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International Civil Aviation Organization
UNDP/ICAO Regional Project RLA/98/003
Transition to CNS/ATM Systems in the CAR and SAM Regions

Tenth Meeting/Workshop of ATM Authorities and Planners in the CAR/SAM Regions (AP/ATM/10)

(Lima, Perú, from 10 to 14 May 2005)

Agenda Item 4: ATM Automation in the CAR/SAM Regions

Survey on ATC Automated Systems in the CAR/SAM Regions

(Presented by the Secretary)

Summary

This Working Paper presents the results of the Survey on ATC Automated Systems in the CAR/SAM Regions.

1. Introduction

1.1 GREPECAS/12 Meeting, La Havana, Cuba, 7 to 11 June 2004, approved **Conclusion 12/31**, through which requested the CAR/SAM Regions Administrations to define their action plans for the integration of ATM automated systems.

1.2 The Seventh Meeting of the Coordination Committee of Regional Project RLA/98/003 – Transition to CNS/ATM Systems in the CAR/SAM Regional, Lima, Peru, on 18 November 2004, as part of its activities for year 2005, approved to carry out a study on the resources available in automated systems in both regions, considering the installed application for operations, as well as the interconnection requirements.

2. Analysis

2.1 On February 28, 2005, ICAO sent to the States, Territories and International Organizations a form in order to obtain updated information on the implemented ATC Automated Systems to be considered for discussion during the AP/ATM/10 Meeting. The limit date to send the respective answer was on March 25, 2005.

2.1 This form has been elaborated with the purpose of obtaining the most precise and complete answers, in order to have a clear and updated vision of the technical and operational progress of the automated systems of the CAR/SAM Administration's automated systems. The results of such survey appear in the **Appendix A** of this Working Paper.

2.2 Keeping in mind that the evaluation of such results shall enable the meeting to establish criteria for the preparation of the ***Guidelines for Strategy Operational Integration of the ATC Automated Systems of the CAR/SAM Regions***, with the aim to have as much information as possible, **Appendix B** to this working paper shows the Guidelines for the Integration Strategy as adopted by GREPECAS/12 Meeting and **Appendix C** shows a brief information on criteria and requirements for the Automation of Air Navigation Services.

3 Suggested action

3.1 The meeting is invited to take note of the information provided in this Working Paper and, that the Administrations that have not yet done so, submit as soon as possible the corresponding information to ICAO Secretariat.

Apéndice/Appendix A

Encuesta sobre Sistemas ATM automatizados en las Regiones CAR/SAM

Survey on Automated ATM Systems in the CAR/SAM Regions

Instrucciones/Instructions

a. Si el sistema está disponible, indique si cuenta con las siguientes capacidades:
If the system is available indicate if the system has the following capacities:

(1) Cantidad / Number
(2) Adjunte un diagrama de cobertura.
Attach a coverage diagram.
(3) Cantidad / Number
(4) Adjunte un diagrama de cobertura.
Attach a coverage diagram.
(5) Modo A/C y/o Modo S: **A/C** y/o **S**
Mode A/C and/or Mode S: **A/C** and/or **S**
(6) Integracción de datos ADS / ADS integration data : **ADS**
(7) Alerta de Conflicto a Corto Plazo / Short Term Conflict Alert: **STCA**
(8) Advertencia de Altitud Mínima de Seguridad / Minimum Safe Altitud Warning: **MSAW**
(9) Impresión automatizada de fichas de vuelo/ Automated printing of flight strips: **P**
(10) Fichas de vuelo electrónica / Electronic Flight strips: **E**
(11) Banco de datos: **DB**
(12) Adjunte un diagrama de cobertura.
Attach a coverage diagram.
(13) Cantidad / Number
(14) Adjunte un diagrama de cobertura.
Attach a coverage diagram.
(15) Modo 2 y/o 3: M2 y/o M3
Mode 2 and/or 3: **M2 and/or M3**
(16) CPDLC
(17) Aplicación en Espacio aéreo Oceánico o Remoto: **R u O**
Oceanic or Remote airspace: **R or O**
(18) AIDC
(19) AMHS

b. En las columnas 2, 4, 12 y 14, anote una "**x**" y adjunte un diagrama de cobertura.
In columns 2, 4, 12 and 14, write an "**x**" and attach a coverage diagram.

c. Utilice la sección Observaciones para describir brevemente detalles técnicos específicos de los sistemas disponibles. Si fuera necesario utilice más hojas.

Use the Remarks section to describe briefly specific technical detail of the available systems. If necessary you may use additional pages.

ENCUESTA SOBRE SISTEMAS AUTOMATIZADOS ATM EN LAS REGIONES CAR/SAM
SURVEY ON ATM AUTOMATED SYSTEMS IN THE CAR/SAM REGIONS

ARGENTINA

ACC	Sensores Radar					Procesamiento Automatizado de Datos / Automated Data Processing							COMUNICACIONES / COMMUNICATIONS							
	PSR		SSR			RDP			FDP		MET	AIS	Red Digital Nacional / National Digital Network	AMS					AFS	
														VDL				HFDL		
	1	2	3	4	5	6	7	8	9	10	11		12	13	14	15	16	17	18	19
Ezeiza	5(i)	(a)	6(i)	(a)	AC		STCA	MSAW	P		(b)	(b)	X							AMHS
Córdoba	1	(a)	1	(a)	AC															AMHS
Mendoza	1	(a)	1	(a)	AC															AMHS
Resistencia		(a)		(a)																AMHS
Comodoro Rivadavia		(a)		(a)																AMHS

Observaciones/Remarks

(a) Coberturas	Ezeiza	Córdoba	Mendoza	Mar del Plata	Paraná	Carrasco (Uruguay)
PSR (NM)	100	80	50	50		80 NM
SSR (NM)	210	160	200	220	220	180 NM

(b) El sistema de procesamiento tiene la capacidad de presentar la información, pero coexisten bancos de datos AIS/MET para entregarla.
(i) Ezeiza recibe las señales PSR y SSR de los radares Ezeiza, Mendoza, Córdoba, Mar del Plata y Carrasco (Uruguay).

ENCUESTA SOBRE SISTEMAS AUTOMATIZADOS ATM EN LAS REGIONES CAR/SAM
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BOLIVIA

ACC	Sensores Radar					Procesamiento Automatizado de Datos / Automated Data Processing							COMUNICACIONES / COMMUNICATIONS							
	PSR		SSR			RDP			FDP		MET	AIS	Red Digital Nacional National Digital Network	AMS				HFDL	AFS	
														VDL						
	1	2	3	4	5	6	7	8	9	10	11		12	13	14	15	16	17	18	19
SLLP			1	(a)	AC		STCA	MSAW			DB		(b)							
TMA SLCB			1	(c)	AC		STCA	MSAW			DB									

Observaciones/Remarks

(a) Se adjunta un mapa de cobertura combinada de los radares de Cochabamba y El Alto. Las señales radar de El Alto y Cochabamba no están integradas para su presentación en el ACC de La Paz. Los controladores disponen de presentaciones separadas.

(b) Se adjunta un mapa de cobertura de la red Digital de Comunicaciones (REDCA) de AASANA (Red Digital para Voz (ATS)/Datos (AFTN) y Red corporativa de Voz e Internet. Esta Red gestiona específicamente lo siguiente:

- Comunicaciones orales ATS entre 20 aeropuertos;
- Voz y control para la frecuencia ampliada 128.2 MHz del ACC La Paz (cuatro estaciones remotas);
- Red de telefonía corporativa para coordinación administrativa con 20 aeropuertos;
- Red WAN que integra a los Centros Regionales de Cochabamba, El Alto, Viru Viru, Trinidad y la Oficina Central de La Paz.

(c) Se adjunta un mapa de cobertura de actuación del radar MSSR de Cochabamba.

ENCUESTA SOBRE SISTEMAS AUTOMATIZADOS ATM EN LAS REGIONES CAR/SAM
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BRASIL

ACC	Sensores Radar					Procesamiento Automatizado de Datos / Automated Data Processing							COMUNICACIONES / COMMUNICATIONS							
													Red Digital Nacional / National Digital Network	AMS					AFS	
	PSR		SSR			RDP			FDP		MET	AIS		VDL				HFDL		
	1	2	3	4	5	6	7	8	9	10	11(a)	11b	12	13	14	15	16	17	18	19
Amazónico	16		23		AC		STCA	MSAW	P	E	DB	DB	(d)							
Atlántico						©			P		DB	DB	(d)			(c)				
Brasilia	11		11		AC		STCA	MSAW	P	E	DB	DB	(d)							
Curitiba	10		10		AC		STCA	MSAW	P		DB	DB	(d)							
Recife	6		10		AC		STCA	MSAW	P		DB	DB	(d)							

Observaciones/Remarks

(a) Un banco de datos central con informaciones meteorológicas disponibles para consulta general.
(b) Un banco de datos con informaciones disponibles NOTAM con distribución regional.
(c) En fase de prueba.
(d) En fase de implantación de una red digital de cobertura nacional, prevista para el segundo semestre 2005.

ENCUESTA SOBRE SISTEMAS AUTOMATIZADOS ATM EN LAS REGIONES CAR/SAM
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CHILE

ACC/FIR	Sensores Radar					Procesamiento Automatizado de Datos / Automated Data Processing							COMUNICACIONES / COMMUNICATIONS							
													Red Digital Nacional / National Digital Network	AMS					AFS	
	PSR		SSR			RDP			FDP		MET	AIS		VDL				HFDL		
	1	2	3	4	5	6	7	8	9	10	11		12	13	14	15	16	17	18	19
ACCU/SCFZ			3	X	ACS	(a)	STCA	MSAW	P	E	DB	(b)	X				(c)			
ACCU/SCEZ	1	X	3	X	ACS		STCA	MSAW	P	E	DB									
ACC/SCTZ	1	X	2	X	ACS		STCA	MSAW	P	E	DB									
ACC/SCCZ	1	X	1	X	ACS		STCA	MSAW	P	E	DB									
ACC/SCIZ																				

Observaciones/Remarks

(a) Durante el año 2005, en lo relativo a la Vigilancia Automática Dependiente (ADS) se comenzarán a realizar las pruebas para su implementación en el espacio aéreo bajo la responsabilidad del estado de Chile.

(b) En la actualidad, no tenemos sistemas de bancos de datos AIS. Estamos trabajando para ello. Hemos avanzado sólo en lo concerniente a facilitar la información electrónicamente.

(c) De la misma manera y en conjunto con las pruebas de ADS, se trabajará en la implantación del sistema CPDLC en el espacio aéreo bajo la jurisdicción del Estado de Chile.

ENCUESTA SOBRE SISTEMAS AUTOMATIZADOS ATM EN LAS REGIONES CAR/SAM
SURVEY ON ATM AUTOMATED SYSTEMS IN THE CAR/SAM REGIONS

CUBA

ACC	Sensores Radar					Procesamiento Automatizado de Datos Automated Data Processing							COMUNICACIONES COMMUNICATIONS							
													Red Digital Nacional National Digital Network	AMS					AFS	
	PSR		SSR			RDP			FDP		MET	AIS		VDL				HFDL		
	1	2	3	4	5	6	7	8	9	10	11		12	13	14	15	16	17	18	19
HABANA			6	(a)	AC	X	X	X	X	X	DB	DB	(b)							

Observaciones/Remarks

(a) Se adjunta los diagramas de cobertura SSR a FL 200 y FL 330
(b) Se adjunta diagrama de la Red Digital de la Aviación Cubana (REDAC)

ENCUESTA SOBRE SISTEMAS AUTOMATIZADOS ATM EN LAS REGIONES CAR/SAM
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NICARAGUA

ACC	Sensores Radar					Procesamiento Automatizado de Datos / Automated Data Processing							COMUNICACIONES / COMMUNICATIONS							
	PSR		SSR			RDP			FDP		MET	AIS	Red Digital Nacional / National Digital Network	AMS				HFDL	AFS	
														VDL						
	1	2	3	4	5	6	7	8	9	10	11		12	13	14	15	16	17	18	19
	(a)		(b)	X	AC		STCA	MSAW	P		DB	DB					(a)			

Observaciones/Remarks

(a) No se encuentra disponible, pero el sistema lo soporta.
(b) Radar Secundario Monopulso (se adjunta diagrama de vigilancia).

ENCUESTA SOBRE SISTEMAS AUTOMATIZADOS ATM EN LAS REGIONES CAR/SAM
SURVEY ON ATM AUTOMATED SYSTEMS IN THE CAR/SAM REGIONS

URUGUAY

ACC	Sensores Radar					Procesamiento Automatizado de Datos / Automated Data Processing							COMUNICACIONES / COMMUNICATIONS							
													Red Digital Nacional / National Digital Network	AMS					AFS	
	PSR		SSR			RDP			FDP		MET	AIS		VDL				HFDL		
	1	2	3	4	5	6	7	8	9	10	11		12	13	14	15	16	17	18	19
MUDO	(a)	60	(b)	250	AC		STCA	MSAW	P	E	DB		(c)						(d)	

Observaciones/Remarks

(a) TA10M M.970 PSR.
(b) MSSR M.970 PSR Carrasco
MSSR INDRA DURAZNO
MSSR THALES EZEIZA
(c) Se posee una Red Digital entre todos los Aeródromos y Aeropuertos del País.
(d) Se posee una Central Distribuidora de Mensajes AFTN.

Nota: No se posee diagramas.

APPENDIX B

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/Organizaitons, 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.

APPENDIX C

Automation of Air Navigation Services

1. Introduction

1.1 The continuous increase of air traffic, restructure of ATS routes and implementation of new RNAV routes, and the implementation of RVSM in the CAR/SAM Regions are originating an increasing demand of aeronautical information and an increasing need to implement new and more complex procedures for managing Air Navigation Services (ANS) with safety and efficiency, which require a more efficient and reliable information processing.

1.2 The interaction speed of many of the complex procedures, as well as the need to count with the information on time, requires of tools that warranty the delivery of the Air Navigation Services (ANS) with safety, integrity and quickly.

1.3 In order to achieve it objectives, it is necessary to achieve a level of automation of the ANS functions to permit a gradual and progressive transition from the present systems, based, principally, in non-automated procedures, or in those which automation has been carried out isolatedly and independently, towards a totally integrated ANS conformed by systems and subsystems that permit the increment of safety, the increase of the airspace capacity, and of the efficiency and economy of the air operations, as well as the collaborative decision making between dependencies of the ATM community.

1.4 It is known that, presently, most of the Administrations of the CAR/SAM Regions have established in their correspondent dependencies of the Air Navigation Services different levels of automation. Therefore, in this context, in order to ensure a harmonic planning and implementation of the ANS Automated Systems in the CAR and SAM Regions, the following criteria should be considered:

a) It should be implemented progressively;
b) It should satisfy the present and future requirements of all users;
c) It should have a modular and flexible configuration, in such a way that could permit to update, expand and continuously and integrally improve the system;
d) It should be inter-operable, that would permit to interact with other systems and subsystems, at local, sub regional, regional and interregional levels;

e) It should support the services for all the flight operation phases in a systemic and integrated form, in accordance with the "gate-to-gate" concept;
f) Its design should be human-centered, permitting the operator to supervise the system and to make the final decision;
g) It should not increment the workload of the system operators;
h) It should be designed with an efficient man-machine inter-phase, and be subject of simple training;
i) It should be able to reject the input of erroneous data;
j) Its design should contemplate the total interaction of the system, and permit the integration of all the required elements, principally ATM, CNS, AIS and MET;
k) It should be protected against non-authorized access;
l) Its design should be fault-tolerant;
m) It should have the capacity to be replaced by another subsystem, at least temporarily, at local, sub regional, regional or interregional level, in case of a total interruption of a subsystem;
n) It should permit technical, normative and operational uniformity.

2. ATM requirements

2.1 *ATS and ATFM – Operations in-route*

2.1.1 According to the frame of reference indicated in the strategy orientations of the ATM Automated Systems Integration in the CAR/SAM regions, adopted during the GREPECAS/12 Meeting, it is necessary to identify the homogeneous areas and the traffic flow that, according to said orientations, would require automation.

2.1.2 In this regard, on the basis of the studies carried out by Project RLA/98/003, considering the RVSM, RNP and RNAV routes implementation programs actually under execution, the GREPECAS/12 Meeting also approved the update of the ATM Evolution Tables of the CAR/SAM Regional Plan for the Implementation of the CNS/ATM Systems – operations in-route, which consider ATM requirements and common dates for most of the established traffic flows.

2.1.3 In accordance to it tables, in year 2008, the implementation of the Air Traffic Flow Management (ATFM) would be started within the principal traffic flows of both regions.

2.1.4 In this sense, it would be necessary for the implementation of the ATFM to compile, exchange and distribute, among other, the following aeronautical information:

- Flight Plans (FPL);
- Repetitive Flight Plans (RPL);

- Cleared Flight Plans (CPL);
- NOTAMs, principally those referred to the operation status of the Air Navigation and Airport Services;
- Airports meteorological information, principally for departures, arrivals and information on alternatives;
- Information on the flight status and of traffic density of the different flows, to be exchange between the Area Control Centers (ACC);

2.1.5 Initially, the previous steps to implement and be able to provide this service safely and efficiently, the ACCs should count with:

- Automated Systems Flight Plan, including the RPL;
- Aeronautical Information Automated Systems, principally the management of the NOTAM Bank;
- Meteorological Information Automated Systems, principally OPSMET meteorological information (METAR, meteorological forecasts, etc.);
- Digital Communications Systems for the exchange of information of the Cleared Flight Plan; principally on departures, transferences, routes and flight level changes, etc.

2.1.6 Subsequently, while the corresponding Flow Traffic Management Units (FMU) are being implemented and a Regional ATFM is consolidated, it is required that it dependencies count with the mentioned Automated Systems or be integrated into this network.

2.1.7 Likewise, as air traffic is being incremented and systems to manage the ATS Services more efficiently are necessary, the ACCs should also count with Surveillance Systems, which coverage permit the share of information and the automated transferences of data radar. In many cases, it would be necessary that it systems also count with the possibility of integrating information of Automatic Dependent Surveillance (ADS).