International Civil Aviation Organisation
South American Regional Office
Eleventh Meeting of Civil Aviation Authorities of the South American Region (RAAC/11)
(Santiago, Chile, May 6-8, 2009)

Agenda Item 2: Review of the Implementation of the Regional Air Navigation Plan

d) Environmental development

(Presented by the Secretariat)

Summary

This paper highlights the growing importance of CNS/ATM activities for managing the environmental impact of aviation and urges all stakeholders to adopt a more proactive approach to environmental management, and to take operational measures to limit or reduce the environmental impact of aircraft engine emissions.

References:

- Report of the 36th ICAO General Assembly, Montreal, Canada, 18-28 September 20017
- Circular 303/AN/176 – *Operational Opportunities for Minimising the Use of Fuel and Reducing Emissions*
- Report of the ALLPIRG/4 meeting, Montreal, Canada, 6-8 February 2001
- Report of the ALLPIRG/5 meeting, Montreal, Canada, 23-24 March 2006
- Report of the GREPECAS/14 meeting, San Jose, Costa Rica, 16-20 April 2007
- Report of the GREPECAS/14meeting, Rio de Janeiro, Brazil, 13-17 October 2009

Strategic Objective:

C. *Environmental Protection – Minimize the adverse effect of global civil aviation on the environment*

1. Introduction

1.1 Civil aviation contributes, in a small but growing portion, to global environmental problems (about 2% of CO2 emissions) and also affects the quality of local air and noise. Aviation is expected to grow 5% a year for the next 25 years, and its environmental impact continues to exert pressure in favour of the mitigation of emissions.

1.2 In the last 40 years, aviation has improved by 70% its fuel consumption efficiency; however, studies suggest that, given the growth potential of this industry and the probability of adopting other industries with cleaner fuels, these problems may get worse in time. Aviation fuel consumption would increase by a factor of 2.5 by 2015, and about 4.0 by 2050.

2. **Discussion**

2.1 The last two meetings of Directors of Civil Aviation took note of the concern of ICAO and unanimously endorsed the measures being taken to mitigate the environmental impact of aviation, and agreed that States should consider an approach based on the traditional strengths of aviation in terms of technological innovation, to manage the long-term increase of aviation emissions.

2.2 The Meeting will recall that the 36th ICAO General Assembly requested the Council to encourage contracting States to improve air traffic efficiency resulting in emission savings, to report progress in this area, and to expedite the development and implementation of routings and procedures that will permit an efficient consumption of fuel in order to reduce aviation emissions.

2.3 In order to support the States, the ICAO Committee on Aviation Environmental Protection (CAEP) developed Circular 303/AN/176 – *Operational Opportunities for Minimising the Use of Fuel and Reducing Emissions.*

2.4 The Meeting might note that the ICAO Committee on Aviation Environmental Protection (CAEP), through the Independent Expert Panel (IE), has begun a study to review and make recommendations on air traffic operational improvements related to nitrogen oxides (NOx) and fuel consumption in the medium (10 years) and long (20 years) term. To support this effort, the IE Group will work in close cooperation with ICAO panels, such as the Air Traffic Management Requirements and Performance Panel (ATMRPP) and other groups and organisations involved in the definition and implementation of CNS/ATM systems, based on the Global Air Navigation Plan and the Global Concept, and intends to have a report available for the CAEP Steering Group by April 2009.

2.5 Pursuant to the conclusions of the fourth meeting of the ALLPIRG Advisory Group (ALLPIRG/4) concerning environmental benefits, as shown in the **Appendix A** to this working paper, the States and GREPECAS should support the efforts of ICAO/CAEP to expand the methodology for quantifying the environmental benefits of CNS/ATM systems in each region, through the collection of data. Likewise, GREPECAS should monitor the implementation of air navigation facilities, taking into account environmental issues, which would include the implementation of environmental improvements, such as:

a) Reducing the distance of air routes,
b) Promoting flexible flight planning,
c) Promoting RNAV and RNP in continental airspace,
d) Completing RVSM expansion,
e) Applying reduced separation minima,
f) Promoting a dynamic shared use of airspace by civil and military aircraft (when not in use by the military),
g) Promoting flexible tracks, dynamic re-routings, and user-preferred routes (UPR) in oceanic airspace
h) Promoting RNAV and RNP procedures in the TMA,
i) Promoting continuous descent arrivals (which can provide savings of 50-200 kg. of fuel per flight),
j) Promoting joint decision-making to reduce delays on ground and re-routings,
k) Promoting cruise climbs and phased oceanic climbs.

2.6 In this sense, the States of the ICAO South American Region have been implementing new RNAV routes since 2001 in order to improve the ATS route network, thus contributing to the reduction of some paths leading to a consistent transition between the en-route flight phase and terminal control areas. Furthermore, their analysis has permitted the development of the CAR/SAM PBN Roadmap approved by GREPECAS through Conclusion 14/46.

2.7 This PBN Roadmap is part of the improvements to the planned ATS route network, through the implementation of RNAV 5 in the short term, and RNAV and RNP procedures in TMAs and approaches in major airports. The Region also deemed it advisable to assess a more in-depth improvement of the SAM route network through a feasibility study to obtain an ATS route network that responded to current operational requirements while reducing the use of fuel and the associated gas emissions. The implementation of RNAV-5, and RNAV and RNP procedures in the TMAs and airports of the SAM Region, together with the optimisation of the ATS route network and the implementation of air traffic flow management, will all address the ICAO Strategic Objective concerning Environmental Protection.

2.8 Likewise, the Meeting will recall that the SAM Region, with the participation of ten (10) States, is carrying out Project RLA/06/901 – *Assistance for the implementation of a regional ATM system, taking into account the ATM operational concept and the corresponding technological support for communications, navigation, and surveillance (CNS)*, one of whose objectives is directly related to ICAO Strategic Objective C: Environmental Protection – *Minimise the adverse effect of global civil aviation on the environment.*

2.9 Within all of this network route improvement in the Region and within project RLA/98/003, a thorough evaluation has been carried out to the 18 traffic flows identified in the Caribbean and South American Regions and, within each flow, an analysis was made to the routes joining pairs of cities. The work carried out showed the operational savings to be achieved by reducing the distances of the routes in question and, consequently, the reduction in flight time.

2.10 For information purposes to this Meeting, a task was carried out oriented towards transforming the reduction in miles achieved in the ATS routes network into CO2 reduction emission in the atmosphere. In this sense, note could be taken that, as regards the routes corresponding to the South American Region, since the beginning of the implementation programme, approximately 134,460 tons of CO2 emission has been reduced. **Appendix B** shows a graphic on the emission reduction in the flows corresponding to the South American Region.

2.11 In addition, in 2007 a restructuring to the South Atlantic airspace route system (Europe/South America EUR/SAM corridor) was carried out, establishing the one way direction of ATS routes UN741 and UN866. This restructuring has permitted a better traffic distribution, and the allocation of flight levels to aircraft operating in the corridor.

2.12 A study carried out by the South Atlantic Monitoring Agency (SATMA), after nine months of having implemented the unidirectional system, indicate that the results of this implementation have been clearly positive, showing that per year the average CO2 emission will be reduced in 5,399 tons, with a 7% traffic growth and, if optimistically thinking of a 10% growth, this amount will reach an average mission reduction of 9,826 tons. **Appendix C** shows a graphic with estimates until 2015.

2.13 Within this context, the Meeting could agree on the need for SAM States to strengthen their commitment to the implementation of environmental improvements through increased efficiency in air operations by means of new routes, terminal area procedures, and surface movements, aimed at limiting or reducing the environmental impact of aircraft engine emissions; and establish environmental policies that promote environmental sustainability in the development of the aeronautical system.

3. Suggested Action

3.1 The Meeting is invited to:

a) take note of the content of this working paper; and

b) agree on other actions as it may deem appropriate.

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APPENDIX A

ALLPIRG/5 MEETING CONCLUSIONS CONCERNING ENVIRONMENTAL BENEFITS

Conclusion 5/7 – Environmental benefits of CNS/ATM Systems

That PIRGs and States:

a) use the Committee on Aviation Environmental Protection (CAEP) provided CO_2 conversion factor in the analysis of environmental benefits of implementing CNS/ATM Systems;

b) prioritize the implementation of voluntary, operationally-based improvements in their air traffic management systems, with emphasis on fuel savings, emissions reductions and noise benefits, and also to mitigate costs to the industry;

c) provide feedback to ICAO on studies conducted on the environmental benefits of implementing CNS/ATM Systems; and

d) share air traffic data to improve future CAEP assessments, in line with State letter AN 1/17-03/86.

Conclusion 5/8 – Globally coordinated air traffic services (ATS) routes

That PIRGs:

a) establish a global consolidated, prioritized list of routes and terminal area (TMA) improvements in close coordination with airspace users; and

b) work with neighbouring PIRGs/States/air navigation service providers (ANSPs) to accelerate international route improvements.

Conclusion 5/9 – Terminal area (TMA) structure and area navigation

That States:

a) employ area navigation in all TMAs, including appropriate arrival and departure procedures, to improve efficiency and reduce emissions in the vicinity of airports; and that, in special cases where there are particularly challenging obstacles and where air traffic density is very high and additional approach paths are possible, the more precise and contained required navigation performance (RNP) procedures be employed; and

b) review operations, procedures and training of controllers to ensure the optimum management of air traffic services.

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Routes	Avg. Conv. Dist	Ortho. Dist	Difference	Time saved	Narrow Body (Small- Medium)	Wide Trí´s & Quad (Large)	Narrow Body (Small- Medium)	Wide Trí´s & Quad (Large)	Narrow Body (Small- Medium)	Wide Trí´s & Quad (Large)	Narrow Body (Small- Medium)	Wide Trí´s & Quad (Large)	Total Kg CO2	Total Tons CO2	Total Tons CO2
						2 semanas	1 semana	1 semana	Fuel (KG) por 1 mes	Fuel (KG) por 1 mes	CO2 (KG) por 1 mes	CO2 (KG) por 1 mes	Por Ruta 1 mes	Por Ruta 1 año	Por Ruta 8 años
TF 1 Buenos Aires - Santiago de Chile															
Santiago - Montevideo	800	739	61	7.625	41	0	21	0	26636	0	84888	0	84888	**1019**	**8149**
Santiago - Buenos Aires	670	616	54	6.750	181	23	91	11	102176	41654	325634	132751	458385	**5501**	**44005**
Santiago - Mendoza	186	106	80	10.000	87	0	43	0	71527	0	227957	0	227957	**2735**	**21884**
TF 2 Buenos Aires/Sao Paulo-Rio de Janeiro															
Buenos Aires - Sao Paulo	954	914	40	5.000	239	23	119	12	98974	33660	315429	107274	422703	**5072**	**40580**
Buenos Aires - Rio de Janeiro	1105	1097	8	1.000	95	0	48	0	7984	0	25446	0	25446	**305**	**2443**
Montevideo - Sao Paulo	878	831	47	5.875	44	0	22	0	1955	0	6229	0	6229	**75**	**598**
Montevideo - Rio de Janeiro	1013	1002	11	1.375	9	0	5	0	1144	0	3645	0	3645	**44**	**350**
TF 3 Santiago de Chile/Sao Paulo-Rio de Janeiro															
Santiago _Sao Paulo	1520	1399	121	15.125	140	0	70	0	176115	0	561279	0	561279	**6735**	**53883**
TF 4 Sao Paulo-Rio de Janeiro/Europe (Corredor EUR/SAM)															
Buenos Aires - Madrid	5499	5439	60	7.500	12	59	6	30	7485	126224	23856	402276	426132	**5114**	**40909**
Rio de Janeiro - Lisbon	4351	4163	188	23.500	16	13	8	7	31272	92284	99665	294108	393773	**4725**	**37802**
Rio de Janeiro - Madrid	4427	4396	31	3.875	21	11	11	6	7090	13043	22597	41568	64165	**770**	**6160**
Santiago - Madrid	5962	5784	178	22.250	0	21	0	11	0	137304	0	437586	437586	**5251**	**42008**
Sao Paulo - Dakar	2889	2853	36	4.500	0	23	0	12	0	30294	0	96546	96546	**1159**	**9268**
TF 5 Sao Paulo-Rio de Janeiro/Lima															
Lima - Sao Paulo	1869	1836	33	4.125	59	0	29	0	19899	0	63417	0	63417	**761**	**6088**
Lima - Santa Cruz	909	878	31	3.875	4	0	2	0	1289	0	4109	0	4109	**49**	**394**
Lima - La Paz	610	583	27	3.375	71	0	36	0	20211	0	64411	0	64411	**773**	**6183**
Santa Cruz - Sao Paulo	960	958	2	0.250	59	0	29	0	1206	0	3843	0	3843	**46**	**369**
Santa Cruz - La Paz	300	300	0	0.000	130	0	65	0	0	0	0	0	0	**0**	**0**
TF 6 Santiago-Lima/Los Angeles															
Santiago - Mexico	3629	3551	78	9.750	34	0	17	0	27571	0	87870	0	87870	**1054**	**8436**
Lima - Mexico	2356	2284	72	9.000	29	0	15	0	22456	0	71568	0	71568	**859**	**6871**
Lima - Los Angeles	3645	3621	24	3.000	34	0	17	0	8483	0	27037	0	27037	**324**	**2596**
TF 7 Santiago-Lima/Miami															
Santiago - Miami	3653	3581	72	9.000	156	0	78	0	116772	0	372154	0	372154	**4466**	**35727**
Santiago - Bogota	2482	2296	186	23.250	13	0	6	0	23205	0	73954	0	73954	**887**	**7100**
Lima - Miami	2320	2266	54	6.750	91	0	45	0	50527	0	161028	0	161028	**1932**	**15459**
Guayaqui - Miami	1696	1669	27	3.375	30	0	15	0	8421	0	26838	0	26838	**322**	**2576**
Panama - Miami	2320	2266	54	6.750	181	0	91	0	102176	0	325634	0	325634	**3908**	**31261**

Routes	Avg. Conv. Dist	Ortho. Dist	Difference	Time saved	Narrow Body (Small- Medium)	Wide Tri´s & Quad (Large)	Narrow Body (Small- Medium)	Wide Tri´s & Quad (Large)	Narrow Body (Small- Medium)	Wide Tri´s & Quad (Large)	Narrow Body (Small- Medium)	Wide Tri´s & Quad (Large)	Total Kg CO2	Total Tons CO2	Total Tons CO2
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TF 8 Sao Paulo-Rio de Janeiro/Los Angeles															
Sao Paulo - Los Angeles	5484	5350	134	16.750	0	60	0	30	0	281900	0	898416	898416	**10781**	**86248**
Sao Paulo - Bogota	2403	2350	53	6.625	30	0	15	0	16530	0	52682	0	52682	**632**	**5057**
Sao Paulo - Panama	2795	2736	59	7.375	13	0	6	0	7361	0	23458	0	23458	**281**	**2252**
Sao Paulo - Mexico	4104	4008	96	12.000	15	0	8	0	15969	0	50893	0	50893	**611**	**4886**
Panama - Los Angeles	2689	2619	70	8.750	13	0	6	0	8733	0	27832	0	27832	**334**	**2672**
TF 9 Sao Paulo-Rio de Janeiro/Miami															
Sao Paulo - Miami	3571	3507	64	8.000	244	85	122	43	162350	192982	517410	615035	1132445	**13589**	**108715**
Rio de Janeiro - Miami	3718	3624	94	11.750	86	1	43	1	84044	6592	267850	21008	288858	**3466**	**27730**
TF 10 Sao Paulo-Rio de Janeiro/New York															
Sao Paulo - New York	4168	4106	62	7.750	45	58	23	29	29651	126084	94496	401829	496325	**5956**	**47647**
Rio de Janeiro - NY	4239	4174	65	8.125	3	20	2	10	2703	45581	8615	145266	153881	**1847**	**14773**
TF 11 Sao Paulo-Rio de Janeiro/New York															
Buenos Aires - New Yrk	4681	4605	76	9.500	67	6	34	3	53729	15988	171233	50955	222188	**2666**	**21330**
TF 12 Buenos Aires/Miami															
Buenos Aires - Bogota	2597	2534	63	7.88	21	0	11	0	14409	0	45923	0	45923	**551**	**4409**
Buenos Aires - Miami	3926	3830	96	12.00	0	123	0	61	0	410648	0	1308737	1308737	**15705**	**125639**
Bogota - Miami	1330	1299	31	3.88	161	0	81	0	52211	0	166396	0	166396	**1997**	**15974**
Kingston - Miami	550	511	39	4.88	119	0	59	0	47844	0	152480	0	152480	**1830**	**14638**
TF 13 North of South America/Europe															
Bogota - Paris	4710	4469	241	30.125	0	12	0	6	0	101400	0	323161	323161	**3878**	**31023**
Bogota - Madrid	4384	4338	46	5.750	0	30	0	15	0	48386	0	154206	154206	**1850**	**14804**
Bogota - London	4745	4430	315	39.375	12	0	6	0	132535	0	422389	0	422389	**5069**	**40549**
Caracas - Paris	4138	4123	15	1.875	0	16	0	8	0	8415	0	26818	26818	**322**	**2575**
Caracas - Madrid	3836	3785	51	6.375	0	40	0	20	0	71527	0	227956	227956	**2735**	**21884**
Caracas - London	4272	4040	232	29.000	0	12	0	6	0	97613	0	311093	311093	**3733**	**29865**
TF 17 Sudamerica/Africa															
Sao Paulo - Johannesburg	4157	4024	133	16.625	0	8	0	4	0	37306	0	118895	118895	**1427**	**11414**
Buenos Aires - Johannes..	4438	4389	49	6.125	0	17	0	8	0	27489	0	87607	87607	**1051**	**8410**
TF 18 Santiago/Easter Island-Papeete															
Santiago - Easer Island	2032	2029	3	0.375	8	0	4	0	499	0	1590	0	1590	**19**	**153**
Easter Island - Papeete	4326	4288	38	4.750	8	0	4	0	6321	0	20145	0	20145	**242**	**1934**
													TOTAL	**134460**	**1075677**

APPENDIX C

AEROPUERTOS ESPAÑOLES Y NAVEGACIÓN AÉREA
ATM OPERATIONS DIRECTORATE

RESULTS

1. RESULT OF FUEL SAVING EXPRESSED IN $ USD:

FUEL SAVING ($ USD)	AVERAGE PER YEAR	2008	2015	2008-2015
NORMAL CASE (7%)	1,500,363	1,228,438	1,729,415	12,002,901
OPTIMIST CASE (10%)	2,028,952	1,572,719	2,321,298	16,231,614

2. RESULT OF CO2 EMISSIONS SAVING EXPRESSED IN TONS-C02:

CO2 EMISSIONS SAVING (TON CO2)	AVERAGE PER YEAR	2008	2015	2008-2015
NORMAL CASE (7%)	5399	4800	8342	55022
OPTIMIST CASE (10%)	9826	5998	11310	73437

EXPECTED BENEFITS DERIVED FROM THE IMPLEMENTATION OF UN-741 AND UN-866 AS UNIDIRECTIONAL ROUTINGS

- END -