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NORTH AMERICAN, CENTRAL AMERICAN AND CARIBBEAN OFFICE
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Havana, Cuba, 20 to 24 February 2006

Agenda Item 3: Activities for the development of the air navigation systems/services
3.3 Communications, Navigation and Surveillance (CNS)

FOLLOW-UP TO THE IMPLEMENTATION OF THE SURVEILLANCE SYSTEMS

(Presented by the Secretariat)

SUMMARY

This working paper presents an analysis of the follow-up plan for the development and implementation of the Surveillance systems in the Central Caribbean, based on the results of the review of the CNS conclusions of C/CAR WG, C/CAR DCA and NACC/DCA Meetings, as well as the GREPECAS mechanism.

References:

- Report of the GREPECAS/12 Meeting (Havana, Cuba, June 2004).
- Report of the C/CAR WG/5 Meeting (Mexico City, Mexico, 9 – 13 February 2005).
- Report of the NACC/DCA/2 Meeting (Tegucigalpa, Honduras, 11 – 14 October 2005).
- Report of GREPECAS/13 Meeting (Santiago, Chile, 14 – 18 November 2005).

1. Introduction

1.1 The Fifth Central Caribbean Working Group Meeting (C/CAR WG/5), held in Mexico City, Mexico, 21 – 24 February 2005, with respect to the surveillance agenda items of their work programme, carried out the follow-up of those tasks in accordance with the CNS guidelines agreed by the First Meeting of Directors of Civil Aviation of North America, Central America and the Caribbean, (NACC/DCA/1), held in Grand Cayman, October 2002, as well by the GREPECAS conclusions. Subsequent to the celebration of the C/CAR WG/5 Meeting the NACC DCA/2 Meeting, Tegucigalpa, Honduras, 11 - 14 October 2005; and the GREPECA/13 Meeting, Santiago, Chile 14 - 18 November 2005 were held, in which appropriate guidelines to the surveillance work of the Central Caribbean Working Group were issued.

1.2 In relation to the Surveillance systems, the CCAR WG/5 Meeting, adopted the following Draft Conclusions and Decisions:

C/CAR WG/5 MEETING

No.	DRAFT CONCLUSIONS ON SURVEILLANCE ISSUES
5/14	*Improvement of Surveillance Services in ATS Units*
5/16	*Provision of Radar Experts to the Radar Data Sharing Task Force*
5/17	*Assessment of the Training Needs for Radar Data Exchange*
5/19	*Data Integrity of the Radar System in Radar Data Exchange*
5/21	*Commencement of the Radar Data Exchange Programmes*

	DECISIONS ON SURVEILLANCE ISSUES
5/18	*Convening of an extended Radar Data Sharing Task Force Meeting*
5/20	*Information request for the Radar Coverage Corresponding to Merida ACC and CENAMER FIR*

1.3 The NACC/DCA/2 Meeting updated its work guidelines on the following surveillance systems:

Radar data Exchange: *"…develop the radar data exchange between ATS units aimed at improving the radar service. States/Territories/International Organizations are urged to consider the regional guidelines developed by the GREPECAS on the radar data exchange"*.

Introduction of ADS-B: *"To guide the strategy and implement the ADS where feasible and operationally advantageous"*.

1.4 The GREPECAS/13 Meeting adopted the following conclusions related to the Central Caribbean Surveillance:

GREPECAS/13 MEETING

No.	CONCLUSIONS ON SURVEILLANCE ISSUES
13/87	*ADS-B trials programme in the CAR/SAM Regions*
13/88	*Proposal for-Amendment to the Regional SAC ASTERIX Code Assignment Plan*

2. Discussion

Update of the surveillance plan corresponding to the Central Caribbean

2.1 Although that the GREPECAS/12 Meeting through its Conclusion 12/50 updated Table CNS 4A of the FASID – *FASID Surveillance Plan* with the information available at the time of the celebration of their meeting, it is consider that the members of the Central Caribbean Working Group who participated in that Meeting, could provide new information to update the corresponding Central Caribbean Surveillance Regional Plan, especially on the Primary Surveillance Radar (PSR), Secondary Surveillance Radar (SSR) and Automatic Dependent Surveillance (ADS). The corresponding part of the CAR Region of Table CNS 4A, is shown in **Appendix A** to this paper.

Radar data sharing

2.2 The Meeting should recalled that the C/CAR WG/5 Meeting, based in the work carried out by the Radar Data Sharing Task Force, followed-up the tasks for the establishment of the radar data exchange in the Central Caribbean. As a result of this work, the mentioned Meeting formulated several draft conclusions and decisions. Based in the information available in the Secretariat it is foreseen that the Meeting should follow-up the main actions contained in these conclusions according to the following aspects:

a) In accordance with Draft Conclusion 5/14, the Meeting is expected to develop an action plan format for the implementation of radar data exchange and that the members of this Group inform the Meeting on their respective action plans to implement surveillance systems where required, including the SSR options, radar data exchange between neighbouring ATS units, ADS-C or ADS-B.

b) Considering the Draft Conclusion 5/15, the MEVA Technical Management Group (TMG) it is expected to inform the Meeting on the MEVA II Network viability to support radar data circuits. It is consider that a 9,6 kbps channel generally could support the data radar transmission.

c) According to the Draft Conclusion 5/16, Netherlands Antilles and Cuba have provided experts to support the work of the mentioned Task Force Group. It is also expected that other members of the Group provide adequate experts who assist to the work of the radar data sharing task force in order to help the Task Force in the execution of its tasks.

d) Based in Draft Conclusion 5/17, it is expected that the Meeting recommends specific actions to perform training of operational and technical staff to support the implementation of radar service and/or radar data sharing.

e) Taking into consideration Decision 5/18, it is expected that the members of the Group submit to this Meeting results on the initial studies on ATS units where the implementation of radar data sharing would be feasible and beneficial.

f) In conformity with Draft Conclusion 5/19, the Group should note the need to establish a system which would guarantee the radar data sharing integrity and develop detailed guidelines in this respect.

g) According to information available by the Secretariat, Mexico and COCESNA have initiated bilateral conversations and studies to establish radar data sharing. Considering Draft Conclusion 5/20, other similar initiatives are expected to be developed and informed.

Studies on the Implementation of secondary surveillance radar in Mode S

2.3 The GREPECAS/13 Meeting received information on the overview on the secondary surveillance radar (SSR) system in Mode S presented in Appendix BE to the Report on Agenda Item 3 and considered that to implement the SSR in Mode S, is essential to study and consider the areas in which the installation of this type of radar might be justified. The Meeting also considered that the implementation of Mode S in these regions are favoured by the fact that numerous SSR installed are monopulse technique and generally have the capacity of allowing Mode S. Moreover, the Meeting noted that Brazil, Colombia, Mexico and the Dominican Republic have installed SSR in Mode S. Information on the overview development of SSR in Mode S is presented in **Appendix B** to this working paper.

2.4 The working paper No. 11 (WP/11) presents a joint analysis on operational and technical aspects of the SSR in Mode S.

Studies on the regional implementation of ADS-C and ADS-B systems

2.5 The GREPECAS/13 Meeting, recalled that the AN-Conf/11 Recommendations 1/6 and 1/7, approved the use of automated dependent surveillance-broadcast (ADS-B) system to support the global ATM system and to contribute to the achievement of global interoperability, taking into account the Recommendations of the AN-Conf/11, the Global Air Navigation Plan for CNS/ATM systems (Doc 9750) and the industry developments.

2.6 The GREPECAS/12 Meeting, through Conclusion 12/44 guided the application of Mode S extended squitter (1090 ES), as initial data link to implement the ASD-B

2.7 The C/CAR WG/6 should study the possibility and need to implement the ADS Contract systems (ADS-C) and/or ADS-B in the Central Caribbean, considering the overview development and this systems SARPs status and the ATM need. The **Appendix C** to this paper contains information on the overview of the ADS-C and ADS-B systems development. Also, the **Appendix D** presents a summary on the SARPs and ICAO guidance material status related with these systems.

2.8 Likewise, WP/11 presents an analysis on the initiatives of the CAR/Region States/Territories/International Organizations for the planning and implementation of the ADS-C and ADS-B systems, related to the potential implementation airspaces, the strategy and target dates, test programmes and other aspects related with the ADS-C and ADS-B systems implementation is presented in WP/11.

3. Suggested action

3.1 The Meeting is invited to:

a) take note of the contents of this working paper;

b) review the possibility of proposing updates to the surveillance systems Plan (Table CNS 4A of the FASID);

c) review the issues related to the radar data sharing, bearing in mind paragraph 2.2 of this paper;

d) follow-up the SSR in Mode S systems development, considering paragraphs 2.3 and 2.4 of this paper;

e) follow-up the air-ground communications development, taking into account paragraphs 2.5 to 2.8 of this working paper; and

f) review other issues as deem appropriate.

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APPENDIX/APENDICE A

Table CNS 4A - SURVEILLANCE SYSTEMS - CAR PART
Tabla CNS 4A - SISTEMAS DE VIGILANCIA - PARTE CAR

(Update by / Actualizada por GREPECAS/12)

State(Territory)/Location Estado(Territorio)/Ubicación	ATS Unite Served Unidad ATS Servida	PSR			SSR				ADS		Remarks Observaciones
		Funtion Función	Coverage Cobertura (NM)	Status Impl. Estado	Funtion Función	Modes Modos (A,C& S)	Coverage Cobertura (NM)	Status Impl. Estado	Type Tipo	Status Impl. Estado	
1	3	4	5	6	7	8	9	10	11	12	13
ANGUILA (UK)								NP			
ANTIGUA & BARBUDA											
Airport (4 NM North)	V.C. Bird APP				T	A/C	180	I*			* MSSR
ARUBA (Kingdom of the Netherlands)	Reina Beatrix APP	T	80	I	T	A/C	256	I*			*MSSR
BAHAMAS											
Nassau	Miami ACC Nassau APP	E/T		I	E/T	A/C		I			
BARBADOS											
Aiport	Adams APP				T	A/C	250	I*			*MSSR
BELIZE	Belize APP							NP			
COSTA RICA											
El Coco	El Coco APP	E/T		I	E/T	A/C	245	I*			*MSSR
CUBA											
Camagüey	Habana ACC				E/T	A/C	200	I/P*			*MSSR
	Camagüey APP										
Habana	Habana TMA	T		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*			*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
DOMINICA				NP				NP			
DOMINICAN REPUBLIC											

State(Territory)/Location Estado(Territorio)/Ubicación	ATS Unite Served Unidad ATS Servida	PSR			SSR				ADS		Remarks Observaciones
		Funtion Función	Coverage Cobertura (NM)	Status Impl. Estado	Funtion Función	Modes Modos (A,C& S)	Coverage Cobertura (NM)	Status Impl. Estado	Type Tipo	Status Impl. Estado	
1	3	4	5	6	7	8	9	10	11	12	13
Barahona	Barahona APP	T	70	I							
Puerto Plata	Puerto Plata APP	T	70	I							
Punta Cana	Santo Domingo ACC	T	70	P	E/T	A/C	250	P*			*MSSR
	Punta Cana APP										
Santo Domingo	Santo Domingo ACC	E/T	70	I	E/T	A/C	250	I*			*MSSR
	Santo Domingo APP										
EL SALVADOR											
El Salvador	El Salvador APP	T		I	T	A/C	200	I*			*MSSR
FRENCH ANTILLES											
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
GRENADA											
	Point Salines APP							N/P			
GUATEMALA											
C. Guatemala	La Aurora APP	T		I	T	A/C	250	I*			*MSSR
HAITI											
	Port-au-Prince ACC				E/T	A/C		P*			*MSSR
	Port-au-Prince APP				T	A/C		P*			*MSSR
HONDURAS											
San Pedro Sula	La Mesa APP	T		I	T	A/C	250	I*			*MSSR
JAMAICA											
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
MEXICO											
Acapulco	Acapulco APP	T		I	T	A/C	240	I*			*MSSR
Bajio Gto	México ACC				E/T	A/C, S	240	I*			*MSSR
	Bajio APP										
Cancún	Mérida ACC	E/T	60	I	E/T	A/C	240	I*			*MSSR
	Cancún APP										
Cerro Potosi	Monterrey ACC				E	A/C	240	I*			*MSSR
	México ACC										
Cerro Rusias	Mazatlán ACC				E	A/C	240	I*			*MSSR
	México ACC										
	Monterrey ACC										
Cerro Los Gallos	Mazatlán ACC				E	A/C	240	I*			*MSSR
	México ACC										
	Monterrey ACC										
Cerro Santa Eulalia	Monterrey ACC				E/T	A/C	240	I*			*MSSR
	Chihuaha APP										
Guadalajara	Guadalajara APP	T	80	I	T	A/C	240	I*			*MSSR
Hermosillo	Mazatlán ACC				E/T	A/C	240	I*			*MSSR

State(Territory)/Location Estado(Territorio)/Ubicación	ATS Unite Served Unidad ATS Servida	PSR			SSR				ADS		Remarks Observaciones
		Funtion Función	Coverage Cobertura (NM)	Status Impl. Estado	Funtion Función	Modes Modos (A,C& S)	Coverage Cobertura (NM)	Status Impl. Estado	Type Tipo	Status Impl. Estado	
1	3	4	5	6	7	8	9	10	11	12	13
	Hermosillo APP										
	Tijuana APP										
Los Mochis	Mazatlán ACC				E	A/C	240	I*			*MSSR
Mazatlán	Mazatlán ACC				E	A/C	240	I*			*MSSR
Mérida	Mérida ACC				E/T	A/C	240	I*			*MSSR
	Mérida APP										
Cerro Sordo	México ACC				E	A/C	240	I*			*MSSR
	Monterrey ACC										
Monterrey	Monterrey ACC	E/T	80	I	E/T	A/C	240	I*			*MSSR
	Monterrey APP										
Peñón	México APP				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				E	A/C, S	240	I*			*MSSR
	Mérida ACC										
	Monterrey ACC										
Tijuana	Tijuana APP				T	A/C	240	I*			*MSSR
Toluca	México ACC	E/T	80	I	E/T	A/C	240	I*			*MSSR
	Toluca APP										
Veracruz	México ACC				E	A/C	240	I*			*MSSR
	Mérida ACC										
Villahermosa	México ACC				E	A/C, S	240	I*			*MSSR
	Mérida ACC										
MONSERRAT (United Kingdowm)								N/P			
NETHERLANDS ANTILLES (Netherlands)											
Willemstad	Curaçao ACC	E/T	120	I	E/T	A/C	256	I*			*MSSR
	Curaçao APP										
Saint Maarten	Juliana APP	T	60	I	T	A/C	256	I*			*MSSR
NICARAGUA											
Managua	Managua APP	T		P	T	A/C	250	P*			*MSSR
Bluefields	Bluefields TWR				T	A/C	250	N/I			
PUERTO RICO (United States)											
Pico del Este	San Juan ACC	E/T		I	E	A/C		I			
San Juan	San Juan APP				T	A/C		I			
SAINT KITTS AND NEVIS								NP			
SAINT LUCIA											

State(Territory)/Location Estado(Territorio)/Ubicación	ATS Unite Served Unidad ATS Servida	PSR			SSR				ADS		Remarks Observaciones
		Funtion Función	Coverage Cobertura (NM)	Status Impl. Estado	Funtion Función	Modes Modos (A,C& S)	Coverage Cobertura (NM)	Status Impl. Estado	Type Tipo	Status Impl. Estado	
1	3	4	5	6	7	8	9	10	11	12	13
	Santa Lucia APP							NP*			* Radar data sharing with Martinica planned/ Proyecta compartir datos radar con Martinica.
SAINT VINVENT & THE GRENADINES	E.T.Joshua APP							NP			
TRINIDAD & TOBAGO											
Piarco (15 NM north)	Piarco ACC Piarco APP	E/T		I	E/T	A/C	230	I*			*MSSR
TURKS & CAICOS IS. (United Kingdom)											
Grand Turks	Miami ACC				E	A/C		I			
VIRGIN IS. (United Kingdom)								NP			
VIRGIN IS. (United States											
Saint Thomas	San Juan ACC San Juan APP	E/T		I	E/T	A/C		I			
COCESNA											
Cerro Santiago, Guatemala	CENAMER ACC				E	A/C	245	I*			*MSSR
Mata de Caña, Costa Rica	CENAMER ACC				E	A/C	245	I*			*MSSR
Puero Cabezas, Nicaragua	CENAMER ACC				E	A/C	245	I*			*MSSR
Roatán, Honduras	CENAMER ACC				E	A/C	245	I*			*MSSR
Tegucigalpa, Honduras	CENAMER ACC				E	A/C	245	I*			*MSSR

APPENDIX B

OVERVIEW ON THE SECONDARY SURVEILLANCE RADAR SYSTEM IN MODE S

Generals

1. SSR is used either as autonomous system or in common movement and synchronised with the primary radar of surveillance (PSR). The ground equipment is an interrogator and the aircraft equipment is a transponder responding to the signals issued by the interrogator. All SSR facilities operate in 1,030 MHz for the air-ground interrogation signal and in 1,090 MHz for the air-ground response. The wide utilisation of the repetitive pulse frequency (RPF) discrimination and the techniques for treatment of the radar points plan, help to reduce the number of invalid responses processing the ground-reception system.

2. SSR employs Mode A to transmit the identification and Mode C to transmit the altitude precision information. Mode S uses the aircraft selective routing and its capacity of data link is limited. Mode S has been established as a permanent need, especially in some high-density air traffic airspace parts.

Mode-S Secondary Surveillance Radar System

3. The Mode-S Secondary Surveillance radar system is a new radar generation that shall replace the current SSR. The general principle of the SSR is to interrogate transponders on board of aircraft, which, as per the interrogation received respond to the aircraft identification (Mode A) or its flight level (Mode C).

4. The current identification methods of SSR have reached its limit, it is always more difficult to assign a unique code Mode A to an individual flight, creating high risk in lack of identification.

5. Mode S radars overcome these difficulties identifying all aircraft individually on a global basis. Hence, their name “S” (selective). Thus, Mode S is based in the selective routing concept in which each aircraft is identified by a single ICAO Code composed of 24 bits; it represents the routing of the aircraft.

6. The selective function of these radars ensures the data integrity and increases the probability of detection. The Mode S radar operates in the same frequency of conventional SSR radars (1030 MHz for ascending link and 1090 MHz for descending link) and is compatible with SSR Mode A and C.

7. Also, the Airborne Collision Avoidance System (ACAS II) uses the Mode S transponder when both systems are connected.

8. ICAO SARPs related with Mode S are contained in Annex 10, Volume III, Chapter 5 (SSR Mode S air-ground link), Chapter 9 (Plan of aircraft directions), Annex 10 Volume IV, Chapters 2 and 3, and Document 9684 (Manual on secondary surveillance radar (SSR), as well as Document 9688 (Manual in Mode S – specific services).

APPENDIX C

OUTLOOK ON THE ADS-C AND ADS-B SYSTEMS DEVELOPMENT

References:

- Global Air Navigation Plan for CNS/ATM systems – Second Edition -– 2002. (Doc 9750 – AN/963).
- Report of the AN-Conf/11. Montreal, 22 Set. – 3 Oct. 2003.
- Annex 10, Volumes III and IV.
- Annex 11 y Doc 4444.
- Data links applications for the air traffic services (Doc 9694).

1. *ADS SYSTEM*

1.1 The automatic dependent surveillance (ADS) is an application for the ATS use in which the aircrafts transmit to the ATC automatically, through the air-ground data communications, information, sufficiently accurate and reliable, derived from the airborne navigations systems. As a minimum those data include the aircraft identification and in three-dimensional position, but additional data may be provided as appropriate. The ATC system would use the ADS data to present information to the controller and it must also have the capacity to exchange messages between the pilot and the controller, through data and voice links, in order to perform emergency and non-routine communications.

1.2 The ADS may provide surveillance services in the following areas:

a) where the current infrastructure lacks of radar surveillance services in particular the oceanic areas and other in which the conventional systems are difficult, very expensive or impossible to implement;
b) in high density air traffic areas where it may serve as an adjunct and/or back-up for the secondary surveillance radar (SSR) thereby reducing the need for primary surveillance radar (PSR); and
c) in some circumstances, it may substitute the secondary radar.

2. *ADS-B SYSTEM*

2.1 The automatic dependent surveillance-broadcast (ADS-B) is an application of the ADS technique defined by ICAO as a surveillance technique which an aircraft periodically and automatically broadcasts, through data links in a broadcast mode, derived data of the airborne navigation systems and its four-dimensional position, including the aircraft identification and additional information when required. The broadcast signals could be received and processed by the aircrafts and ATM units under the coverage of those signals. Nowadays, the ADS-B is defined only for line-of-sight operations (e.g. broadcast over VHF digital link or by SSR Mode S extended squitter).

2.2 ADS-B facilitates ATM automation, as a subsystem of the future ATN, given its component of inter-operability that ensures interconnectivity with radar systems and other communication subsystems by data link communications at a national, regional and global scale.

2.3 Tests carried out in other ICAO regions of the world on the performance of the ADS-B system have superseded the expectations with operational applications in diverse scenarios for all flight phases, an excellent coverage and updated information rate superior than the performance level expected from a secondary radar installed in the same site, the human performance is better than with the radar and the identity data is received reliably.

2.4 The ADS-B goes beyond the traditional surveillance service, since it takes into account the heterogeneous and evolutionary situation of the available ground infrastructure, extending its capability in air-air, air-ground and ground-ground applications through the interaction among the airborne and ground elements and ATM automated systems; as well as the performance of the human element for the collaborative decision-making process.

2.5 The surveillance levels attained by the ADS-B are the elementary surveillance, the perfected surveillance (using the status vector), the objective-based surveillance (using the envisaged path) in terrain and on the air, as applicable, providing additional data such as the status vector and the envisaged path of "gate-to-gate" operations, which is to say, airport surveillance. Likewise, the ADS-B allows to increase the capacity of the future ATM system and to improve the safety levels.

Scenarios of the global ATM defined to obtained improvements by ADS-B

2.6 The Global Air Navigation Plan for CNS/ATM systems defined that improvements could be obtained through ADS and ADS-B functions in the following type of spaces:

- oceanic/continental en-route airspace with low density traffic;
- oceanic airspace with high-density traffic;
- continental airspace with high-density traffic;
- terminal area with high-density traffic; and
- terminal area with low-density traffic.

ADS-B Application

2.7 The AN-Conf/11 identified an initial set of operational applications of air-ground and air-air surveillance through the ADS-B, suitable for the high density traffic areas, without excluding other areas, and among these applications are the following:

<u>ADS-B main applications for ATC surveillance:</u>

2.8 If aircrafts are well equipped, ADS-B could be used to:

a) to complete the coverage of SSR (to cover areas without secondary radar coverage);
b) replace the SSR service in areas with low and medium traffic density;
c) en-route airspace;
d) terminal areas;
e) as the basis for a air traffic presentation of the piloting position (CDTI); and
f) for the surface movement, therefore becoming an alternative for the surface radar such as the airport surface detection equipment (ASDE) and the Advanced Surface Movement Guidance and Control System (A-SMGCS).

ADS-B main applications for airborne surveillance:

a) enhanced traffic situational awareness on the airport surface;
b) enhanced traffic situational awareness during flight operations;
c) enhanced visual acquisition for see and avoid;
d) enhanced successive visual approaches;
e) enhanced sequencing and merging operations;
f) in-trail procedure in oceanic airspace; and
g) enhanced crossing and passing operations.

ADS-B Technology

2.9 The Eleventh Air Navigation Conference (AN-Conf/11), by Recommendations 1/6 and 1/7 approved the use of the concept of ADS-B as an enabler of the global ATM operational concept contributing to achieve the global interoperability. Likewise, based in Recommendation 7/1 of the An-Conf/11, GREPECAS, through its Conclusion 12/44 guided to the initial use of data links SSR Mode S extended squitter for the ADS-B implementation in the CAR/SAM Regions.

2.10 The surveillance systems established have limitations that could not satisfy the capacity, flexibility and efficiency needs which are required to fulfil the air traffic growth in the future. To overcome these limitations the aeronautical industry has developed various surveillance technologies including the data links SSR Mode S 1090 MHz extended squitter (1090 ES) as a mean of interoperability for ADS-broadcast in a short term. The 1090 ES system can support an air-ground coverage up to more than 200 NM to provide ATC surveillance, depending on the configuration and location of the ground stations. Also, air-air coverage of more than 100 NM depending on the avionics configuration used and the air traffic density involved.

2.11 Other technologies are being studied as candidates for the ADS-B data links, among them are the VDL in Mode 4 and the universal access transceiver (UAT).

Avionics

2.12 Boeing and Airbus are installing the ADS-B 1090ES capacity diffusion in their new aircrafts. Also, various ACAS installations could be ready to be updated for 1090ES transmissions. These avionic technologies for ADS-B data links are already in the market and are being successfully use, this has encouraged the users to its equipment installation.

Essential technical requirements for ADS and ADS-B

2.13 The essential technical requirements for the ADS-C and the ADS-B implementation systems are the following:

Technical requirements for the implementation of the ADS-C and ADS-B in the short term			
No.	Technical requirement	**ADS-C**	**ADS-B**
1	Position data supplied by the airborne navigational equipment.	✓	✓
2	Message time stamp within one second coordinated universal time (UTC).	✓	✓
3	VHF data communication links by air-ground or bi-directional satellite.	✓	
4	Unidirectional data links by spontaneous extended squitter of the SSR in Mode S.		✓
5	A ground infrastructure that provides ATC information.	✓	✓

Benefits

2.14 The ADS-B provides important benefits in view of its support capabilities to air navigation through the ground-based stations system to increase coverage or by a digital communications network such as controller-pilot data link communications (CPDLC) and of meteorological data to support the provision of ATC and FIS in the lower and upper airspace, and SAR in the lower airspace. Moreover, it facilitates the application of other capabilities such as traffic synchronization and conflict management to comply with new ATM operational requirements.

2.15 For conflict management, the ADS-B uses air-ground data link communications that support other automatic components for ATC surveillance such as short-term conflict alert, offset advisories to an assigned route and altitude and violation to special use airspace advisories, which will undoubtedly improve ATS safety.

2.16 Moreover, for the application of the interphase for the ADS-B provides potential benefits significantly reduces the workload of ATC controllers, as well as the negative impact of human resources, and it increases the precision of data which also results in the increase of safety.

2.17 For the future environment, the ADS-B provides potential benefits to the ATM community with new key operational applications in a more advanced and global ATM environment and it offers to widen its coverage to other mixed surveillance capabilities for crew as well as for air traffic services.

Cost of the ADS-B system implementation

2.18 The ADS-B system implementation is a very useful surveillance option and some pioneering States determined its lower cost than the secondary surveillance radar.

APPENDIX D

STATUS OF THE SARPS AND GUIDANCE MATERIAL ON ADS-C AND ADS-B

1. ICAO has published operational guidance material on ADS for air traffic services in Annex 2, Annex 11 and Doc 4444, and Doc. 9694. The Operational Data Link Panel (OPLINKP) developed the ADS-B concept, which was adopted by the AN-Conf/11 as a key application of data link for the future ATM system offering new surveillance capabilities to the aircraft crew and to the air traffic services. As a full environment of cooperation and collaboration it is included a new distribution of surveillance responsibilities between the flight crew and the ATS controller, and the ADS-B would serve as an important factor to facilitate various of the new global ATM operational systems components, including the traffic synchronizations and management of conflicts.

2. In accordance with Recommendation 1/6 of the AN-Conf/11, the OPLINKP is continuing with the investigation and development tasks in the ADS-B application areas, updating and maintaining the ADS-B use concept as far as necessary, as a based to develop the SARPs and the guidance material for the ground-air and air-air surveillance applications.

3. Annex 11 considered the ADS-B use for the air traffic services in emergency and ATC transfer messages. Likewise, Doc 4444, Air Traffic Management – Chapter 13 contemplates the ADS operational applications and meteorological aspects and position reports, and Doc. 9694 *Manual of Air Traffic Services Data Link Applications* contains the guidance material related to the ADS-B use.

4. Annex 10, Volume III contains the SARPs for the air-ground Mode S data links, including extended squitter. Volume IV of this Annex contains additional SARPS on the mentioned signals.

5. Currently, ICAO is developing work to include additional amendments on ADS-B in several of its documents. The overall intention of these proposals for amendment is to carry out procedures regarding the use of radar and ADS-B as identical as possible. The result of this, from the pilot's and the air traffic controller's perspective, is the provision of a highly up-to-date surveillance system technology. Other tasks assigned by the ANC to the OPLINKP include the operational concept of the Required Communication Performance (RCP), ADS-C, CPDLC and AIDC.

6. Regarding the ADS-B data links, based on studies carried out by the Aeronautical Mobile Communications Panel (AMCP), the AN-Conf/11 through Recommendation 7/1 Strategy for the near-term introduction ADS-B, adopted the implementation of SSR Mode S extended squitter recommending their national and regional implementation to facilitate global interoperability for the initial introduction of ADS-B. The Aeronautical Communication Panel (ACP) continues studying the VDL in Mode 4, the Universal Access Transceiver (UAT) and the SSR Mode S extended squitter as the candidates for the long term ADS-B data links. Recently, the ACP developed SARPs and preliminary guidance material on the UAT.

7. On the other hand, the Surveillance and Conflict Resolutions Systems Panel (SCRSP) under ANC tasks number CNS-9601 and CNS-9701 is developing new guidelines text and amendments to the existing texts that relate to the ADS-B and the Airborne Separation Assistance System (ASAS), as well as improvements to the SSR Mode S. The amendments to Annex 10 on ADS-B, SSR Mode S and ASAS and related documents are expected to be finalized in the fourth quarter of 2007.

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