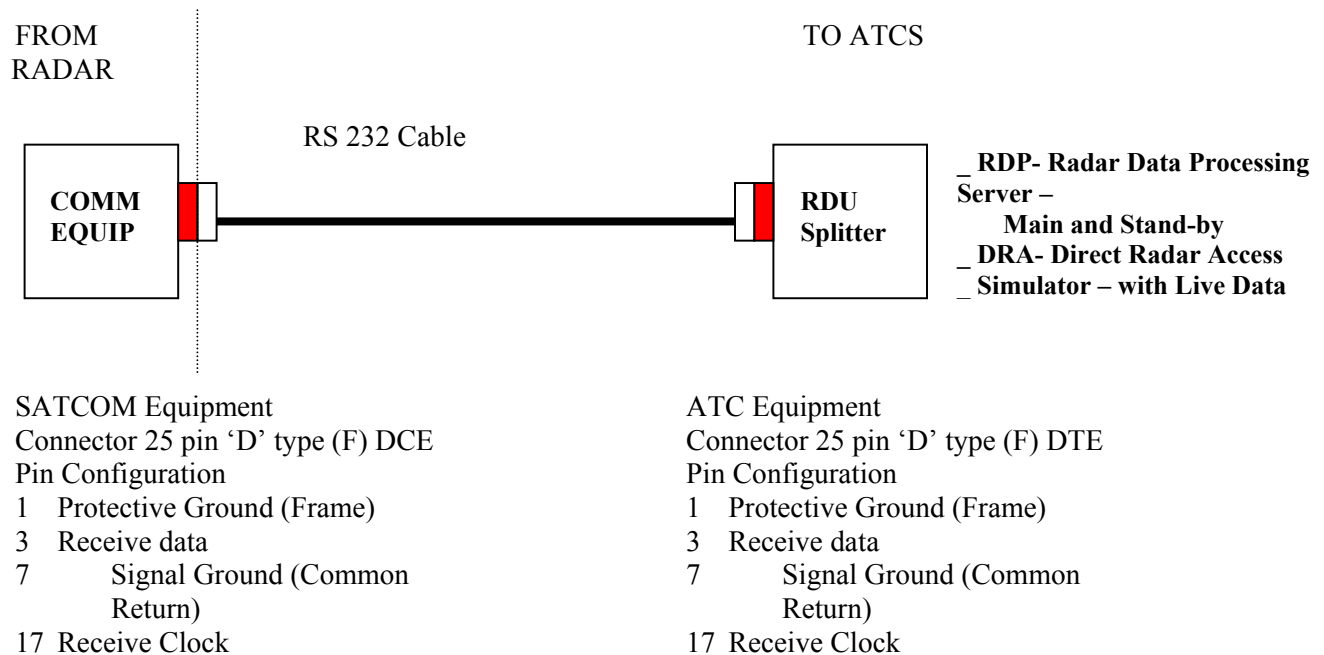
Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX
Message Definition:	ASTERIX messages types 034 Radar target report 048 Radar service message 008 Mono-radar derived weather information
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	D' type 25 pin at input to Radar Distribution Unit (RDU)
Reference	THALES SICD

3.4.3 Special Features

Radar data links are organized as Simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.4.4 Typical Interface Connection for HDLC

The following diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.



3.4.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.4.5-1 HDLC Frame Structure

3.5 3D-PSR/MSSR TRS2230 + RSM 970 Interface

3.5.1 General

The 3D TRS2230 sensor is a primary radar system with a co-mounted secondary radar. Each system contains plot extraction facilities and remote control and monitoring capability. Each radar site provides radar plot and track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site and does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communication between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.5.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX

Message Definition:	ASTERIX messages types
	048 Radar target report
	034 Radar service message
	008 Mono-radar derived weather information
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	'D' type 25 pin at input to Radar Distribution Unit (RDU)
Reference	SICD TRS2230 from THALES

3.5.3 Special Features

Radar data links are organized as Simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.5.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.5.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.5.5-1 HDLC Frame Structure

3.6 2D-PSR/MSSR TRACKER 2000 + RSM 970 Interface

3.6.1 General

The 2D PSR sensor is a co-mounted primary (TRACKER 2000) and secondary radar system with plot extraction facilities and remote control and monitoring capability. These radar sites are existing radar facilities. Each site provides radar track data in a standard format to the ATCS. Information provided by the radar supports ATC Operations. Communications is provided between the ATCS and the radar site by telephone channels, using landline and microwave links.

3.6.2 Interface Definition

Type:	Serial – binary-synchronous
Description	Simplex (AIRCAT500)
Data Type:	Radar data
Format:	PR 800

Message Definition:	AIRCAT 500 messages types Message 'Status' (Sector Message) Message 'Piste' (Track Report) Message 'Correspondance Horloge' (North Mark) Message 'Suppression Piste' (Track Drop)
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232
Physical Connection:	'D' type 25 pin at input to Radar Distribution Units
Reference	AIRCAT 500 Specification

3.6.3 Special Features

These radars use a common format (AIRCAT500) for data transmission between the radar site and the existing ATC centers.

3.6.4 Interface Connection

The 3.2.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.6.5 Interface Protocol

The data provided by the radar site is formatted into a BISYNC data block as shown below. Order of transmission is LSB sent first.

SYN	SYN	SOH	HEADER	STX	TEXT	ETX/ETB	BCC
-----	-----	-----	--------	-----	------	---------	-----

Table 3.6.5-1 Binary Synchronous Frame Structure

3.7 2D-PSR/MSSR ATCR33M/S + SIR-M(S) Interface

3.7.1 General

The 2D PSR/MSSR sensor is a primary radar system with a co-mounted secondary radar. Each system contains plot extraction facilities and remote control and monitoring capability. Each radar site provides radar plot and track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site and does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communication between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.7.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX

Message Definition:	ASTERIX messages types
	001 Radar target report
	002 Radar service message
	008 Mono-radar derived weather information
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	'D' type 25 pin at input to Radar Distribution Unit (RDU)
Reference:	TBD

3.7.3 Special Features

Radar data links are organized as Simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.7.4 Interface Connection

The 3.1.4 defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.7.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.7.5-1 HDLC Frame Structure

3.8 ATCR33DPC + SIR-S ALENIA

3.8.1 General

The 2D PSR/MSSR sensor is a primary radar system with a co-mounted secondary radar. Each system contains plot extraction facilities and remote control and monitoring capability. Each radar site provides radar plot and track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site and does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communication between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.8.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX

Message Definition:	ASTERIX messages types
	048 Radar target report
	034 Radar service message
	008 Mono-radar derived weather information
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	'D' type 25 pin at input to Radar Distribution Unit (RDU)
Reference	E-277-01-2132SSDD - USER APPLICATION PROFILE (UAP) FOR TRANSMISSION OF MONORADAR TARGET REPORT (ASTERIX CATEGORY 34 & 48)

3.8.3 Special Features

Radar data links are organized as Simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.8.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.8.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.8.5-1 HDLC Frame Structure

3.9 2D PSR + MSSR ATCR22M+ SIR-M

3.9.1 General

The 2D PSR/MSSR sensor is a primary radar system with a co-mounted secondary radar. Each system contains plot extraction facilities and remote control and monitoring capability. Each radar site provides radar plot and track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site and does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communication between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.9.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data

Format: ASTERIX
 Message Definition: ASTERIX messages types
 001 Radar target report
 002 Radar service message
 008 Mono-radar derived weather information
 Data Rate: 9.6 kbps
 Electrical Characteristics: RS 232c V24/V28
 Physical Connection: 'D' type 25 pin at input to Radar Distribution Unit (RDU)
 Reference: TBD

3.9.3 Special Features

Radar data links are organized as Simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.9.4 Interface Connection

The following diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.9.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.9.5-1 HDLC Frame Structure

3.10 2D PSR SKYTRACKER + IRS20MPL

3.10.1 General

The 2D PSR/MSSR sensor is a primary radar system with a co-mounted secondary radar. Each system contains plot extraction facilities and remote control and monitoring capability. Each radar site provides radar plot and track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site and does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communication between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.10.2 Interface Definition

Type: Serial - synchronous
 Description: HDLC, Simplex – one way transmission
 Data Type: Radar data
 Format: ASTERIX

Message Definition:	ASTERIX messages types
	001 Radar target report
	002 Radar service message
	008 Mono-radar derived weather information
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	'D' type 25 pin at input to Radar Distribution Unit (RDU)
Reference:	TBD

3.10.3 Special Features

Radar data links are organized as Simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.10.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.10.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.10.5-1 HDLC Frame Structure

3.11 3D PSR/MSSR TPS-70

3.11.1 General

The 3D PSR sensor is a co-mounted primary (TPS-70) and secondary radar system with plot extraction facilities and remote control and monitoring capability. These radar sites are existing radar facilities. Each site provides radar track data in a standard format to the ATCS. Information provided by the radar supports ATC Operations. Communications is provided between the ATCS and the radar site by telephone channels, using landline and microwave links.

3.11.2 Interface Definition

Type:	Serial – binary-synchronous
Description	Simplex
Data Type:	Radar data
Format:	BiSYNC
Message Definition:	CD-2 messages types
Data Rate:	9.6 kbps

Electrical Characteristics: RS 232
Physical Connection: 'D' type 25 pin at input to Radar Distribution Units
Reference: CD2 (FPS-117) Specification

3.11.3 Special Features

These radars use a common format (CD2) for data transmission between the radar site and the existing ATC centers. CD2 stands for Common Digitizer Protocol - enables the transmission and reception of synchronous radar data.

3.11.4 Interface Connection

The following diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.11.5 Interface Protocol

The data provided by the radar site is formatted into a BISYNC data block as shown below. Order of transmission is LSB sent first.

SYN	SYN	SOH	HEADER	STX	TEXT	ETX/ETB	BCC
-----	-----	-----	--------	-----	------	---------	-----

Table 3.11.5-1 Binary Synchronous Frame Structure

3.12 2D SSR STAR2000 + RSM 970

3.12.1 General

The 2D PSR STAR2000 sensor is a primary radar system with a co-mounted secondary radar. Each system contains plot extraction facilities and remote control and monitoring capability. Each radar site provides radar plot and track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site and does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communication between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.12.2 Interface Definition

Type: Serial - synchronous
Description: HDLC, Simplex – one way transmission
Data Type: Radar data
Format: ASTERIX
Message Definition: ASTERIX messages types
001 Radar target report
002 Radar service message
008 Mono-radar derived weather information
Data Rate: 9.6 kbps
Electrical Characteristics: RS 232c V24/V28
Physical Connection: 'D' type 25 pin at input to Radar Distribution Unit (RDU)
Reference: SICD STAR2000 from THALES

3.12.3 Special Features

Radar data links are organized as Simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.12.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.12.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.12.5-1 HDLC Frame Structure

3.13 2D TA-10 + RSM 970

3.13.1 General

The 2D PSR TA-10 sensor is a primary radar system with a co-mounted secondary radar. Each system contains plot extraction facilities and remote control and monitoring capability. Each radar site provides radar plot and track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site and does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communication between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.13.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX
Message Definition:	ASTERIX messages types 001 Radar target report 002 Radar service message 008 Mono-radar derived weather information
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	‘D’ type 25 pin at input to Radar Distribution Unit (RDU)
Reference	SICD TA-10 from THALES

3.13.3 Special Features

Radar data links are organized as Simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.13.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.13.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.13.5-1 HDLC Frame Structure

3.14 2D TA-10 + RSM 770

3.14.1 General

The 2D PSR TA-10 sensor is a primary radar system with a co-mounted secondary radar. Each system contains plot extraction facilities and remote control and monitoring capability. Each radar site provides radar plot and track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site and does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communication between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.14.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX
Message Definition:	ASTERIX messages types
	001 Radar target report
	002 Radar service message
	008 Mono-radar derived weather information
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	‘D’ type 25 pin at input to Radar Distribution Unit (RDU)
Reference	SICD TA-10 from THALES

3.14.3 Special Features

Radar data links are organized as Simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.14.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.14.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.14.5-1 HDLC Frame Structure

3.15 2D PSR ASR23SS + MSSR

3.15.1 General

The PSR/MSSR sensor is a co-mounted dual primary (ASR 23 SS/16) and dual secondary (Condor Mk 2) radar system with plot extraction facilities and remote control and monitoring capability. Each site provides radar plot, track and weather data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site but does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communications between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.15.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX
Message Definition:	ASTERIX message types
	001 Radar target report
	002 Radar service message
	008 Mono-radar derived weather information
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	‘D’ type 25 pin at input to Radar Distribution Unit (RDU)
Reference	G535530 - INTERFACE CONTROL DOCUMENT BETWEEN THE ASR23SS AND THE AUTOMATION SYSTEM

3.15.3 Special Features

Radar data links are organized as simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.15.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.15.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown in below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.15.5-1 HDLC Frame Structure

3.16 ASR12SS + MSSR

3.16.1 General

The 2D PSR sensor is a co-mounted primary and secondary radar system with plot extraction facilities and remote control and monitoring capability. These radar sites are existing radar facilities. Each site provides radar track data in a standard format to the ATCS. Information provided by the radar supports ATC Operations. Communications is provided between the ATCS and the radar site by telephone channels, using landline and microwave links.

3.16.2 Interface Definition

Type:	Serial – binary-synchronous
Description	Simplex
Data Type:	Radar data
Format:	BiSYNC
Message Definition:	CD-2 messages types
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232
Physical Connection:	‘D’ type 25 pin at input to Radar Distribution Units
Reference	CD2 (FPS-117) Specification

3.16.3 Special Features

These radars use a common format (CD2) for data transmission between the radar site and the existing ATC centers. CD2 stands for Common Digitizer Protocol - enables the transmission and reception of synchronous radar data.

3.16.4 Interface Connection

The 3.2.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.16.5 Interface Protocol

The data provided by the radar site is formatted into a BISYNC data block as shown below. Order of transmission is LSB sent first.

SYN	SYN	SOH	HEADER	STX	TEXT	ETX/ETB	BCC
-----	-----	-----	--------	-----	------	---------	-----

Table 3.16.5-1 Binary Synchronous Frame Structure

3.17 MSSR RSMA INVAP

3.17.1 General

The MSSR INVAP sensor is dual secondary radar system with plot extraction facilities and remote control and monitoring capability. Each site provides radar plot, track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site but does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communications between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.17.2 Interface Definition

Type:	Serial - synchronous
Description	ASTERIX over TCP/IP, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX
Message Definition:	ASTERIX message types 001 Radar target report 002 Radar service message
Data Rate:	128 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	‘D’ type 25 pin at input to Radar Distribution Unit (RDU)
Reference	TBD

3.17.3 Special Features

Radar data links are organized as simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames. The data is sent to the Center using a TCP/IP Wrapper.

3.17.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.17.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown in below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.17.5-1 HDLC Frame Structure

3.18 MSSR CARDION

3.18.1 General

The MSSR CARDION sensor is a dual secondary radar system with plot extraction facilities and remote control and monitoring capability. Each site provides radar plot, track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site but does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communications between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.18.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX
Message Definition:	ASTERIX message types 001 Radar target report 002 Radar service message
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	'D' type 25 pin at input to Radar Distribution Unit (RDU)
Reference	TBD

3.18.3 Special Features

Radar data links are organized as simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.18.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.18.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown in below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.18.5-1 HDLC Frame Structure

3.19 MSSR SIR-7 ALENIA

3.19.1 General

The MSSR sensor is dual secondary radar system with plot extraction facilities and remote control and monitoring capability. Each site provides radar plot, track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site but does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communications between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.19.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX
Message Definition:	ASTERIX message types 001 Radar target report 002 Radar service message
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	‘D’ type 25 pin at input to Radar Distribution Unit (RDU)
Reference	TBD

3.19.3 Special Features

Radar data links are organized as simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.19.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.19.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown in below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.19.5-1 HDLC Frame Structure

3.20 MSSR SIR-S SELEX

3.20.1 General

The MSSR sensor is dual secondary radar system with plot extraction facilities and remote control and monitoring capability. Each site provides radar plot, track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site but does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communications between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.20.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX
Message Definition:	ASTERIX message types 001 Radar target report 002 Radar service message
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	D' type 25 pin at input to Radar Distribution Unit (RDU)
Reference	TBD

3.20.3 Special Features

Radar data links are organized as simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.20.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.20.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown in below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.20.5-1 HDLC Frame Structure

3.21 MSSR CONDOR MK2D

3.21.1 General

The MSSR sensor is a dual secondary radar system with plot extraction facilities and remote control and monitoring capability. Each site provides radar plot, track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site but does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communications between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.21.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX
Message Definition:	ASTERIX message types 001 Radar target report 002 Radar service message
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	‘D’ type 25 pin at input to Radar Distribution Unit (RDU)
Reference	IC808466/801 FOR THE CONDOR MK2D ASTERIX RADAR DATA OUTPUT SIVAM - FREE- STANDING INSTALLATIONS

3.21.3 Special Features

Radar data links are organized as simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.21.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.21.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown in below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.21.5-1 HDLC Frame Structure

3.22 MSSR ISIR-M ALENIA

3.22.1 General

The MSSR sensor is a dual secondary radar system with plot extraction facilities and remote control and monitoring capability. Each site provides radar plot, track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site but does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communications between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.22.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX
Message Definition:	ASTERIX message types 001 Radar target report 002 Radar service message
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	‘D’ type 25 pin at input to Radar Distribution Unit (RDU)
Reference	Mensajes Radar ASTERIX con UAPs de Alenia. COCESNA

3.22.3 Special Features

Radar data links are organized as simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.22.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.22.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown in below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.22.5-1 HDLC Frame Structure

3.23 MSSR IRS-20MP/L INDRA

3.23.1 General

The MSSR sensor is a dual secondary radar system with plot extraction facilities and remote control and monitoring capability. Each site provides radar plot, track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site but does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communications between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.23.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX
Message Definition:	ASTERIX message types 001 Radar target report 002 Radar service message
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	‘D’ type 25 pin at input to Radar Distribution Unit (RDU)
Reference	Specification IRS-20MP/L INDRA COCESNA

3.23.3 Special Features

Radar data links are organized as simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.23.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.23.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown in below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.23.5-1 HDLC Frame Structure

3.24 MSSR RSM 970 THALES

3.24.1 General

The MSSR sensor is a dual secondary radar system with plot extraction facilities and remote control and monitoring capability. Each site provides radar plot, track data in a standard format to the ATCS. A remote monitoring and control (M&C) terminal is located at the ATCS site but does not directly connect to the ATCS. Information provided by the radar supports ATC Operations. Communications between the ATCS and the radar site is provided by telephone channels, using satellite links and land-lines.

3.24.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Simplex – one way transmission
Data Type:	Radar data
Format:	ASTERIX
Message Definition:	ASTERIX message types 001 Radar target report 002 Radar service message
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	‘D’ type 25 pin at input to Radar Distribution Unit (RDU)
Reference	TBD

3.24.3 Special Features

Radar data links are organized as simplex transmission from Radar to ATCS. The serial data stream is synchronous with the clock provided by the source (radar site). Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.24.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.24.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown in below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.24.5-1 HDLC Frame Structure

3.25 AMS (Alenia Marconi Systems) Interface (Intercenter System Radar Track)

3.25.1 General

This interface allows to send and receive system track data, resulting of the fusion of the information from several PSR/MSSR and MSSR sensors, the coordinate are sent in latitude, longitude. The track is sent with the flight Plan information associated to the track. The cycle update is generated by the center, usually 4, 5 or 10 sec. Communications is provided between the ATCS and the radar site by telephone channels, using landline and microwave links.

3.25.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Full-duplex
Data Type:	System Track data
Format:	ASTERIX
Message Definition:	ASTERIX message types 062 Radar target report 063 Sensor status service message
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	'D' type 25 pin at input to Radar Distribution Unit (RDU)
Reference	EUROCONTROL Surveillance Data Exchange

3.25.3 Special Features

System Track Radar data links are organized as full-duplex transmission from ATCS to an adjacent ATCS. The serial data stream is synchronous with the clock provided by the source ATCS. Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.25.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.25.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown in below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.25.5-1 HDLC Frame Structure

3.26 Inter-CINDACTA (Intercenter System Radar Track)

3.26.1 General

This interface allows to send and receive system track data, resulting of the fusion of the information from several PSR/MSSR and MSSR sensors, the coordinate are sent in stereographical projection referenced to the Center. The track is sent with the CALLSIGN associated to the track. The cycle update is generated by the center, usually 4, 5 or 10 sec. Communications is provided between the ATCS and the radar site by telephone channels, using landline and microwave links.

3.26.2 Interface Definition

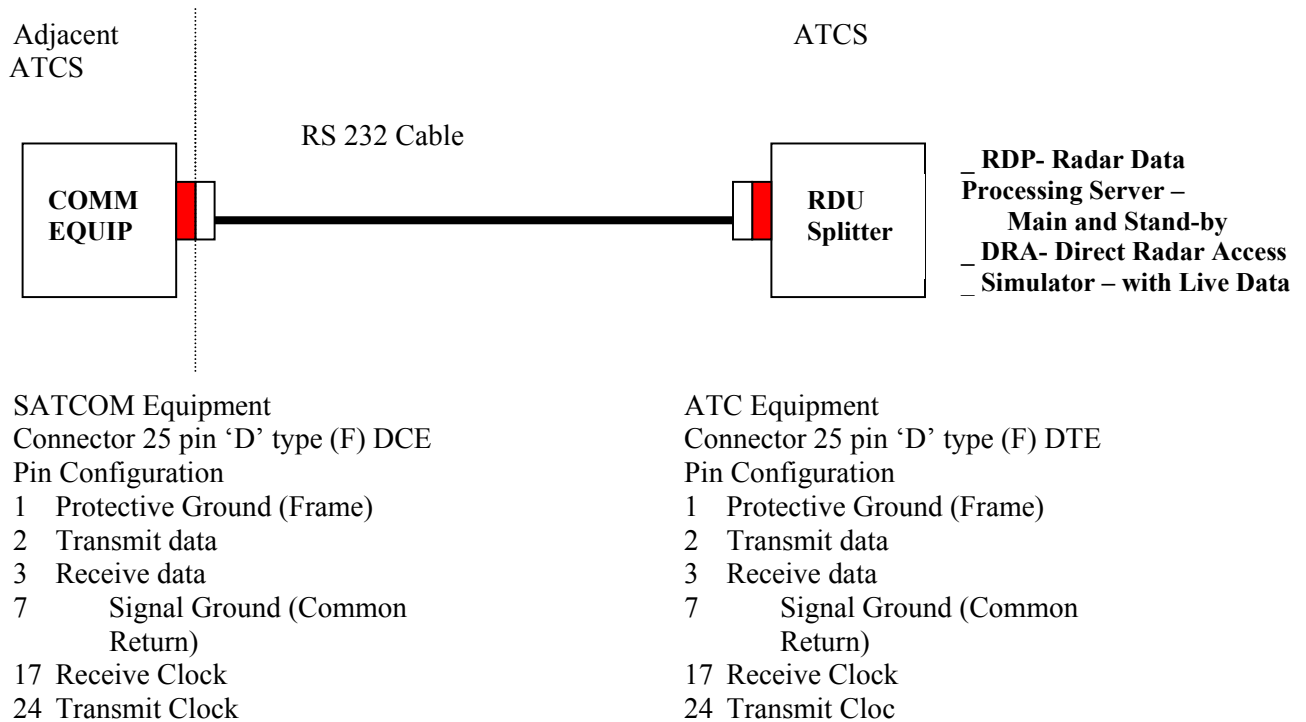
Type:	Serial – binary-synchronous
Description	Full-duplex (TVT2)
Data Type:	Radar data
Format:	System Radar Data
Message Definition:	TVT2 messages types – Ref. ‘Procedure de Transmission TVT2’
	Message ‘Status’ (Sector Message)
	Message ‘Piste’ (Track Report)
	Message ‘Correspondance Horloge’ (North Mark)
	Message ‘Suppression Piste’ (Track Drop)
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232
Physical Connection:	‘D’ type 25 pin at input to Radar Distribution Units
Reference	SICD ACC-BS

3.26.3 Special Features

These interface use a common format (TVT2) for data transmission between the ATCS Site from/to an adjacent ATCS center.

3.26.4 Typical Interface Connection for BI-SYNC Protocol

The following diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.



3.26.5 Interface Protocol

The data provided by the radar site is formatted into a BISYNC data block as shown below. Order of transmission is LSB sent first.

SYN	SYN	SOH	HEADER	STX	TEXT	ETX/ETB	BCC
-----	-----	-----	--------	-----	------	---------	-----

Table 3.26.5-1 Binary Synchronous Frame Structure

3.27 INDRA Interface (Intercenter System Radar Track)

3.27.1 General

This interface allows to send and receive system track data, resulting of the fusion of the information from several PSR/MSSR and MSSR sensors, the coordinate are sent in latitude, longitude. The track is sent with the flight Plan information associated to the track. The cycle update is generated by the center, usually 4, 5 or 10 sec. Communications is provided between the ATCS and the radar site by telephone channels, using landline and microwave links.

3.27.2 Interface Definition

Type:	Serial - synchronous
Description	HDLC, Full-duplex
Data Type:	System Track data
Format:	ASTERIX
Message Definition:	ASTERIX message types 062 Radar target report 063 Sensor status service message
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	'D' type 25 pin at input to Radar Distribution Unit (RDU)
Reference	EUROCONTROL Surveillance Data Exchange

3.27.3 Special Features

System Track Radar data links are organized as full-duplex transmission from ATCS to ATCS. The serial data stream is synchronous with the clock provided by the source ATCS. Each physical communications link consists of two signals, data and clock, from the radar site. The HDLC procedure is defined in accordance with ISO 3309 for one way transmission with no acknowledgement of received frames.

3.27.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the radar serial interface. See also Figure 3.1-1 for details of the Radar Distribution Unit.

3.27.5 Interface Protocol

The data provided by the radar site is formatted into an HDLC frame structure as shown in below. Order of transmission is LSB sent first.

FLAG	ADDRESS	CONTROL	ASTERIX MESSAGE BLOCK	FCS	FLAG
01111110	8 bits	8 bits	Variable length (bytes)	16 bits	01111110

Table 3.27.5-1 HDLC Frame Structure

3.28 Flight Plan interface with Hand-off Coordination ICAO

3.28.1 General

The Aeronautical Fixed Telecommunications Network (AFTN) is a Worldwide network specifically for the transmission of Flight Plans and related information (aeronautical and meteorological) between Airports, ATC Centers, Meteorological centers and Air Traffic Services. The network is essentially a low speed data network designed for use over low-grade telephone lines. Data rates can be as low as 75 baud (telex rates) or may be as high as 9.6 kbps as output from modern Automatic Message Switch System (AMSS). These AMSS usually form a hub at many centers to provide local distribution and also allow direct access to the network. Communications between the ATCS and the AMSS is provided by point-to-point serial digital links. The AMSS is also referred to as a AFTN Server in this document.

3.28.2 Interface Definition

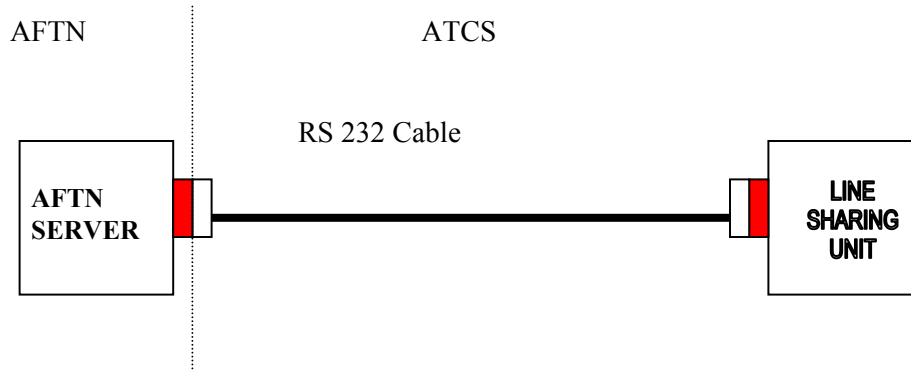
Type:	Serial - asynchronous
Description	FULL DUPLEX
Data Type:	AFTN messages
Format:	ICAO
Message Identity:	FPL, CHG, CNL, DLA, DEP, CPL, EST, ARR, including also CDN, LAM and ACP for Hand-off
Message Definition:	Refer to ICAO Annex 10 and Doc 4444
Data Rate:	2.4 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	'D' type 25 pin at input to Flight Data Processors
Reference	ICAO Doc 4444

3.28.3 Special Features

A line-sharing unit is employed at the input to the FDPs to allow for un-interrupted connection should one of the FDPs fail and a switch over occurs.

3.28.4 Interface Connection

The following diagram defines the interface connection point for the AFTN serial interface. See also Figure 3.1-4 for details of the connection to the FDP processors.



Connector 25 pin 'D' type (F) DCE
Pin Configuration

- | | |
|---|-------------------------------|
| 1 | Protective Ground (Frame) |
| 2 | Transmit data |
| 3 | Receive data |
| 4 | Request to Send |
| 5 | Clear to Send |
| 7 | Signal Ground (Common Return) |

ATC Equipment

Connector 25 pin 'D' type (F) DTE
Pin Configuration

- | | |
|---|-------------------------------|
| 1 | Protective Ground (Frame) |
| 2 | Transmit data |
| 3 | Receive data |
| 4 | Request to Send |
| 5 | Clear to Send |
| 7 | Signal Ground (Common Return) |

3.29 Flight Plan interface without Hand-off Coordination ICAO

3.29.1 General

The Aeronautical Fixed Telecommunications Network (AFTN) is a Worldwide network specifically for the transmission of Flight Plans and related information (aeronautical and meteorological) between Airports, ATC Centers, Meteorological centers and Air Traffic Services. The network is essentially a low speed data network designed for use over low-grade telephone lines. Data rates can be as low as 75 baud (telex rates) or may be as high as 9.6 kbps as output from modern Automatic Message Switch System (AMSS). These AMSS usually form a hub at many centers to provide local distribution and also allow direct access to the network. Communications between the ATCS and the AMSS is provided by point-to-point serial digital links. The AMSS is also referred to as a AFTN Server in this document.

3.29.2 Interface Definition

Type:	Serial - asynchronous
Description	FULL DUPLEX
Data Type:	AFTN messages
Format:	ICAO
Message Identity:	FPL, CHG, CNL, DLA, DEP, CPL, EST, ARR
Message Definition:	Refer to ICAO Annex 10 and Doc 4444
Data Rate:	2.4 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	'D' type 25 pin at input to Flight Data Processors
Reference:	ICAO Doc 4444

3.29.3 Special Features

A line-sharing unit is employed at the input to the FDPs to allow for un-interrupted connection should one of the FDPs fail and a switch over occurs.

3.29.4 Interface Connection

The 3.26.4 diagram defines the interface connection point for the AFTN serial interface. See also Figure 3.1-4 for details of the connection to the FDP processors.

3.30 OLDI Interface

3.30.1 General

This interface is used to coordinate Flight Plans (Hand-Off) between Adjacent ATC Centers. This protocol is used for Entry Coordination and Exit Coordination, using a specific set of messages to transfer a flight Plan from/to a Adjacent Center, with specific signalization on the Human-Machine Interface to the Controller.

3.30.2 Interface Definition

Type:	Serial - synchronous
Description	X.25, HDLC, FULL DUPLEX
Data Type:	Flight Plan Coordination
Format:	OLDI
Message Identity:	ABI, ACT, REV, PAC, MAC e LAM
Message Definition:	Refer to OLDI EUROCONTROL doc
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	'D' type 25 pin at input to Flight Data Processors
Reference	Estándar de Eurocontrol de intercambio de datos en línea (OLDI, On-Line Interchange) Eurocontrol Edición 2.3 diciembre de 2001

3.30.3 Special Features

A line-sharing unit is employed at the input to the FDPs to allow for un-interrupted connection should one of the FDPs fail and a switch over occurs.

3.30.4 Interface Connection

The 3.1.4 diagram defines the interface connection point for the OLDI serial interface.

3.30.5 Interface Protocol

The data provided by the radar site is formatted into a BISYNC data block as shown below. Order of transmission is LSB sent first.

SYN	SYN	SOH	HEADER	STX	TEXT	ETX/ETB	BCC
-----	-----	-----	--------	-----	------	---------	-----

Table 3.30.5-1 Binary Synchronous Frame Structure

3.31 AIDC interface

3.31.1 General

This interface is used to coordinate Flight Plans (Hand-Off) between Adjacent ATC Centers. This protocol is used for Entry Coordination and Exit Coordination, using a specific set of messages to transfer a flight Plan from/to a Adjacent Center, with specific signalization on the Human-Machine Interface to the Controller.

3.31.2 Interface Definition

Type:	Serial - synchronous
Description	X.25, HDLC, FULL DUPLEX (and future ATN)
Data Type:	AIDC messages
Format:	ICAO
Message Identity:	ABI, CPL, EST, PAC, ACP, MAC, LAM, LRM, TOC, AOC
Message Definition:	Refer to ICAO Doc

Data Rate:	2.4 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	'D' type 25 pin at input to Flight Data Processors
Reference	APANPIRG ICD

3.31.3 Special Features

A line-sharing unit is employed at the input to the FDPs to allow for un-interrupted connection should one of the FDPs fail and a switch over occurs.

3.31.4 Interface Connection

The 3.26.4 diagram defines the interface connection point for the HDLC (X.25) serial interface. See also Figure 3.1-4 for details of the connection to the FDP processors.

3.31.5 Interface Protocol

The data provided by the radar site is formatted into a BISYNC data block as shown below. Order of transmission is LSB sent first.

SYN	SYN	SOH	HEADER	STX	TEXT	ETX/ETB	BCC
-----	-----	-----	--------	-----	------	---------	-----

Table 3.31.5-1 Binary Synchronous Frame Structure

3.32 ATCS to ATCS (CINDACTA) Interface Flight Plan Data Message

3.32.1 General

Flight plan data will be exchanged between the ATCS and adjacent ATCS (CINDACTA). The primary communication path for this exchange is via the digital comms infrastructure. Digital comms nodes are available at the major sites and are interconnected using digital data links. The links are supported by landline, microwave or satellite links. The information that is provided by these links supports ATC Operations. The communication path between the SCO and a CINDACTA is a point to point data circuit.

3.32.2 Interface Definition

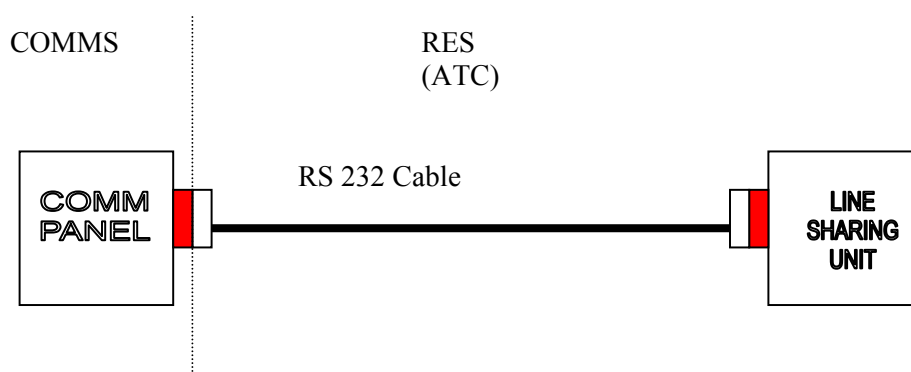
Type:	Serial – binary-synchronous
Description	FULL DUPLEX (TVT2)
Data Type:	Flight Plan Data
Format:	ICAO in TVT2 wrapper
Message Identity:	CDN, LAM, ACP
Message Definition:	Refer to Doc 4444
Data Rate:	9.6 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	'D' type 25 pin at input to FDPS
Reference	SICD ACC-BS

3.32.3 Special Features

The Line Sharing Units allow connection between the active Flight Plan Data Processor of the ATCS and the equivalent units in the adjacent CINDACTA. The active FDP will exchange messages for flights in a defined region on each side of the FIR boundary, controlled by the respective ATC centers. Messages will be received and transmitted using NOS to implement the network communications function.

3.32.4 Interface Connections

The following diagram defines the interface connection point for the SCO to CINDACTA serial interface. See also Figure 3.1-4 for details of the connection to the FDP processors.



COMM PANEL
Connector 25 pin 'D' type (F) DCE
Pin Configuration

1	Protective Ground (Frame)
2	Transmit data
3	Receive data
7	Signal Ground (Common Return)
17	Receive Clock
24	Transmit Clock

ATC Equipment
Connector 25 pin 'D' type (F) DTE
Pin Configuration

1	Protective Ground (Frame)
2	Transmit data
3	Receive data
7	Signal Ground (Common Return)
17	Receive Clock
24	Transmit Clock

3.32.5 Interface Protocol

The data provided by the SCO is formatted into a BISYNC data block as shown in below. Order of transmission is LSB sent first.

SYN	SYN	SOH	HEADER	STX	TEXT	ETX/ETB	BCC
-----	-----	-----	--------	-----	------	---------	-----

Table 3.32.5-1 Binary Synchronous Frame Structure

3.33 RCMS (Radar Sensors) Interface

3.33.1 General

For each of the PSR/MSSR sensors, MSSR sensors and the 3-D radars, Remote Control and Monitoring facilities are provided. The Remote monitoring and control (M&C) terminals which can be situated both at the radar head (site) and in the ATCS are used to control (configure) and monitor the status of the radars. The data links used with the remote monitoring and control (M&C) terminals are the same type as used for the radar data except the links are full-duplex in operation. These remote monitoring and control (M&C) terminals which are situated in the ATCS do not directly connect to the ATCS. Communications between the ATCS and the radar site is provided by telephone channels, satellite links and land-lines.

3.33.2 Interface Definition

Part of the Radar system. Refer to the specific Radar ICD such as: G630621, G628715 and IC808136/802

3.33.3 Special Features

One remote terminal will be provided for each radar site.

3.34 AFTN AMSS (to/from AIS) Interface

3.34.1 General

The Aeronautical Fixed Telecommunications Network (AFTN) is a Worldwide network specifically for the transmission of Flight Plans and related information (aeronautical and meteorological) between Airports, ATC Centers, Meteorological centers and Air Traffic Services. The network is essentially a low speed data network designed for use over low-grade telephone lines. Data rates can be as low as 75 baud (telex rates) or may be as high as 9.6 kbps as output from modern Automatic Message Switch System (AMSS). These AMSS usually form a hub at many centers to provide local distribution and also allow direct access to the network. Communications between the ATCS and the AMSS is provided by point-to-point serial digital links. The AMSS is also referred to as a Text Server in this document.

3.34.2 Interface Definition

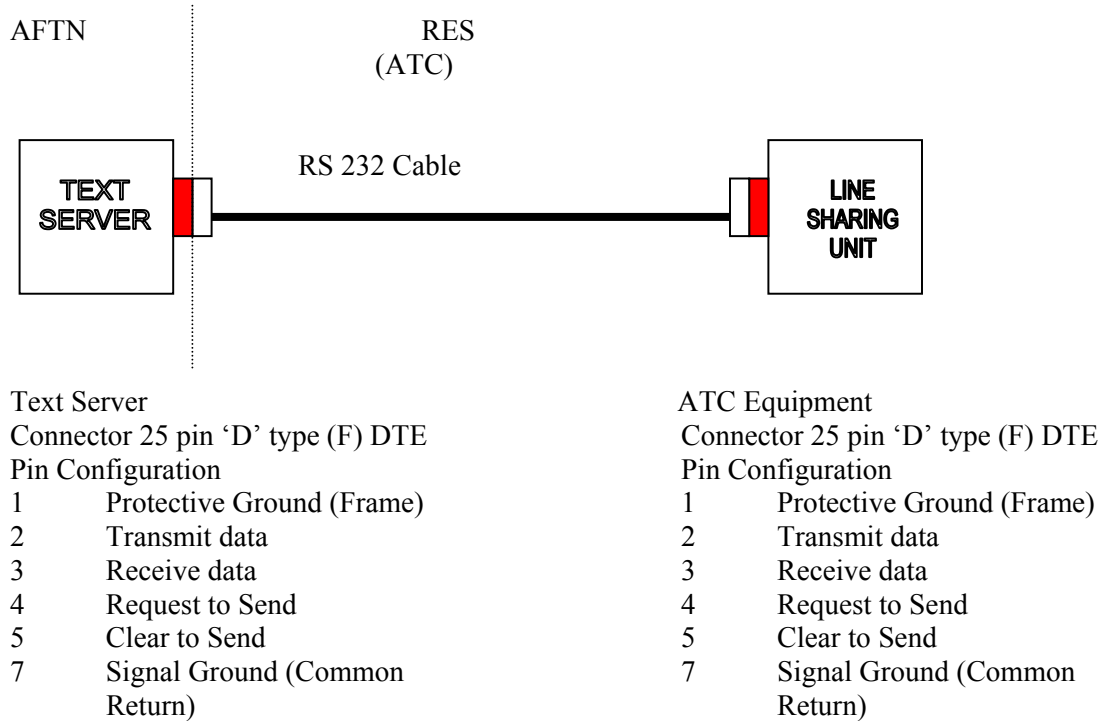
Type:	Serial - asynchronous
Description	FULL DUPLEX
Data Type:	AFTN messages
Format:	ICAO
Message Identity:	AFTN Messages
Message Definition:	Refer to ICAO Annex 10
	Wind Data
	ICAO_Meteorological Data
Data Rate:	2.4 kbps
Electrical Characteristics:	RS 232c V24/V28
Physical Connection:	'D' type 25 pin at input to AIS Processors

3.34.3 Special Features

A line sharing unit is employed at the input to the AIS servers to allow for un-interrupted connection should one of the AIS fail and a switch over occurs.

3.34.5 Interface Connection

The following diagram defines the interface connection point for the AFTN serial interface. See also Figure 3.1-4 for details of the connections to the FDP and AIS processors.



3.35 Time Server to ATCS Interface (Time Synchronization Message)

3.35.1 General

The Time server sent Time synchronization Messages to the ATCS dual LAN, using nntp service in the RDP to synchronize all the workstations. This will provide the System Time.

3.35.2 Interface Definition

Type:	LAN
Description	Ethernet
Data Type:	Time synchronization Message
Format:	TCP/IP, Internal LAN Message structure
Message Identity:	ATCS TimeSynchronization
Message Definition:	LAN Message Time synchronization
Source Mail Box:	(TBD)
Source IP Address:	(TBD)
Destination Mail Box:	(TBD)
Destination IP Address:	(TBD)
Data Rate:	100 Mbps
Electrical Characteristics:	ISO3309 and ISO7776
Physical Connection:	RJ45

3.35.3 Special Features

A time synchronization message will be generated at regular intervals (every 10 seconds) to ensure that the ATCS has the same time, which is synchronized to the GPS Universal Time Coordinated (UTC). The message will be sent to a unique node address in the ATCS using a Mail box number scheme.

3.35.4 Interface Protocol

The data provided by the Time server is formatted into a Message data block. Order of transmission is LSB sent first.

Figure 3.1-1 Typical Radar Data Interface – dual links from each radar (A+B)

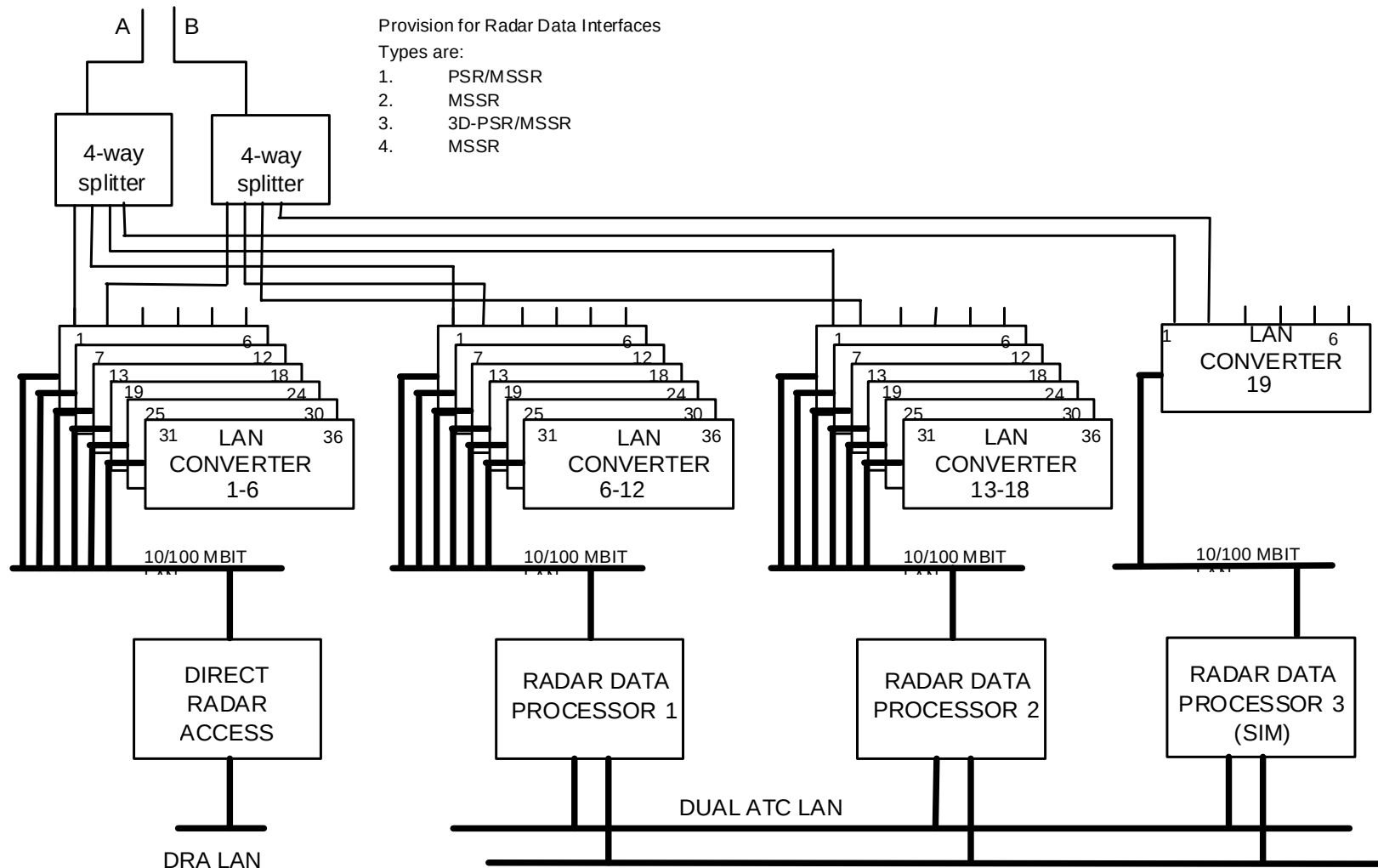


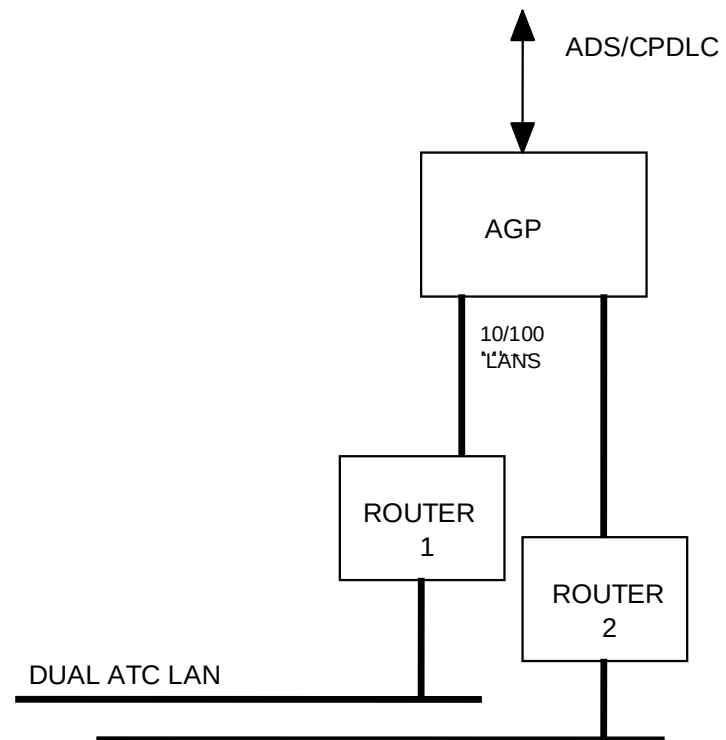
Figure 3.1-2 Typical Interface to the AGP for Future ADS Data Reception

Figure 3.1-3 Typical ATCS Configuration

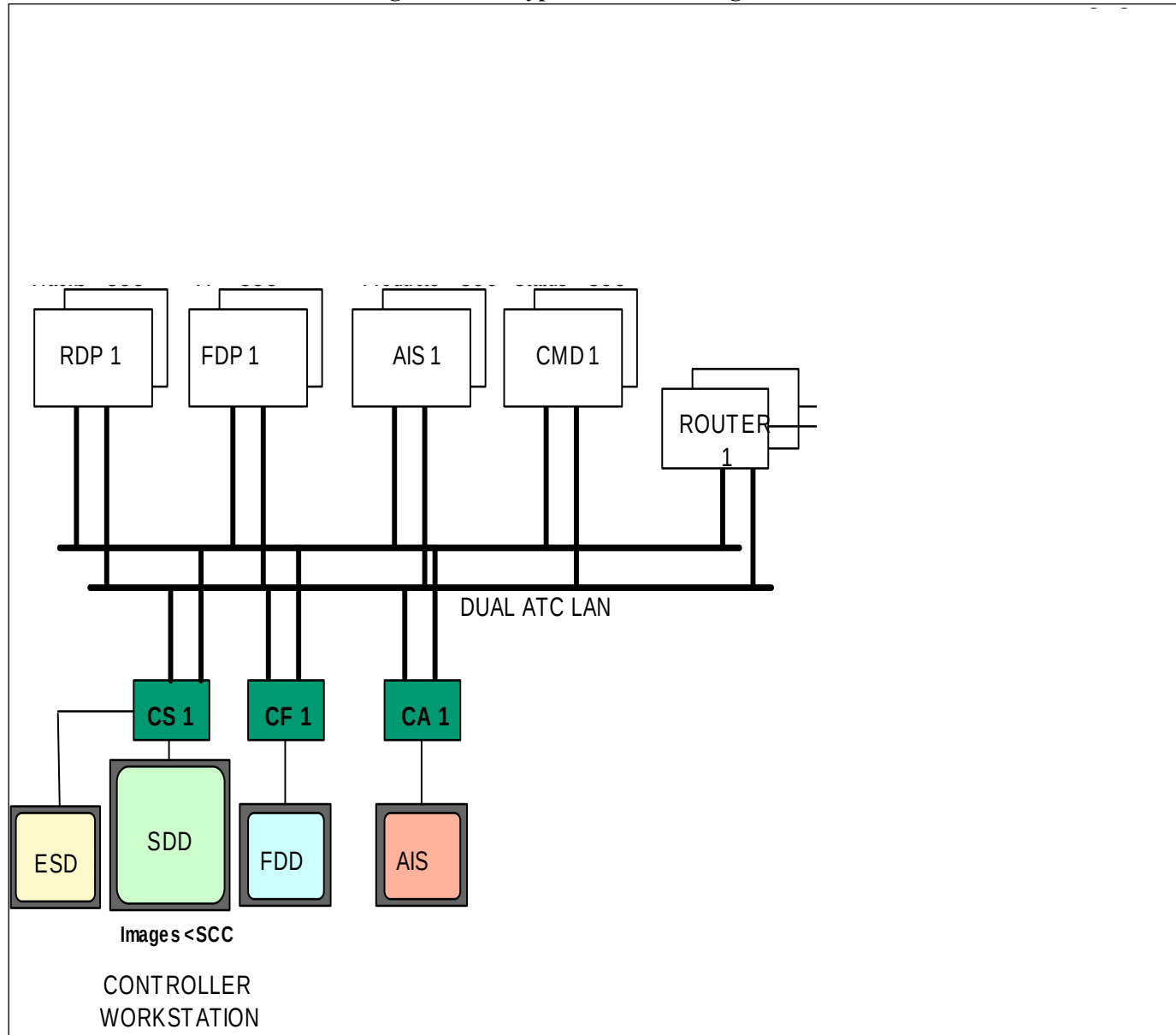
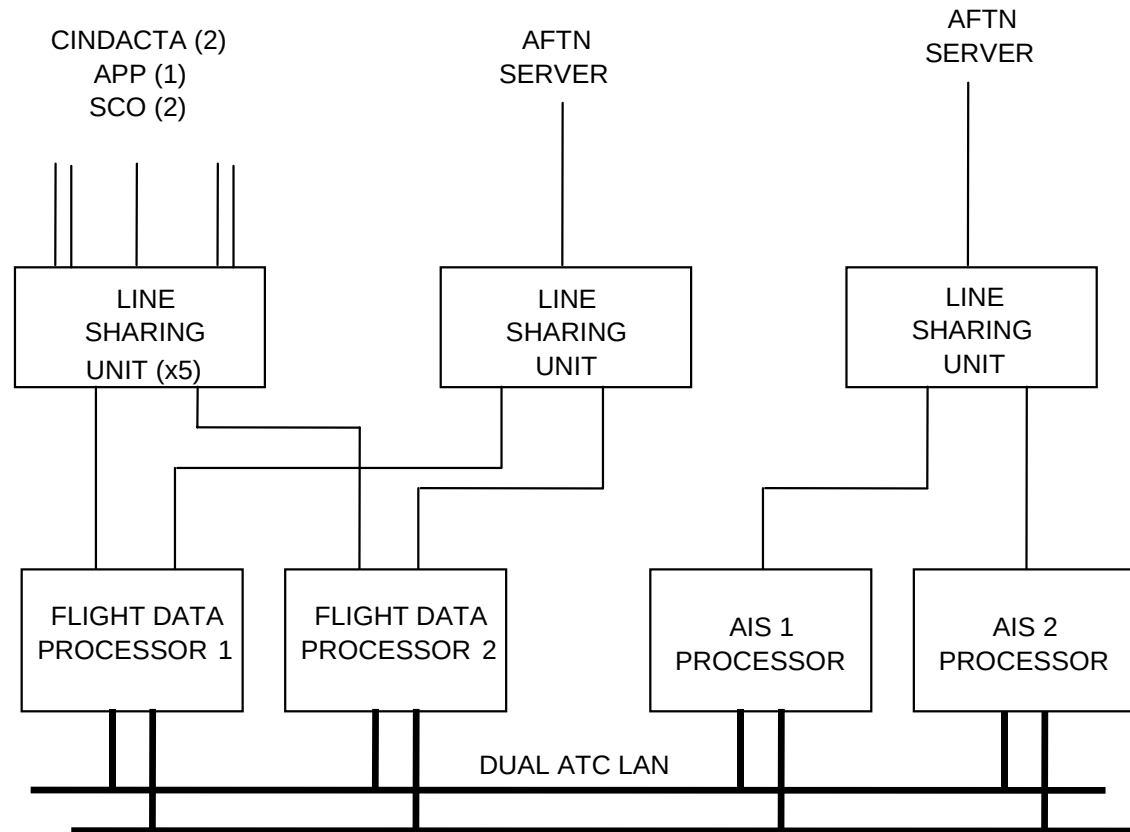


Figure 3.1-4 Interface to ATC Centers and AFTN for Flight data exchange

4.0 Recommended interfaces

The recommend interfaces are:

_ Surveillance: as defined in the Item 3.25 – Intercenter ASTERIX Radar Data category 62 and 63.

_ Flight Plan: as defined in the item 3.31 – AIDC Messages over ATN.

5.0 Notes

5.1 Glossary

This section contains a list of abbreviation used in this document.

AFTN	Aeronautical Fixed Telecommunications Network
AGDLIC	Air/Ground Data Link Interface Controller
AIS	Aeronautical Information Services
AMS	Alenia Marconi Systems
AMSS	Automatic Message Switch System
APP	Approach Control
ASTERIX	All purpose structure Eurocontrol radar information exchange
ATC	Air Traffic Control
ATCS	Air Traffic Control System
CFE	Customer Furnished Equipment
CINDACTA	Centro Integrado de Defesa Aerea e Controle de Trafego Aereo
DCE	Data Circuit-Terminating Equipment
DTE	Data Terminal Equipment
EMA	Altitude Weather Station
EMS	Surface Meteorological Station
FCS	Frame Check Sequence
FDDI	Fibre (optic) Distributed Data Interface
FDP	Flight Data Processor
FIR	Flight Information Region
FP	Flight Plan
GPS	Global Positioning Satellite
HDLC	High-level data link control
HF	High Frequency
HTTP	Hyper-text Transfer Protocol
ICAO	International Civil Aviation Organization
ICD	Interface Control Document
IDD	Interface Design Document
IRS	Interface Requirements Specification
LAB	Laboratory
LAN	Local Area Network
M&C	Monitor and Control
MSSR	Monopulse Secondary Surveillance Radar
NOTAM	Notice to Airmen
OUE	User Organization Equipment
PSR	Primary Surveillance Radar
RDP	Radar Data Processor

RDSS	Radio Determination Sub-system
RDU	Radar Distribution Unit
RES	Raytheon Electronic Systems
RF	Radio Frequency (normally rf)
RM	Regional Monitoring
RPL	Repetitive Flight Plan
RS	Remote Sensing
SCD	Brazilian low Earth orbiting satellite
SCO	Operations Sub-center
SICD	System Interface Control Document
SIVAM	System for the Vigilance of the Amazon
STV	Data Treatment and Visualization Center
TBD	To be determined
TCP/IP	Transmission Control Protocol/Internet Protocol
TEL	Telecommunications
TIROS	Television and infra-red observation satellite
UDP	User Datagram Protocol
UTC	Universal Time Coordinated
VCCS	Voice Communications Control System
WAN	Wide Area Network
WMO	World Meteorological Organization

APPENDIX D / APENDICE D

**CAR/SAM AUTOMATED ACC INTERCONNECTION
PLAN**

PREFACE

This document defines the Plan for Automated ACC Interconnection of the CAR/SAM region. This document is subject to change based on continuing review by ICAO Offices and the States members.

REVISION HISTORY

Revision/Date	Description of Change	Change Pages

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1. PURPOSE

1.1 Identification

This document presents the operational concept, objectives and strategies for the Interconnection of Automated Air Traffic Control Centers of the CAR/SAM Regions, and establishes the related Implementation Plan.

1.2 Overview

Air Traffic Control Centers of the CAR/SAM Regions have been faced with difficulties on proper air traffic coordination, that has been appointed as a major contributing factor to air traffic incidents, which could be significantly reduced through the Interconnection of the Automated Air Traffic Control Systems. The interconnection is based on an implementation strategy that counts on the REDDIG as the primary means for all required data communication. Whilst considering the interconnection of ACCs with automated systems as the main objective, alternate solutions to improve air traffic coordination with and between non-automated Centers are also dealt with. Detailed information on all relevant aspects of the interconnection is contained in the following sections of this document.

1.2.1 Introduction

The interconnection of the Automated Air Traffic Control Centers will allow the implementation of automated air traffic coordination for the transfer of control responsibilities between adjacent Area Control Centers of the CAR/SAM Regions, thus reducing the risks of aeronautical incidents due to eventually improper coordination activities, whilst also improving the planning phases for an efficient control of the flights coming or leaving from the corresponding Flight Information Regions (FIR). In order to accomplish the interconnection, the regional office of ICAO at Lima established the following agenda of activities, within the scope of Project RLA98/003:

- Missions to States, for Data Gathering: Activity performed during 2007, by a team of experts provided by DECEA and ICAO/LIMA, with the purpose of assessing the current situation of the automated air traffic control systems installed in the Area Control Centers of CAR/SAM States. On site technical visits were accomplished in Peru, Ecuador, Venezuela, Colombia, Panama, COCESNA, Chile, Uruguay, Argentina and Brazil.
- Elaboration of the Interface Control Document (SICD): based on the data collected during the visits, the team prepared a document of interfaces that contains all the related data and a description of the existing interfaces of the many systems available at the ACCs of CAR/SAM States, therefore, providing an overview of the current situation and providing the subsidies for adopting the necessary measures to interconnect those systems.
- Interconnection Plan: based on the information consolidated in the SICD and taking into consideration the peculiarities of each State's ACCs, an interconnection plan is being proposed, which is the aim of this document. Thus, the present document represents the summary of the work done by the team of experts and outlines the objectives, concepts, strategy and actions deemed necessary for the accomplishment of the operational requirements associated with the interconnection of automated ATC Facilities.

In order to assess the complexity and technical feasibility of a system interconnection between adjacent ATC centers, a team of technical experts provided by a SAM Air Navigation Services Provider (ANSP), duly coordinated by ICAO-Lima, performed interconnection tests between the automated systems of Manaus-ACC (FIR Amazonica), in Brazil and Maiquetía-ACC (FIR Maiquetía) in Venezuela, with excellent results and thus validating the proof-of-concept activity.

1.3 Context Diagram

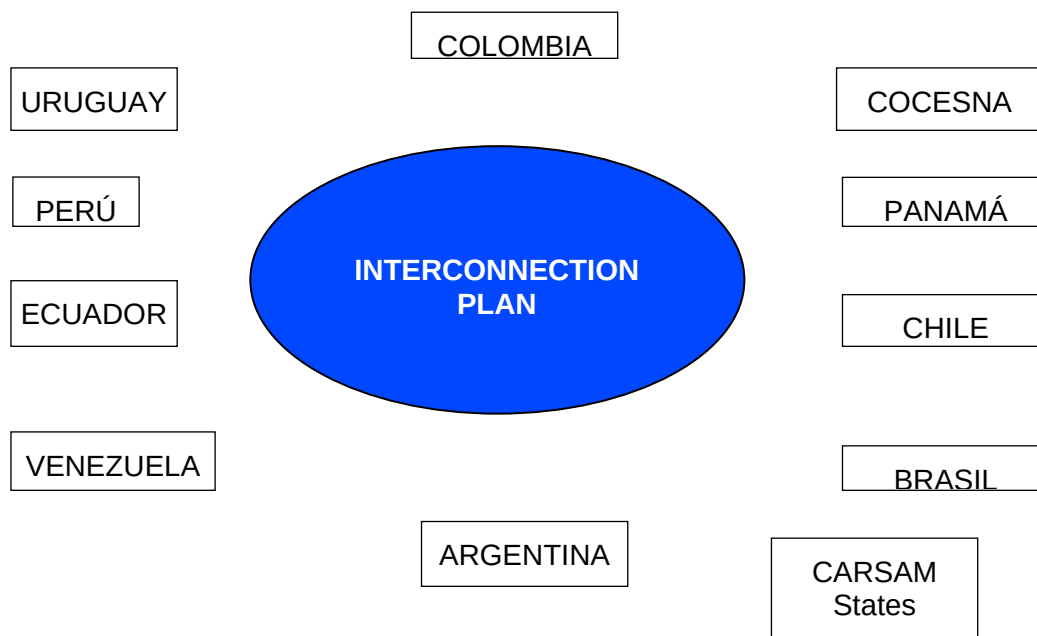
This interconnection plan is applicable in the context of the automated ATC Facilities, namely ACCs, of CAR/SAM States, with characteristics as follows:

The data flows will be established between adjacent ACCs, subject to formal operational agreements. Data will encompass:

- Flight plan data (up-dated); and
- Surveillance (Radar) data.

The data flow will occur in both directions.

FIGURE 1.3-1 CARSAM CONTEXT (WITH THE VISITED STATES)



1.4 Organization of the Document

This document presents the operational concept, objectives and strategies for the Interconnection of Automated Air Traffic Control Centers of the CAR/SAM Regions, and establishes the related Implementation Plan, according to the operational requirements presented by users. It also describes how the System will be used and its relationship with other existing systems.

This document is divided in the following chapters:

- | | |
|-----------|--|
| Section 1 | Purpose: introduction and overview of the system. |
| Section 2 | Reference documents: list of the applicable documents relevant to this document. |
| Section 3 | System or Current situation: describes the system or the current procedure that the user requires to be changed. |
| Section 4 | Justifies the nature of the changes: justifications for a new or a modified system and any restrictions to the current system. |
| Section 5 | Concepts of the new or the modified system: describes the system being proposed. |
| Section 6 | Operational Setting: describes one or more operational settings in the new or modified system. |
| Section 7 | Summary of the Impacts: impacts on the organization arising from the implantation of the new or the modified system. |
| Section 8 | Analysis of the proposed system: analysis of the advantages and disadvantages of the proposed system. |
| Section 9 | Notes: abbreviations and definitions used in this document. |

2. DOCUMENTS OF REFERENCE

STANDARDS

OLDI	Standard Document for On-Line Data Interchange (EUROCONTROL).
Preliminary CARSAM SICD	Preliminary System Interface Control Document for the Interconnection of ACC Centers of the CARSAM Region
SICD RADNET	System Interface Control Document for the EUROCONTROL RADNET
DOC 9705	Manual of Technical Provisions for the Aeronautical Telecommunication Network (ATN)
DOC 4444-PANS/ATM	AIR TRAFFIC MANAGEMENT
Annex 10 – Vol III	Aeronautical Telecommunications
ASIA/PACIFIC ICD FOR AIDC	ASIA/PACIFIC INTERFACE CONTROL DOCUMENT FOR ATS INTERFACILITY DATA COMMUNICATIONS

3. CURRENT SITUATION

3.1 Statements, Objectives and Scope

The interconnection of automated systems of Air Traffic Control Facilities of the CAR/SAM regions has the objective of establishing the automated transmission of flight plan data and surveillance data of the flights that are transitioning from one FIR to the adjacent FIR, as a way of improving the air traffic control coordination process and transfer of control of flights between affected Air Traffic Control Centers. The system's interconnection will be dependant upon the application of specific procedures and filtering criteria, that will allow the control of the process of the distribution of the information to accredited users only.

The Interconnection Plan is subject to further detailing in the operational agreements, to be established between the interested ATC Facilities.

3.2 Policies and Operational Restrictions

3.2.1 Organization

The ICAO SAM Regional Office (Lima) will coordinate the implementation of the plan with the States involved, publishing criteria and policies for the shared use of the information on flights, of strictly civil nature.

The implementation of the Plan demands the signing of operational agreements between the States interested in sharing the information.

Those agreements will give due considerations to all the relevant technical and operational aspects, with clear statement of the responsibilities and duties of each part, as well as the designation of the respective managers and points of contact.

Each participating State may define that portions of its FIR where surveillance and flight plan data are to be shared, observing, however, that the common areas of interest are large enough to allow the timely completion of air traffic coordination for all flights concerned, as established by ICAO Standards.

A specific Managing Committee will be created with a mandate of supervising the provisions and implementation of this Plan, coordinated by ICAO-Lima and having representatives of the participating States as members.

All the suggestions to enhance the Plan or to clarify operational questions shall be submitted to the consideration of ICAO-Lima.

3.2.2 Information Security

The usage of information made available according to this Plan shall remain restricted to applications of the civil air traffic control systems. For that, each participating State shall implement all reasonable measures in order to guarantee the integrity and confidentiality of information. Also, release of the information to third parties shall not be allowed without prior authorization of the Managing Committee, in written.

In order to assure the level of security for the information, the Management Committee may conduct periodical site visits, being in a position of denying the continuity of the interconnection service if there is a clear and serious risk of data corruption or misuse.

3.3 Current Scenario

At the time of elaboration of this document, many States and/or ANSPs own a national net of fixed radars and get a synthesis of the information received from those sensors which, complemented by flight plan information, constitutes basic data used for air traffic control. In addition to these data, other information from adjacent ATC Units may be fed into the automated systems, in order to provide a wider picture of the air traffic under their responsibility.

The transfer of responsibility of control of flights between adjacent Centers is initiated via transmission of data from the flight plans through AFTN messages and is finally accomplished through oral bilateral communications of the air traffic controllers on duty. This manual, non-automated process, has been identified as a root-cause of several operational mishaps.

The missions to States of the ICAO Experts for data gathering purpose on the current ATC systems installed throughout the region, resulted in the elaboration of a document of external interfaces (SICD), which presents the description of the internal characteristics of ATC systems installed in the CAR/SAM regions.

The SICD provides an easy overview of different systems installed at ATC Facilities in the Region, developed and installed by different suppliers, with each system having its own architecture and reflecting a certain technological development stage. Therefore, some systems already are prepared to allow for the use of advanced technologies, such as ADS/CDPLC, whilst others still rely upon the use of basic features.

The visits to States confirmed that the system most widely installed in the region is AIRCON 2000, provided by INDRA. A total of five Area Control Centers already rely on this system, however, there are different versions of the mentioned system, with some different functionalities.

Radar coverage in the different FIR is quite diverse, the case being that some of them have full coverage at upper airspace levels, whilst in others only a very limited radar coverage is provided.

Another aspect that has been observed is the great difference on how dependent certain States are of the supplier of the solution. Some ANSPs depend totally on the supplier to implement even very simple changes to the system, whilst others succeeded in having a technical team highly capable and up-to-date, that is capable of performing configuration changes as needed and specify new functionalities to optimize the provision of air navigations services.

Throughout the region, only one effective case of radar data sharing has been implemented, between Argentina and Uruguay, with some others being under consideration and at different stages of the corresponding bilateral agreements. However, there are no implementations or concrete plans that deal with the coordination of crossborder flights in an automated way between air traffic control centers.

Although the existing systems of most ATC Centers present the basic feature that would allow coordinating flight plans through the OLDI protocol, this function is not in use yet, mainly due difficulties shown by the local technicians to configure the system accordingly, as well as the apparent differences of implementations of the protocol by the systems providers. In one case, a tentative establishment of flight plan coordination between two adjacent ACCs using OLDI went unsuccessful, probably due the differences of implementation of the protocol by competing providers.

Some ATC Systems make use of coordination messages (CDN, LAM, ACP) as specified in ICAO Document 4444-PANS/ATM for flight plan coordination between adjacent ACCs, this being the specific case of Brazil (where plans of eventually using OLDI for the same purpose and upgrading to AIDC are in place).

Also, Venezuela too has the capacity to coordinate through ICAO Document 4444-PANS/ATM Messages, and, although it is not been used operationally, this feature has been subject to feasibility demonstration during the interconnection tests conducted between Amazon-FIR and Maiquetía-FIR, that were realized in the scope of RLA/98/003.

Overall, only Chile makes operational use of an OLDI protocol implementation, in order to accomplish automated air traffic coordination between its ACC and national Approach Control Centers.

3.4 Organizations and Interested Users

The initial clients of the current Plan are the Air Navigation Service Providers of States or Organizations of the CAR/SAM regions that have, or are in the process of acquiring automated systems of air traffic control and, in the interest of better service provision for the end user, should take all reasonable action in order to share relevant surveillance and flight data information of operational interest.

3.5 Supporting Strategy

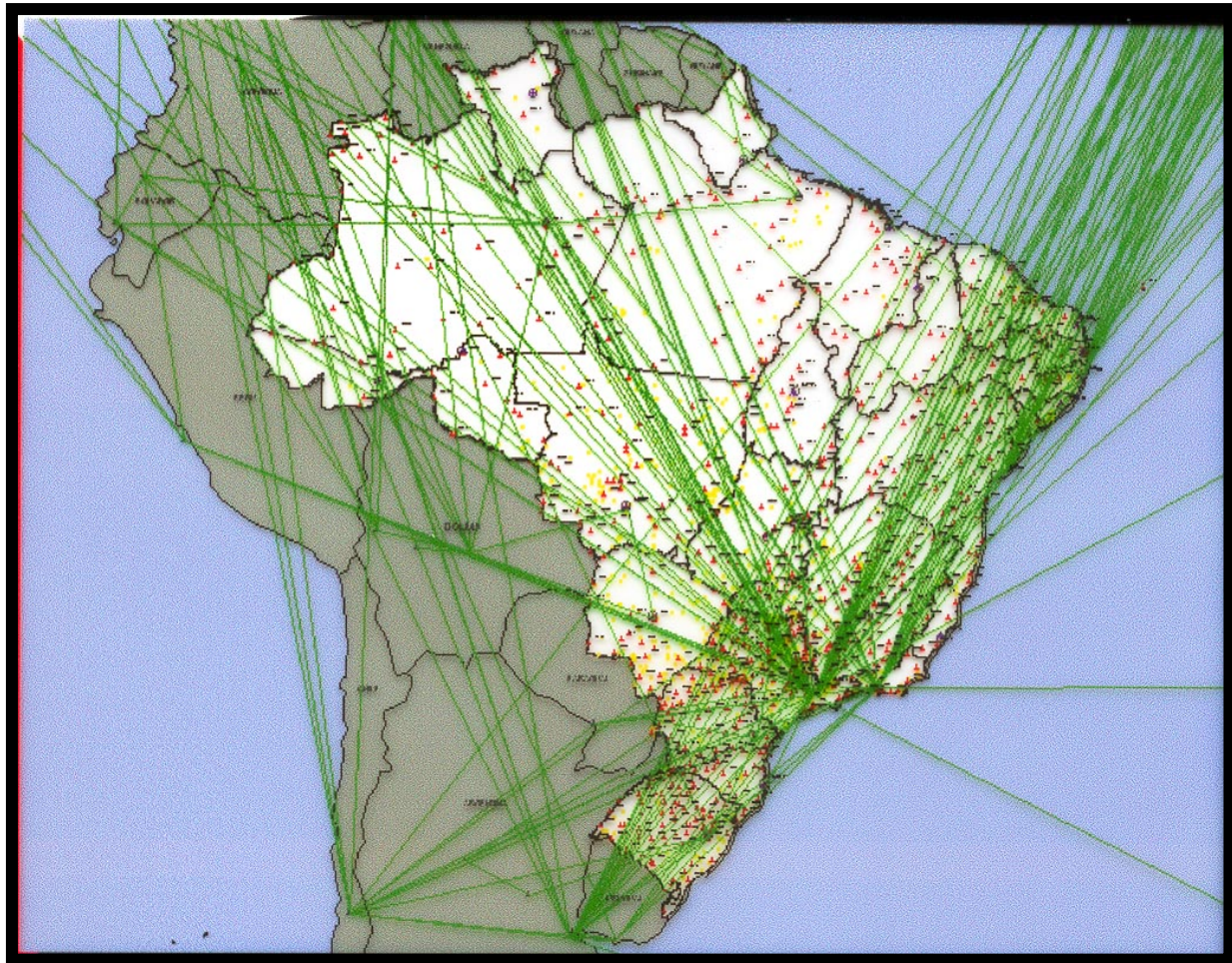
The implementation of the Automated ATC Systems Interconnection Plan counts on an active coordination role of ICAO, besides a strategy of fostering the support of the end users of the current system to speed up the interconnection implementation activities.

4. JUSTIFICATION AND NATURE OF CHANGES

The air traffic services are provided in accordance to the standards, recommended practices and procedures for air navigation services, as published by ICAO. The units in charge of those services encompass the Area Control Centers (ACC), Approach Control Centers (APP) and Aerodrome Control Towers (TWR).

Major air traffic flows in the CAR/SAM regions, as shown on figure 4-1, cross the borders of several Flight Information Regions and areas of responsibility of the corresponding ACCs.

FIGURE 4-1 CAR/SAM MAJOR TRAFFIC FLOWS



At the transition of flights from the area under the responsibility of one Air Traffic Control Unit to the next, the continuity of the air traffic services depends mostly of the timely and correct coordination between the ATC Units in charge, shown in figure 4-2.

The implementation of the REDDIG solved the communication deficiency, but the introduction of the Reduced Vertical Separation Minima(RVSM), the increase of the air traffic at international routes and air transport market characteristics that concentrate flights and generate peak loadings at certain hours, brought along new operational requirements and demand new, automated and integrated, solutions for improved air traffic control coordination. Any case, the need for a reduction in verbal coordination between adjacent control positions and ATC units has been consistently identified by ICAO and many ANSPs, worldwide.

Inefficiencies in the coordination process have been appointed as contributing to air traffic incidents and aircraft accidents and, therefore, a provision of ATS Safety Management calls for the *“automation systems {to} generate and display flight plan, control and coordination data in a timely, accurate and easily recognizable manner and in accordance with Human Factors principles”*.

4.1 “NON AUTOMATED” AIR TRAFFIC COORDINATION

The coordination and transfer of control of a flight between successive ATC units and control sectors is normally be effected by a dialogue comprising the following stages:

- a) notification of the flight in order to prepare for coordination, as necessary;
- b) coordination of conditions of transfer of control by the transferring ATC unit;
- c) coordination, if necessary, and acceptance of conditions of transfer of control by the accepting ATC unit; and
- d) the transfer of control to the accepting ATC unit or control sector.

Although there are ICAO provisions and internal rules in each State for the use of standard expressions to be used in this process, it is known that situations vary a lot and the standard expressions, as well as letters of agreement, may not be enough to treat properly every case. Furthermore, although even the AFTN may be used for the exchange of coordination messages (CDN, LAM, ACP), what really happens is that the process is bound to the limitations of the human oral communication through telephone, and not always in the language that is the native idiom of the air traffic controllers involved.

There is an additional difficulty, arising from the increased workload that air traffic controllers have recently being faced with in the Region due to a growing demand of aircraft movements, a situation at which the other typical activities of tactical air traffic control may “compete” with the demands arising from the coordination process, consequently, making it more compelling to automate this process in order to alleviate the work load. Obviously, the flight plan and control information has to be transmitted in sufficient time to permit reception and analysis of the data by the receiving unit and necessary coordination between the units concerned.

Finally, recent information on Large Height Deviations (LHD) that were made public by the CARSAMMA (NE03/AP/ATM/13), indicate that the TLS for the RVSM operations at the CAR/SAM regions may not being maintained. For this reason, short term actions are urgently required in order to revert the unacceptable situation of more risks than those admitted by the TLS assessment. Among the main measures to be taken, the one to improve the air traffic coordination through interconnection of the ATC automated centers has been identified as a major initiative of capital interest.

4.2 “AUTOMATED” AIR TRAFFIC COORDINATION

The interconnection of the automated ATC centers, with the purpose of improving the air traffic coordination, needs an automatic interchange of the data from the surveillance subsystem and data from the flight plan processing subsystem, as set forth in the reference SICD.

ICAO provisions clearly recommend that *“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”* (PANS/ATM, 8.1.6).

In the same line, at the regional level it has been stated at several occasions that the *“Progressive implementation of ATS interfacility data communications (AIDC)”* will enhance the safety of the airspace and would reduce category “M” error. Code M stands for Error in ATC-unit to ATC-unit transition messages, and account for the largest cause of LHDs since the monitoring system went into operation.

Based on the availability of surveillance systems coverage at areas of common interest of different FIRs, the following scenarios for automated data interchange can be identified:

- 1) Only surveillance data interchange;
- 2) Only flight plan data interchange; and
- 3) Both surveillance data interchange and flight plan data interchange.

4.2.1 Scenario 1 - Only surveillance data interchange

This case is limited to the situations where surveillance system (radar, ADS) coverage is available at the limits of adjacent FIRs and where, for some reason, there is no sharing and integration of radar data in the respective control centers.

Regarding this case, ICAO recommends that *“States should, to the extent possible, facilitate the sharing of information derived from ATS surveillance systems in order to extend and improve surveillance coverage in adjacent control areas”* (PANS/ATM, 8.1.5).

The recommended solution for surveillance data interchange is to share radar data, which should be implemented according the pertinent decisions of GREPECAS.

4.2.2 Scenario 2 - Only flight plan data interchange

This case covers the situations where there is NO coverage of the surveillance system (radar, ADS) at the limits of adjacent FIRs. Therefore, the data interchange is limited to the flight plan data, as updated by the correspondent flight plan processing system.

The automated exchange of updated flight plan data between adjacent ATC Centers has been classified of utmost importance for the optimization of air traffic coordination.

4.2.3 Scenario 3 - Both surveillance data interchange and flight plan data interchange

This is the situation where there is coverage of the surveillance system (radar, ADS) at the limits of adjacent FIRs and the interchange of flight plan data could also be obtained through the interconnection of the automated systems.

5. CONCEPTS FOR AUTOMATED ATC SYSTEMS INTERCONNECTION

5.1 Interconnection Levels

Based on the technical information gathered at Control Centers of the CAR/SAM region, as consolidated in the reference SICD, several levels of System Interconnection can be established, in regard of the coordination and exchange of flight plan data as well as exchange of surveillance data at areas of common interest.

The established interconnection levels are deemed to serve as planning factors for the definition of the implementation strategies, since they characterize and categorize the current stage and readiness of each ATC Center for such interconnection.

5.2 Flight Plan Data Exchange

The following table shows the Flight Plan Interconnection Levels identified:

Flight Plan Data Interconnection Level	Communication Protocol	State/ATC Center	Notes
1	AIDC	Argentina (Ezeiza, Cordoba)	System contemplated, but not used yet.
2	OLDI	Argentina, Chile, Colombia, Ecuador, Panamá, Uruguay, and CENAMER	System contemplated, but not used, with the exception of Chile.
3	ICAO Doc 4444 Coordination	Brazil, Venezuela	Implemented in the ACCs of Brazil for coordination between Internal Air Traffic Control Centers.
4	ICAO Doc 4444 (Manual Messages)		

TABLE 5.2-1 FLIGHT PLAN INTERCONNECTION LEVEL

5.2.1 AIDC Application

The passing of data on individual flights, over telephone, as part of the co-ordination process has always been a major support task at ATC units, particularly at Area Control Centers (ACC). Therefore, the operational use of direct connections between Flight Data Processing Systems (FDPS) at ACCs for the purpose of replacing such verbal "estimates", referred to as On-Line Data Interchange (OLDI), began within Europe in the early nineteen eighties.

ATS interfacility data communication (AIDC), as defined by ICAO, stands for automated data exchange between air traffic services units, particularly in regard to coordination and transfer of flights.

AIDC is an ATN application that is used by two air traffic service units to enable the exchange of ATS information for active flights related to flight notification, flight coordination, transfer of control, surveillance data and free (i.e. unstructured) text data.

AIDC application functions are applicable to normal-priority flight safety messages, encompassing the following:

- flight notification;
- flight coordination;
- transfer of control;
- transfer of communications;
- transfer of surveillance data; and
- transfer of general data.

The technical provisions for the AIDC application are defined in ICAO Doc 9705, Sub-volume III. An example of regional AIDC implementation may be found in the Asia/Pacific AIDC ICD, as referenced in this document.

It should be noted that provisions on the AIDC application are currently also contained in ICAO Doc 4444, according to which AIDC messages, include:

- notification messages;
- coordination messages;
- transfer of control messages;
- general information messages; and
- application management messages.

When the transfer of control involves exchange of data, the proposal for transfer shall include information derived from an ATS surveillance system, if appropriate.

5.2.2 OLDI Protocol

The passing of data on individual flights, over telephone, as part of the co-ordination process has always been a major support task at ATC units, particularly at Area Control Centers (ACC). Therefore, the operational use of direct connections between Flight Data Processing Systems (FDPS) at ACCs for the purpose of replacing such verbal "estimates", referred to as On-Line Data Interchange (OLDI), began within Europe in the early nineteen eighties.

Through the use of OLDI, an ATC system may become able to:

- receive OLDI messages;
- process them automatically in accordance with this Standard;

- output flight data in accordance with the message received, and display required warnings in case of inconsistency in the data received;
- generate and transmit acknowledgement messages automatically at the application level.

Reliability on every OLDI link shall be at least 99.86 % (equivalent to a downtime of not more than 12 hours per year based on 24-hour availability). Additional information on the OLDI Protocol, including message categories, contents, classification and transaction times, may be found in the reference documentation.

5.2.3 ICAO Doc 4444-PANS/ATM Coordination Messages

ICAO Doc 4444-PANS/ATM contains provisions for coordination messages, that are authorized for transmission via the aeronautical fixed service (including the aeronautical telecommunication network (ATN) and the aeronautical fixed telecommunication network (AFTN), direct-speech circuits or digital data interchange between ATS units, and direct teletypewriter and computer-computer circuits), or via the aeronautical mobile service, as applicable.

Coordination messages (priority FF), include:

- current flight plan messages (CPL);
- estimate messages (EST);
- coordination messages (CDN);
- acceptance messages (ACP); and
- logical acknowledgement messages (LAM).

The method of message exchange shall also be dependent upon the availability of adequate communications channels, the function to be performed, the types of data to be exchanged and the processing facilities at the centres concerned.

Basic flight plan data necessary for air traffic control purposes shall be furnished to the first en-route control centre at least 30 minutes in advance of the flight, and to each successive centre at least 20 minutes before the aircraft enters that centre's area of jurisdiction, in order for it to prepare for the transfer of control. The second en-route centre and each successive centre shall be provided with current data, including updated basic flight plan data, contained in a current flight plan message or in an estimate message supplementing already available updated basic flight plan data.

5.3 Surveillance Data Exchange

The following table shows the Surveillance Interconnection Levels identified:

Surveillance Data Interconnection Level	Communication Protocol	Notes
1	Intercenter ASTERIX cat 62,63	Ecuador
2	Proprietary Intercenter ICD	Brazil, Venezuela
3	ASTERIX ICD Radar	
4	Proprietary ICD	Uruguay, Argentina
5	No shared Data	

TABLE 5.3-1 SURVEILLANCE DATA INTERCONNECTION LEVEL

Examples of current interconnection:

- Data Transmission between Uruguay and Argentina, thorough Aircat 500 protocol;
- Essay of Interconnection Brazil – Venezuela using Flight Plan Coordination Level 3 and Surveillance Data Interconnection Level 2 (ACC Interconnection Trials - 2006)

5.3.1 ASTERIX Protocol

ASTERIX has been designed as a flexible way of encoding surveillance related information to be exchanged between users. It is characterised by the grouping of information in data categories and the flexible generation of messages in order to save bandwidth in the transmission.

For the various applications within the surveillance domain, individual data categories are defined. This allows the designer of a system to implement exactly what is needed, not more and not less. The software to be implemented can be tailored exactly to the function of the respective system. Should at any stage additional functionality be required, the necessary interface can easily be added by integrating the ASTERIX category defined for the specific application.

The same flexibility applies to the generation of the ASTERIX messages itself. Subdividing the whole information into individual data-items, a message can be composed according to the information available. Items carrying no information are simply left out when creating the message. The FSPEC, a sort of "Table of Contents" for each ASTERIX message precedes the data items, indicating unambiguously to the receiving system, which data items are present and which are not. This allows the processing to be adapted to the real message contents. There is no need anymore to transmit useless bits and bytes or to skip unwanted information in a message.

The sequence of items in the message has been defined in the co-called “User Application Profile” UAP. The application domain of ASTERIX has constantly expanded, and ASTERIX has now been adopted world-wide as the standard format for exchanging data from primary, secondary, monopulse, Mode S and weather radars, and also for carrying multiradar data, data-link, SMGCS, control & monitoring, etc.

5.3.1.1 Relevant ASTERIX Categories

To implement the ASTERIX data format in a structured way, the set of documentation has been subdivided into **Parts**, each of which grouping the data for a specific application and purpose. Each ASTERIX Part contains one or more **Data Categories**. The information contained in these categories is dedicated to a specific area of application and defines which data in which format is to be transmitted between the users of these applications.

Each category consist of a **Catalogue of Data Items**, with the Data Item being the smallest unit of standardised information. This categorisation serves multiple purposes:

- it is easy to identify the application;
- The dispatching of the data to the appropriate task within the receiving system is facilitated;
- only the category for applications implemented in the user system have to be implemented.

Up to **256 Data Categories** can be defined and their usage is as follows:

- Data Categories **000 to 127** for standard civil and military applications;
- Data Categories **128 to 240** reserved for special military applications;
- Data Categories **241 to 255** used for both civil and military non-standard applications.
- The categories relevant for the interconnection of automated systems are as follows:
- ASTERIX Cat 001 - Monoradar Data Target Reports, from a Radar Surveillance System to an SDPS (plots and tracks from PSRs, SSRs, MSSRs, excluding Mode S and ground surveillance)
- ASTERIX Cat 002 – Monoradar Service Messages (status, North marker, sector crossing messages)
- ASTERIX Cat 008 – Monoradar Derived Weather Information
- ASTERIX Cat 034 – Next version of Category 002 (PSR Radar, SSR Radar, M-SSR Radar and Mode-S Station)
- ASTERIX Cat 048 – Next version of Category 001 (PSR Radar, SSR Radar, M-SSR Radar and Mode-S Station)
- ASTERIX Cat 062 – System Track Data (Surveillance Data processing System (SDPS))
- ASTERIX Cat 063 – Sensor Status Messages (Surveillance Data processing System (SDPS))

- ASTERIX Cat 253 – Remote Station Monitoring and Control Information (Used by RMCDE/RMCDS)
- ASTERIX implementations also incorporate a User Application Profile (UAP), i. e., a mechanism whereby the correspondence between Data Items and Data Fields shall be standardized for each application making use of the ASTERIX message structure. Besides, there is a special feature, called Special Purpose field, allowing a user subgroup to exchange a variable length field which shall be transparent to non-interested users.

5.3.2 Proprietary Radar Data Protocols

Until the 1980s and previously the existence of ASTERIX, every National Administration developed its own format for delivering radar data to Air Traffic Control Centres. This is a situation that still persists in some surveillance Facilities, but it makes exchange of radar data across borders a more complicated issue. The proprietary radar data protocols still in use in the CAR/SAM regions are listed in the reference SICD.

5.4 Requirements

The interconnection of automated ATC Centers shall be in compliance with the following requirements:

- Allow the transference of flight plans between adjacent ATC Centers in an automated manner, in addition to the manual coordination over telephone;
- Allow the sharing of surveillance data (mostly radar) at areas of common interest.

5.5 Solutions

The analysis of the current state of readiness for interconnection of ATC Centers in the region shows different technological stages at each State or ACC, which guides the implementation strategy for the adoption of interconnections alternatives, with their associated costs and benefits.

Of course, the ideal solution would be the accomplishment of interconnection of all ATC Centers in the Region, making use of advanced technologies and standardized communication protocols, but also demanding major investments by most States and/or ANSPs, and that might constitute a critical factor for successful implementation.

Therefore, the alternate possibility of considering implementation of the interconnection of ATC Centers by stages, with short, medium and long term objectives, has been developed and is being proposed in this Plan.

Nevertheless, at the time of bilateral agreement negotiations, institutional aspects of sharing surveillance information should be considered, in order to cope with unique specifications of different Centers.

A basic part of the implementation strategy is the specification of the REDDIG as the primary means for all required data communication.

Based on these aspects, the following interconnection possibilities were considered:

5.5.1 Bilateral Interconnection (Center to Center)

This is done when a common protocol is established to exchange de data of flight plans and radars between two neighbor States, with the necessary adjustments to integrate those data in each system.

This way has the advantage of establishing short period actions and using the existing technologies common to each neighbor State. With this, it is possible to use the existing technical knowledge and resources saving money and means.

The adoption of this option should follow the steps:

- Establish a transition area where the vigilance data will be shared;
- Agreement about the necessary interfaces, establishing, hence, the communication protocols for exchange of information;
- Configuration of the Flight and Radar Plan connections, with adjustments in each system, which might involve:
 - Physical configuration of the lines;
 - Logical configuration of the lines through files of configurations and generations of data base;
 - Occasional alteration of the software in order to include protocol differences or functionalities;
 - Occasional use of protocol converters and interconnection equipments;
- Configuration of the means of data communication, preferably through REDDIG;
- Hiring of a firm or system provider to do the modifications;
- Establishing of a Work Schedule to do coordinated actions;
- Making of a book of procedures for the tests of the connections;
- Tests;
- Establishing of a formal procedure of Interconnection Confirmation;
- Follow-up on the operation of the air traffic coordination under the aspects of availability, integrity, trustworthy with monitoring of the data communication traffic;
- Data gathering for the statistics of Air Traffic and the establishment of performance indicators to evaluate the cost-benefit of the interconnection.

Ex: Brasil – Venezuela (ACC Maiquetía – ACC Amazonico) Interconnection Trials

5.5.2 Multilateral Interconnection Solution

As a benchmark, the Project Team analyzed the European solution for surveillance data integration by means of the “RADNET” (Radar Data Network), a European initiative that provides a network specifically to facilitate extensive surveillance data sharing. In this network, all data (radar and ADS-B) from different sites/locations in several European States are received at the specific interface of each sensor, converted to standard ASTERIX format and shared according to a geographical filtration based on each State interests.

The basic equipment is the RMCDE (Radar Message Conversion and Distribution Equipment), which normally is first applied to give support to national programs of modernization. Later on, the equipment also provides for a given State to connect with adjacent States’ Facilities to exchange surveillance data of common interest and, at advanced stages, the same physical equipment allows for integration to a radar data net that is flexible and of a wide-spanning range.

It allows that any kind of radar data be used by any kind of user anywhere. That is why many States chose, in the past, the RMCDE as the base element for its national infra-structure of radar communication.

As it was demonstrated successfully by the European RADNET, the RMCDE allows the construction of national nets or multinational communication. The ATC Centers will not have to be connected separately to all the sensors, but may obtain total coverage through radar, independently of its geographical location or the location of the radar stations.

The RMCDE allows the use of old sensors with new equipments that process radar and vice-versa. This guarantees a security to the investment and helps States or centers to separate the modernizations of the radar stations from the modernizations of the RDP, allowing a smooth transition step by step to this new technology.

In general, the following steps are necessary:

- Recognition Mission to find out about the implanted solution in the EUROCONTROL context, to know the options used, limitations and performance restrictions, as well as requirements for the implementation;
- Contact with the suppliers, giving priority to the usage of COTS equipments and software;
- Creation of a Work Plan that involves all the necessary activities and definition of responsibilities among the States that are part of the enterprise, including:
 - Acquisition activities;
 - Costs survey;
 - Creation of a schedule for payment in infra-structure investment;
 - Survey of the estimated traffic and necessary adaptation for the current REDDIG net to accommodate the new data flow;
 - Definition of the protocols that are going to be used at the beginning, as well as provision for the usage other vigilance data such as ADS-B;

- Establish each State activity for the integration of the information on their respective system;
- Establish a proof-of-concept project for the validation of the concept and future expansion.

5.5.3 Interim Alternate Solution for Sharing of Surveillance Data

On the case of States that borders Brazil, there is a possibility of establishing stand-alone clients to use the radar data of the border region, using the SISTRASAG system, which is in its final stages of development.

The SISTRASAG is a system that aims to allow Brazil to distribute selectively the synthesis of the national radar to the Clients that need to use the data for their operational planning.

It is going to be implanted a redundant Server-Distributor, with the ability to connect itself to at least thirty-two first level Clients.

The communications will be limited to the functions implanted in the system itself, which are necessary for the request, confirmation and distribution of the information between Server-Distributor and the Clients.

The system should be implemented in order to allow interactions Server/Client through the following ways:

- INTERNET;
- Local Net;
- Dialing Line or Dedicated Line;

Each client will pay for the telecommunications allocated to their needs.

The SISTRASAG System Synchronism is implemented through a time reference of the system installed in Brasília.

However, each client will be responsible for adjusting its own clock (computer clock) within the limits that will not hinder the data interpretation given.

5.5.3.1 Organizational Impacts

The effective implantation of the SISTRASAG will result in a series of impacts, both immediate and future, described as follow:

The distribution of the radar synthesis through the SISTRASAG will allow the Organizations to use those information when planning their operational activities.

The system will allow ATC organizations that need to have some knowledge of the air situation in general, to do so in a simple manner and safely.

Impacts during the SISTRASAG Implementation:

- It will be necessary to fit the SISTRASAG to attend the requirements for the necessary performance to coordinate the air traffic.

The figure 5.5.4-1, that follows, presents a diagram of the SISTRASAG.

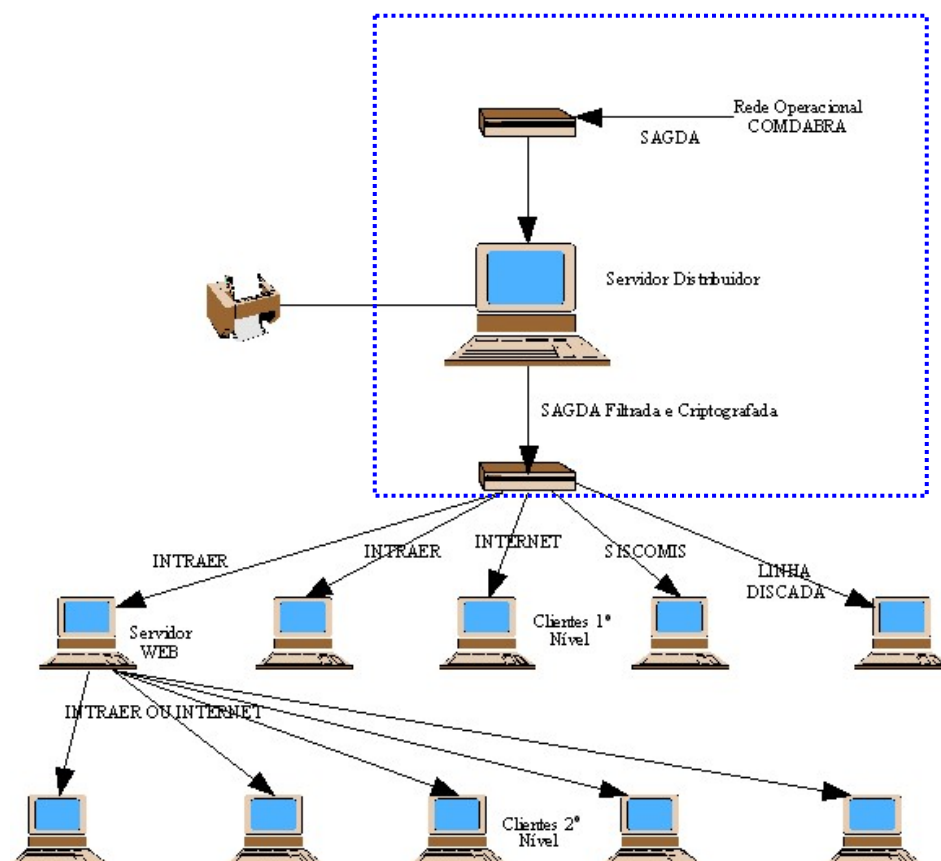


FIGURE 5.5.4-1 – SISTRASAG DIAGRAM

The Figure 5.5.4-2 presents a detailed diagram of the connection between Server-Distributor and Clients Level 1 (that represents, on the Figure 5.5.4-1, above the contents of the broken line area).

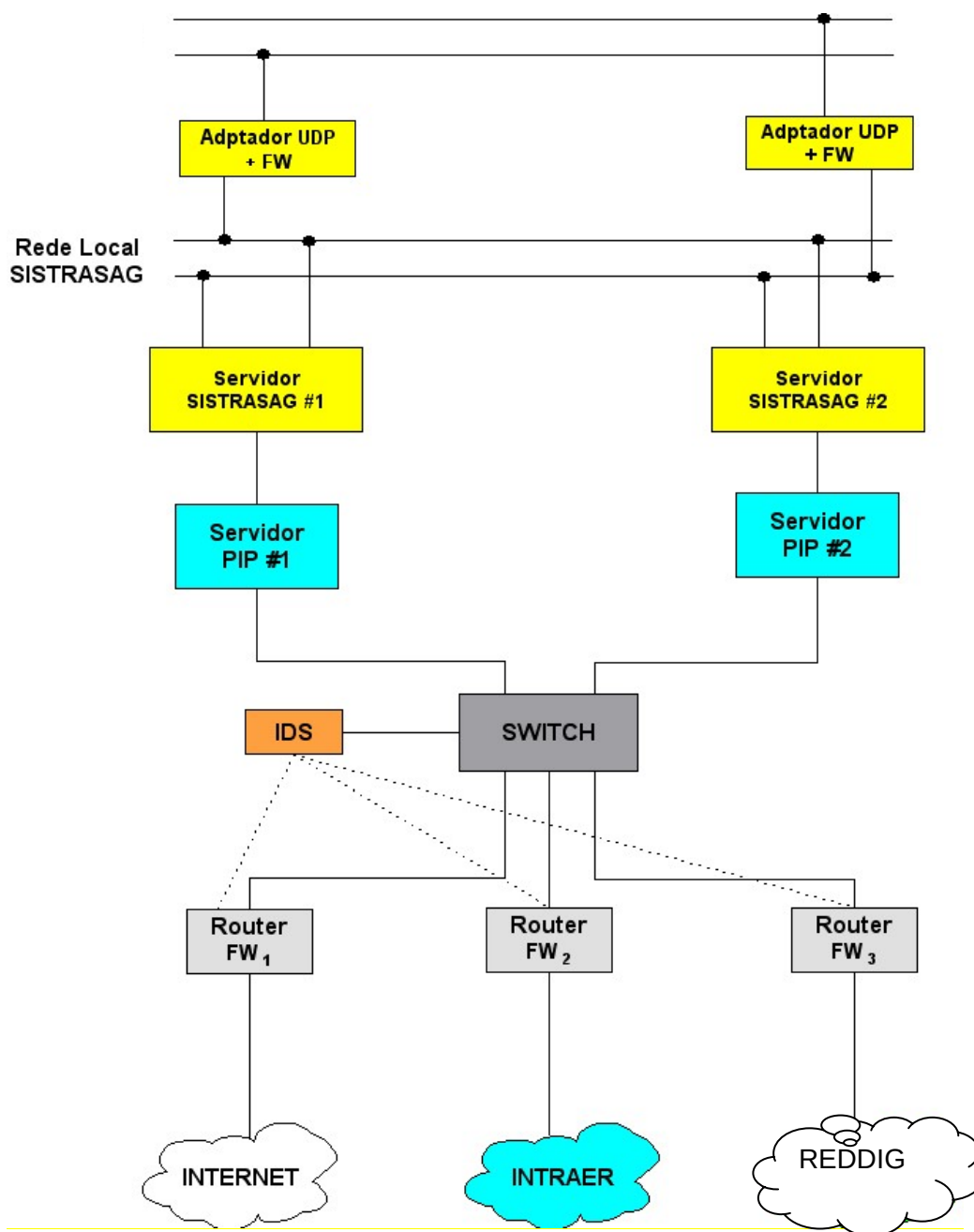


FIGURE 5.5.4-2 – SERVER/LEVEL 1 CLIENT CONNECTION DIAGRAM

On the above figure, it is possible to note the implementation of protection walls (“firewalls”) and intrusion monitoring (IDS – “Intrusion Detection System”) so as to insure net safety.

5.5.3.2 Hardware

The SISTRASAG configuration will happen according to the description presented on the document of Technical Specification of Basic Hardware and Software of the SISTRASAG. The following table transcribes the configuration table of the document:

TABLE 5.5.3.2-1 - TYPICAL HARDWARE COMPOSITION FOR THE CLIENT

Position	Quantity	Hardware configuration
Client Level 1 Desktop	1*	HP dx2250 Microtower - AMD Athlon 64 3800+ Dual Core 2.0GHz Processor; 1 GB RAM PC2-5300 DDR - 667 MHZ (2x512MB); 80 GB SATA SMART III 7200 HDD; 48x/32x CD-RW/DVD-ROM Combo Drive; Integrated ATIX300 Radeon Graphics; Realtek 8100c 10/100 LAN controller; HP PS/2 standard Keyboard; HP USB optical scroll mouse.
Client Level 1 Laptop	1*	Laptop DELL Latitude D620 - Intel Core 2 Duo T5500 1.66GHz Processor; 2M L2 Cache; 14.1 inch wide Screen WXGA LCD Panel; 1.0GB DDR2-533 SDRAM; 80GB 5400rpm Hard Drive; 24x CD-RW/DVD; Intel Integrated Graphics Media Accelerator 950; Dell Wireless 1390 802.11g Mini Card; 56K v92 Internal Modem; 10/100/1000 Gigabit Ethernet Network Adapter; Serial Port; 4 USB Ports 6 Cell Primary Battery; 65W A/C Adapter.

5.5.3.3 Software

The software will be supplied with the basic visualization functions, operating on LINUX platform.

5.5.3.4 Installation of the SISTRASAG System

The hardware and software installation is documented in the SISTRASAG Manual of Installation.

5.5.3.5 SISTRASAG Servers

The Server-Distributor of the SISTRASAG system will be implanted in Brasília – DF.

5.6 Solution Allocation for the Interconnection of the ACC Centers

The Interconnection Levels were allocated using the following convention:

A – Current Level of Interconnection

S – Possibility of Surveillance Radar Data Sharing using SISTRASAG

P – Possibility of Interconnection using the current Air Traffic Control System

P* - Possibility of interconnection using the Air Traffic Control System that is being installed

The following tables show the solution that might be used for each ACC and their Adjacent ACC in a specific State:

STATE: ARGENTINA										
ACC	ACC ADJ	FLIGHT PLAN				SURVEILLANCE				
		INTERCONNECTION LEVELS				INTERCONNECTION LEVELS				
		1	2	3	4	1	2	3	4	5
CORDOBA INSTAL.	ASSUNÇÃO				A					A
	LA PAZ				A					A
	EZEIZA	P*	P*		A	P*		P*		A
	MENDOZA				A					A
	RESISTENCIA				A					A
RESISTENCIA (NON-AUTO)	ASSUNÇÃO				A					A
	CORDOBA				A					A
	CURITIBA				A					A
	MENDOZA				A					A
	MONTEVIDEO				A					A
EZEIZA	RIVADAVIA				A					A
	MENDOZA				A					A
	SANTIAGO		P*		A			P*		A
	CORDOBA	P*	P*		A	P*		P*		A
	RESISTENCIA				A					A
	JOHANNESBURG				A					A
	MONTEVIDEO		P*		A	P*			A	
MENDOZA (NON AUTO)	EZEIZA				A					A
	SANTIAGO				A					A
	CORDOBA				A					A
RIVADAVIA (NON-AUTO)	EZEIZA				A					A
	SANTIAGO				A					A

TABLE 5.6-1 INTERCONNECTION LEVELS FOR ARGENTINA

STATE: BRASIL										
ACC	ACC ADJ	FLIGHT PLAN				SURVEILLANCE				
		INTERCONNECTION LEVELS				INTERCONNECTION LEVELS				
		1	2	3	4	1	2	3	4	5
AMAZÔNICO	BRASÍLIA			A				A		
	BOGOTÁ				A			P		A
	GEORGETOWN				A				S	A
	LA PAZ				A				S	A
	LIMA				A				S	A
	MAIQUETIA			P	A		P			A
	PARAMARIBO				A				S	A
	RECIFE			A				A		
	ROCHAMBEAU				A				S	A
	ATLÂNTICO				A					A
BRASÍLIA	AMAZÔNICO			A				A		
	CURITIBA			A				A		
	LA PAZ				A				S	A
	RECIFE			A				A		
	ATLÂNTICO				A					A
CURITIBA	ASSUNÇÃO				A				S	A
	BRASÍLIA			A				A		
	LA PAZ				A				S	A
	MONTEVIDEO				A			P		A
	RESISTÊNCIA				A				S	A
	ATLÂNTICO				A					A
RECIFE	AMAZÔNICO			A				A		
	BRASÍLIA			A				A		
	ATLÂNTICO				A					A
ATLÂNTICO (NON-AUTO)	AMAZÔNICO				A					A
	BRASÍLIA				A					A
	CURITIBA				A					A
	DAKAR				A					A
	JOHANNESBURG				A					A
	LUANDA				A					A
	MONTEVIDEO				A					A

STATE: BRASIL										
ACC	ACC ADJ	FLIGHT PLAN				SURVEILLANCE				
		INTERCONNECTION LEVELS				INTERCONNECTION LEVELS				
		1	2	3	4	1	2	3	4	5
	RECIFE				A					A
	ROCHAMBEAU				A					A

TABLE 5.6-2 INTERCONNECTION LEVELS FOR BRAZIL

STATE: BOLIVIA										
ACC	ACC ADJ	FLIGHT PLAN				SURVEILLANCE				
		INTERCONNECTION LEVELS				INTERCONNECTION LEVELS				
		1	2	3	4	1	2	3	4	5
LA PAZ (NON-AUTO)	AMAZÔNICO				A				S	A
	ASSUNÇÃO				A					A
	BRASÍLIA				A				S	A
	CURITIBA				A				S	A
	CORDOBA				A					A
	LIMA				A					A
	SANTIAGO				A					A

TABLE 5.6-3 INTERCONNECTION LEVELS FOR BOLIVIA

STATE: CHILE										
ACC	ACC ADJ	FLIGHT PLAN				SURVEILLANCE				
		INTERCONNECTION LEVELS				INTERCONNECTION LEVELS				
		1	2	3	4	1	2	3	4	5
SANTIAGO	CORDOBA		P		A			P		A
	LIMA				A					A
	LA PAZ				A					A
	MENDOZA				A					A
	RIVADAVIA				A					A

TABLE 5.6-4 INTERCONNECTION LEVELS FOR CHILE

STATE: COLOMBIA										
ACC	ACC ADJ	FLIGHT PLAN				SURVEILLANCE				
		NÍVEIS DE IMPLEMENTAÇÃO				NÍVEIS DE IMPLEMENTAÇÃO				
		1	2	3	4	1	2	3	4	5
BOGOTÁ	AMAZÔNICO				A			P	S	A
	GUAYAQUIL		P		A			P		A
	LIMA				A					A
	MAIQUETIA				A			P		A
	PANAMÁ		P		A			P		A
	BARRANQUILLA		P		A			P		A
BARRANQUILLA	MAIQUETIA				A			P		A
	PANAMÁ		P		A			P		A
	BOGOTÁ		P		A			P		A
	KINGSTON				A					A
	CURAÇAO				A					A

TABLE 5.6-5 INTERCONNECTION LEVELS FOR COLOMBIA

STATE: ECUADOR										
ACC	ACC ADJ	FLIGHT PLAN				SURVEILLANCE				
		INTERCONNECTION LEVELS				INTERCONNECTION LEVELS				
		1	2	3	4	1	2	3	4	5
GUAYAQUIL	BOGOTA		P		A	P		P		A
	LIMA				A					A
	CENAMER				A					A

TABLE 5.6-6 INTERCONNECTION LEVELS FOR ECUADOR

STATE: FRENCH GUYANA										
ACC	ACC ADJ	FLIGHT PLAN				SURVEILLANCE				
		INTERCONNECTION LEVELS				INTERCONNECTION LEVELS				
		1	2	3	4	1	2	3	4	5
ROCHAMBEAU	AMAZÔNICO				A				S	A
	PARAMARIBO				A					A
	PIARCO				A					A
	ATLANTICO				A					A

TABLE 5.6-7 INTERCONNECTION LEVELS FOR FRENCH GUYANA

STATE: GUYANA										
ACC	ACC ADJ	FLIGHT PLAN				SURVEILLANCE				
		NÍVEIS DE IMPLEMENTAÇÃO				NÍVEIS DE IMPLEMENTAÇÃO				
		1	2	3	4	1	2	3	4	5
GEORGETOWN	AMAZONICO				A				S	A
	PIARCO				A					A
	MAIQUETIA				A					A
	PARAMARIBO				A					A

TABLE 5.6-7 INTERCONNECTION LEVELS FOR GUYANA

STATE: PANAMA										
ACC	ACC ADJ	FLIGHT PLAN				SURVEILLANCE				
		INTERCONNECTION LEVELS				INTERCONNECTION LEVELS				
		1		3	4	1	2	3	4	5
PANAMA	BOGOTA		P		A			P		A
	BARRANQUILLA		P		A			P		A
	CENAMER		P		A			P		A

TABLE 5.6-8 INTERCONNECTION LEVELS FOR PANAMA

STATE: PARAGUAY										
ACC	ACC ADJ	FLIGHT PLAN				SURVEILLANCE				
		INTERCONNECTION LEVELS				INTERCONNECTION LEVELS				
		1	2	3	4	1	2	3	4	5
ASSUNCION (NON-AUTO)	CURITIBA				A				S	A
	LA PAZ				A					A
	RESISTÊNCIA				A					A

TABLE 5.6-9 INTERCONNECTION LEVELS FOR PARAGUAY

STATE: PERU										
ACC	ACC ADJ	FLIGHT PLAN				SURVEILLANCE				
		INTERCONNECTION LEVELS				INTERCONNECTION LEVELS				
		1	2	3	4	1	2	3	4	5
LIMA	AMAZONICO				A				S	A
	BOGOTÁ				A				P	A
	CHILE				A					A
	GUAYAQUIL				A					A
	LA PAZ				A					A

TABLE 5.6-10 INTERCONNECTION LEVELS FOR PERU

STATE: SURINAME										
ACC	ACC ADJ	FLIGHT PLAN				SURVEILLANCE				
		INTERCONNECTION LEVELS				INTERCONNECTION LEVELS				
		1	2	3	4	1	2	3	4	5
PARAMARIBO	AMAZÔNICO				A				S	A
	GEORGETOWN				A					A
	PIARCO				A					A
	ROCHAMBEAU				A					A

TABLE 5.6-11 INTERCONNECTION LEVELS FOR SURINAME

STATE: VENEZUELA										
ACC	ACC ADJ	FLIGHT PLAN				SURVEILLANCE				
		INTERCONNECTION LEVELS				INTERCONNECTION LEVELS				
		1	2	3	4	1	2	3	4	5
MAIQUETIA	AMAZONICO			P	A		P			A
	BOGOTA		P		A			P		A
	BARRANQUILLA				A			P		A
	PIARCO				A			P		A
	ROCHAMBEAU				A					A

TABLE 5.6-12 INTERCONNECTION LEVELS FOR VENEZUELA

STATE: URUGUAY										
ACC	ACC ADJ	FLIGHT PLAN				SURVEILLANCE				
		INTERCONNECTION LEVELS				INTERCONNECTION LEVELS				
		1	2	3	4	1	2	3	4	5
MONTEVIDEO	CURITIBA				A				S	A
	EZEIZA		P		A	P*		P	A	
	RESISTENCIA				A					A
	ATLANTICO				A					A
	JOHANNESBURG				A					A

TABLE 5.6-13 INTERCONNECTION LEVELS FOR URUGUAY

INTERNATIONAL ORGANIZATION: COCESNA										
ACC	ACC ADJ	FLIGHT PLAN				SURVEILLANCE				
		INTERCONNECTION LEVELS				INTERCONNECTION LEVELS				
		1	2	3	4	1	2	3	4	5
CENAMER	GUAIAQUIL				A					A
	KINGSTON				A					A
	LA HABANA				A					A
	MERIDA				A					A
	PANAMA		P		A					A
	MEXICO				A					A

TABLE 5.6-14 INTERCONNECTION LEVELS FOR COCESNA

Key:

A – Current Level of Interconnection

S – Possibility of Surveillance Radar Data Sharing using SISTRASAG

P – Possibility of Interconnection using the current Air Traffic Control System

P* - Possibility of interconnection using the Air Traffic Control System that is being installed

6. SUMMARY OF IMPACTS

The implementation of the Interconnection of Automated ATC Systems in the CAR/SAM Regions may have an impact on a variety of related systems, organizations, procedures, and people, as stated in the following items of this section.

6.1 Impacts on Communications Systems

The impacts caused in the architecture and topology of the Telecommunications Digital Architecture, necessary to a global ATM in Region CAR/SAM, are linked to the speed of implementation and the traffic generated by these new services, such as: AMHS, AIDC, ADS / CPDLC, among others. This will eventually demand the upgrade to the ATN network using the protocol IPV6. (Refer to Appendix A for details)

6.2 Impacts on Surveillance Systems

No significant impacts on the existing surveillance systems and facilities are foreseen as a consequence of the interconnection Project.

6.3 Impacts on Automated ATC Systems

The impacts of the interconnection on automated ATC Systems will largely be dependent on which one of the implementation options is chosen. The integration of additional surveillance data from different sources will be of none or minor impact, but the sharing of flight plan data may constitute a more significant factor to the existing systems. For example, the common interconnection, based on the use of OLDI, implies that each system's parameters be assessed in order to ensure timely, automatic initiation of OLDI messages. Also, the system's capability to manually initiate the transmission of a coordination message prior to the calculated transmission time should be provided.

The Human-Machine Interface (HMI) may also be subject to certain impacts, including, inter alia, that the system shall be able to:

- display the operational contents of OLDI messages and relevant warnings related to received messages for immediate attention;
- route co-ordination and transfer message warnings to the operational positions responsible for the co-ordination of the flights concerned.

The system will have to be checked and, eventually, configured so that the HMI indicates when the transmission of an OLDI message is in progress or has been successfully transmitted as appropriate. A warning or notification to the appropriate ATC or technical position shall be generated automatically if no acknowledgement has been received within the parameter time following a transmission of a co-ordination or transfer message.

The HMI at ATC positions using OLDI should provide a warning if a pertinent OLDI facility is not available.

6.4 Impacts on non-automated ATC Units

No impacts on the existing non-automated ATC Units in the Region are foreseen as a consequence of the interconnection Project. Even the proposed interim solution for sharing of surveillance data, based on SISTRASAG, will only facilitate the coordination process, without significant changes to established procedures and current practices.

6.5 Impacts on the ANSP Workforce

Air Traffic Control Officers, Supervisors, and Technicians will be required to show knowledge and proficiency at the use of the new system functionalities, as installed, including specific contingency procedures.

6.6 Impacts on Operational Regulations and Agreements

Each new OLDI facility, including a new facility on an existing link, shall be subject to an evaluation period to verify the data integrity, accuracy, performance, compatibility with ATC procedures and overall safety prior to its operational implementation.

Independently of any activities performed by ICAO in the context of the interconnectin project, the date of the operational introduction, implying completion of the evaluation period, has to be formally agreed between any two ATC units concerned.

The failure of automated coordination shall be presented clearly to the controller responsible for coordinating the flight at the transferring unit. This controller shall then facilitate the required coordination using prescribed alternative methods, as stated, for example, in the correspondent letter of agreement.

7. ANALYSIS OF THE PROPOSED SYSTEM

7.1 Summary of benefits of surveillance data sharing options

Advantages of each possible solution or alternative for surveillance data sharing are presented in this chapter. Further, it should be observed that the benefits listed are not mutually exclusive and may be cumulative, depending on the context and the selected implementation options.

7.1.1 Advantages of the Bilateral Solution for surveillance data sharing

The bilateral solution for surveillance data sharing, on the basis of direct agreements between interested parties may, in certain cases, be implemented at very short notice, particularly where the systems have been provided by the same supplier, or technical compatibility is assured by the use of common protocols.

7.1.2 Advantages of the Multilateral Solution for surveillance data sharing

The multilateral solution for surveillance data sharing on the basis of RADNET-alike architecture, presents a set of operational advantages, including:

- COTS Products, minimizing the implementation effort to develop interfaces;
- Reduced implementation risks, as the specifications and interfaces are defined by the EUROCONTROL;
- Can be used at a national level, with early benefits for the national control centers, and evolution for future integration with adjacent ATC Centers;
- Prepared to incorporate new surveillance technologies, such as ADS-B.

7.1.3 Advantages of the Interim Solution with SISTRASAG

The interim solution of surveillance data sharing on the basis of the SISTRASAG presents a set of operational advantages, including:

- Possibility of being used by all ATC Centers adjacent to the Brazilian FIRs , even if they are currently not equipped with automated systems;
- Possibility of ready, almost immediate implementation;
- Uses data transmission through IP (compatible with REDDIG);
- Client software works with PC platform based on Linux;
- Allows cost-benefit evaluation of cross-border surveillance data sharing, in advance of decision taking on investing in more complex systems, such as RADNET-alike solution.

7.2 Summary of Disadvantages/Limitations

The solutions for interconnection of systems, as stated before, also present some disadvantages and limitations, inherent to each of the implementation options.

7.2.1 Limitations of the Bilateral Solution

The bilateral solution for surveillance data sharing, on the basis of direct agreements between interested parties may also present some limitations, including:

- The common interface could be very specific and limited for the bilateral integration, only;
- Need of a consensus for the interfaces in case of different suppliers, eventually requiring protocol conversion;
- The implementation timing for each pair of ATC Centers will certainly be different.

7.2.2 Limitations of the Multilateral Solution

The multilateral solution for surveillance data sharing on the basis of RADNET-alike architecture, also presents a set of inherent limitations, including:

- Needs consensus and overall agreement of all or most of the CAR/SAM States for its complete implementation;
- Early Costs estimates indicate an amount of investment that requires a complete CBA (Cost-Benefit Analysis);
- In being a more complex solution, it demands a longer period of implementation and, therefore, may only be accomplished at the medium or long term.

7.2.3 Limitations of the Interim Solution with SISTRASAG

The interim solution of surveillance data sharing on the basis of the SISTRASAG also presents some limitations, including:

- Integration limited to ATC Units located adjacent to Brazilian ACCs;
- Solution involves only radar information sharing.

7.3 Advantages and Limitations of Flight Plan Data Sharing Options

Advantages of each possible solution or alternative for Flight Plan data sharing are presented in this chapter.

7.3.1 Advantages

The AIDC is a ICAO recommended solution for interconnection.

Most of the systems are OLDI capable.

7.3.2 Limitations

The Doc 4444 using CDN, LAM, ACP messages is a limited solution, since there is coordination situations that are not completely automated.

The OLDI protocol is not ATN compatible.

The AIDC is a recommended solution for interconnection, but most of the States have not implemented yet.

7.4 Implementation Option - Recommended

Based on the analysis of the advantages and limitations of each possible solution or alternative for Flight Plan Data sharing, as well as for Surveillance Data sharing, and with due consideration that:

- The sharing of relevant data on flight plans between adjacent ATC units is urgently required in order to facilitate the air traffic coordination process and thus reduce one major contributing factor to air traffic incidents;
- The bilateral solutions for Flight Plan and/or Surveillance Data Sharing may not be implemented in a timely manner and, under certain conditions, are not the most convenient way of accomplishment of the interconnection;
- The multilateral solution for Flight Plan and/or Surveillance Data Sharing may prove itself of difficult implementation without a centralized project coordination;
- The eventually required support of Systems Providers to configure the systems or implement minor changes or upgrades may be more effectively negotiated collectively, rather than by individual ANSPs;
- The experience gained with multinational implementations, e.g. REDDIG, accomplished under the provisions of a specific Project coordinated by the ICAO SAM Regional Office;

and, therefore, it is highly recommended that the interconnection of the automated ATC Centers in the CAR/SAM Region is accomplished via a specific Project, in a similar way to the former REDDIG Project.

7.4.1 ICAO Automated ATC Systems Interconnection Project

The set up of the proposed ICAO Automated ATC Systems Interconnection Project is seen as a SAM Region initiative and, therefore, it will have to be submitted to the decision of the Directors – Civil Aviation Authorities. Besides, there is a clear operational requirement of close coordination with the adjacent ATC Facilities of the CAR Region on this subject, which indicates that the project should also be taken to the consideration of GREPECAS, specifically, the ATM/CNS Sub-group.

Eventually, the establishment of such a project might also be considered via an already existing mechanism, e.g., including the interconnection project as a new objective of RLA/06/901.

7.4.1.1 Project Objectives

Implementation of the Interconnection of Automated ATC Systems in the SAM Region, using standard protocols and based on the existing capabilities of the REDDIG.

7.4.1.2 Project Outline

The Project for Interconnection of Automated ATC Systems in the SAM Region, under the overall coordination of the ICAO SAM Regional Office, shall provide for the accomplishment of all pertinent activities, including:

- Operational Requirements Revision;
- Technical description;
- Technical cooperation activities, including support on operational agreements development;
- On-site Installation activities;
- Site Acceptance
- Documentation;
- Follow-on activities.

7.4.1.3 Project Activities

A preliminary, comprehensive list of Project Activities has been defined and is presented in Appendix “B” of this document, which also contains the estimated duration of each listed activity.

8. NOTES

8.1 Acronyms

ACC	Area Control Center
AIDC	ATS Interfacility Data Communications
ANSP	Air Navigation Service Provider
APP	Approach Control Center
ATC	Air Traffic Control
ASTERIX	All-purpose Structured Eurocontrol Surveillance Information Data Exchange
CINDACTA	Centro Integrado de Defesa Aérea e Controle de Tráfego Aéreo
COCESNA	Corporación Centroamericana de Servicios de Navegación Aérea
COTS	Commercial Off The Shelf
ATC	Air Traffic Control
EUROCONTROL	European Organization for the Safety of Air Navigation
HW	Hardware
IDS	<i>Intrusion Detection System</i> (Sistema de Detecção de Intrusão)
IHM	Interface Homem-Máquina
OCD	Operational Concepts Description
OLDI	On line data Interchange
RADNET	Radar Network
REDDIG	“Red Digital”
RJ	Rio de Janeiro
RMCD	Radar Message Conversion and Distribution Equipment
SICD	Descrição de Interfaces Externas (<i>System Interface Control Document</i>).
SISTRASAG	Sistema de Transmissão da Situação Aérea Geral
SSS	System/Subsystem Specification
TLS	Target Level of Safety
UAP	User Application Profile

8.2 Glossary

AIDC application	An ATN application dedicated to exchanges between ATS units (ATSUs) of air traffic control (ATC) information in support of flight notification, flight coordination, transfer of control, transfer of communication, transfer of surveillance data and transfer of general data.
Client Level 1	Organization or authority with connection to the national security, properly accredited and registered in the SISTRASAG to receive information for the visualization.
ATS surveillance system	An ATS surveillance system will normally consist of a number of integrated elements, including sensor(s), data transmission links, data-processing systems and situation displays.
Co-ordination (of air traffic)	The process, executed between ATC units with adjoining areas of responsibility, of formally advising each other of the planned passage of flights across the boundary, in order to ensure flight safety through consistency of intended actions.
Co-ordination Phase	In respect of a given flight, the phase during which the transferring and receiving ATC units agree the conditions (e.g. flight level, boundary point) under which a flight will pass from the control of one to the other (EUROCONTROL).
Co-ordination Message	A generic term referring to a message used for accomplishing ATC co-ordination, including the CDN.
Flight Plan	Specified information provided to air traffic service units, relative to an intended flight or portion of flight of an aircraft. In addition, information derived from the flight plan of a specific flight held within an FDPS (EUROCONTROL).

APPENDIX A – COMMUNICATION NETWORK

A.1) The Architecture for Digital Communications, which is necessary for the integration of automation systems of the Regions CAR / SAM, proposed in this document will be divided in the following segments of telecommunications networks:

- a) Access Network: Also known as the last mile, is responsible for taking information from radar data and flight plan data, from its sources to the Radar Data Processor (RDP) and the Flight Plan Data Processor (FDP), located in the ATCS.
- b) Local Network (LAN) are usually dual. The interconnection between the ATCS LANs with the communications LAN is made through a router. The router provides the necessary isolation of ATCS, radar data and flight plan.
- c) Network Long Distance - WAN (Backbone) :The exchange of messages (radar and flight plan) between two adjacent centers, will be through channels of communication point to point. These digital links might be type E1 links radio and/or communications systems via geostationary satellites of the type VSAT, with multiple access technology such as: FDMA PAMA SCPC or TDMA DAMA. The types of communication protocols might be Frame Relay (FR), X-25 and IP, using the physical interface such as RS232C and V-35, with the transmission rate ranging from 2400 bps to 19200 bps.

A.2) Based on the previous concepts, you can set the following requirements of communication for ATM Automation and Integration of the Regions CAR / SAM:

- Communications between adjacent facilities ATS should be through the Aeronautical Communications Network (ATN), as DOC 9694 Part VI, item 1.2.
- The ATN, for ATM Automation, will be implemented using IPS-capable routers "dual stack", which allows the use of IPv4 and IPv6 networks. These routers IPS should be scaled to operate as we ATN network of the future IPS Regional. Thus the SICD of Automation ATM would, together with the AMHS, encouraging the establishment of the Regional ATN.

A.3) The ATN routers (IPV4/IPV6) will be interconnected through VSAT networks existing Regional: REDDIG SAM in the Region and the Region II MEVA CAR.

- Each node of REDDIG and MEVA II should receive a router ATN / IPS, in order to compose a network with regional presence in all states of the Regions CAR / SAM.
- Access of routers to networks REDDIG and MEVA II should use the link protocol Frame Relay.
- Each node of the network of communication should be composed of routers in 1 +1 configuration, to ensure the continuity of service.
- The Frame Relay network routers should be set to achieve the FIR adjacent using a single hop satellite.

- The routers of limits of Regions (Brazil, Argentina, Chile, Peru, Venezuela, COCESNA, among others) should have additional capabilities to support features of BIS and should compose the main backbone Regional.
- A draft of the Plan of Transition AMHS, developed in ATN-TF, considers the existence of a "backbone" in the main Regions CAR / SAM and recommends it to be considered part of the "backbone", the States must meet all the following criteria: have at least a connection to another Region ICAO;
 - o • Having have at least two connections within the Region;
 - o • Having high-speed circuits that are able to handle large volume of traffic, including alternative to routing of messages;
 - o • Having a AMHS and a Gateway AMHS / AFTN, and
 - o • Having 24H support
- The architecture of the network ATN / IPS should be based on the model proposed ACP, as shown below:

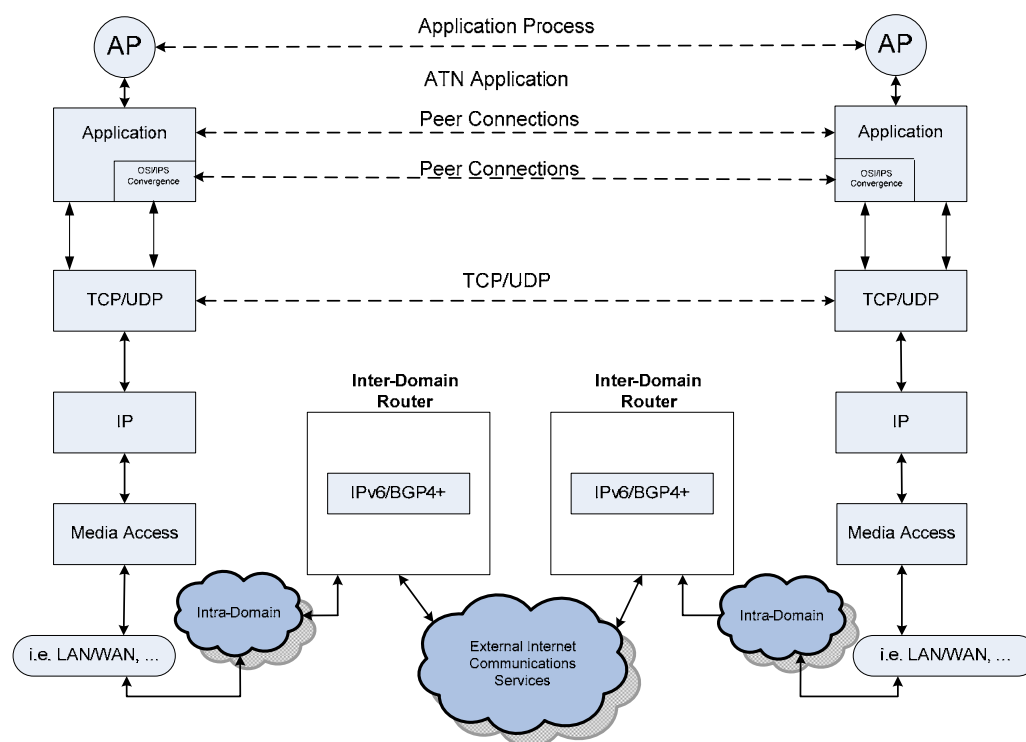


FIGURE A-1 - IPS ARCHITECTURE IN THE ATN

- The service external communication (External Internet Communications Services) should be provided, the level of link Frame Relay, the REDDIG and MEVA II respectively for the Regions and SAM CAR.
- The ATN routers / IPS could have additional ports to facilitate future alternative connections that could take advantage of the Internet in the future.

Considering it has been a gradual evolution in the implementation of systems / services CNS / ATM, in the Regions CAR / SAM. There are more details to be defined, including information from physical character (site of the installation of routers, type of routers, interconnections internal to the State [intra-domain], etc. ..) and information that are logical (Band of the channels between routers, addressing IP, protocol routing, network management, safety mechanism, etc..). That, of course, will be treated in forums ICAO AMHS / ATN / AIDC, among others.

APPENDIX E

**PRELIMINARY REFERENCE SYSTEM/SUBSYSTEM SPECIFICATION FOR THE
AIR TRAFFIC CONTROL AUTOMATION SYSTEM**

CHANGE RECORD

Rev	Description of Change	Page No's Affected	Date
-	Initial Release	All	22 Sept 2008
A	Preliminary Release	All	04 Oct 2008

SUMMARY

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1. **SCOPE**

1.1 **Identification**

This document is based on the requirements identified in the OACI Project RLA/06/901 for Air Traffic Control Automation Systems. This System Specification is based on the pre-existing systems used in the SAM Region and it incorporates requirements from the ATM Group as required. SAM Automation Team will update this document to reflect the required refinement.

The main objective of this specification is to consolidate all the requirements, mainly the mandatory ones to be used as a reference for future implantations of new ATCAS Systems and upgrades as well.

These requirements originated in a survey in the States, where each country presented an abstract of all the functionalities available in their automation systems.

This effort is in line with the need of harmonization to provide interchange of flight plan and surveillance data, and establish a minimum common level ground among the several ACC installed in the SAM region and the new systems as well.

1.2 **System Overview**

1.2.1 **Introduction**

This specification includes detailed requirements for ATC Automation Systems.

The system's mission is to enhance the safety of air travel by providing controllers with information on flights from surveillance sensors and adjacent centers. The information is presented on different functional displays, including situation displays, flight data displays, supervisor positions and aeronautical information displays.

The system must follow the International Civil Aviation Organization (ICAO) standards to provide routine ATC services for aircraft operating in SAM airspace.

ATM is described in the ICAO Global ATM operational Concept (Doc 9854) as the dynamic, integrated management of air traffic and airspace in a safe, economical and efficient manner through the provision of facilities and seamless services in collaboration with all parties. The operational concept also describes a system that provides ATM through the collaborative integration of humans, information, technology, facilities and services, supported by air, ground and/or space-based communications, navigation and surveillance.

This operational concept identifies seven interdependent components of the future ATM system. They comprise:

- a) Airspace organization and management;
- b) Aerodrome operations;
- c) Demand and capacity balancing;
- d) Traffic synchronization;
- e) Conflict management;
- f) Airspace user operations;
- g) ATM Service Delivery Management.

1.2.2 Context Diagram

The following Figure 1.1 illustrates the relationship of the ATCAS with its external entities:

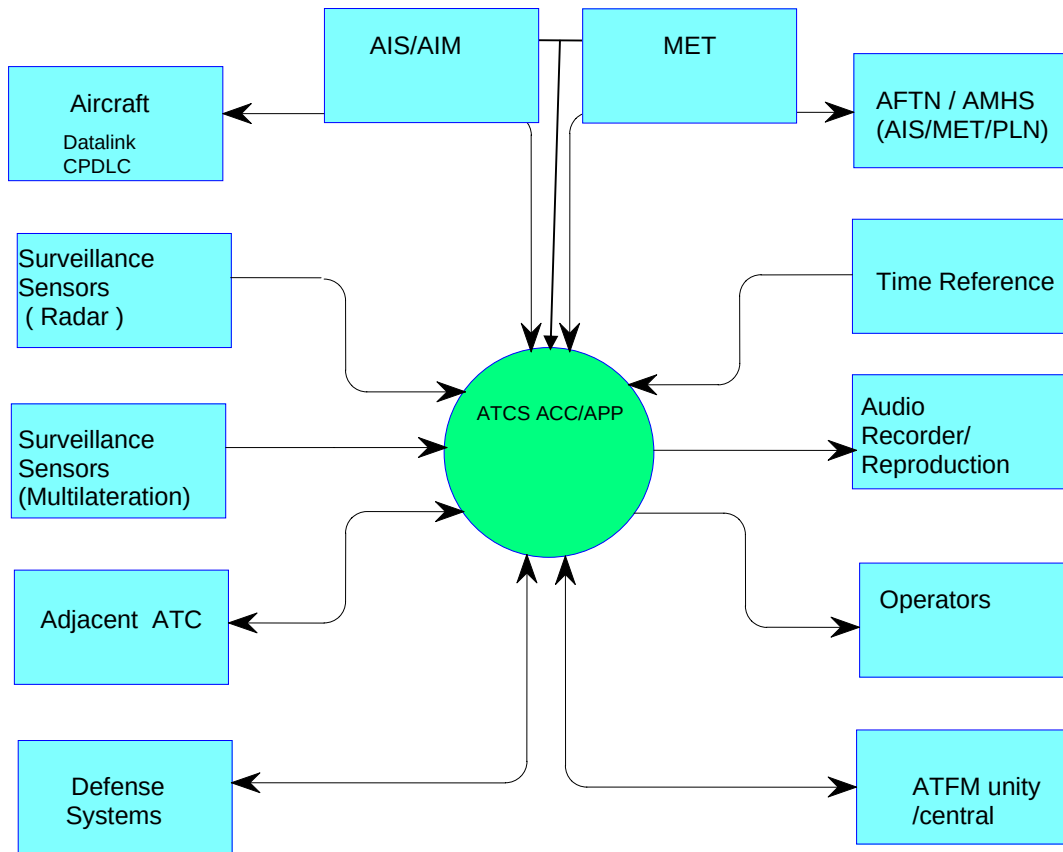


FIGURE 1.1 – CONTEXT DIAGRAM FOR ATCAS

1.2.3 Component and External Interfaces

The main components and External interfaces of the ATCAS are:

1.2.3.1 Components

Operational System

The Operational System takes the information from surveillances systems such as Radar and ADS, and integrates them with other information. Then, all the information is put together to form a representation of the airspace traffic environment.

Simulation and Training

This system is capable to provide a realistic simulation of the Air Traffic environment in order to serve as a training platform for the operational and maintenance personnel. It uses Pilot Workstations to provide the training personnel with skills necessary to operate the ATCAS.

1.2.3.2 External Interfaces

The external interfaces to the ATCAS are:

a) Surveillance Sensors:

- PSR/MSSR surveillance;
- MSSR surveillance;
- ADS-B and ADS-C datalink;
- Multilateration;

The system receives surveillance data, processes the information and presents a synthetic image of the Air Situation to the controller.

b) Aircraft

The controller uses a communication with the pilot through a specific protocol called CPDLC (Controller Pilot Data Link Communications).

The system receives track and flight plan information and sends commands to the pilot.

c) Adjacent ATCAS

The adjacent Centers represent the Area control centers and Approach control. This interface sends and receives mainly flight plan coordination messages, using the standard ICAO 4444 messages or OLDI and AIDC protocols.

The system will share surveillance data with adjacent centers.

d) Time Reference System

Time Reference System receives the UTC Time from the GPS and sends this information to synchronize the ATCAS Workstations time.

e) Audio Recorder

This interface is used to synchronize the recording and the playback system activities with the audio recording and playback.

f) Operators

They are represented by the main controllers, assistant, Flight data Operators and Technical/ Operational supervisors.

g) AFTN Interface

It represents the interface with the AFTN to receive and transmit ATS messages, when the AMHS system is not available.

h) AMHS Interface

It represents the new interface for sending and receiving ATS messages. This system has a gateway to the AFTN.

i) ATFM Unity

This link is used to transmit the flight plan and traffic information and coordinate measures to diminish problems associated with the flow management.

j) Defense Systems

This interface is used to exchange surveillance information and coordination information with defense systems.

k) AIS and MET

This interface is designed for Web interfaces (HTTP) to access AIS and MET database using a Web Browser with a LAN connection.

1.2.3.3 System Features

The system includes the following features: Dual Surveillance Data Processing Servers- SDPS; Dual Flight Data Processing Servers- FDPS; Dual Data Recording Servers – DRS; Dual System Monitoring and Control – SMC; Multiple ASTERIX-format surveillance interfaces; Multiple Surveillance input formats; Surveillance Displays with 2048 x 2048 high resolution color monitors; Flight Data Displays; Supervisor Displays with printers; Flight Progress Strip Printers; Dual LAN; Database Management System for site adaptation and map generation; Interface for Time Synchronization with Audio Recorders; Electronic Flight Strip Displays; Direct Surveillance Access; Kalman-filter based Surveillance Tracker; Dual-redundant surveillance input lines; Physical Integration with Voice Control System; Interface with adjacent ACCs; Simulation/Training and Test System; Aeronautical Information System; Datalink interface; Air Defense interface to exchange surveillance data and other coordination information.

1.3 Document Overview

This document is identified as the System Subsystem Specification (SSS) for the ATC Automation Systems in the SAM region.

The document is organized as follows:

Chapter 1	Scope: This chapter contains the identification and a overview of the system
Chapter 2	Referenced Documents: contains the list of documents referenced in this document.
Chapter 3	Requirements: contains the list of characteristics and functionalities available in the system.
Chapter 4	Qualification Methods: defines the way that each requirement is tested.
Chapter 5	Requirements Traceability: contains the list of requirements with specific identifiers that will follow till the formal acceptance Test and documentation.
Chapter 6	Notes: Contains the glossary and abbreviations used in this document.

1.3.1 Document Conventions

These operational requirements and specifications use the words "shall", "will", "should", and "option (ally)" with definite meanings. These are defined below:

1. "Shall" indicates that the requirement or specification it refers to is mandatory.
2. "Will", "should", or "option (ally)" indicates intent to realize the functionality within the system (unless it concerns functionality within the scope of external systems) but such statements are not testable.

Note that "will" is also used to introduce requirements that are more precisely stated elsewhere in the document.

2. REFERENCED DOCUMENTS
INTERNATIONAL ATC DOCUMENTS AND OTHER STANDARDS:

AIDC	<i>International Civil Aviation Organization – Asia and Pacific Office - Asia/Pacific Regional Interface Control Document (ICD) for ATS Interfacility Data Communications (AIDC) – Version 3.0 – September 2007</i>
OLDI	<i>Eurocontrol standard document for On-Line Data Interchange (OLDI) - edition: 3.00, edition date: 31/10/2003.</i>
ICAO Doc 4444 ATM/501	<i>Air Traffic Management - Procedures for Air Navigation Services 15^a edition – 2007 and Amendment 1 (Jan 2008)</i>
ICAO ANNEX 10	<i>Volume II- Aeronautical Telecommunications;, Communication Procedures Volume III, Communication Systems</i>
ICAO ANNEX 15	<i>Aeronautical Information Services</i>
ASTERIX	<i>Eurocontrol Standard for Surveillance Data Exchange Issue 0.1, September 1991</i>
ICAO Doc 9705 AN956	<i>Manual of Technical Provisions for the Aeronautical Telecommunication Network – ATN.</i>
ICAO Doc 9578	<i>Manual of the Aeronautical Telecommunication Network (ATN)</i>
ICAO Doc 9694 AN/955	<i>Manual of Air Traffic Services Data Link Applications</i>
ICAO Doc 9854	<i>Global Ait Traffic Operational Concept - ATM</i>
ICAO Doc 9880 AN/466	<i>MANUAL ON DETAILED TECHNICAL SPECIFICATIONS FOR - Aeronautical Telecommunication Network – ATN - 5 April 2007</i>
ICAO Doc 9896	<i>Aeronautical Telecommunication Network - ATN IPS</i>
ICD for AIDC	<i>Asia/Pacific Regional Interface Control Document version 2</i>
ICAO Doc 9613	<i>Performance Based Navigation Manual – PBN Volume I - concept and implementation guidance</i>
SGN2-8 IP 10	<i>Aeronautical Communication Panel ATN – CPDLC, ADS, FIS – June 2006</i>
(MLAT)	<i>Multilateration Concept of use Edition 1.0 – September 2007</i>
(Doc 9688)	<i>Manual on Mode S Specific Services - 2nd edition, 2004</i>
ICAO Doc 9377 AN/915	<i>Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services. 3rd edition, 2007. 142 pp.</i>
ICAO Doc 9873	<i>Manual on the Quality Management System for the Provision of Meteorological Service to International Air Navigation. 1st edition, 2007. 62 pp</i>
ARINC 622	<i>ATS Datalink Applications over ACARS Air-Ground Network (end-to-end).</i>
RTCA DO-258/EUROCAE ED-100	<i>Interoperability Requirements for ATS Applications Using ARINC 622 Data Communications.</i>
ARINC 620	<i>Datalink Ground System Standard and Interface Specification (ground-to-ground)</i>
ICAO Guidance Material	<i>GUIDANCE MATERIAL OR THE ASIA/PACIFIC REGION FOR ADS/CPDLC/AIDC GROUND SYSTEMS PROCUREMENT AND IMPLEMENTATION Version 1 - September 2007</i>
	<i>Preliminary System Interface Control Document for the Interconnection of ACC Centers of the CARSAM Region</i>
	<i>CAR/SAM Automated ACC Interconnection Plan</i>

3. **REQUIREMENTS**

These requirements represent a database of functionalities that can be shaped accordingly in the system. The States are responsible for the decision of implementation involved in the installation or in the modernization process.

3.1 **Required States and Modes**

SSS 1 - The system shall have the capability to operate in Operational Partition or in Simulator Partition.

SSS 2 - The surveillance and Flight display consoles shall have the capability to operate in Operational Mode, Direct Radar Access Mode, Simulator Mode, and Playback Mode.

SSS 3 - The servers shall have the capability to operate in Mode Active, Hot Stand-by and Maintenance Mode.

3.2 **System Capability Requirements**

3.2.1 **Man-Machine Interface**

The surveillance positions will be able to provide surveillance tracks without interruption.

Data will be displayed in a clear way avoiding confusion and/or misunderstanding, and taking into consideration its contents, meaning, or the importance of the data displayed.

3.2.1.1 **Graphic Interface**

3.2.1.1.1 **Predicted Position Indicator**

SSS 4 - The Main Controller Display shall be able to designate a track vector and to define the predicted ahead in time (minutes) what those vectors represent.

SSS 5 - The system shall have a command to designate a track for display and define a specific time ahead.

SSS 6 - The graphic representation of a velocity will be displayed as an extended velocity vector and the length of the vector shall be a function of the controller selected time for predicted positions.

3.2.1.1.2 **Functional Controls**

SSS 7 - The system shall have the capability to cancel or delete any input action that has been initiated, before the completion or confirmation of execution of the command.

SSS 8 - The system shall have functional controls using dedicated function keys and a trackball.

3.2.1.1.3 **Radar Coverage Diagrams and Color Assignment**

SSS 9 - The supervisor position shall have the capability to select colors to be applied to various display elements, in a manner not to degrade or affect the processing of operational functions.

SSS 10 - Selection of color brightness and intensity shall be available as an operational function in the individual workstation.

SSS 11 - The main controller position shall have capability to display coverage diagrams for each surveillance sensor and resultant coverage diagram for all ground based surveillance sensors presented in a specific color.

SSS 12 - These coverage diagrams shall be customized to emulate the theoretical coverage for the heights 5,000 feet, 10,000 feet, and 20,000 feet for each azimuth. Areas with no surveillance coverage shall have a special color.

3.2.1.1.4 **Screen Annotation**

SSS 13 - The surveillance workstations shall have the capability for entering up to TBD annotations for display. Each annotation will have a specific text and color.

SSS 14 - The surveillance workstation shall have the capability to route the screen annotation to other surveillance workstations and to suppress displayed annotations as well.

3.2.1.1.5 **Windows Presentation**

SSS 15 - The surveillance workstation shall organize all the information presented in windows to present surveillance data, flight plan data, alerts, status, commands, where each window shall be selected, resized or moved by the controller.

SSS 16 - The system shall have the capability to notify any critical information shown in a minimized or inactive window.

3.2.1.1.5.1 **Main Surveillance Window**

SSS 17 - The main surveillance window shall present the surveillance data with the capability to zoom and pan.

3.2.1.1.5.2 **Secondary Surveillance Window**

SSS 18 - The secondary surveillance windows shall provide the same capability than the main surveillance window with independent resize, zoom and pan.

3.2.1.1.5.3 **System Status Window**

SSS 19 - The System Status Window shall display the following information:

- Time and Date;
- Selected display range;
- Altitude filter bounds;
- SSR block code selections;
- CJS Designation;
- Presentation mode;
- Magnetic Variation;
- Label line selections.

3.2.1.1.5.4 **General Information Window**

SSS 20 - The system shall provide the capability to display the following information on the Flight Data Display:

- Flight Plan
- MET data
- Aeronautical/Meteorological Information: Notice to Airmen (NOTAM) and Meteorological Report (METAR), and other meteorological messages (SIGMET, AIRMET, GAMET, SPECI and TAF);
- General Purpose Information;
- QNH values for aerodromes and regions.

3.2.1.1.5.5 **Messages Windows**

SSS 21 - The system shall have the capability to display pending coordination messages between centers, sectors or tracks (via Datalink).

SSS 22 - The system shall have the capability to register all the coordination actions even when the interface between the systems is not working.

SSS 23 - The system shall have the capability to display an alert when a response to a coordination message is not received.

SSS 24 - The system shall have the capability to display the coordination messages received till the operator send the answer correctly.

SSS 25 - The system shall have the capability to display the history of coordination messages.

3.2.1.1.6 **Images**

SSS 26 - The main surveillance window shall have the capability to display georeferenced images representing meteorological information as an overlay under operator control.

3.2.1.1.7 **Surveillance Data Display Elements**

SSS 27 - ADS-B, ADS-C, PSR, SSR, and PSR/SSR plot presentation shall be available as a selectable function.

SSS 28 - Surveillance workstations shall have the capability of manually enable or disable the presentation of plot data besides the presentation of tracked targets.

SSS 29 - The track information shall indicate:

- Aircraft position;
- Track history information.

SSS 30 - The system shall have the capability to process and display:

- SSR code or callsign when correlated with a flight plan;
- Flight level/altitude based on Mode C or barometric corrected altitude (below the transition level) surveillance information;
- Heading and ground speed (as a speed vector);
- Altitude indicator, i.e., climb, descent, or level flight.

The system will have the capability to calculate and display the predicted position of any track as designated by a controller input action.

SSS 31 - The surveillance position shall have the capability to process and display alphanumerically the ground speed and heading (track) of any track designated.

SSS 32 - The following elements shall be available for display:

- Map information;
- Range rings;
- Time;
- Selected Surveillance Display range;
- Selected height filter;
- Controller jurisdiction indicator;
- Handoff indication;
- Range/bearing line (cursor);
- Indication when the Air Situation Display is not being updated;
- Selected track presentation mode/surveillance sensor;
- Special codes;
- STCA (Short Term Conflict Alert);
- MSAW (Minimum Safe Altitude Warning);
- MTCD (Medium Term Conflict Detection);
- CLAM (Cleared Level Adherence Monitoring);
- AIW (Area Infringing Warning);
- RAM (Route Adherence Monitoring);
- Track information, including:
 - o Position symbols;
 - o Track history information.
- Label information.

SSS 33 - Critical information related to the display of special codes, STCA, MSAW, MTCD, CLAM, AIW Data or information considered to be critical for the operation shall always be displayed in a clear and unambiguous manner.

3.2.1.1.8 Surveillance Data Position Symbols

SSS 34 - Different symbols shall be used for indicating a PSR plot, SSR plot, PSR track, SSR track, PSR/SSR track, ADS-B Track, ADS-C Track, Multilateration Surveillance track, Flight Plan navigated track.

3.2.1.1.9 Track History Information

SSS 35 - The surveillance workstation shall have the capability to enable or disable track history information in each position.

SSS 36 - The surveillance workstation shall have a capability to select the number of track history positions, using a specific symbol.

3.2.1.1.10 Display Range

SSS 37 - The Surveillance Display shall have the capability to select a specific range for each surveillance workstation.

3.2.1.1.11 **Range Rings**

SSS 38 - The system shall have the capability to display Range rings individually selectable at each surveillance workstation as circles centered on the selected ground based surveillance sensor in monoradar mode and multiradar mode.

3.2.1.1.12 **Quick Look**

SSS 39 - The system shall have a capability to display all tracks and labels through an individual quick look function.

SSS 40 - The quick look function shall enable display of label track data bypassing all local filters.

3.2.1.2 **Range Bearing Line**

SSS 41 - Each Surveillance Display shall have the capability to display a minimum of 3 range/bearing lines, displayed at the end of the line, as the following types:

- Between any two operator selectable points;
- Between any two moving targets, including a time field,
- Between a operator selectable point and a moving target, including a time field;

3.2.1.3 **Smart Labels**

The smart label will be the main way to interact with the system.

SSS 42 - The system shall have a capability to display three types of label:

- Standard Label – with the minimal track/flight plan information.
- Extended Label – activated when the cursor pass over the label.
- Selected Label- similar to the extended label but with interaction in the fields.

3.2.1.3.1 **Controller Jurisdiction Indicator (CJI)**

SSS 43 - The system shall have a capability to display an indication an indication of which sector has jurisdiction over the track in question.

SSS 44 - The system shall allocate a separate jurisdiction indicator as defined in adaptation data.

SSS 45 - This CJI shall be shown in conjunction with the handoff function.

SSS 46 - The system shall display involved in a handoff through a distinct presentation.

3.2.1.3.2 **Special Position Indicator (SPI)**

SSS 47 - The system shall display activation of SPI using a unique indication.

SSS 48 - The system shall have the capability to re-position any label relative to the position symbol, manually or using an automatic algorithm.

SSS 49 - The following data shall be displayed in a label, if available:

- SSR code or call sign when correlated with a flight plan or entered manually from a surveillance workstation;
- Mode C flight level/altitude;
- Attitude indicator, i.e., climb, descent, or level flight;
- Controller jurisdiction indicator;
- Calculated ground speed, expressed in tens of knots;
- Cleared flight level;
- Quality Factor;
- ADS Data;
- Coordination Data;
- Free text, entered manually.

SSS 50 - The calculated vertical speed shall be displayed after an appropriate controller input action.

3.2.1.4 **Filters**

SSS 51 - The system shall have a capability to select an upper and lower limit for the level filter, at each surveillance workstation.

SSS 52 - The following conditions shall override the filters:

- Tracks which are under the jurisdiction of this workstation;
- Special condition tracks;
- Tracks that are quick-looked at the display;
- Active handoff tracks;
- Targets that do not currently have valid Mode C data;
- Tracks which are individually selected for display by the controller;
- Unsuppressed tracks in MSAW, STCA, MTCD, CLAM, RAM, AIW alerts.

SSS 53 - The surveillance shall have a capability to display the height filter limits selected.

SSS 54 - The system shall have the capability enable/disable adapted areas within which detected tracks will not be displayed.

SSS 55 - The system shall have a capability to designate specific codes or code groups to filter the track label presentation.

3.2.1.5 **Maps**

SSS 56 - The system shall have a capability to select and present map data in each surveillance workstation.

SSS 57 - The map presented shall have specific graphic representation for the following entities:

- FIR/UIR borders;
- Lateral limits of sectors;
- Terminal control areas;
- Control zones;
- Traffic information zones;
- Airways and ATS routes;
- Restricted areas.

3.2.1.5.1 **Weather Surveillance Data**

SSS 58 - The system shall have the capability to display weather surveillance data from PSR radars or Meteorological radars.

SSS 59 - The system shall have a capability to select the display of high intensity, both high and low intensity, or no weather, if this information is available.

3.2.1.5.2 **Private Maps**

SSS 60 - The surveillance workstation shall provide the capability to define and to display private maps created on-line with different attributes of lines.

SSS 61 - Presentation of each private map shall be individually selectable.

3.2.1.6 **Flight Plan**

3.2.1.6.1 **Flight Strip Window**

SSS 62 - The system shall provide the capability to display up to TBD pages of flight strip information in this window on the ESD.

3.2.1.6.2 **Flight Data Displays**

SSS 63 - The system shall provide functional controls to enter, modify, cancel and display flight plan data.

SSS 64 - The system shall have the capability to insert a change in a flight plan route through graphical point selection.

SSS 65 - The flight plan functions shall include:

- flight plan data entry;
- flight plan update data update;
- Display of flight plan data;
- Edition of stored/displayed information;
- Printing of Flight Progress Strips;
- Edition of departure clearance for inactive and pre-active flight plans;
- Manual edition of ATS messages;

SSS 66 - The system shall have the capability to edit a flight plan using a graphic tool over a specific thematic map.

SSS 67 - The system shall have a capability to display a flight plan history, with all the actions and message updates received or transmitted related to that flight plan.

3.2.1.6.3 **Flight List Presentation**

SSS 68 - The system shall have the capability to display traffic lists, based on the flight plan status, including coast and hold information.

3.2.1.6.4 **Flight Strip Presentation**

SSS 69 - The system shall have the capability to display Electronic Flight Strip and to print Paper Flight Progress Strip.

3.2.1.6.4.1 **Paper flight progress strip**

SSS 70 - The system shall have the capability to define a flight Strip format and layout in adaptation data.

SSS 71 - The system shall distribute flight strips in accordance with the route system and the Strips distribution plan as defined in adaptation, and the capability to print flight strips at any time.

3.2.1.6.4.2 **Electronic Flight Strips**

SSS 72 - The system shall have the capability to display electronic flight strips.

SSS 73 - The system shall have the capability to allow the operator to select pre-defined flight level using smart labels.

SSS 74 - The system shall display electronic flight strips associated with the flight under control or prior to control of the associated jurisdiction sector at the position associated to the sector.

SSS 75 - The system shall have the capability to display at least the following sub-states for a flight plan:

- active not controlled;
- active controlled;
- in transfer (donor, receptor and proposed);
- announced;
- holding;
- transferred;

SSS 76 - There shall be specific presentations for the following conditions:

- correlated;
- multicorrelation (two or more tracks having identical SSR code associated to the same flight plan);
- non-conformance route/track position indication;

SSS 77 - There shall be a unique presentation for the first display of the flight plan.

3.2.1.6.5 **Flight Plan Data Retrieval**

SSS 78 - The system shall have the capability to retrieve flight Plans, repetitive flight plans, and flight plan history from the database.

SSS 79 - The system shall have the capability to retrieve flight plan data available on the basis of: Flight identification, in combination with departure aerodrome, and/or EOB/ETA (validity times).

3.2.1.6.6 **Repetitive Flight Plan Retrieval**

SSS 80 - The Flight plan workstations shall have access to RPL data in the RPL file, and to retrieve RPL data available on the basis of: Flight identification, in combination with departure aerodrome and/or EOB/ETA.

3.2.1.6.7 **Flight Plan History**

SSS 81 - The system shall have a capability to display and print all messages concerning a flight plan, including associated update messages, for at least adaptable hours after termination of flight plan.

3.2.1.6.8 **Free Text Input and Distribution**

SSS 82 - The system shall have the capability to perform "free text" input, and to be able to route this information for output to other designated workstations or any AFTN/AMHS address.

3.2.1.6.9 **RVSM**

SSS 83 - The system shall have the capability to process and display RVSM status according with the associated flight plan, the operator input data and coordination messages as well, considering the RVSM airspace;

3.2.1.6.10 **PBN**

SSS 84 - The system shall have the capability to process and display the PBN status associated to the flight plan according with the Amendment 1 of Doc 4444, considering the operator input data and coordination messages as well;

3.2.2 **Datalink Communication**

SSS 85 - The system shall be linked to aircraft by a datalink service provider (DSP).

SSS 86 - The system shall be capable of transmitting and receiving AFN, ADS and CPDLC messages complying with RTCA/DO258A-EUROCAE/ED-100 and AIDC messages complying with the Asia/Pacific Regional Interface Control Document for AIDC (ICD).

SSS 87 - The system shall include the ACARS Convergence Function (ACF) to convert messages between the character-oriented data of ACARS and the bit-oriented data used in ADS and CPDLC.

SSS 88 - The system shall provide air traffic controllers with:

- Display of message exchanges;
- Display of updated aircraft positions and maps;
- Tools for measuring separation in distance or time;
- Tools for measuring angles between aircraft flight paths;
- Information on aircraft flight status;
- HMI tools for composing ADS and CPDLC messages;
- Alerts for exception conditions;
- Conflict probe capability;
- Electronic flight progress strips, and paper strips if required;
- Presentation of emergency status;
- Other information pertinent to ATS operations.

3.2.2.1 CPDLC

SSS 89 - The system shall have the capability to communicate using the protocol CPDLC (“Controller- Pilot Datalink Communication”).

SSS 90 - The system shall be capable of processing the specified number of message exchanged with each of the aircraft.

SSS 91 - Down-linked CPDLC messages shall be displayed to controllers. Tools shall be provided to allow simple and intuitive initiation of, or response to, CPDLC messages.

SSS 92 - CPDLC position reports shall be used to display aircraft positions when no ADS report is available.

SSS 93 - The system shall have the capability of terminating CPDLC connection with the aircraft.

SSS 94 - The system shall allow transfer of CPDLC between sectors of an ATCAS without changing the data authority and with the same CPDLC link.

SSS 95 - The system shall be capable of handling the message set and the standardized free text messages defined in the FOM, as well as free text.

SSS 96 - The system shall allow controllers to review uplink messages prior to sending.

SSS 97 - Messages shall be handled in order of priority.

SSS 98 - Messages with the same priority shall be processed in the time order of receipt.

SSS 99 - The controller shall be alerted to unsuccessful receipt of the required response in the specified time or receipt of Message Assurance Failure (MAF).

SSS 100 - The system shall allow controllers to send any response messages linking with the reference number of the message received.

SSS 101 - A CPDLC dialogue shall not be closed until an appropriate closure response for that message with same reference number is received.

SSS 102 - When the closure response message is sent, the dialogue is closed and the system shall reject any further attempt to send a response message.

SSS 103 - The capability of closing a CPDLC dialogue, independent of CPDLC closure message receipt, shall be provided.

SSS 104 - The system shall have the capability to send the more frequent CPDLC messages through an interface using the associated track label.

SSS 105 - The system shall have the capability to display aircraft data, received by ADS, in the standard or extended track label.

SSS 106 - The system shall have the capability to display different shapes or symbols to differentiate that the aircraft is ADS/CPDLC capable and it is in contact with the Center.

SSS 107 - The system shall have the capability to allow the operator to differentiate information of course, speed and vertical speed received automatically by ADS.

SSS 108 - The system shall have the capability to uplink messages to the aircraft regarding the controller actions that the pilot need to know.

SSS 109 - The system shall have the capability to display in the outbox message list all the uplink CPDLC messages that are pending for an answer from the pilot.

SSS 110 - The system shall have the capability to display in a unique way the field associated to a change made by the controller till a downlink message is received from a pilot saying the change was made.

SSS 111 - The system shall have the capability to display a communication failure message, when an expected downlink message is not received during a time-out (adaptable).

3.2.2.2 **ADS**

SSS 112 - The capacity of the ADS function shall be determined from the operational policy and procedures and the airspace characteristics, including number of FANS capable aircraft, periodic reporting rate, airspace size, waypoint event report frequency, usage of event and demand contracts, and projected traffic growth.

SSS 113 - The system shall be capable of initiating periodic, event and demand contracts.

SSS 114 - The system shall be able to support a demand, an event and a periodic contract simultaneously with each aircraft.

SSS 115 - The system shall apply validation checks to incoming data by reference to flight plan data in relation to time, altitude, direction and position.

SSS 116 - The system shall be capable of processing ADS reports to display aircraft positions, tracks and altitude. Between ADS reports, aircraft positions shall be extrapolated and displayed automatically at specified intervals.

SSS 117 - Air and earth reference data of ADS reports shall be provided to controllers if required. The types of ADS contract are described at ICAO 9694 and 9880 documents.

SSS 118 - ADS messages shall be processed by the system in the following order:

1. ADS emergency mode.
2. Demand/event reports.
3. Periodic report.

SSS 119 - Within these categories, messages shall be handled in the order received.

SSS 120 - The following errors shall be notified to controllers:

- Message validation error.
- Message sequence error detected with time stamp.
- Time-out of ADS report in response to request.
- Periodic and waypoint event report failure.

3.2.2.3 **Notification of Error Messages**

SSS 121 - The system shall be capable of performing the cyclic redundancy check (CRC) on each message.

SSS 122 - The system shall be capable of verifying the format and validity checks appropriate to each message.

SSS 123 - Controllers shall be notified when the system detects:

- A message error;
- A message sequence error;
- A duplicate message identification number;
- Message non-delivery;
- An expected response not received.

SSS 124 - The system shall have a capability to display ADS or CPDLC emergency message received from an ADS/CPDLC equipped aircraft.

3.2.2.4 **Timestamps and Timers**

SSS 125 - CPDLC and AIDC messages shall be timestamped.

SSS 126 - By setting and/or deactivating various timer values for the messages received in response to transmitted messages, the system shall monitor whether or not aircraft responses arrive within a specified time limit.

Timers are generally based on the operational requirements of each ATCAS.

SSS 127 - The timers for sending messages relating to the automatic transfer of CPDLC connection and to AIDC shall be set according to bilateral agreements with adjacent ATCAS concerned.

SSS 128 - A timer file shall be provided in the system for:

- Timeout settings for delayed response.
- Timing to initiate actions in ADS/CPDLC operations for:
 - o Connection request (CR);
 - o ADS periodic, event and demand requests;
 - o Automated transfer of connection to the next ATCS;
 - o Sending Next Data Authority (NDA) message;
 - o Sending AFN Contact Advisory (FN_CAD): at least 30 minutes prior to FIR boundary message;
 - o Sending End Service message prior to the aircraft crossing the FIR boundary (e.g. 5 minutes before);
 - o Timer to trigger actions for sending AIDC messages;
 - o Timer for re-transmission of the message when no response is received within a specified time.

3.2.2.5 **AFN Logon Functions**

The AFN logon functions provide the necessary information to enable ADS and CPDLC communications between the system and aircraft avionics systems for:

- Logon;
- Forwarding logon information to the next ATCAS.

Note: Details of Datalink Initiation Capability (DLIC) functional capabilities are provided in Doc 9694 Part 2.

The required capacity for AFN logons will be determined from the operational requirements, such as estimated number of FANS aircraft at the peak hours and anticipated growth of FANS traffic.

SSS 129 - The system shall be capable of accepting or rejecting AFN logon requests.

SSS 130 - The system shall have the capability to correlate the AFN logon data automatically with the aircraft flight plan.

SSS 131 - The controller's workstation shall be capable of displaying the following data:

- Address and version number of the aircraft applications, if required;
- Response from the aircraft with timestamp;
- Status of correlation of the aircraft with its stored flight plan;
- Indication of 'Acceptance' or 'Rejection' to the logon request from aircraft.

SSS 132 - When an aircraft downlinks its supported applications and their version numbers in an FN-CON message, the ATCAS system response shall indicate whether or not it supports those version numbers.

SSS 133 - The system shall be capable of sending the Acceptance message or the Rejection message with reason, as appropriate.

3.2.3 Surveillance Data Processing

Ideally, surveillance systems shall incorporate all available data to provide a coherent picture that improves both the amount and utility of surveillance data to the user. The choice of the optimal mix of data sources shall be defined on the basis of operational demands, available technology, safety and cost-benefit considerations.

3.2.3.1 Air Situation establishment

SSS 134 - The system shall make available a plot position presentation as a selectable function.

SSS 135 - The system shall have the capability to receive, process and integrate all the messages (plots and tracks) to create and update a dynamic Air Situation received from the following surveillance sources:

- ADS-B: Eurocontrol Asterix Protocol Standard including Categories 10, 11, 21 e 23;
- ADS-C: ACARS Protocol;
- Multilateration: Eurocontrol Asterix Protocol Standard including Categories 10, 11, 19 e 20;
- Mode S: Eurocontrol Asterix Protocol Standard including Categories 10, 11, 34 e 48;
- Adjacent Centers: Eurocontrol Asterix Protocol Standard including Categories 62, 63 e TVT2;
- Radars: Eurocontrol ASTERIX protocols including categories 1, 2, 8, 34, 48 with UAP from Raytheon, Thales, SELEX, Lockheed Martin, INDRA, INVAP;
- Radars: CD2, AIRCAT500, TVT2 legacy Protocols.

SSS 136 - The system shall have the capability to create and update track information based on the flight plan information and controller data input (Flight Plan Navigated tracks);

SSS 137 - All the messages shall be submitted to a process to validate the message format before the surveillance integration, discarding erroneous messages and logging all errors found.

SSS 138 - The system shall have the capability to create a timestamp for all the messages using an UTC Time reference sent by the sensor, or using the local relative time.

SSS 139 - The system shall have the capability to integrate all the meteorological information from the primary radars (cat 8 messages) to display at the surveillance display.

SSS 140 - The system shall have a capability to tracking all the surveillance reports using a Surveillance Multisensor Tracking, improving accuracy and smoothing of the resulting system tracks through adaptative Kalman filters.

SSS 141 - The system shall have the capability to manage the status of all sensors, to determine which of the sensors are available to participate of the data fusion.

SSS 142 - The system shall have the capability to manage the surveillance report aging from all the sensors, and to verify the eventual interruption of message flow.

SSS 143 - The system shall have the capability to manage the surveillance track update and the track suppression for both the system track file and the local track file.

SSS 144 - The system shall have the capability to evaluate in real-time the highest quality information, and use the highest quality component information to update the system tracks, establishing priorities for the sensor types as defined in adaptation.

At the current stage of development of ADS-B systems, radar is generally accepted as the best surveillance data, followed by ADS-B and then by ADS-C. Flight plan tracks have the lowest quality.

3.2.3.2 Surveillance Data Output

SSS 145 - The system shall have the capability to forward surveillance track and flight plan information associated to the Adjacent ATCAS, using an ASTERIX interface categories 62, 63, and following a geographical filter previously defined in adaptation.

3.2.3.3 Surveillance Data Processing Capabilities

SSS 146 - The SDPS shall support the updating of system tracks with a Surveillance Tracking (ST) method which uses data from multiple sensors when overlapping surveillance coverage exists. The ST capability includes a track filtering algorithm capable of processing data from different surveillances. The data will be received at irregular times and each surveillance data will have unique position error variances.

SSS 147 - The SDPS shall maintain a system track and shall have the capability to display smooth system tracks which are updated based on surveillance data from multiple sensors.

3.2.3.4 Surveillance Presentation

SSS 148 - The SDPS will have the capability to present surveillance data in two modes:

- System Track Presentation Mode: A surveillance mosaic (the system mosaic) based on an integration of all surveillance sensors.
- Local Track Presentation Mode: Any single sensor connected to the SDPS.

SSS 149 - Each Surveillance Controller workstation shall individually be able to select a presentation mode, with a clear indication of the mode of presentation selected.

SSS 150 - When switching from one track presentation mode to another, there shall be no noticeable disruption in the presentation of data, except that some targets may not be detected anymore and others will be repositioned.

SSS 151 - When Local Track Presentation Mode has been selected, data processed at system track level shall be maintained for display and cinematic surveillance data presented shall be derived from the designated single sensor.

3.2.3.5 Surveillance Data Processing Functions

SSS 152 - The system shall provide the following functions:

- SSR reflection suppression;
- Processing and displaying of aircraft ground speeds, headings, predicted positions, SSR Mode C data, ADS Data;
- Display of position symbols (radar and ADS symbols) and specified track and label data;
- Processing and displaying of SPI and special codes;
- Provision for filtering;
- Display of coasting tracks;
- Surveillance data recording.

3.2.3.6 Direct Surveillance Access (DSA) Back-up Mode

SSS 153 - The DSA server shall provide surveillance sensor data onto the DSA LAN for selection by controller surveillance workstations in the DSA Back-up mode.

SSS 154 - The Direct Surveillance Access server shall process all surveillance data formats specified for the SDP.

SSS 155 - The controller specified DSA surveillance information shall be available upon selection of the DSA Back-up mode.

SSS 156 - Each surveillance workstation shall receive and process data from the Direct Surveillance Access server.

SSS 157 - The back-up mode shall provide map selection, range selection, off-centering, and manual code/callsign association, as well as display management functions in each surveillance workstation.

3.2.3.7 Real-Time Quality Control (RTQC) of Surveillance Data

3.2.3.7.1 Automatic Test Target Monitoring

In accordance with ICAO recommendations, fixed SSR Test Transponders will be installed within the surveillance coverage for each of the SSR sources integrated to the system.

SSS 158 - Test Targets shall be available for presentation in any surveillance position.

SSS 159 - The system shall have the capability to monitor the geographical position of the Test Transponders. If a Test Transponders position falls out of tolerance (adaptation), the SDPS shall notify and log at the Technical and Operational Supervisor Position.

3.2.3.7.2 **Status Message Monitoring**

SSS 160 - The system shall monitor the status messages to detect a change in the status of the surveillance sensor link or an increase in the error rate status message to declare a surveillance link down or up.

3.2.3.7.3 **Surveillance Data Counts Monitoring**

SSS 161 - The system shall maintain a count of the various types of surveillance messages in the system, including SSR and PSR messages. All anomalies in these controls shall be reported to the Technical and Operational Supervisor.

3.2.3.7.4 **Registration Analysis**

SSS 162 - The system shall provide the RTQC capability for ground based radars to perform range deviation and azimuth deviation computations on targets of opportunity. The capability will be continuously active and will monitor target reports received from surveillance pairs identified in adaptation.

SSS 163 - The system shall have the capability to calculate range and azimuth bias errors, and if these errors exceed adapted tolerance standards, an alert message shall be reported to the Technical and Operational Supervisor.

SSS 164 - The system shall have the capability to print a report of the most recent registration analysis on request.

3.2.3.7.5 **Registration Correction**

SSS 165 - The system shall provide the capability to manually update the surveillance registration corrections.

3.2.3.7.6 **SSR Reflections**

SSS 166 - The system shall have the capability to suppress SSR reflections, using the following conditions:

- The plot/track report has an SSR code that is one of the adapted discrete codes;
- The range and azimuth of the report lie within one of the reporting surveillance's adaptable reflection areas;
- Another report from the same radar that has the same code (duplicate) from the same surveillance scan, and its range is less than the range of the current plot/track report minus a design parameter range delta.

3.2.3.7.7 **Altitude Processing**

SSS 167 - The system shall have the capability to process QNH values for a minimum of TBD airports for the calculation of Transition Levels and conversion of Mode C derived data.

SSS 168 - The system shall have the capability to convert Mode C derived flight levels into altitudes for all aircraft in a QNH area below the relevant Transition Level.

SSS 169 - The system shall have the capability to process area QNH values for a minimum of TBD areas for the calculation of minimum usable flight levels on airways and other ATS routes.

3.2.4 **Flight Plan Data Processing**

3.2.4.1 Flight Data Processing Functions

SSS 170 - The system shall have the capability to receive, store, process, update, and display, repetitive flight plans (RPL), flight plans, and other ATS messages.

SSS 171 - The system shall have the capability to receive ATS messages from several sources, including AFTN/AMHS and adjacent centers.

3.2.4.2 **Flight Data Processing Capabilities**

SSS 172 - The system shall include the following capabilities:

- Flight plan routes analysis and flight trajectory and times calculation;
- Flight plan status determination based on inputs and timed events;
- Displaying and/or printing of flight plan data to relevant sectors;
- Automatic and manual Secondary Surveillance (SSR) code allocation;
- MET data processing;
- Flight plan / track association;
- Intersector and interunit coordination;
- Automated updating of flight plans based on Estimated Time Over (ETO) through correlation of flight plan data and surveillance data;
- AFTN Message processing.

SSS 173 - The system shall make available fully automatic processing of the standard ICAO flight plan messages, including the coordination message as foreseen in the OLDI (used only to exchange data with pre-existent ACC/APP that use this interface) and AIDC specification.

SSS 174 - The system shall support the current and new flight plan format, as in the Amendment 1 to the Procedures for Air Navigation Services — Air Traffic Management, Fifteenth Edition (PANS-ATM, Doc 4444) for applicability on 15 November 2012.

SSS 175 - The system shall generate and maintain a system flight plan which will be kept until it is terminated.

SSS 176 - The system shall ensure that equipment or communication unavailability in a sector will not cause any disturbances to the data interchange between other sectors/ centers.

SSS 177 - The system shall process VFR flights in the same manner as IFR flights unless otherwise specified.

3.2.4.3 **Flight Data Database**

SSS 178 - The system shall have the capability to establish and maintain a database of flight plans and to activate these flight plans for further processing, permitting modification, addition, and deletion of previously entered flight plans.

3.2.4.3.1 **Repetitive Flight Plan (RPL) Data**

SSS 179 - The system shall have the capability to receive RPL data via media, download or manually entered and store them in the RPL file.

SSS 180 - The system shall have a capability to transfer a RPL automatically to a flight plan database at a stipulated (adaptable) time prior to the time of entry into the area of responsibility.

SSS 181 - The FDPS shall provide the operator with the capability to create, modify and delete flight plans from the RPL file.

3.2.4.3.2 **AFTN/AMHS Flight Plan Data**

SSS 182 - The system shall have the capability to receive and process the following ATS messages received from AFTN/AMHS: FPL, DEP, ARR, RQP, ALR, RCF, RQS, AFP, SPL, CPL, DLA, CNL, EST, CHG, CDN, LAM, ACP and AIREP as foreseen in the ICAO 4444 Document and include other coordination messages.

SSS 183 - The system shall have a capability to enable or disable via a VSP the automatic processing of ATS messages for each message type. When it is enabled, ATS messages shall be processed for display to specific Flight Plan positions in the following conditions:

1. Whenever the message contains an error, discrepancy or other invalid data.
2. Whenever the flight plan contains data in field 18, except when the data are prefixed by "REG/", "SEL/", "OPR/", "ALTN/" or "EET/".

SSS 184 - In the cases where a message is not identified, or contains data that are not valid, or cannot be paired with previously stored data, an "invalid" response as well as the message itself shall be displayed to the specific flight plan positions. The message shall in such cases be displayed in the format in which it was received and with an indication of the "invalid" data.

SSS 185 - The system shall have the capability to check all ATS messages for:

- Format errors;
- Syntax errors;
- Previous receipt of the same message;
- Validity, with respect to whether the flight plan or flight update message will affect the area of responsibility;
- Compatibility, with respect to conformance between aircraft type, True Airspeed (TAS), flight level/altitude, EET, departure aerodrome, route within the defined route system, and destination;
- Validity time;
- Channel sequence number.

3.2.4.3.3 **Operator Flight Data Input**

SSS 186 - The system shall have the capability to display at the Surveillance Display and Flight Data display and input the following types of flight plan messages:

- FPL and CPL;
- Flight updates messages;
- Departure state transition messages;
- Fix estimate updates;
- Cleared level updates.

3.2.4.3.4 **MET Data**

SSS 187 - The wind direction and speed, referenced as MET Data shall be able to be received through the AFTN/AMHS interface, as defined in the SICD.

SSS 188 - The MET data shall be processed for multiple height layers and areas for use in trajectory and times calculation, employing the data valid for the route (area).

SSS 189 - The Flight Data Display shall have the capability to display and change the MET data.

3.2.4.3.5 **Input Message Processing**

SSS 190 - The FDPS data base shall have the capability to identify, classify, and process the message types received, as well as identify the originator (source) of the message.

SSS 191 - Received CNL-messages with respect to pre-active and active flight plans shall be processed for display to the sectors concerned.

SSS 192 - Flight update messages shall automatically change the parent flight, causing, if necessary, the re-processing of the flight plan.

SSS 193 - The system shall have a capability to do the following actions, as required, when a flight update message is received:

1. New calculation of flight trajectory/flight times;
2. New analysis of flight plan route;
3. New analysis of flight strip distribution plan;
4. New distribution of flight data for display update.

3.2.4.4 **Flight Progress Processing**

SSS 194 - The system shall have a capability to determine the status for each flight plan, reflecting the current state of the flight.

SSS 195 - During a flight plan lifetime, the system shall have a capability to attribute a flight plan the following states and its transitions:

- Inactive - when a new flight plan is created;
- Pre-active – VSP time before the effective realization of the flight;
- Active - corresponds to the effective realization of the flight;
- Terminated - corresponds to the period when the flight plan is ended by operator action or automatically, staying in the system only for consulting features.

3.2.4.5 **Route Processing**

SSS 196 - The system shall have the capability to produce and maintain a continuous flight profile/trajectory for every valid flight plan received.

SSS 197 - The system route system shall include:

- The defined airspace, airways, and ATS route structure;
- Navigational aids/significant positions and Aerodromes;
- Sector boundaries;
- SID/STAR procedures.

SSS 198 - The route processing function shall accept input data based on:

- Route as indicated in the flight plan or, if applicable, as subsequently indicated by

- an update message;
- Entry of significant positions defining the route by significant points/positions, latitude/longitude positions.

SSS 199 - The system shall have a capability to do a Route analysis/conversion automatically.

SSS 200 - Trajectory estimation shall be based on route, flight planned level/altitude, available wind data, and aircraft performance characteristics.

SSS 201 - The route processing function shall determine significant positions and calculate ETOs for those positions.

SSS 202 - The system shall have the capability to integrate an AMAN (Arrival Management) and/or a DMAN (Departure Management) and/or SMAN (Surface Manager) tools for Tactical Local Planning.

3.2.4.6 **Secondary Surveillance (SSR) Code Allocation**

SSS 203 - The system shall have the capability to process both manual and automatic SSR code allocation.

SSS 204 - The system shall have the capability to maintain lists of codes to be used for automatic code allocation.

SSS 205 - The system shall have the capability to maintain lists of codes to be retained for flights from another ATC Center.

SSS 206 - The system shall have the capability to automatically allocate non-duplicated codes to flight plans for flights generated within the FIR and equipped with a 4096 SSR code transponder.

SSS 207 - The system shall have the capability to assign non-duplicated adapted discrete codes and adapted non-discrete codes to designated flights as specified by controller input action.

SSS 208 - The system shall have the capability to release previously assigned codes for re-allocation.

3.2.4.7 **Flight Plan/Track Association Function**

SSS 209 - The system shall have the capability to automatically associate flight plans with the appropriate surveillance system tracks.

SSS 210 - The system shall have a capability to allow the operator to initiate an association.

SSS 211 - The system shall have the capability to terminate the association (also called disassociation) between a track and a flight plan either automatically or manually.

SSS 212 - The system shall have the capability to do an automatic association only with discrete SSR codes.

SSS 213 - The system shall have the capability to allow the operator to do a manual association with discrete and nondiscrete SSR codes and tracks without an SSR code (primary tracks).

SSS 214 - The system shall allow the manual association only if the track and flight have the same CALLSIGN.

SSS 215 - The system shall have the capability to monitor periodically each controlled flight for conformance with its planned route, using the associated surveillance system track's position to compute the ETO for each fix in the route, and to determine when each fix has been passed.

3.2.4.8 **Sectorization**

The airspace of interest is described geographically in the adaptation data in terms of nonoverlapping volumes of airspace known as geographic sectors.

These volumes are polygons in the horizontal plane and have an up to TBD different levels dividing the airspace that can be controlled by a controller. This unit of airspace is usually called a controlled sector.

SSS 216 - The system shall have the capability to declare up to TBD different levels to define the control sectors.

3.2.4.8.1 **Sector Reconfiguration Function**

SSS 217 - The system shall have the capability to change the definition of control positions and the assignment of control sectors to positions through the consolidation input.

SSS 218 - The system shall check if the new position has the capacity for all the flights affected by the requested consolidation and to automatically change the ownership to this new position.

3.2.4.9 **ATFM Functions**

SSS 219 - The system shall have the capability to analyze the air traffic with anticipation for Air Traffic Flow Management purposes.

SSS 220 - The system shall have the capability to display a graphic of flight plans associated to a predicted period of time , using a filter for a specific:

- Airport: classified by flights in ETA or ETD;
- Coordination point: classified for ETO;
- Sector: classified for time of arrival in the sector;

3.2.4.10 **FDPS Output**

SSS 221 - The system shall have the capability to provide all controller workstations with an up-to-date presentation of the state of all individual flights assigned to, or otherwise of significance to (i.e., to be assigned to) each workstation.

SSS 222 - The system shall have the capability to transmit flight update messages to all ATC workstations and adjacent ATC centers.

3.2.4.10.1 **Output of Messages to AFTN/AMHS Network**

SSS 223 - The system shall have the capability to support a protocol for communication with interactive ACCs, where adapted, and the transmission of the FPL, DEP, ARR, RQP, ALR, RCF, RQS, AFP, SPL, CPL, DLA, CNL, EST, CHG, CDN, LAM, ACP and AIREP messages.

3.2.4.10.2 **Flight plan Handoff**

SSS 224 - The system shall have the capability to determine automatically when a surveillance track associated with a flight plan is about to cross sector or FIR boundaries, in order to transfer the flight plan from one controller to another or from one controller to another ATC system sector.

SSS 225 - The system shall have the capability to allow the controller do a handoff between the involved sectors or Adjacent ATCAS involving the main phases:

- handoff warning: it is generated at a time (adaptable) before the ETO of the coordination point to the current owner of the flight to indicate that the handoff to the next sector is due;
- handoff initiation: the owning controller requests the hand-off function to validate and initiate the control transfer to the next sector on the flight's planned route;
- handoff acceptance: the receiving controller can accept and conclude the control transfer processing.

SSS 226 - The system shall have the capability to output flight plan data to the Adjacent ATCAS as specified in the SICD.

SSS 227 - The system shall have the capability to exchange coordination messages, with the following protocols:

- Messages ICAO 4444 standard, using the AFTN/AMHS;
- Messages AIDC as specified in the Asia-Pacific ICD, using the AFTN/AMHS;
- Messages OLDI as specified by EUROCONTROL, using dedicated links.

SSS 228 - For AIDC protocol, the system shall have the capability to exchange the minimum set of messages (ABI, CPL, EST, PAC, ACP, MAC, LAM, LRM, TOC, AOC) for the Notification, Coordination and Handoff phases defined in the referenced AIDC ICD.

SSS 229 - For OLDI protocol, the system shall have the capability to exchange the minimum set of messages (ABI, ACT, REV, PAC, MAC e LAM) for the Basic Procedure, Dialogue Procedure – Coordination Phase and Dialogue Procedure – Transfers Phase as defined in the referenced OLDI ICD.

SSS 230 - The actual protocol used to Exchange flight plan messages with adjacent ATCAS shall be defined in adaptation data.

3.2.4.10.3 **ATFM unity**

SSS 231 - The system shall have a capability to send coordination information, slot information, predicted and current traffic load and flight plan updates to an ATFM unity.

SSS 232 - The system shall have the capability to send to the ATFM unity the go/no-go status on the major ATCAS subsystems and sensors.

3.2.5 **Alerts**

SSS 233 - The system shall provide a window dedicated to display all the conflicts detected during the flight plan life.

SSS 234 - The system shall display all the alerts detected during the flight plan route visualization.

SSS 235 - The system shall display all the flights involved in a conflict.

3.2.5.1 **Special Codes and Emergency Messages**

SSS 236 - The system shall display codes reserved for special purposes, such as A7500, A7600, A7700, using also a time-limited (VSP) audio signal, of individual activation's of special codes.

SSS 237 - The system shall have a capability to display ADS or CPDLC emergency message received from an ADS/CPDLC equipped aircraft.

SSS 238 - The system shall have the capability to display the last detected position of a special code squawk and the associated track history as well, till the controller acknowledges the alert at the supervisor position. The capability to print all the data associated shall be provided.

3.2.5.2 **Short Term Conflict Alert (STCA)**

SSS 239 - The system shall have the capability to generate a Short Term Conflict Alert (STCA) with respect to tracks, taking into account the CFL and considering the PBN status information. If the system determines that a violation of vertical separation minima (adaptable) and horizontal separation minima (adaptable) is calculated within a pre-determined (adaptable) time period.

SSS 240 - The system shall have the capability to define adapted areas where the STCA feature will be applicable.

SSS 241 - The system shall have the capability to process tracks in respect to heading, speed, altitude/flight level, vertical speed, when available for a pre-determined (adaptable) time ahead.

SSS 242 - The alert STCA generated shall include a visual and aural (time-limited) indication to the workstation(s) that are responsible for the tracks concerned, which will be extinguishable upon acknowledgment by the controller.

3.2.5.3 **Minimum Safe Altitude Warning (MSAW)**

SSS 243 - The system shall have the capability to generate MSAW with respect to tracks providing SSR Mode C information. A minimum safe altitude warning will be generated when SSR Mode C information indicates that an aircraft:

- In level flight is inside or within (adaptable) NM of an area where the minimum safe flight level is greater than the aircraft flight level.
- Has a rate of descent (adaptable time) indicating that a minimum safe altitude will be penetrated.
- Has a rate of climb (adaptable time) insufficient to obtain a minimum safe altitude.

SSS 244 - The system shall have the capability to define adapted areas where the MSAW feature will be applicable.

SSS 245 - The alert MSAW generated shall include a visual and aural (time-limited) indication to the workstation that has the track, which will be extinguishable upon acknowledgment by the controller.

3.2.5.4 **Medium Term Conflict Detection (MTCD)**

SSS 246 - The system shall have the capability to generate a MTCD when a new or modified flight plan create a conflict in any point of its route with other active flight plan, taking into consideration the PBN status, airspace RVSM and the APP airspace as well.

SSS 247 - The MTCD shall be generated only to the Controller and Assistant that has a sector jurisdiction over the flight plan. This alert will be displayed at the operational supervisor as well.

SSS 248 - When any events or changes in the route, level or estimated time occur the system shall have the capability to recalculate the conflict prediction automatically taking into consideration all others flight plans.

3.2.5.5 **Cleared Level Adherence Monitoring (CLAM)**

SSS 249 - The system shall have the capability to display at the track label an alert when an aircraft is deviating from its Cleared Flight level by a value greater than a threshold.

3.2.5.6 **Route Adherence Monitoring (RAM)**

SSS 250 - The system shall be able to monitor if a trajectory flight is in conformance with its flight route, and to alert when an aircraft is deviating from its planned route, considering the PBN status information.

3.2.5.7 **Area Infringement Warning (AIW)**

SSS 251 - The system shall be able to alert in situations when an aircraft is, or is predicted to be, crossing the border of a reserved area (restricted or dangerous) on-line predefined or off-line adapted.

3.2.5.8 **Conflict Probe**

SSS 252 - The system shall have a tool (Conflict Probe) initiated by the controller for a particular aircraft, to determine whether a proposed flight plan will come into conflict with another during a specified period.

SSS 253 - The system shall compare the proposed trajectory with the current planned trajectories of other aircraft information and displays the position and time of calculated conflicts to the controller, considering the PBN status information.

3.2.5.9 **Approach Funnel Deviation Alert**

SSS 254 - The Approach Funnel Deviation Alert (sometimes also known as Approach Monitoring Aid) is the Safety Net function responsible to alert in situations when an aircraft deviates from the approach funnel, either laterally or vertically.

3.2.6 **Recording and Playback**

SSS 255 - The operational system shall include a data recording facility to record and replay data.

SSS 256 - The recording function shall be able to operate concurrently with the playback function.

3.2.6.1 **Recording**

SSS 257 - It shall be possible to record data continuously for 48 hours without operator intervention. The replacement of the non-volatile removable storage medium shall be limited to a maximum of once every 48 hours.

SSS 258 - It shall be possible to record all displayed targets, weather information, maps, lists, images, filter limits, display control settings, and all Surveillance Display operator actions performed shall be date/time stamped and recorded.

SSS 259 - The system shall record all operational actions and system messages at the Surveillance Display, Flight Data Display and Electronic Flight Display and the Technical/Operational Supervisor.

SSS 260 - The system shall have the capability to record online all the surveillance and flight plan data in a commercial database, in order to execute queries to generate reports.

SSS 261 - The system shall record each system flight plan record whenever its flight state or holding state changes or whenever an item changes as a result of operator input or an external message.

SSS 262 - The system shall record the data while still meeting its response time requirements.

SSS 263 - For archival purposes, recorded data shall also be copied to a non-volatile removable storage medium for permanent storage. The recording computer may use internal hard disks as temporary storage medium.

3.2.6.2 **Playback**

SSS 264 - The system shall have a capability to record data and playback to be used in the following activities:

- to create the air situation display at the surveillance display with all the flight plan events associated;
- to obtain a log of operator actions and system messages;
- to perform data analysis and statistics;

SSS 265 - The recorded information shall be capable of being played back at selected working positions without interrupting the operational system.

SSS 266 - It shall be possible to playback data archived on removable storage medium loaded.

SSS 267 - The system shall be capable of performing a high speed search of the recording medium in relation to time of day.

SSS 268 - It shall be possible to select a specific time to the nearest minute from which the data playback is to commence.

SSS 269 - The system shall be capable of replaying data that has been recorded up to 60 days prior in a slow, normal or fast mode.

SSS 270 - The system shall provide an interface to synchronize the playback with the Audio Recorder.

3.2.6.3 **Surveillance Display Playback**

SSS 271 - The system shall have the capability to change the playback mode to an interactive playback mode in which it is possible to change the Surveillance Display presentation.

SSS 272 - The system shall have the capability to display recorded data at any surveillance display working position configured for playback.

3.2.6.4 **Non-interactive Playback Mode**

SSS 273 - During non-interactive replay, the replayed data shall be presented in a manner that emulates the display presentation at the time of recording including the result of controller display input actions and all functions executed using all input devices.

3.2.6.5 **Interactive Playback Mode**

SSS 274 - In the interactive mode, the selected working position receives all of the recorded data and the user can change the display of this data as if in an operational environment, without interference with the operational system.

SSS 275 - A working position configured to operate in playback mode shall be able to enter interactive mode at any time during the playback.

3.2.6.6 **Flight Data Display Replay**

SSS 276 - The system shall have the capability to provide a log of all previously recorded controller and assistant actions to a printer.

3.2.7 **Architecture and Supervision**

3.2.7.1 **Functional Redundancy**

SSS 277 - Critical functions shall be dualized to provide redundancy ensuring continued full system operation in the event of single failures, such as:

- The Flight Plan Data Processing Servers;
- The Surveillance Data Processing Servers;
- The Data recording servers;
- The Control and Monitoring Servers and Displays;
- The Aeronautical and Meteorological Servers.

3.2.7.2 **System Requirements**

SSS 278 - The system shall have the capability to ensure that the failure of any single functional unit will not cause the total failure of the system.

SSS 279 - The system shall have the capability to distribute a time Reference to all positions in accordance with the mode of operation (on-line, playback or simulation).

SSS 280 - The system shall have the capability to automatically restore itself to normal operation after interruptions due to power failure.

SSS 281 - In case of power return after complete power outage, the ATCAS shall automatically restart and go into operation in the same configuration as before the outage.

SSS 282 - The system shall have the capability to provide the following functions.

- Monitor the status of all system elements;
- Perform manual and automatic system reconfigurations;
- Supply status information for display;

SSS 283 - All events shall be stored on disk and classified depending on its relevance.

SSS 284 - The system shall have the capability to filter and display all the events and system error reports recorded based on its type, relevance and time, as an interactive data base.

SSS 285 - The system shall have the capability to switch over its critical function servers with no loss of information.

SSS 286 - The system shall have the capability to restart any nodes and perform reconfiguration of all servers.

SSS 287 - The system shall have the capability to display and print out the actual operational configuration and status, including the monitored external sources.

SSS 288 - The system shall have the capability to use dual LAN (Local area network) and meet all functional and performance requirements with one of the dual LANs out of service.

SSS 289 - The system shall have the capability to supervise and display the status of the dual LANs and perform automatic reconfiguration to the standby LAN if necessary.

SSS 290 - The system shall have the capability to monitor continuously all the local and remote net nodes using the SNMP protocol.

SSS 291 - The system shall monitor, using the SNMP protocol the following hardware devices status:

- CPU load and temperature;
- RAM memory use;
- Disk partition use;
- Network traffic.

SSS 292 - The system shall monitor, using the SNMP protocol, the availability of UPS and generators used to supply Power to all equipments.

SSS 293 - The system shall have the capability to display the status of all equipments and network in a synoptic view of the system.

SSS 294 - The system shall have the capability to detect and display alerts and alarms at the Supervisor Positions, and all the critical and non critical errors generated by the system.

SSS 295 - The system shall have the capability to configure the acceptable limits, frequency and Time-out values for the events of the system monitored using the SNMP protocol.

SSS 296 - The system shall have the capability to operate each Supervisor position in the Technical, Operational and Read-only (only Display) defined by the login, including also others backup positions. Each mode shall have a specific authorization to execute determined commands in accordance with their role.

SSS 297 - The system shall have the capability to define a regional operational supervisor responsible for a subset of sectors, used for centers with a big number of sectors.

3.2.7.3 **Online Test**

SSS 298 - Online tests of the hardware as well as the software shall be provided to verify the operation of the computer systems.

SSS 299 - The online test functions shall periodically check the subsystem and display alerts for fault situations.

SSS 300 - The online test functions shall periodically verify the communication availability of all nodes in the local network and all the external interfaces.

3.2.7.4 **ATCAS System Control and Reconfiguration**

SSS 301 - The system shall have the capability to execute the following action from the Supervisor Position:

- System Startups;
- Disable/Enable of automatic equipment switchover;
- Reconfigurations;
- Variable System Parameter updates.

3.2.7.5 **ATCAS Sector Reconfiguration**

SSS 302 - The system shall have the capability to provide a graphical display of the ATCAS sector configuration.

SSS 303 - The system shall have the capability to use preset sector configurations defined in the adaptation data.

SSS 304 - Sector reconfigurations shall be performed at the Operational Supervisor.

SSS 305 - The Operational Supervisor shall have the capability to print a consolidation report.

SSS 306 - The system shall have the capability to display and print a current sector load and a predict sector load, based on a specific time ahead.

3.2.8 **Aeronautical and Meteorological Information**

SSS 307 - The system shall have a capability to receive aeronautical and meteorological information from the AFTN/AMHS:

- Meteorological information: MET data as defined in section 3.2.4.3.4 and METAR, according to ICAO Annex 3 and other meteorological messages, such as SIGMET, AIRMET, GAMET, SPECI and TAF, according to Annex 15;
- Aeronautical information: NOTAM, according to ICAO Annex 15.

SSS 308 - The MET data will be received every 6 hours from the AFTN/AMHS; in case of absence or a delay greater than 30 minutes (adaptable), the system shall have the capability to send a message to the Operational Supervisor and it shall use the latest data stored.

SSS 309 - The system shall have the capability to receive aeronautical and meteorological information for display via a Web Browser.

SSS 310 - The system shall have the capability to input and display QNH values.

SSS 311 - The system shall have the capability to check the MET data for format and syntax errors.

SSS 312 - The system shall have the capability to display and modify aeronautical information.

SSS 313 - The system shall have the capability to display and modify the MET data.

SSS 314 - The system shall have the capability to identify and classify MET data messages with respect to type of data and area of validity.

SSS 315 - The system shall have the capability to compose and display a web browser window with general purpose information to be used internally by the controllers.

SSS 316 - The system shall have the capability to compose free text input (no pre-defined format, up to 1800 characters) to be routed to AFTN/AMHS addresses.

3.2.9 **Management, Operational and Technical Information Report Tool**

SSS 317 - The system shall have the capability to produce monthly statistics of end-to-end system datalink performance in daily operations. The system shall have appropriate tools for monitoring and analyzing the performance data for reporting.

SSS 318 - The system shall have the capability to generate reports, using predefined queries or ones defined by the operator, such as: total number of flight plans in a sector during a specific period of time, with filters defined by the user (aircraft type, level, airway, VFR or IFR rules, ATCAS origin, and airport).

SSS 319 - The system shall have a capability to generate reports with a list of all strips updates during a specific flight plan lifetime.

SSS 320 - The system shall have a capability to generate reports with a list of working hours for each operator during a specific time and their respective totals consolidation, based in the logon/logoff records.

SSS 321 - The system shall have a capability to generate reports with a list of sectors allocation hours, taking into account all the sector consolidation/deconsolidation.

SSS 322 - The system shall have a capability to generate reports with a list of all alerts distributed per type, criticality, sector and time.

SSS 323 - The system shall have a capability to execute scheduled (E.g.: annually, monthly, daily, hourly) pre-defined reports.

SSS 324 - The system shall have a capability to provide commercial tools to create user-defined reports.

SSS 325 - The system shall have the capability to define different Access levels for data and reports.

SSS 326 - The system shall have a capability to generate graphical and textual reports and print.

3.3 **System External Interface Requirements**

The network shall conform to the protocol suite defined as part of the ATN concept. For messages from controller to pilot, the ground ATN routers must choose the most suitable data link device available and route the messages to that transmitting station.

It is intended that the ADS and CPDLC functions shall eventually be carried by the ATN. The purpose of the ATN is to “provide data communication services and application entities in support of the delivery of air traffic services (ATS) to aircraft; the exchange of ATS information between ATS units; and other applications such as aeronautical operational control (AOC) and aeronautical administrative communication (AAC).” [Annex 10, Vol III, 3.3].

It is important, therefore, that any new system should either include provisions for, or have a defined upgrade path to provide, interfacing with the ATN. ICAO Doc 9705 - Manual of Technical Provisions for the Aeronautical Telecommunication Network (ATN) is the appropriate source of interface data for the ATN.

At present, the ATN is under development and trials are being carried out in several ICAO Regions.

3.3.1 Datalink and Surveillance sensors interfaces

3.3.1.1 Datalink Service Provider

In the current FANS 1/A environment, ADS and CPDLC messages are passed between aircraft and the System using the ACARS data messaging system. ACARS was developed by the DSPs to pass information between the airline operating centre (AOC) and the aircraft. ADS and CPDLC required an air-ground datalink and, in the absence of the Aeronautical Telecommunication Network (ATN), the ACARS system was used.

It is essential therefore to specify the appropriate interface port(s) to connect to the chosen DSP. This is typically an RS232 serial port, but the exact requirement needs to be confirmed with the DSP.

3.3.1.2 Radar Data

Data imported from a separate radar system will take the form of track data or possibly plot data, using a standardized interface ASTERIX.

3.3.1.3 Multilateration (MLAT)

MLAT is an enabling technology that will enhance the provision of ATM in a variety of applications, from “radar-like” air traffic control purposes to enhanced situational awareness of surface movements. MLAT offers most advantages in situations where other surveillance systems (e.g. radar) are not available. It can also be combined with other surveillance systems, such as radar and ADS-B, to improve the total surveillance picture.

MLAT is dependent on the aircraft having at least a Mode A/C transponder. It can receive identity through correlation of a code with the flight plan, or the flight identification transmitted by ADS-B or Mode S transponder.

3.3.2 AFTN/AMHS

The AFTN is currently the carrier for ground-ground messaging between ATC units and carries AIDC messages in the FANS 1/A environment. The AMHS (Aeronautical Message Handling System) is the ground-ground messaging application of the ATN.

Any new system AMHS shall include at least one AFTN gateway. AIDC messages generated in AMHS structure can then be transmitted via the AFTN and incoming messages from the AFTN shall be transposed to AMHS structure.

After the ATN becomes operational and the AFTN is no longer used, the gateway can be removed.

The AMHS specification, as defined in ICAO Doc. 9705 (Document that will be consolidated with Doc. 8080) and ICAO Doc 9880, includes only two levels of service which correspond to a different level of functionality for the AMHS. They are the Basic ATS Message Handling Service and the Extended ATS Message Handling Service.

SSS 327 - The system shall accept and transmit ICAO flight plan data messages via the AMHS or AFTN, as defined in ICAO documents Doc 4444 15^a Ed and 9705.

3.3.3 **Adjacent ATCAS interface**

Direct Connection between ATCAS Systems – It is necessary when a full system must be connected directly to an existing system for flight plan coordination and surveillance data sharing.

3.3.3.1 **Flight Plan Coordination**

SSS 328 - The Flight plan data shall be exchanged with adjacent ATC centers (Others ACC). The system shall provide the capability to exchange flight plan data with these ATC centers, using OLDI or AIDC messages.

The OLDI application, which is implemented in the EUR Region, consists of the exchange of messages (a subset of AIDC messages), using a dedicated OLDI protocol operating directly over X.25. This is going to evolve in the short- to mid-term towards FMTP (Flight Message Transfer Protocol), which is a specific protocol operating over TCP/IP.

SSS 329 - For flight plan coordination, the interface shall be AIDC over AMHS/AFTN or the future ATN, but for compatibility with pre-existent legacy systems OLDI may be implemented over X-25 with direct links or over TCP/IP (using a X.25 to TCP/IP converter).

AIDC messages will be passed via the AFTN until the ATN is operational. However, AFTN/AMHS gateways shall increasingly be used to provide a transition between the AFTN and ATN. These gateways transpose AFTN messages into AMHS format and vice versa.

This consists in the exchange of AIDC messages over AFTN, using the "Optional Data Field" included in the header of AFTN messages. This application is governed by the document named "Asia/Pacific Regional Interface Control Document (ICD) for ATS Interfacility Data Communications (AIDC)".

3.3.3.2 **Surveillance Data Sharing**

SSS 330 - The system shall provide an interface to exchange track data with adjacent ATC centers. This can be implemented by sharing the radar sensor using ASTERIX or exchanging system surveillance data between surveillance servers using ASTERIX format cat 62, 63.

3.3.4 **Defense systems interfaces**

This interface will be used to surveillance data sharing, since there will be sensors used in Air Defense Systems that can be useful for Air traffic Control.

This also can be implemented by sharing the radar sensor using ASTERIX or exchanging system surveillance data between surveillance servers using ASTERIX format cat 62, 63.

3.3.5 **Operator interface**

3.3.5.1 **Human Factors**

Human factors play a major part in the success or failure of a system to meet its operational objectives. A system that is uncomfortable to use will lead to controller dissatisfaction. As controllers are an essential part of the overall system, it can only degrade the overall system performance.

Displays and keyboards that are poorly designed from a human factors aspect will be inefficient and may cause actual harm to the users. Bad display design can affect the eyes and bad keyboard design may result in occupational overuse syndrome (repetitive strain injury). The human factors implications of the system specification should be considered very carefully.

3.3.5.2 **Displays**

One or more displays are required to handle the Surveillance, Flight plan interface with ADS, CPDLC and AIDC messages. Many systems incorporate message handling in the situation display.

Modern displays use LCD technology and may be as large as 600 x 600mm, with typical resolution of 2048 x 2048 pixels. Smaller displays may be more appropriate for some uses, particularly if there are 2 displays at a controller position: a second display is often used for flight data handling. However, the arrangement of displays will largely depend on the extent to which the new system is to be integrated with existing systems.

While color displays offer great advantages in differentiating between different categories of data, the choice of colors for the various categories can be very contentious. It is essential that color allocation is not arbitrarily decided, but is based upon sound human factors principles. Inappropriate color choices can contribute to fatigue, confusion and errors.

Different symbols will be used for radar tracks, ADS-B tracks, ADS-C tracks and tracks generated from flight plan information. The track symbol shall be that of the source of the highest quality information. At the current stage of development of ADS-B systems, radar is generally accepted as the best surveillance data, followed by ADS-B and then by ADS-C. Flight plan tracks are the lowest quality.

The status of the CPDLC connection is an important information for the controller and is best displayed in the track label.

3.3.5.3 **Message Handling**

Message handling for ADS, CPDLC and AIDC messages is usually achieved by some form of menu access for generating messages and by pop-up windows for replying to incoming messages. Most systems now offer access via the track label.

For CPDLC, there are two elements to generating most messages: selection of the specific message and entry of necessary data. The message selection shall be simple: there are about 180 uplink messages available. Some systems present a selection of appropriate messages – for example, by offering only height-related messages if the height field in the track label is selected. ADS contract messages are more simple and infrequently required, so that a simple menu-type operation is normally adequate. AIDC messages can usually be generated automatically to form flight plan data.

3.3.5.4 **Input Devices**

The controller input devices include the text input device and the pointing device.

The text input device is normally a keyboard and there are various types of keyboard (standard, ergonomic, etc).

3.3.6 **Time Reference System and Audio Recorder interface**

The system contains a Time Reference System which will establish a common time source for all subsystems. In addition, outputs will exist to synchronize external systems with the common time source, such as the Audio Recorder for Playback activities.

The Time Reference System will be used to keep time synchronization in the Operational and Simulator Partition.

The TRS will be synchronized to GPS signals received by the antenna, and it will be distributed to all net nodes by ntp protocol.

SSS 331 - The system shall have the capability to synchronize all subsystems to a common time source with a maximum deviation of 100 milliseconds.

SSS 332 - Time reference outputs shall be provided to synchronize other clocks with the common time source, typically Audio Recorder Systems.

3.3.7 **ATFM Unity Interface**

SSS 333 - The system shall provide an interface with a central ATFM for flight plan information and coordination.

SSS 334 - An air traffic flow management (ATFM) service shall be implemented for airspace where traffic demand at times exceeds the defined ATC capacity.

ATFM will be implemented on the basis of a national/regional air navigation agreement or, when appropriate, as a multilateral agreement.

The ATFM service within a region or other defined area, will be developed and implemented as a centralized ATFM organization, supported by flow management positions established at each area control centre (ACC) within the region or area of applicability.

SSS 335 - The responsible ATFM unit shall receive the traffic demand continuously from the responsible ATC unit, allowing the ATFM unit to monitor if this demand exceeds, or is foreseen to exceed, the capacity of a particular sector or aerodrome in order to coordinate ATFM measures.

3.3.8 **AIS and MET**

This interface is used for Web interfaces (HTTP) to access AIS and MET data using a Web Browser with a LAN connection. It represents a new tendency to access data information using the future ATN.

3.4 **System Internal Interface Requirements**

The system usually will use a LAN 100/1000 Mbps as specified in the IEEE 802.3x with protocol TCP/IP.

3.5 **System internal data Requirements**

Not applicable.

3.6 **Adaptation requirements**

3.6.1.1 Database Management

SSS 336 - It shall be possible at the Database Management position, to print-out for visual presentation maps entered into the system via the DMS, including graphic presentation.

SSS 337 - The system shall have a capability to edit a database with the following data sets:

- Airways;
- Airports and Runways;
- Restricted areas;
- NAVAIDS;
- SID/STAR Procedures;
- AFTN/AMHS Directions;
- Sectors;
- Adjacent ATCAS;
- Coordination points;
- Adaptable System Parameter;
- Default values for Variable System Parameter;
- FIR/UIR borders;
- Terminal control areas;
- Control zones;
- Traffic information zones;
- Airways and ATS routes;
- Radars sensors information and protocol;
- Configuration files;
- Time Parameters;
- Alerts Parameters;
- Flight Plan parameters;
- Coordination Protocols;
- Aircraft Types and performance;
- Significant points;
- ATS routes;
- TMA Areas;
- PBN data;
- Alerts data;
- Adaptable System Parameters;
- Variable System Parameters;
- Etc.

SSS 338 - The system shall verify the data validation and consistency before the generation of a set of adaptation data.

SSS 339 - The system shall have a capability to download a new set of adaptation data to all positions or a group of positions without interfering with the operation.

3.7 **Safety requirements**

Safety assessments are described in detail in ICAO Doc 9859, Safety Management Manual.

Safety nets are described in the item 3.2.5.

3.8 **Security and Privacy Requirements**

SSS 340 - The system shall have the capability to control users and password and display the list of users logged at the operational supervisor and record all the actions with the responsible user information based in the logon/logoff control.

3.9 **System environment requirements**

SSS 341 - The acoustic noise level shall be no greater than 50 dBA at 1 meter for servers and peripherals normally located in an equipment room.

SSS 342 - The acoustic noise level shall be no greater than 50 dBA from the front surface of fully enclosed consoles normally located at the ATC operations room.

3.10 **Computer Resource Requirements**

SSS 343 - The maximum load admitted in any condition for any processor shall be 50% of maximum capacity.

SSS 344 - The maximum memory occupation admitted in any condition shall be 50 % of the maximum available memory.

3.11 **System Quality Factors**

3.11.1 **System Reliability**

Reliability predictions will be made for all equipment through observation or calculated using a specific standard. The system reliability will be maximized through use of redundant equipment configurations where a single failure would impact system operation. All single point failures will be identified.

3.11.2 **System Maintainability**

The system design will employ system fault detection and fault isolation.

SSS 345 - The system shall have the capability to detect 90% of all system failures.

SSS 346 - The system shall provide the mean time to repair to be less than 30 minutes.

3.11.3 **System Availability**

The system will provide operational availability through use of redundant/fault tolerant system architecture, system fault coverage and fault detection, and preventative and corrective maintenance.

SSS 347 - The system availability of the ATCAS shall exceed 99.999%.

3.12 **Design and Construction constraints**

SSS 348 - The system shall be built using open systems technology, using an operating system like UNIX or similar.

SSS 349 - The system shall make full use of help files and hints for button options to improve the usability.

3.13 **Personnel-related requirements**

Not applicable.

3.14 **Training-related requirements**

Training must involve:

- Controller Training;
- System Operator Training;
- Maintenance Training;
- Simulator Based Training.

3.15 **Logistics-related requirements**

SSS 350 - The system shall have the capability to restore the operating system software on the workstation using the network or the peripheral device required to transfer the operating system from standard distribution media.

3.16 **Other requirements**

3.16.1 **Time Requirements**

SSS 351 - The system shall have a capability to display a track at a maximum time of 500 milliseconds, since the track message reception (95 percentile).

SSS 352 - The system shall have a capability to display all remote status and all external alarms at the Supervisor Position within 3 seconds after the detection of the event.

SSS 353 - The system shall have a capability to execute a switch-over to the stand-by server with the following time requirements:

- Surveillance Server : maximum 2 sec
- Flight Plan Server: maximum 10 sec
- Data recording Server: maximum 2 sec

SSS 354 - The system shall have a capability to restart and become fully operational at up to ten minutes (cold start).

3.16.2 **Capacity Requirements**

The system shall meet the following operational capacities:

SSS 355 - Size of system plane : 2048 x 2048 NM

SSS 356 - Point of tangency (latitude/longitude): 1

- SSS 357 - Surveillance data sources : TBD simultaneous
- SSS 358 - Weather data sources : TBD primary surveillances
- SSS 359 - Maximum single surveillance data rate : 64 Kbps
- SSS 360 - Display update rate : continuous (based on inputs)
- SSS 361 - Maximum surveillance reports per second from all surveillances : TBD
- SSS 362 - Minimum system track display capability : TBD
- SSS 363 - Adjacent ACC interfaces : TBD
- SSS 364 - AMHS interfaces : TBD
- SSS 365 - AFTN interface: TBD
- SSS 366 - Stored flight plans (RPL's) : TBD
- SSS 367 - Inactive Flight Plans (stored FPL's) : TBD
- SSS 368 - Active flight plans (at any one time) : TBD
- SSS 369 - Aircraft classes : TBD
- SSS 370 - Wind/temperature layers (MET data) : 8
- SSS 371 - Wind/temperature areas (MET data) : 10
- SSS 372 - Maps (fully digital – labels and vectors) : TBD
- SSS 373 - SID/STAR Procedure: TBD
- SSS 374 - Hold Procedures: TBD

The datalink system capacity will be determined from:

- Traffic density at the peak hours.
- Frequency and size of messages per aircraft.
- Airspace size and number of waypoints.
- Number of FANS capable aircraft operating in the airspace.
- Anticipated growth of FANS operation.
- Number of displays.
- Number of connections for terminal systems.

3.17 **Packaging requirements**

Not applicable.

3.18 **Precedence and criticality of requirements**

Each requirement can be classified as a mandatory for Regional Harmonization or optional, for example:

REQUIREMENT PRECEDENCE TABLE

Requirement	Mandatory	Optional	Notes
011		X	
017	X		

4. **QUALIFICATION PROVISIONS**

Special attention must be given to Quality assurance, in all implementation phases such as: design review, manufacture, factory testing, documentation, training, delivery, installation, site acceptance testing and handover.

The main phases include:

_ IMPLEMENTATION SCHEDULE

_ CONTRACT SUPERVISION

_ SYSTEM DESIGN REVIEW

_ FACTORY ACCEPTANCE TEST

_ PREPARATION FOR OPERATION

- Operational Procedures
- System Management Procedures
- Preparation of System Data
- Establishment of System Parameters
- Development of Training Courses
- Operational Transfer Plan
- Safety Assessment

_ TRAINING

- Controller Training
- System Operator Training
- Maintenance Training
- Simulator Based Training

_ SITE ACCEPTANCE TEST

- Physical Checks
- Technical Tests
- Operational Tests
- Results

_ OPERATIONAL TRANSFER

- Parallel Operation Transfer
- Phased Transfer
- Preparation for Transfer

For further details look for *GUIDANCE MATERIAL OR THE ASIA/PACIFIC REGION FOR ADS/CPDLC/AIDC GROUND SYSTEMS PROCUREMENT AND IMPLEMENTATION*.

5. **REQUIREMENTS TRACEABILITY**
TBD.

6. NOTES

6.1 Abbreviations

ACARS	<i>Aircraft Communication Addressing and Reporting System</i>
ACC	<i>Area Center Control</i>
ADS	<i>Automatic Dependent Surveillance</i>
ADS-B	<i>Automatic Dependent Surveillance - Broadcast</i>
ADS-C	<i>Automatic Dependent Surveillance Contract</i>
AFN	<i>ATS Facilities Notification</i>
AFTN	<i>Aeronautical Fixed Telecommunications Network</i>
AIDC	<i>ATS Interfacility Data Communication</i>
AIS	<i>Aeronautical Information Service</i>
AIW	<i>Area Infringement Warning</i>
AMAN	<i>Arrival Manager</i>
AMHS	<i>Aeronautical Message Handling System</i>
AOC	<i>Airline Operating Centre</i>
APP	<i>Approach Center</i>
ASTERIX	<i>All-purpose Structured EUROCONTROL Radar Information Exchange Protocol</i>
ATC	<i>Air Traffic Control</i>
ATCAS	<i>Air Traffic Control Automation System</i>
ATFM	<i>Air Traffic Flow Management</i>
ATM	<i>Air Traffic Management</i>
ATN	<i>Aeronautical Telecommunication Network</i>
ATS	<i>Air Traffic Services</i>
CDM	<i>Collaborative Decision Making</i>
CFL	<i>Cleared Flight Level</i>
CJI	<i>Controller Jurisdiction Indicator</i>
CLAM	<i>Cleared Level Adherence Monitoring</i>
CPDLC	<i>Controller-Pilot Data Link Communications</i>
CR	<i>Connection Request</i>
CRC	<i>Cyclic Redundancy Check</i>
DMAN	<i>Departure Manager</i>
DMS	<i>Data Management System</i>
DSA	<i>Direct Surveillance Access</i>
DSP	<i>Datalink Service Provider</i>
EET	<i>Estimated Elapsed Time</i>
EOBT	<i>Estimated Off Blocks Time</i>
ESD	<i>Electronic Strip Display</i>
ETA	<i>Estimated Time of Arrival</i>
ETD	<i>Estimated Time of Departure</i>
ETO	<i>Estimated Time Over</i>
FANS	<i>Future Air Navigation Systems</i>
FDPS	<i>Flight Data Processing Server</i>
FIR	<i>Flight Information Region</i>
FN_CAD	<i>AFN Contact Advisor</i>
FN_CON	<i>AFN CONTACT message</i>
FOM	<i>FANS 1/A Operations Manual</i>
FT	<i>Feet</i>
GPS	<i>Global Positioning System</i>
HTTP	<i>HyperText Transfer Protocol</i>
IAL	<i>Instrument Approach and Landing chart</i>
ICAO	<i>International Civil Aviation Organization</i>
ICD	<i>Interface Control Document</i>
IFR	<i>Instrument Flight Rules</i>

IMM	<i>Interactive Multiple Models</i>
LAM	<i>Logical Acknowledge Message</i>
LAN	<i>Local Area Network</i>
MAF	<i>Message Assurance Failure</i>
METAR	<i>Meteorological Report</i>
MET	<i>Meteorological</i>
MLAT	<i>Multilateration</i>
MRT	<i>Multi-Radar Tracking</i>
MSAW	<i>Minimum Safe Altitude Warning</i>
msec	<i>Milliseconds</i>
MSSR	<i>Monopulse Secondary Surveillance Radar</i>
MTCD	<i>Medium Term Conflict Detection</i>
NAVAIDS	<i>Navigational Aids</i>
NDA	<i>Next Data Authority</i>
NOTAM	<i>Notice to Airmen</i>
OLDI	<i>Online Data Interchange</i>
OST	<i>Off-line System Parameter</i>
PBN	<i>Performance Based Navigation</i>
PEL	<i>Planned Entry Level</i>
PSR	<i>Primary Surveillance Radar</i>
QNH	<i>Regional Pressure Setting</i>
RAM	<i>Route Adherence Monitoring</i>
RPL	<i>Repetitive Flight Plan</i>
RTQC	<i>Real-Time Quality Control</i>
RVSM	<i>Reduced Vertical Separation Minimum</i>
SID	<i>Standard Instrument of Departure</i>
SDP	<i>Surveillance Data Processing</i>
SDPS	<i>Surveillance Data Processing Server</i>
SICD	<i>System Interface Control Document</i>
SMAN	<i>Surface Manager</i>
SMC	<i>System Monitoring and Control</i>
SNMP	<i>Simple Network Management Protocol</i>
SPI	<i>Special Position Indicator</i>
SSR	<i>Secondary Surveillance Radar</i>
SSS	<i>System/Subsystem Specification</i>
ST	<i>Surveillance Tracking</i>
STAR	<i>Standard instrument Arrival</i>
STCA	<i>Short Term Conflict Alert</i>
TAF	<i>Terminal Aerodrome Forecast</i>
TBD	<i>To Be Defined</i>
TFL	<i>Transfer Flight Level</i>
TMA	<i>Traffic Management Area</i>
UIR	<i>Upper Information Region</i>
UTC	<i>Universal Time Coordinated</i>
VFR	<i>Visual Flight Rules</i>
VSP	<i>Variable System Parameter</i>

6.2

Glossary

- **Air traffic services interfacility data communication (AIDC):** A data link application that provides the capability to exchange data between air traffic service units during the notification, coordination and transfer of aircraft between flight information regions.
- **Automatic dependent surveillance (ADS-C):** A surveillance technique in which aircraft automatically provide, via a data link, data derived from on-board navigation and position-fixing systems, including aircraft identification, fourdimensional position, and additional data as appropriate. ADS-C is a data link application.
- **Automatic dependent surveillance-broadcast (ADS-B):** ADS-B is a surveillance application transmitting parameters, such as position, track and ground speed, via a broadcast mode data link, at specified intervals, for utilization by any air and/or ground users requiring it. ADS-B is a data link application.
- **Controller-pilot data link communications (CPDLC):** A data link application that provides a means of communication between controller and pilot, using data link for ATC communications.

APPENDIX F

MEMORANDUM OF UNDERSTANDING FOR THE INTERCONNECTION OF AUTOMATED SYSTEMS OF STATES/TERRITORIES OF THE ICAO SAM REGION

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1. **Section 1 – Introduction and Purpose**

1.1 **Introduction**

1.1.1 GREPECAS/15, taking into account the impact that operational errors in the ATC coordination loop between adjacent ACCs have on safety, considered, in its Conclusion 15/36, that “CAR/SAM States/Territories/International Organisations (should) gradually implement the interface for the exchange of data between ATC units (AIDC);” and that “ICAO (should) coordinate, provide assistance, and monitor the implementation of these corrective measures.”

1.1.2 After analysing the problem, it was concluded that the solution was based on the intense use of CNS/ATM technologies, in accordance with ICAO recommendations, especially the ones related to the interconnection of automated systems, as described in Document 4444-PANS/ATM, Section 8.1.6: “States should foresee the automated exchange of coordination data regarding the aircraft which are provided ATS surveillance services, based on regional air navigation agreements, and should establish automated coordination procedures.”

1.1.3 In this sense, through Projects RLA/98/003 and RLA /06/901, studies were carried out in order to have a full view on this topic, including obstacles and necessary actions, as well as the implementation strategy.

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

1.1.5 The body of this document consists of ten (10) sections and one (1) appendix. The content of the sections and the appendix is summarised below:

- a) Section 1 – Brief overview and purpose statement;
- b) Section 2 – Describes the basic principles driving the drafting of this document;
- c) Section 3 – Considers the cases to which this Memorandum applies;
- d) Section 4 – Describes the version control process;
- e) Section 5 – Lists the laws considered;
- f) Section 6 – Establishes criteria and restrictions for the use of information shared between two countries;
- g) Section 7 – Presents the operational aspects that must be taken into account for the interconnection of automated systems;
- h) Section 8 – Presents the technical aspects that must be considered for the interconnection of automated systems;
- i) Section 9 - Presents the administrative aspects that must be considered for the interconnection of automated systems;

- j) Section 10 - Presents the financial aspects that must be considered for the interconnection of automated systems;
- k) Appendix 1 – Technical and Operational Agreement.

1.2 **Purpose**

1.2.1 The goal of this MoU is to provide the planning for the interconnection of automated systems in the SAM Region, establishing standard procedures covering operational, technical, administrative, and financial considerations.

2. **Section 2 – Principles**

2.1 In preparing this document, the following aspects have been taken into account:

- a) This Memorandum is a guide for SAM States to enter into bilateral agreements; and
- b) This document takes into account the aspects contained in the documents dealing with the interconnection of automated systems prepared under Projects RLA/98/003 and RLA 06/901, as well as the recommendations and documentation prepared by GREPECAS.

3. **Section 3 – Application**

3.1 This document applies to all SAM States that have automated air traffic control systems and that wish to interconnect them.

3.2 This document applies only to the interconnection of automated systems between two (2) States.

4. **Section – Organisation**

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

4.2 Revised versions of this Memorandum or changes to its paragraphs will be coordinated by the participating States.

5. **Section 5 – References**

5.1 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 II (AIDC);
- g) RLA/98/003 Project Document;
- h) RLA/06/901 Project Document; and
- i) Final reports of the SAM/IG/1 and SAM/IG/2 meetings.

6. **Section 6 – Confidentiality**

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

6.2 This data may only be disclosed to other organisations not included in this Memorandum if previously authorised by the participating States.

7. **Section 7 – Operational Aspects**

7.1 The application of this Memorandum may entail the need to make adjustments to the Operational Agreements already existing among the States.

7.2 The Administrations agree to instruct the personnel of the involved ACCs on the relevant parts of this MOU.

7.3 Automated hand-off shall be used as a priority, through transmission of the necessary data between automated systems, in accordance with the specifications set forth in the Appendix to this Memorandum of Understanding.

7.4 However, the hand-off may be carried out by using other means of communication in such cases where automatic hand-off is not possible.

8. **Section 8 – Technical Aspects**

8.1 The necessary technical considerations for States to determine the interconnection scenarios, the implementation strategy, the implementation of the solution, the operation supervision, and the staff training aspects that will best address their needs are contained in Section 6 of the Appendix to this Memorandum.

9. **Section 9 – Administrative Aspects**

9.1 In order to orderly manage the interconnection solution adopted, the participating States agree to create an administrative structure based on an Interconnection Management Committee, which duties, detailed composition, and activities are described in Section 7 of the Appendix to this Memorandum.

9.2 The States must appoint their representatives, members of their respective groups, who will be part of the basic structure of the cited Committee.

9.3 The States must select a forum to discuss outstanding cases and to settle potential disputes.

9.4 This Memorandum has a continuous nature, and may be interrupted at any time by mutual agreement of the Parties involved.

10. **Section 10 – Financial Aspects**

10.1 The participating States, as independent administrations, will be responsible for any financial obligation to cover direct or indirect expenses related to the fulfilment of this Memorandum, including those related to the purchase of equipment, spare parts, training of technical and operational personnel, communication lines, and others.

10.2 Each State will be responsible for paying its share of any cost related to upgrades to the REDDIG to support traffic increase, in accordance with the guidelines of the REDDIG Administration.

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

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

APPENDIX TO THE MEMORANDUM OF UNDERSTANDING

TECHNICAL AND OPERATIONAL AGREEMENT FOR THE INTERCONNECTION OF THE AUTOMATED SYSTEMS OF THE STATES/TERRITORIES OF THE ICAO SAM REGION

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1. **Purpose**

1.1 To provide details on the technical, operational, and administrative aspects of the Memorandum of Understanding that are necessary for the interconnection of automated systems in the SAM Region.

2. **Summary**

2.1 ICAO Projects RLA/98/003 and RLA/06/901 defined the resources for conducting studies in order to have a full view of the interconnection of automated systems, including the obstacles and necessary actions, as well as the implementation strategy.

2.2 The work carried out was the following:

- a) Drafting of the Initial Action Plan – July 2006;
- b) Brazil-Venezuela Concept Trial – September 2006;
- c) Data Collection– Phase 1 – survey to countries – current interfaces;
- d) Data Collection– Phase 2 – missions to the countries – details of interfaces – 2007
 - 1st mission: Peru, Ecuador, and Venezuela – September 2007,
 - 2nd mission: Colombia, Panama, and COCESNA – October 2007, and
 - 3rd mission: Chile, Argentina, and Uruguay - November 2007.
- e) Drafting of the Interconnection Plan– February 2008;
- f) Drafting of the SICD (System Interface Control Document) – March 2008; and
- g) Drafting of the SSS (System Subsystem Specification) document – September 2008.

2.3 The products generated contain, in summary, the following aspects:

- a) SICD: contains all the data collected in the SAM States that have automated systems, as well as descriptions of their interfaces, thereby providing an overview of the current status and the recommendations for the adoption of measures necessary for their interconnection;
- b) Interconnection Plan: contains the objectives, concepts, strategies, and actions necessary to address the operational requirements related to traffic hand-off between adjacent ACCs in the SAM Region; and
- c) SSS: presents the requirements, particularly the mandatory ones, for ACC automated systems, to be used as reference for future implementations of new automated air traffic control systems and their upgrades, when necessary.

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

a) Interconnection Plan and SICD:

- Project RLA 06/901 – First Meeting of the SAM Implementation Group (SAM IG/1) Regional Project RLA/06/901, Peru, April 2007.
- Sixth Meeting of the GREPECAS ATM/CNS Subgroup, Dominican Republic, July 2008.
- Seminar/Workshop on ATM Automation, Brazil, June 2008.

b) SSS:

Project RLA/06/901 - Second Meeting of the SAM Implementation Group (SAM/IG/2), Peru, November 2008.

3. **Reference**

3.1 This Agreement follows the ICAO recommendations set forth in the following documents:

- a) Annex11 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; and
- i) Final reports of the SAM/IG/1 and SAM/IG/2 meetings.

4. **Safety**

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

- a) protection from invasions by unauthorised persons and/or systems;
- b) protection from computer virus attacks; and
- c) exclusive use of the equipment for the interconnection services of automated systems.

5. **Operational Aspects**

5.1 The Administrations agree, within their own jurisdictions, to provide direct training on the content of this Memorandum of Understanding to the personnel of the ACCs involved.

5.2 Automated hand-off shall be used as a priority, through transmission of the necessary data between automated systems, in accordance with the specifications set forth in this Agreement.

5.3 However, the transfer may be carried out through other means of communication in such cases where automatic hand-off is not possible.

5.4 The chosen interconnection alternative implies that the States will have to establish specific operational procedures, taking into account available functionalities in each automated system, selecting the set of messages to be used, but observing the specifications and requirements set forth in the documents concerning the chosen solution.

5.5 The States agree to the joint definition of the transition area for the exchange of surveillance data between adjacent ACCs.

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

6. **Technical Aspects**

6.1 Interconnection shall meet the following requirements:

- a) Enable the automatic transfer of flight plans between adjacent ACCs; and
- b) Enable the sharing of surveillance data in areas of common interest.

6.2 The main aspects are:

6.2.1 **Analysis of the Current Scenario**

6.2.1.1 The analysis of the technical situation of participating States is the first step to complete this mission. In this sense, the SICD, Annex 1 to this Appendix, is the basis to obtain such information, since it contains a detailed description of the interfaces existing in CAR/SAM automated systems, collected and consolidated by type of interface, including radars, their communication protocols, the functionalities of each automated system, and the respective software versions, for example.

6.2.1.2 Each State agrees to verify if the information contained in the SICD needs to be updated and, if so, to inform ICAO of such changes so that they may be included in a new version of the document.

6.2.2 **Choosing the Exchange Scenario**

6.2.2.1 It is up to the States to choose the exchange scenarios to be adopted, based on the interconnection levels existing in their facilities, according to the following alternatives described in Section 4 (Justification and Nature of Changes) in Annex 2 to this Appendix:

- a) Only automatic exchange of surveillance data;
- b) Only automatic exchange of flight plan data; and
- c) Automatic exchange of surveillance data and flight plan data.

6.2.2.2 The States agree to adopt one of the flight plan transfer options established in Section 5 (Concepts for Automated ATC Systems Interconnection) of Annex 2 to this Appendix:

- a) Transfer based on ICAO Doc 4444-PANS/ATM;
- b) Transfer based on EUROCONTROL OLDI; and
- c) Transfer based on ICAO AIDC.

6.2.2.3 Likewise, the States agree to adopt one of the surveillance data exchange options contained in Section 5 (Concepts for Automated ATC Systems Interconnection) of Annex 2 to this Appendix:

- a) Exchange based on the Asterix protocol; and
- b) Exchange based on proprietary protocols.

6.2.3 **Implementation Strategy**

6.2.3.1 The implementation strategy must include at least the following aspects:

- a) Analysis of the impact that the possible solutions could have on the automated systems, the communication systems, and the logistic support;
- b) Joint definition of interfaces, including communication protocols;
- c) Configuration of the logical and physical connections in the respective sites;
- d) Necessary adjustments to both hardware and software;
- e) Definition of the means for data transmission, using the REDDIG for communications between the States; and
- f) Testing of all infrastructure including the verification and certification of the interconnection for both flight plans and radar data.

6.2.4 **Implementation**

6.2.4.1 The Interconnection Management Committee must manage the implementation in accordance with the directions issued by common agreement by the States, establishing implementation deadlines, the hiring of third party services, and the distribution of responsibilities, among other relevant topics.

6.2.5 **Operation Supervision**

6.2.5.1 Each State must be responsible for supervising the operation of its systems, including the maintenance of its equipment and systems, ensuring availability, performance, safety, and efficiency required.

6.2.5.2 All of the problems of uncertain origin must be analysed jointly by the States, through the Interconnection Management Committee, which will coordinate the necessary actions to correct them.

6.2.5.3 However, each State must take all the measures within its reach to carry out the actions under its responsibility, reporting its completion to the Interconnection Management Committee.

6.2.5.4 In any event, the Interconnection Management Committee must be constantly informed of any anomalies, regardless of their origin.

6.2.6 **Training**

6.2.6.1 The participating States must develop training programmes for the technical teams responsible for maintaining their systems, taking into account aspects such as duration, frequency, and technical evolution.

6.2.6.2 Teams must be prepared for contingencies and must have the technical capacity to analyse anomalies.

6.2.6.3 Each State shall develop its own Action Plan, containing the technical information required for the interconnection with adjacent ACCs. The plan shall include at least:

- a) the topology of the networks involved, with the technical details of the necessary bandwidth, availability, latency, and redundancy;
- b) the specification of the equipment used;
- c) maintenance requirements;
- d) maintenance procedures: preventive, predictive, and corrective; and
- e) all of the associated technical documents.

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

7. **Administrative Aspects**

7.1 This Agreement is a dynamic document that can be revisited at any time, in keeping with the technological evolution of automated systems and of the communication networks of the participating States.

7.2 All interconnection management shall be under the responsibility of the Interconnection Management Committee established by the two (2) States, in accordance with the following:

7.2.1 **Organisational Structure**

7.2.1.1 In order to carry out its activities, the Committee shall have the following organisational structure:

a) **Coordinator**

- The States agree on the appointment of a Coordinator, who may be from any of the States involved, from other States, or from an international organisation; and
- The coordinator will be responsible for the general coordination of all the activities of the technical and operational groups, and for contacting other organisations to discuss interconnection issues.

b) **Technical Group**

- It must include technical experts, designated by the two States, with proven training in the areas of expertise, especially on communication networks and automated computer systems; and

- Will be responsible for carrying out and/or coordinating, in their own countries, the technical activities necessary for the implementation, maintenance, and support of automated systems, communication networks, and interconnection equipment components.

c) **Operational Group**

- It must include air traffic control specialists designated by the two States, with proven training in their areas of expertise, especially on the automated computer systems used in the ACCs.

7.2.2 **Duties**

7.2.2.1 The Committee is responsible for all coordination necessary for planning, implementation, maintenance, and support to the operation of systems and equipment involved in the interconnection of automated systems.

7.2.2.2 It must also ensure the security of the information transmitted between the automated systems involved in the interconnection.

7.2.2.3 As part of its duties, it must control and update all the technical and operational documentation.

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

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

7.2.2.6 The Committee shall advise the States on the need for technological evolution of the equipment and systems involved in the interconnection, taking into account the technical requirements set forth in Annex 3 – SSS, to this Appendix, among others.

7.2.2.7 Its teams must monitor the performance, stability, reliability, and integrity parameters of the equipment and systems used in the interconnection, as well as propose and supervise corrective actions. To this end, they must use tools for analysing anomalies, such as radar protocol analysers and communication lines.

7.2.2.8 The Committee shall establish the necessary procedures to correct failures.

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

7.2.3 **Management Process**

7.2.3.1 In order to carry out its activities, the Interconnection Management Committee will use the following management approach:

- a) Holding periodical meetings and discussions to identify the requirements, preferred technical solution(s), alternatives, and options for achieving the interconnection of automated systems;
- b) Exchanging the technical reports and documentation, plans, and programmes that could be necessary to ensure the successful and timely completion of these efforts; and
- c) The planning, technical coordination, and development of activities between the two (2) States.

8. **Financial Aspects**

8.1 Regarding financial aspects, the States agree to the following:

8.1.1 **Procurement of equipment, components, and systems**

8.1.1.1 The equipment required for implementing the interconnection will be procured by each State, in accordance with the technical specifications approved by the Interconnection Management Committee.

8.1.2 **Procurement of Spare Part Lots**

8.1.2.1 The spare parts of the equipment used for the interconnection will be procured by each State, based on its specific needs, but in keeping with the maintenance guidelines issued by the Interconnection Management Committee.

8.1.3 **Procurement of Third Party Services**

8.1.3.1 Each State agrees to pay for the expenses of any third party service that may be required, such as software adjustments, projects, and communication network implementation.

8.1.3.2 Each State will be responsible for covering its respective share of the expenses related to upgrades to the REDDIG to address increased traffic, in accordance with the guidelines of the REDDIG Administration.

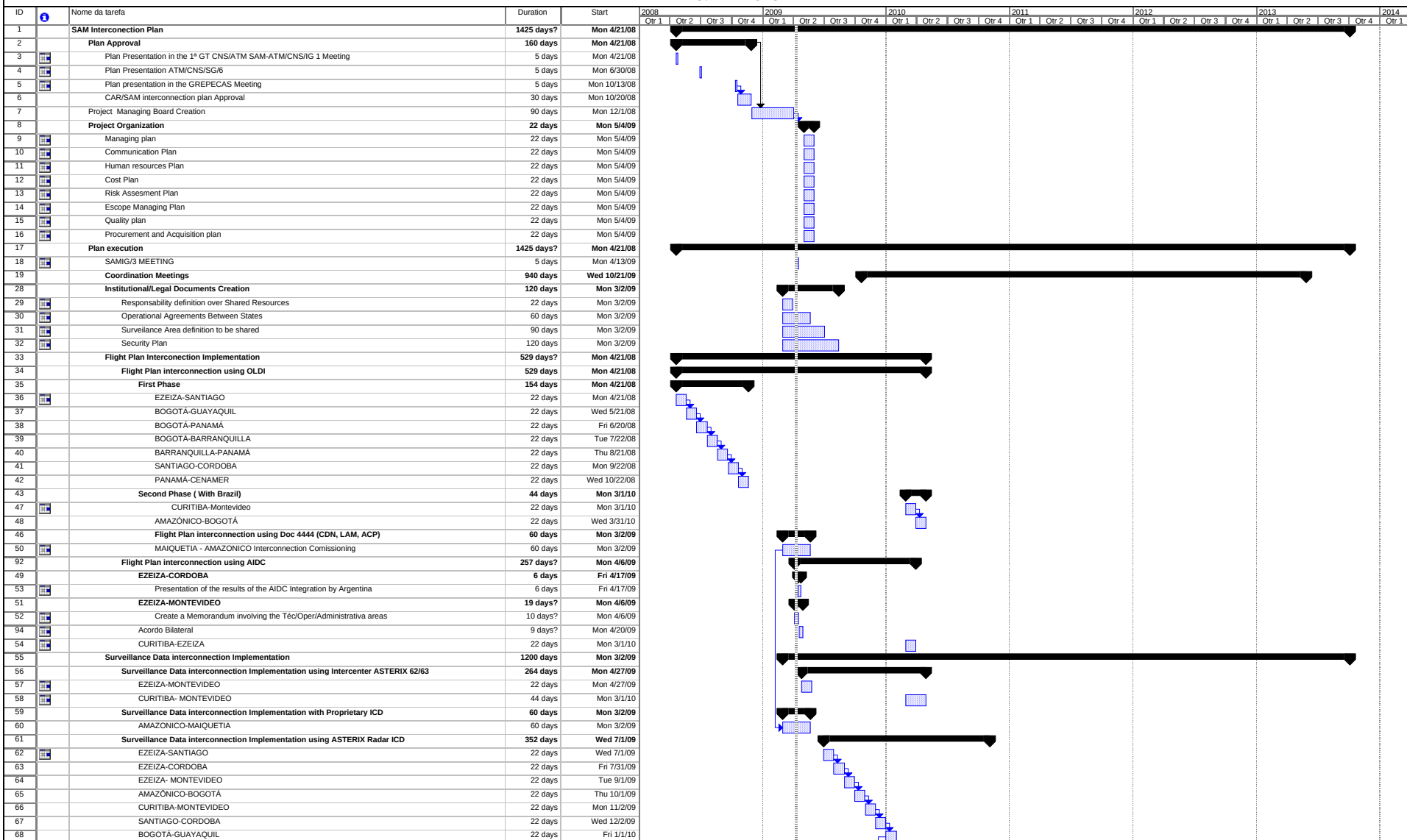
9. **Attachments**

- a) Preliminary System Interface Control Document for the Interconnection of ACC Centers of the CARSAM Region – SICD;
- b) CAR/SAM Automated ACC interconnection Plan;
- c) Preliminary Reference System/Subsystem Specification SSS for the Air Traffic Control Automation System; and
- d) Interface Control Document (ICD) for data communication between ATS units in the Caribbean and South American Regions (CAR/SAM ICD).

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APPENDIX G / APENDICE G

SAM/IG/3-NE/07 - WP/07



Projeto: SAMIG2_Asu6 ApA Bil
Data: Wed 4/8/09

Tarefa
Divisão

Andamento
Etapa

Resumo
Resumo do projeto

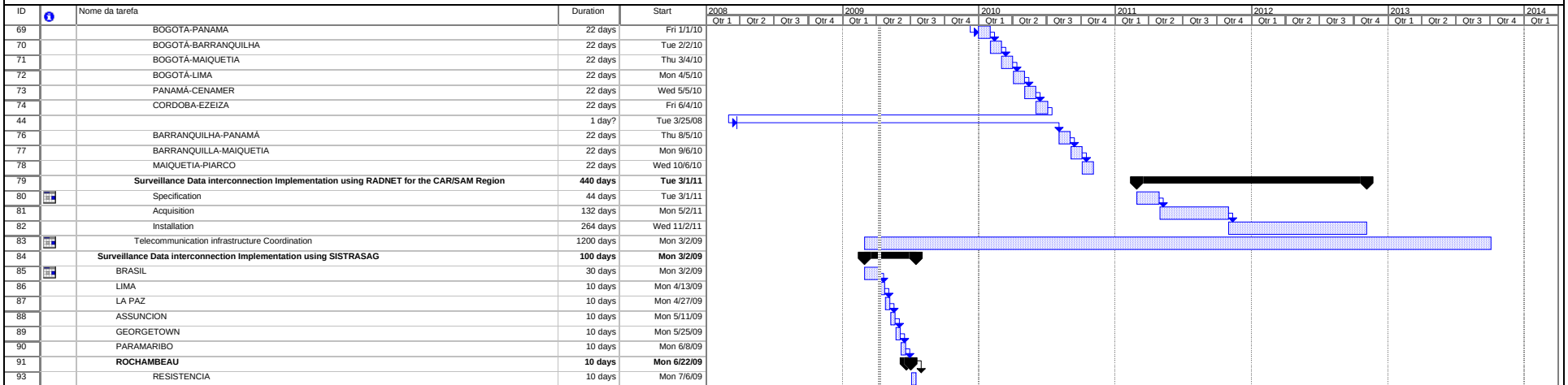
Tarefas externas
Etapa Tarefa

Divisão



APPENDIX G / APENDICE G

SAM/IG/3-NE/07 - WP/07

Projeto: SAMIG2_Asu6 ApA Bil
Data: Wed 4/8/09Tarefa
DivisãoAndamento
EtapaResumo
Resumo do projetoTarefas externas
Etapa Tarefa

Divisão

