



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

**Follow-up to the Implementation of ATM Situational Awareness in the SAM Region**

(Presented by the Secretariat)

**SUMMARY**

This working paper presents information on the implementation of ATM situational awareness in the SAM Region, especially concerning ADS-B implementation aspects, and the progress made in activities related to GREPECAS Project C2.

**References**

- Report of the Second Workshop/Meeting of the SAM Implementation Group (SAM/IG/2 Lima, Peru, 3-7 November 2008)
- Report of the Fourteenth Workshop/Meeting of the SAM Implementation Group (SAM/IG/14) (Lima, Peru, 21-25 April 2014)
- GREPECAS/17 meeting report (Cochabamba, Bolivia, 21-25 July 2014)

*ICAO strategic objectives:*

*A – Safety*

*B – Air navigation capacity and efficiency*

**1 Background**

1.1 The SAM/IG/13 meeting deemed it advisable to draft an ADS-B operational implementation action plan for the SAM Region, in accordance with the Regional Performance-Based Air Navigation Plan for the SAM Region (PBIP), as harmonised with the ASBU.

1.2 Regarding the drafting of the guides foreseen in Project C2, the SAM/IG/13 meeting discussed the drafting of a *Technical/operational guide for MLAT implementation*, to be submitted to the SAM/IG/14 meeting, and a *Technical guide to support ATFM implementation*, which will be drafted once the revised guide of the ATFM group has been completed, in order to have well-defined operational requirements for preparing the guide.

1.3 The description of Project C2 and the status of the activities it contemplates are shown in **Appendix A** to this working paper.

**2 Discussion**

***Follow-up to ADS-B implementation***

2,1 The performance-based air navigation implementation plan for the SAM Region contemplates the implementation of en-route ADS-B, with a view to enhancing ATM situational awareness and airspace capacity (PFF CNS 04, B0 SURF, and B0 ASUR).

2.2 During the last decade, most SAM States have implemented mono-pulse secondary radars with mode S capability, as well as secondary radars in mode S. In general, this equipment has a useful life of 15 to 20 years.

2.3 In this regard, it is expected that, by 2018, there will be a substantial implementation of ADS-B systems. In the meantime, States that have not installed radar surveillance systems have installed ADS-B stations, as is the case of Guyana, which has implemented an ADS-B station at the international airport of Timehri. Likewise, those States that do not have radar coverage in their territory have decided to purchase ADS-B stations, as is the case of Paraguay, which acquired five ADS-B stations through which they will have surveillance coverage of almost all routes and main terminal areas.

2.4 Furthermore, other States of the Region, like Peru, have installed ADS-B stations to cover areas with no surveillance coverage. Similarly, Brazil, Chile, Colombia, and Panama have initial plans to implement ADS-B stations in areas lacking radar surveillance coverage.

2.5 The latest automated systems installed in ATS units (ACC, APP) of the SAM Region are capable of integrating radar surveillance systems, as well as ADS-C, ADS-B, and multilateration. States are expected to inform the Meeting about ADS-B implementation plans and progress, as well as on their integration with radar surveillance systems.

2.6 The SAM/IG group has always deemed it important to provide guidance to States when implementing ADS-B. In this sense, an initial action plan was developed for the conduction of ADS-B trials; an ADS-B station was installed for a period of six months at the Jorge Chávez international airport in Lima, at no cost (thanks to Thales), through which comparative trials were conducted with secondary radar data; data was collected; recommendations were formulated; several training events were conducted; and a technical-operational guide for ADS-B implementation in the SAM Region was developed.

2.7 FASID Table CNS 4, shown in **Appendix B** to this working paper, contains information on surveillance requirements of the Region. It is expected that the Meeting will be able to update the information contained in said table.

2.8 **Appendix C** to this working paper contains the updated ADS-B implementation action plan for review by the Meeting. The plan consists of three phases: Phase I, ADS-B trials; Phase II, operational implementation; and Phase III, monitoring of the whole ADS-B implementation process.

2.9 Phase I can be considered as completed, since ADS-B trials have been conducted for a period of six months (May through October 2009). As a result of these trials, first-hand information was obtained on ADS-B equipment and the aspects to be taken into account for their installation and operation; ADS-B surveillance services were compared to radar surveillance (SSR) systems; and note was taken of the large number of flights reporting on extended mode S. Likewise, the need was identified for pilots and ATS personnel to receive training prior to using ADS-B surveillance, with a view to reducing many of the errors identified during the trials. More information on this matter is contained in Appendix D to agenda item 6 of the SAM/IG/4 meeting report. These aspects have been taken into account in the technical-operational guide on ADS-B implementation in the SAM Region.

2.10 Phase 2 describes the activities required for the operational implementation of ADS-B, including the operational definition of ADS-B, the safety assessment, the drafting and publication of documents for ADS-B operational implementation, and the drafting of a training programme for pilots and ATS personnel. Phase III corresponds to the follow-up of the whole process by the SAM/IG.

2.11 A CAR/SAM seminar/workshop on the implementation of ADS-B, multilateralism, and automation is foreseen to be held in September 2015 (see WP/12, Appendix D).

### ***Drafting of guides***

2.12 The *Technical-operational guide for MLAT implementation* could not be developed and was rescheduled for 2015. This activity will require the mission of an expert in the area, for a period of one week in Lima.

2.13 Likewise, the *Technical guide to support ATFM implementation* will be developed once the revised guide of the ATFM group has been completed, in order to have well-defined operational requirements for preparing the guide.

## **3 Suggested action**

The Meeting is invited to:

- a) Take note of the information contained in this working paper;
- b) review the aspects presented in section 2 and the appendices to this working paper; and
- c) discuss any other related issues it may deem necessary.

## APPENDIX A

SAM Region	PROJECT DESCRIPTION (PD)	PD N° C2	
Programme	Project Title	Starting Date	Ending Date
ATM Automation and Situational Awareness <i>(Programme Coordinator: Onofrio Smarrelli)</i>	<p>Improve ATM Situational Awareness in the SAM Region</p> <p><i>Project Coordinator: Paulo Vila (Peru)</i></p> <p><i>Contributing experts: José Rubira, Marcos Vidal and Jorge Otiniano (Peru); Javier Vittor (Argentina), André Jansen (Brazil)</i></p>	October 2011	May 2015
<b>Objective</b>	Develop guidelines supporting the implementation of improvements in the situational awareness of ATS units in the South American Region		
<b>Scope</b>	<p>Guidelines supporting the implementation of various applications, such as common traffic visualization, common meteorological conditions visualization and communications in general</p> <ul style="list-style-type: none"> <li>• Analysis of the current surveillance infrastructure and identification of necessary improvements to support en route and terminal airspaces, airspace classification, PBN and ATFM</li> <li>• Implementation of ADS-B, ADS-c and/or MLAT surveillance systems at selected airspaces</li> <li>• Minimum common electronic information and data bases required in support of decision-making process and alert systems towards an interoperable situational awareness among centralized ATFM units</li> <li>• Implement flight plan data process systems (new FPL format) and data communications tools among ACC's</li> <li>• Implement advanced automation support tools to contribute towards the sharing of aeronautical information</li> </ul>		
<b>Metrics</b>	<p>Drafting of following documents:</p> <ul style="list-style-type: none"> <li>• Regional surveillance strategy for the implementation of systems in support of improvement of situational awareness – revised</li> <li>• Evaluation of the surveillance systems coverage in the SAM Region - completed</li> <li>• Guideline on technical/operational considerations for ADS-B implementation – completed</li> <li>• Guideline on technical/operational considerations for MLAT implementation - completed</li> <li>• Guideline on technical considerations in support of ATFM implementation – completed</li> <li>• Guideline for the presentation of MET products in graphic format - completed</li> </ul>		
<b>Strategy</b>	<ul style="list-style-type: none"> <li>• All tasks will be conducted by experts nominated by States and organizations of the SAM Region members of the Project <i>Improve ATM situational awareness in the SAM Region</i>, under management of the project coordinator. Communications among project members, as well as between the project coordinator and programme coordinator, shall be carried out through teleconferences and the Internet.</li> <li>• Once studies are completed, the results will be submitted to the ICAO programme coordinator as a final consolidated document for its analysis, review, approval and presentation at the GREPECAS PPRC</li> </ul>		

<p><b>Goals</b></p>	<ul style="list-style-type: none"> <li>• Regional surveillance strategy for the implementation of systems in support to situational awareness improvement for July 2012 (completed)</li> <li>• Evaluation of SAM surveillance systems coverage for October 2012 (completed)</li> <li>• Guideline on technical/operational considerations for ADS-B implementation for June 2012 (completed)</li> <li>• Guideline for the drafting of SIGMET in graphic format (March 2013) (completed)</li> <li>• Guideline for technical/operational considerations for MLAT implementation for March 2015</li> <li>• Guideline for technical considerations in support of ATFM implementation</li> <li>• Action plan for ADS-B implementation in the SAM Region (November 2014)</li> </ul>
<p><b>Justification</b></p>	<ul style="list-style-type: none"> <li>• Improve situational awareness has been identified as a great support for ATM, contributing in the increase of safety and in flight efficiency</li> <li>• In addition, a close relationship with the other programmes and their respective projects is necessary, with the aim of collecting the operational requirements demanded by the mentioned applications and their respective tentative implementation dates</li> <li>• This project contributes to the implementation of modules B0 ASUR, B0 SURV, B0 NOPS and B0 AMET of the <i>Air Navigation System Performance-Based Implementation Plan for the SAM Region (SAM PBIP)</i></li> </ul>
<p><b>Related Projects</b></p>	<ul style="list-style-type: none"> <li>• Air Navigation Systems in Support of PBN</li> <li>• Automation</li> <li>• ATFM</li> <li>• ATN Ground-ground and Air-ground Applications</li> </ul>

Project Deliverables	Relationship with Performance Based Regional Plan aligned with ASBU	Responsible	Status of Implementation <sup>1</sup>	Delivery Date	Remarks
<i>Evaluation of surveillance infrastructure and identification of surveillance systems improvements</i>					
Evaluation of current surveillance systems coverage in the SAM Region	PFF SAM CNS 04  B0 ASUR	Paulo Vila (Peru)		October 2012	Presented as Appendix to the Guideline on technical/operational considerations for ADS-B implementation.
<i>Drafting of regional plan for ADS-B and MLAT implementation</i>					
Guideline on technical/operational considerations for ADS-B implementation	PFF SAM CNS 04  B0 SURF  B0 ASUR	José Rubira (Peru) Marco Vidal (Peru)		October 2012	The Guideline includes comments from Brazil, Chile and Guyana, presented through SAM/IG/11-WP/06. The Meeting approved the Guide. Peru will later include considerations to determine the values recommended for NIC, SIL and NAC for operational application.
Guideline on technical/operational considerations for MLAT implementation	PFF SAM CNS 04  B0 SURF  B0 ASUR	(Brazil)		March 2015	The Guideline has not been started, as MLAT installation in Brazil is being awaited for.

<sup>1</sup> **Gray:** Activity has not started

**Green:** Activity has or will deliver planned milestone as scheduled

**Yellow:** Activity is behind schedule on milestone, but still within acceptable parameters to deliver milestone on time

**Red:** Activity has failed to deliver milestone on time, mitigation measures need to be identified and implemented

Project Deliverables	Relationship with Performance Based Regional Plan aligned with ASBU	Responsible	Status of Implementation <sup>1</sup>	Delivery Date	Remarks
Guideline on technical considerations in support of ATFM implementation	PFF SAM ATM 05 B0 NOPS	Pending designation		March 2015	The guideline will base itself on the CAR/SAM ATFM Manual approved through GREPECAS Conclusion 16/35.  The ATFM Guide is being awaited for in order to define the operational requirements enabling the drafting of this Guideline.
Guideline for the presentation of MET products in graphical format	PFF SAM MET 03 B0 AMET	Jorge Otiniano (Peru)		2013	The document was delivered to the Secretariat (MET) for its review by the corresponding meteorology specialists.
Action plan for regional ADS-B implementation	BO 84	Paulo Vila (Peru)		October 2014	The action plan will be drafted by experts from Brazil and Peru.
Resources necessary	Experts in the carrying out of the deliverables				

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## APPENDIX B

CAR/SAM FASID

IV-CNS 4A-1

## TABLE CNS 4A - TABLA CNS 4A

## SURVEILLANCE SYSTEMS - SISTEMAS DE VIGILANCIA

## EXPLANATION OF THE TABLE

*Column*

- |    |   |
|----|---|
| 1  | Name of State/Territory and location of the radar station   |
| 2  | Air traffic services unit served by the facility  |
| 3  | PSR/Function - Primary surveillance radar/Function<br>E - En-route area control centres<br>T - Terminal   |
| 4  | Coverage of primary surveillance radar in nautical miles  |
| 5  | PSR/Status - Primary surveillance radar/Status of implementation  |
| 6  | SSR/MSSR/Function - Secondary surveillance radar/Monopulse secondary surveillance radar/Function<br>E - En-route area control centres<br>T - Terminal |
| 7  | SSR/MSSR/Modes - Modes A, C or S  |
| 8  | Coverage of secondary surveillance radar in nautical miles  |
| 9  | SSR/MSSR/Status - Secondary surveillance radar/Monopulse secondary surveillance radar/Status of implementation  |
| 10 | ADS/Type - Automatic dependent surveillance/Type  |
| 11 | ADS/Status - Automatic dependent surveillance/Status of implementation  |
| 12 | Remarks   |

*Note.- The following codes are used in columns 5, 9, 11 and 12:*

- |             |   |
|-------------|---|
| 5, 9 and 11 | I - Implemented using conventional SSR  |
|             | I* - Implemented using monopulse SSR  |
|             | NI - Not implemented  |
|             | I/P - (Implemented/Planned) Indicates the implemented radar system and enlargement and/or replacement of the radar system at short term (2 years) |
|             | P - Planned using SSR   |
|             | P* - stands for future plan using monopulse SSR   |
|             | NP - (Not planned) Indicates that the State has no plans for radar implementation   |
|             | R - Recommended   |
| 12          | * MSSR - Monopulse SSR  |

**EXPLICACIÓN DE LA TABLA***Columna*

- |    |   |
|----|---|
| 1  | Nombre del Estado/Territorio y ubicación de la estación radar   |
| 2  | Dependencia de los servicios de tránsito aéreo servida por la instalación   |
| 3  | Función PSR - Función/Radar primario de vigilancia<br>E - Centros de control de área en ruta<br>T - Terminal  |
| 4  | Cobertura del radar primario de vigilancia en millas marinas  |
| 5  | Situación PSR - Situación de la implantación/Radar primario de vigilancia   |
| 6  | Función SSR/MSSR - Función/Radar secundario de vigilancia/Radar secundario de vigilancia de monoimpulso<br>E - Centros de control de área en ruta<br>T - Terminal |
| 7  | Modos SSR/MSSR - en Modos A, C o S  |
| 8  | Cobertura del radar secundario de vigilancia en millas marinas  |
| 9  | Situación SSR/MSSR - Situación de la implantación/Radar secundario de vigilancia/Radar secundario de vigilancia de monoimpulso                                    |
| 10 | Tipo ADS - Tipo/Vigilancia dependiente automática   |
| 11 | Situación ADS - Situación de la implantación/Vigilancia dependiente automática  |
| 12 | Observaciones   |

*Nota.- Los códigos siguientes se utilizan en las Columnas 5, 9, 11 y 12:*

- |           |   |
|-----------|---|
| 5, 9 y 11 | I - Implantado con SSR convencional<br>I* - Implantado con SSR de monoimpulso<br>NI - Sin implantar<br>I/P - (Implantado/previsto) Indica un sistema radar implantado y ampliación o reemplazo de un sistema radar a corto plazo (dos años)<br>P - Previsto SSR<br>P* - Futuro plan con SSR de monoimpulso<br>NP - (No previsto) Indica que el Estado no ha previsto la implantación del radar<br>R - Recomendado |
| 12        | * MSSR - SSR de monoimpulso<br>< -  |

State(Territory)/Location Estado(Territorio)/Ubicación	ATS Unite Served Unidad ATS Servida	PSR			SSR				ADS		Remarks Observaciones
		Function Función	Coverage Cobertura (NM)	Status Impl. Estado	Function Función	Modes Modos (A,C&S)	Coverage Cobertura (NM)	Status Impl. Estado	Type Tipo	Status Impl. Estado	
1	2	3	4	5	6	7	8	9	10	11	12
<b>ANGUILLA (UK)</b>								NP			
<b>ANTIGUA &amp; BARBUDA</b> Airport (4 NM North)	V.C. Bird APP				T	A/C	180	I*			* MSSR
<b>ARGENTINA</b> Bahía Blanca, Airport	Ezeiza ACC Bahía Blanca TMA				E/T	A/C/S	200	I*			* MSSR
Córdoba, Airport	Córdoba ACC Ezeiza ACC Córdoba APP	T	80	I	E	A/C	180	I*			* MSSR
Ezeiza, Airport	Ezeiza ACC Buenos Aires APP Cordoba ACC	T	90	I	E	A/C	220	I*	C		* MSSR
La Rioja, Airport	Córdoba ACC La Rioja TMA				E/T	A/C/S	200	I*			* MSSR
Mar de Plata, Airport	Ezeiza ACC Mar del Plata TMA	T	90	I	E	A/C	180	I*			* MSSR
Mendoza, Airport	Mendoza TMA Cordoba ACC	T	60	I	E	A/C	180	I*			
Neuquen	Ezeiza ACC Neuquen TMA				E/T	A/C/S	200	I			* MSSR
Paraná, Airport	Ezeiza ACC Córdoba ACC				E	A/C	180	I*			
Quilmes	Ezeiza ACC Cordoba ACC Buenos Aires APP				E/T	A/C/S	200	I			* MSSR
San Carlos de Bariloche, Airport	Ezeiza ACC Bariloche TMA				E/T	A/C/S	200	I*			
Salta	Cordoba ACC Salta TMA				E/T	A/C/S	200	I*			* MSSR
San Luis, Airport	Córdoba ACC Ezeiza ACC				E	A/C/S	200	I*			* MSSR
Santa Rosa, Airport	Santa Rosa TMA Ezeiza ACC Cordoba ACC				E/T	A/C/S	200	I*			* MSSR
Tucumán, Airport	Córdoba ACC Tucuman TMA				E/T	A/C/S	200	I*			* MSSR
<b>ARUBA</b> (Kingdom of the Netherlands)	Reina Beatrix APP	T	80	I	T	A/C	256	I*			*MSSR
<b>BAHAMAS</b> Nassau	Miami ACC Nassau APP	E/T		I	E/T	A/C	200	I			

State(Territory)/Location Estado(Territorio)/Ubicación	ATS Unite Served Unidad ATS Servida	PSR			SSR				ADS		Remarks Observaciones
		Function Función	Coverage Cobertura (NM)	Status Impl. Estado	Function Función	Modes Modos (A,C& S)	Coverage Cobertura (NM)	Status Impl. Estado	Type Tipo	Status Impl. Estado	
1	2	3	4	5	6	7	8	9	10	11	12
<b>BARBADOS</b>											
Aiport	Adams APP				T	A/C	250	I*			*MSSR
<b>BELIZE</b>											
	Belize APP				E/T	A/C	250	I*			*MSSR
<b>BOLIVIA</b>											
Cochabamba	Cochabamba APP				E/T	A/C		I*			
	La Paz ACC										
La Paz	La Paz ACC				E	A/C		P*			
La Paz	La Paz APP	T		P	T	A/C		P*			*Replacement by MSSR is recommended / Recomendado reemplazo por MSSR
<b>BRASIL</b>											
Barcelos	Manaus ACC			NP	E	A/C	220	P*			* MSSR
Barra do Carcas	Brasilia ACC	E	180	I	E	A/C	220	I*			* MSSR
Belém	Manaos ACC	E	180	I	E	A/C	220	I*			* MSSR
Belém	Belem APP	T	60	I	T	A/C	220	I*			* MSSR
Boa Vista	Manaus ACC	E	180	I	E	A/C	220	I*			* MSSR
Bom Jesus da Lapa	Recife ACC			NI	E	A/C	220	I*			* MSSR
Brasília	Brasília APP	T	60	I	T	A/C	220	I*			* MSSR
Cachimbo	Manaus ACC			NI	E	A/C	220	I*			* MSSR
Campinas	Campinas APP	T	60	I	T	A/C	220	I*			* MSSR
Campo Grande	Campo Grande APP	T	60	I	T	A/C	220	I*			* MSSR
Cangucu	Curitiba ACC	E	180	I	E	A/C	220	I*			* MSSR
Catanduas	Curitiba ACC	E	180	I	E	A/C	220	I*			* MSSR
Chapada Dos Guimaraes	Brasilia ACC	E	180	I	E	A/C	220	I*			* MSSR
Conceição do Araguaia	Manaus ACC	E	180	I	E	A/C	220	I*			* MSSR
Confins	Confins APP	T	60	I	T	A/C	220	I*			* MSSR
Congonhas	São Paulo APP	T	60	I	T	A/C	220	I*			* MSSR
Cruzeiro do Sul	Manaus ACC	E	180	I	E	A/C	220	I*			* MSSR
Cuiabá	Cuiabá APP	T	60	I	T	A/C	220	I*			* MSSR
Curitiba	Curitiba APP	T	60	I	T	A/C	220	I*			* MSSR
Eduardo Gomes	Manaus APP	T	60	I	T	A/C	220	I*			* MSSR
Eirunepé	Manaus ACC	E	180	I	E	A/C	220	I*			* MSSR
Fernando Noronha	Recife ACC			NI	E	A/C	220	I*			* MSSR
Florianópolis	Florianópolis APP	T	60	I	T	A/C	220	I*			* MSSR
Fortaleza	Recife ACC	E	180	I	E	A/C	220	I*			* MSSR
Fortaleza	Fotaleza APP	T	60	I	T	A/C	220	I*			* MSSR
Foz do Iguazu	Foz do Iguacu APP	T	60	I	T	A/C	220	I*			* MSSR
Galeão	Galeão APP	T	60	I	T	A/C	220	I*			* MSSR
Gama	Brasília ACC	E	180	I	E	A/C	220	I*			* MSSR
Guajaramirim	Manaus ACC	E	180	P	E	A/C	220	I*			* MSSR
Guarulhos	Sao Paulo APP	T	60	I	T	A/C	220	I*			* MSSR
Imperatriz	Manaus ACC			NI	E	A/C	220	I*			* MSSR
Jacarcacanga	Manaus ACC			NI	E	A/C	220	I*			* MSSR

State(Territory)/Location Estado(Territorio)/Ubicación	ATS Unite Served Unidad ATS Servida	PSR			SSR				ADS		Remarks Observaciones
		Function Función	Coverage Cobertura (NM)	Status Impl. Estado	Function Función	Modes Modos (A,C& S)	Coverage Cobertura (NM)	Status Impl. Estado	Type Tipo	Status Impl. Estado	
1	2	3	4	5	6	7	8	9	10	11	12
Jaraguari	Curitiba ACC	E	180	I	E	A/C	220	I*			* MSSR
Macapa	Manaus ACC	E	180	I	E	A/C	220	I*			* MSSR
Maceió	Recife ACC	E	180	I	E	A/C	220	I*			* MSSR
Manaus	Manaus ACC	E	180	I	E	A/C	220	I*			* MSSR
Manaus	Manaus APP	T	60	I	T	A/C	220	I*			* MSSR
Manicoré	Manaus ACC			NI	E	A/C	220	I*			* MSSR
Mombaça	São Paulo APP	T	60	I	T	A/C	220	I*			* MSSR
Morro da Igreja	Curitiba ACC	E	180	I	E	A/C	220	I*			* MSSR
Natal	Recife ACC	E	180	I	E	A/C	220	I*			* MSSR
Natal	Natal APP	T	60	I	T	A/C	220	I*			* MSSR
Palmas	Brasília ACC	E	180	P	E	A/C	220	P*			* MSSR
Petrolina	Recife ACC			NI	E	A/C	220	I*			* MSSR
Pico do Couto	Brasília ACC	E	180	I	E	A/C	220	I*			* MSSR
Porto Alegre	Porto Alegre APP	T	60	I	T	A/C	220	I*			* MSSR
Porto Espiridiao	Manaus ACC	E	180	P	E	A/C	220	I*			* MSSR
Porto Seguro	Recife ACC	E	180	P	E	A/C	220	I*			* MSSR
Porto Velho	Manaus ACC	E	180	P	E	A/C	220	I*			* MSSR
Recife	Recife APP	T	60	I	T	A/C	220	I*			* MSSR
Rio Branco	Manaus ACC	E	180	P	E	A/C	220	I*			* MSSR
Rio de Janeiro	Galeão APP	T	60	I	T	A/C	220	P*			* MSSR
Salvador	Recife ACC	E	180	I	E	A/C	220	I*			* MSSR
Salvador	Salvador APP	T	60	I	T	A/C	220	I*			* MSSR
Santa Teresa	Brasília ACC	E	180	I	E	A/C	220	I*			* MSSR
Santarém	Manaus ACC	E	180	P	E	A/C	220	I*			* MSSR
Santiago	Curitiba ACC	E	180	I	E	A/C	220	I*			* MSSR
Sao Felix do Araguaia				NI	E	A/C	220	I*			* MSSR
S. Feliz do Xingu				NI	E	A/C	220	I*			* MSSR
Sao Gabriel Cachoeira	Manaus ACC	E	180	I	E	A/C	220	I*			* MSSR
Sao Luiz	Manaus ACC	E	180	P	E	A/C	220	I*			* MSSR
Sao Roque	Brasília ACC	E	180	I	E	A/C	220	I*			* MSSR
Sinop	Brasília ACC	E	180	P	E	A/C	220	I*			* MSSR
Tabatinga	Manaus ACC	E	180	I	E	A/C	220	I*			* MSSR
Tanabi	Brasília ACC	E	180	I	E	A/C	220	I*			* MSSR
Tefé	Manaus ACC	E	180	P	E	A/C	220	I*			* MSSR
Tirios	Manaus ACC			NI	E	A/C	220	I*			* MSSR
Tres Marias	Brasília ACC	E	180	I	E	A/C	220	I*			* MSSR
Vilhena	Manaus ACC	E	180	P	E	A/C	220	I*			* MSSR
<b>CHILE</b>											
Antofagasta	Santiago ACC				E/T	A/C	250	I			
	Antofagasta APP				T						
	Iquique APP				T						
Atacama	Santiago ACC				E	A/C	250	I			
	Antofagasta APP				T						
Aysen	Puerto Montt ACC				E	A/C	250	I			
	Punta Arenas ACC				E						
	Santiago ACC				E						
Cautin	Santiago ACC				E	A/C	250	I			



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1	2	3	4	5	6	7	8	9	10	11	12
Leticia (MIL)	Villavicencio APP	T	240	P	T	A/C	240	P			
Marandúa	Bogotá ACC	E/T	240	I	E/T	A/C	240	I			
	Villavicencio APP										
Pereira	Bogotá ACC				E/T	A/C	250	P*			*MSSR,
	Bogotá APP										
	Cali APP										
	Pereira APP										
	Rio Negro APP										
Ríohacha	Barranquilla ACC	E	240	I	E	A/C	240	I			
S. J. Guaviare	Bogotá ACC	E/T	240	I	E/T	A/C	240	I			
	Villavicencio APP										
San Andrés	Barranquilla ACC				E/T	A/C	250	I*			*MSSR,
	San Andrés APP										
San Andrés (MIL)	Barranquilla ACC	E/T	240	I	E/T	A/C	240	I			
	San Andrés APP										
Santa Ana	Bogotá ACC	E/T	165	I	E/T	A/C	250	I*			*MSSR
	Cali ACC/APP										
	Pereira APP										
Tablazo	Bogotá ACC	E/T	80	P	E/T	A/C	250	P*			*MSSR,
	Bogotá APP										
	Cali APP										
	Pereira APP										
	Rio Negro APP										
	Villavicencio APP										
Tubará (Barranquilla)	Barranquilla ACC	E/T	80	I	E/T	A/C	250	I*			*MSSR
	Barranquilla APP										
	San Andrés APP										
Villavicencio	Villavicencio APP	T	80	I	E	A/C	150	I			
<b>COSTA RICA</b>											
El Coco	El Coco APP	E/T	60	I	E/T	A/C	245	I*			*MSSR
<b>CUBA</b>											
Camagüey	Habana ACC				E/T	A/C	200	I/P*			*MSSR
	Camagüey APP										
Habana	Habana TMA	T	60	P	T	A/C	200	I/P*			*MSSR
	Habana APP										
Holguín	Habana ACC				E/T	A/C	200	I/P*			*MSSR
	Santiago de Cuba TMA										
	Holguín APP										
Menocal	Habana ACC				E/T	A/C	200	I/P*			*MSSR
	Habana TMA										
	Habana APP										
	Varadero APP										
San Julián	Habana ACC				E	A/C	200	I/P*			*MSSR
Sta. Clara	Habana ACC				E	A/C	200	I/P*			*MSSR

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1	2	3	4	5	6	7	8	9	10	11	12
<b>DOMINICA</b>				NP				NP			
<b>DOMINICAN REPUBLIC</b>											
Puerto Plata	Puerto Plata APP	T	70	I							
Punta Cana	Santo Domingo ACC Punta Cana APP	T	70	P	E/T	A/C	250	P*			*MSSR
Santo Domingo	Santo Domingo ACC Santo Domingo APP	E/T	70	I	E/T	A/C	250	I*			*MSSR
<b>ECUADOR</b>											
Guayaquil	Guayaquil ACC				E	A/C/S		I*			*MSSR
	Guayaquil APP	T	50	I	T	A/C/S	250	I*			*MSSR
Quito APP	Guayaquil ACC				E	A/C/S	250	I*			*MSSR
	Quito APP	T	50	I	T	A/C/S	250	I*			*MSSR
San Cristobal	Guayaquil ACC				E	A/C/S	250	I*			*MSSR
<b>EL SALVADOR</b>											
El Salvador	El Salvador APP	T		I	T	A/C	200	I*			*MSSR
					E/T	A/C	250	P*			*MSSR
<b>FRENCH ANTILLES</b>											
Fort-de-France	Fort-de-France APP				T	A/C	250	I*			*MSSR
Point-à-Pitre	Point-à-Pitre APP				T	A/C	250	I*			*MSSR
<b>GRENADA</b>											
	Point Salines APP							NP			
<b>GUATEMALA</b>											
C. Guatemala	La Aurora APP	T	80	I	T	A/C	250	I*			*MSSR
San José Escuintla	San José APP				T	A/C	250	P*			
Santa Elena	Tikal APP				T	A/C	250	I*			
Quetzaltenango	Quetzaltenango APP				T	A/C	250	P*			
<b>GUYANA</b>											
	Georgetown ACC							NP	I		ADS B
<b>HAITI</b>											
	Port-au-Prince ACC				E/T	A/C		P*			*MSSR
	Port-au-Prince APP				T	A/C		P*			*MSSR
<b>HONDURAS</b>											
San Pedro Sula	La Mesa APP				T	A/C	250	I*			*MSSR
<b>JAMAICA</b>											
Kingston	Kingston APP	T	60	I	E/T	A/C	250	I*			*MSSR
Montego Bay	Montego Bay APP	T	60	I	T	A/C	250	I*			*MSSR
Mount Denham	Kingston ACC	E	120	I	E	A/C	250	I*			*MSSR

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1	2	3	4	5	6	7	8	9	10	11	12
<b>MEXICO</b>											
Acapulco	Acapulco APP				T	A/C	240	I*			*MSSR
Bajo Gto	México ACC Bajo APP				E/T	A/C, S	240	I*			*MSSR
Cancún	Mérida ACC Cancún APP	E/T	60	I	E/T	A/C	240	I*			*MSSR
Cerro Gordo	México ACC				E	A/C	240	I*			*MSSR
Cerro Potosi	Monterrey ACC				E	A/C	240	I*			*MSSR
Cerro Rusias	Mazatlán ACC México ACC				E	A/C	240	I*			*MSSR
Cerro Los Gallos	Monterrey ACC Mazatlán ACC				E	A/C	240	I*			*MSSR
Cerro Santa Eulalia	México ACC Monterrey ACC				E/T	A/C	240	I*			*MSSR
Guadalajara	Monterrey ACC Chihuahua APP										
Hermosillo	Guadalajara APP Mazatlán ACC	T	80	I	T	A/C	240	I*			*MSSR
	Hermosillo APP				E/T	A/C	240	I*			*MSSR
La Paz	Tijuana APP Mazatlan ACC				E/T	A/C	240	I*			*MSSR
	San Jose del Cabo										
Los Mochis	Mazatlán ACC				E	A/C	240	I*			*MSSR
Mazatlán	Mazatlán ACC				E	A/C	240	I*			*MSSR
Mérida	Mérida ACC Mérida APP	E/T		I	E/T	A/C	240	I*			*MSSR
Monterrey	Monterrey ACC Monterrey APP	E/T	80	I	E/T	A/C	240	I*			*MSSR
Peñón	México APP	E/T	80	I	E	A/C	240	I*			*MSSR
Puerto Peñasco	Mazatlán ACC				E	A/C	240	I*			*MSSR
Puerto Vallarta	Puerto Vallarta APP				T	A/C	240	I*			*MSSR
San José del Cabo	Mazatlán ACC				E	A/C, S	240	I*			*MSSR
Tampico	México ACC Mérida ACC				E	A/C, S	240	I*			*MSSR
	Monterrey ACC										
Tijuana	Tijuana APP				T	A/C	240	I*			*MSSR
Toluca	México ACC Toluca APP	E/T	80	I	E/T	A/C	240	I*			*MSSR
Veracruz	México ACC Mérida ACC				E	A/C	240	I*			*MSSR
Villahermosa	México ACC Mérida ACC				E	A/C, S	240	I*			*MSSR
<b>MONTERRAT (United Kingdom)</b>								NP			

State(Territory)/Location Estado(Territorio)/Ubicación	ATS Unite Served Unidad ATS Servida	PSR			SSR				ADS		Remarks Observaciones
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1	2	3	4	5	6	7	8	9	10	11	12
<b>NETHERLANDS ANTILLES (Netherlands)</b>											
Willemstad	Curaçao ACC Curaçao APP	E/T	120	I	E/T	A/C	256	I*			*MSSR
Saint Maarten	Juliana APP	T	60	I	T	A/C	256	I*			*MSSR
<b>NICARAGUA</b>											
Managua	Managua APP	T	60	P	T	A/C	250	I/P*			*MSSR
Bluefields	Bluefields TWR				T	A/C	250	NI			
<b>PANAMA</b>											
Panamá	Panamá ACC Panamá APP	T	60	I	E/T	A/C/S	200	I*			*MSSR
<b>PARAGUAY</b>											
Asunción	Asunción ACC	T	60	I	E/T	A/C	200	I*			*MSSR
Ciudad del Este	Ciudad del Este APP							I	I		ADS B
<b>PERU</b>											
Ayacucho	Lima ACC				E	A/C/S	250	I*			*MSSR
Arequipa	Lima ACC				E	A/C/S	250	I*			*MSSR
Cajamarca	Lima ACC Chiclayo APP				E/T E/T	A/C/S A/C/S	250 250	I* P*			*MSSR
Cusco	Lima ACC				E	A/C/S	250	P*			
Iquitos	Lima ACC Iquitos APP				E/T E/T	A/C/S A/C/S	250 250	I* P			*MSSR
Lima	Lima ACC	E	60	I*	E	A/C/S	250	I*			*MSSR
	Lima APP	T	60	I*	T	A/C/S	250	I*			*MSSR
Pucallpa	Lima ACC				E/T	A/C/S	250	I*			*MSSR
Talara	Lima ACC Chiclayo APP				E/T E/T	A/C/S A/C/S	250 250	I* P			*MSSR
<b>PUERTO RICO (United States)</b>											
Pico del Este	San Juan ACC	E/T	200	I	E/T	A/C	200	IP*			*MSSR
San Juan	San Juan APP	E/T	60	I	E/T	A/C	180	I			
<b>SAINT KITTS AND NEVIS</b>											
								NP			
<b>SAINT LUCIA</b>											
	Santa Lucia APP							NP*			* Radar data sharing with Martinica planned/ Proyecto compartir datos radar con Martinica.

State(Territory)/Location Estado(Territorio)/Ubicación	ATS Unite Served Unidad ATS Servida	PSR			SSR				ADS		Remarks Observaciones
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1	2	3	4	5	6	7	8	9	10	11	12
<b>SAINT VINCENT &amp; THE GRENADINES</b>	E.T.Joshua APP							NP			
<b>SURINAME</b>	Paramaribo ACC	E/T	80	I	E/T	A/C/S	250	IP			
<b>TRINIDAD &amp; TOBAGO</b> Piarco (15 NM north)	Piarco ACC Piarco APP	E/T	60	I	E/T	A/C	230	I*			*MSSR
<b>TURKS &amp; CAICOS IS. (United Kingdom)</b> Grand Turks	Miami ACC San Juan ACC				E	A/C	250	IP*			*MSSR
<b>URUGUAY</b> Carrasco	Montevideo ACC	E/T	80	I	E/T	A/C	180	I*			*MSSR
	Carrasco APP										
Durazno	Montevideo ACC Carrasco APP				E/T	A/C	256	P			*MSSR
<b>IVENEZUELA</b>											
Barcelona	Barcelona APP Maiquetia ACC	E/T	60	P	E/T	A/C	250	I*			*MSSR
Barquisimeto	Barquisimeto APP Maiquetia ACC	E/T	60	I	E/T	A/C	250	I*			*MSSR
San Carlos de Rio Negro	Maiquetia ACC				E	A/C	250	P*			*MSSR
Isla Margarita	Margarita APP Maiquetia ACC	E/T	60	P	E/T	A/C	250	I*			*SSR/M
Las Coloradas	Maiquetia ACC				E	A/C	250	I*			*MSSR
Maiquetía	Maiquetia ACC Maiquetia APP	E/T	80	I	E/T	A/C	250	I*			
Maracaibo	Maracaibo APP Maiquetia ACC	E/T	60	I	E/T	A/C	250	I*			*MSSR
Puerto Ayacucho	Maiquetia ACC	E/T	200	I	E/T	A/C	250	I*			*MSSR
Puerto Ordaz	Puerto Ordaz APP Maiquetia ACC	E/T	200	P	E/T	A/C	250	I*			*MSSR

State(Territory)/Location Estado(Territorio)/Ubicación	ATS Unite Served Unidad ATS Servida	PSR			SSR				ADS		Remarks Observaciones
		Function Función	Coverage Cobertura (NM)	Status Impl. Estado	Function Función	Modes Modos (A,C&S)	Coverage Cobertura (NM)	Status Impl. Estado	Type Tipo	Status Impl. Estado	
1	2	3	4	5	6	7	8	9	10	11	12
Santa Elena de Uairen	Maiquetia ACC				E/T	A/C	250	I*			*MSSR
<b>VIRGIN IS. (United Kingdom)</b>								NP			
<b>VIRGIN IS. (United States)</b>											
Saint Thomas	San Juan ACC San Juan APP	E/T	60	I	E/T	A/C	180	I			
<b>COCESNA</b>											
Cerro Santiago, Guatemala	CENAMER ACC				E	A/C/S*	250	I/P*			*MSSR-Modo S
Costa Rica	CENAMER ACC El Coco APP				E/T	A/C/S*	250	I/P*			*MSSR-Modo S
Grand Cayman, Cayman I.	CENAMER ACC Owen Roberts TWR				E/T	A/C/S*	250	I*			*MSSR-Modo S
Mata de Caña, Costa Rica	CENAMER ACC				E	A/C/S*	250	I/P*			*MSSR-Modo S
Puerto Cabezas, Nicaragua	CENAMER ACC				E	A/C/S*	250	I/P*			*MSSR-Modo S
Dixon Hill, Honduras	CENAMER ACC				E	A/C/S*	250	I*			*MSSR-Modo S
Monte Crudo, Honduras	CENAMER ACC				E	A/C/S*	250	I*			*MSSR-Modo S

## APPENDIX C

## ACTION PLAN FOR THE CONDUCTION OF ADS-B TRIALS IN THE SAM REGION

IMPLEMENTATION PHASE	TASK	ACTIVITY	RESPONSIBLE PARTY	DELIVERABLE	STATUS
<b>PHASE I</b> <b>Conduction of ADS-B trials, collection and processing of data, submission of results</b>	1	Define trial objectives, aiming at studying the possibility for States to benefit from ADS-B as surveillance system in the Region.	CNS Task Force	Trial objectives	<b>Finalised</b>
	2	Review and describe in detail the activities to be considered for ADS-B trials designed by the GREPECAS mechanism.	Secretariat	Revised regional plan of activities for ADS-B trials	<b>Finalised</b>
	3	Define the equipment and configuration needed to begin trials. Define trial costs.	Rapporteur	Definition of equipment and its configuration for the trial	<b>Finalised</b> A Thales ADS-B station was used for the trial at no cost.
	4	Define the geographical area where trials will be conducted	Rapporteur	Geographical area defined (operational concept)	<b>Finalised</b> The terminal area of the Jorge Chavez international airport of Lima, Peru, was selected
	5	Consult States and users about their participation in the trials	Secretariat	Confirmation of participation by States	<b>Finalised</b>
	6	Select the entity, organisation or State in charge of conducting the trials	States	Selection of the entity, organisation or State	<b>Finalised</b> CORPAC, the air navigation service provider of Peru, was selected
	7	Installation of the ADS-B equipment required for the trial in the defined geographical area	Selected entity, organisation or State	Equipment installed	<b>Finalised</b> It was installed at the Jorge Chavez international airport of Lima, Peru.
	8	Conduction of trials (data collection).	State (Peru), manufacturer (Thales),	Start-up of trials	<b>Finalised</b> Trials were conducted for a

IMPLEMENTATION PHASE	TASK	ACTIVITY	RESPONSIBLE PARTY	DELIVERABLE	STATUS
			Secretariat		period of six months
	9	Processing of collected data	State (Peru), manufacturer /Thales), Secretariat	Processing of data	<b>Finalised</b> Processing of the data collected was done by the air navigation service provider (CORPAC)
	10	Presentation of results obtained	State (Peru), Secretariat	Presentation of results	<b>Finalised</b> Results were presented at the ADS-B workshop (Lima, Peru) and SAM/IG meeting.
<b>PHASE II</b> <b>OPERATIONAL IMPLEMENTATION OF ADS-B</b>	11	Define operational use of ADS-B, based on the airspace concept defined at national level	States	Presentation of results	<b>Valid</b>
	12	Safety assessment based on the defined operational use(s)	States	Presentation of results	<b>Valid</b> In this task, it is important to analyse the behaviour of global positioning satellites in these latitudes.
	13	Drafting of model documents for operational implementation of ADS-B  <ul style="list-style-type: none"> <li>• Drafting of model advisory circulars for airworthiness approval and operation with ADS-B</li> <li>• Drafting of model AIC to report ADS-B implementation plans</li> <li>• Develop model AIP supplement</li> </ul>	Regional projects RLA/99/901 RLA/06/901 States	Publications in support of ADS-B implementation	<b>Valid</b> December 2016 All model publications on operational use of ADS-B

IMPLEMENTATION PHASE	TASK	ACTIVITY	RESPONSIBLE PARTY	DELIVERABLE	STATUS
		containing standards and procedures applicable to ADS-B, in accordance with the operational use defined <ul style="list-style-type: none"> <li>• Review the procedural handbooks of ATS units, in accordance with the operational use defined for ADS-B</li> </ul>			
	14	Publication of documents in support of ADS-B operational implementation	States	Publication of documents	<b>Valid</b> December 2017
	15	Training programme: <ul style="list-style-type: none"> <li>• Establishment of a training programme for ATS personnel on the operational implementation of ADS-B, in accordance with the operational use defined</li> <li>• Establishment of a training programme for airworthiness and operation inspectors on the operational implementation of ADS-B, in accordance with the operational use defined</li> <li>• Establishment of a training programme for pilots on the operational implementation of ADS-B, in accordance with the operational use defined</li> </ul>	Regional projects RLA/99/901 RLA706/901 States	Training programme	<b>Valid</b> December 2016

<b>IMPLEMENTATION PHASE</b>	<b>TASK</b>	<b>ACTIVITY</b>	<b>RESPONSIBLE PARTY</b>	<b>DELIVERABLE</b>	<b>STATUS</b>
<b>PHASE III</b> <b>ADS-B</b> <b>IMPLEMENTATION</b> <b>MONITORING</b>	16	ADS-B implementation monitoring	SAM/IG Secretariat	ADS-B implementation monitoring	<b>Valid</b> 2018