



**INTERNATIONAL CIVIL AVIATION ORGANIZATION**

**South American Regional Office**

**UNDP/ICAO Regional Project RLA/98/003**

**Transition to the CNS/ATM Systems in the CAR/SAM Regions**

**REPORT**

**RLA/98/003 – TENTH MEETING/WORKSHOP OF ATM AUTHORITIES  
AND PLANNERS OF THE CAR/SAM REGIONS**

**(AP/ATM/10)**

**(Lima, Peru, 10 to 14 May 2005)**

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## INDEX

i -	Index .....	i-1
ii -	History of the Meeting .....	ii-1
	Place and duration of the Meeting .....	ii-1
	Opening ceremony and other matters .....	ii-1
	Schedule, Organization, Working Methods, Officers and Secretariat .....	ii-1
	Working languages .....	ii-2
	Agenda .....	ii-2
	Attendance .....	ii-2
	List of Conclusions of the AP/ATM/10 Meeting.....	ii-6
iii -	List of participants .....	iii-1
	<b>Report on Agenda Item 1:</b> .....	1-1
	RNAV Routes Implementation Programme in the CAR/SAM Regions	
	a) Follow up of the status of Implementation Phase II- a.....	1-1
	b) Review of the Action Plan of Phases II-.....	1-1
	c) RNAV Routes Implementation in the TMAs of the CAR/SAM Regions.....	1-3
	<b>Appendix A:</b> Implementation of RNAV Routes Phase II-b .....	1A-1
	<b>Appendix B:</b> Routes not corresponding to Phase II-b of RNAV Routes Implementation Programme .....	1B-1
	<b>Appendix C:</b> Present State of Implementation of RNAV Routes Phase II-b.....	1C-1
	<b>Appendix D:</b> General Vision of the National System of the United States Airspace based in performance.....	1D-1
	<b>Appendix E:</b> Guidelines for Uniform Implementation of RNP RNAV Operations .....	1E-1
	<b>Appendix F:</b> Traffic Flow Evaluation Form .....	1F-1
	<b>Report on Agenda Item 2:</b> .....	2-1
	Evaluation of RNP 10 Pre-Operational Implementation in the Santiago de Chile-Lima segment of parallel routes UL 780 and UL 302	
	<b>Report on Agenda Item 3:</b> .....	3-1
	Review of RVSM issues in the CAR/SAM Regions	
	a) ATC Operations Working Group (ATC/WG) .....	3-1
	b) Aircraft Operation and Airworthiness Working Group (OPS/AIR/WG) .....	3-4
	c) Safety and Airspace Monitoring Working Group (SAM/WG) .....	3-7
	d) Scrutiny Working Group (S/WG) .....	3-9
	<b>Appendix A:</b> Letter of ICAO Council congratulating ATC Operations .....	3A-1
	<b>Appendix B:</b> Brazil RVSM OPERATINS Follow-up Programme .....	3B-1
	<b>Appendix C:</b> RVSM Post-Implementation Assessment in Asuncion FIR.....	3C-1
	<b>Appendix D:</b> Traffic Distribution since RVSM Implementation.....	3D-1
	<b>Appendix E:</b> Proposal of Amendment to Section J, item f, of AC 6.425 .....	3E-1
	<b>Appendix F:</b> Caribbean and South American RVSM Minimum Monitoring Requirements .....	3F-1
	<b>Appendix G:</b> Conclusion AP/ATM/9/4 – Measures to be adopted to reduce operational errors in the coordination loop between adjacent control centres .....	3G-1

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<b>Appendix H:</b> Report of Large Altitude Deviation for aircraft Cleared at or above FL290 and at or below FL410.....	3H-1
<b>Appendix I:</b> Terms of reference of the CAR/SAM Scrutiny Group (GTE).....	3I-1
<b>Appendix J:</b> Large Altitude Deviations .....	3J-1
<b>Report on Agenda Item 4:</b> .....	4-1
ATM Automation in the CAR/SAM Regions	
<b>Appendix A:</b> Survey on automated ATM Systems in the CAR/SAM Regions.....	4A-1
<b>Appendix B:</b> CAN/MEX/USA Automation Systems Interface .....	4B-1
<b>Appendix C:</b> Guidelines for Strategy Operational Integration of the ATM Automated Systems of the CAR/SAM Regions.....	4C-1
<b>Appendix D:</b> Automation of Air Navigation Services.....	4D-1
<b>Report on Agenda Item 5:</b> .....	5-1
ATFM Implementation in the CAR/SAM Regions	
<b>Appendix A:</b> Likely functions of a centralized regional ATFM.....	5A-1
<b>Appendix B:</b> Aspects that could be considered for ATFM implementation .....	5B-1
<b>Appendix C:</b> Orientation guidelines for the ATFM implementation In the CAR/SAM Regions .....	5C-1
<b>Appendix D:</b> AFTM Task Force .....	5D-1
<b>Appendix E:</b> Resources available and ATFM implementation strategy In the Central American FIR.....	5E-1
<b>Appendix F:</b> Operational concept and ATFM capacity already implemented at CGNA .....	5F-1
<b>Report on Agenda Item 6:</b> .....	6-1
Other matters	

## **HISTORY OF THE MEETING**

### **ii-1 PLACE AND DURATION OF THE MEETING**

The Tenth Meeting/Workshop of Air Traffic Management (ATM) Authorities and Planners of the CAR/SAM Regions was held in Lima, Peru, from 10 to 14 May 2005.

### **ii-2 OPENING CEREMONY AND OTHER MATTERS**

Mr. José Miguel Ceppi, Regional Director of the ICAO Lima Office, welcomed the participants, expressed his gratitude to the Peruvian authorities for their attendance and continuous support to the events carried out in Peru, and gave a brief explanation of the issues to be reviewed during the meeting.

Mr. José Miguel Ceppi congratulated States/Territories/International Organizations and users for the effort made for RVSM implementation on 20 January 2005, highlighting the coordination made and the teamwork which permitted its successful implementation. Also, he encouraged States in the CAR/SAM Regions to continue working with the same regional collaboration and cooperation spirit which, undoubtedly, shall facilitate facing new challenges for the implementation of global ATM and the corresponding CNS support.

Likewise, Mr. Roberto Rodríguez Galloso, Director General of Civil Aviation, greeted the participants, highlighted the importance of the issues to be dealt with and encouraged all the parties involved to complete the pending tasks, inaugurating the meeting. Mr. Carlos Alburquerque, President of CORPAC Board, and Mr. Guido Niño de Guzmán, CORPAC General Manager, were present at the opening ceremony.

### **ii-3 SCHEDULE, ORGANIZATION, WORKING METHODS, OFFICERS AND SECRETARIAT**

The Meeting agreed to hold its sessions from 0900 to 1600 hours, with appropriate breaks. The work was done with the Meeting as a Single Committee, Working Groups and Ad-hoc Groups.

Mr. Juan Ramón González, delegate from Panama, was elected as Chairman of the Meeting.

Mr. Jorge Fernández Demarco, ATM/SAR Regional Office, Lima, acted as Secretary, being assisted by Mrs. Leslie Cary, who chaired the RVSM/TF activities, as well as by the Rapporteurs of the RVSM TF, Mr. Brian Throop from USA (ATC/WG), Mr. Saulo José Da Silva from Brazil (SAM/WG), and Mr. Andrés Prado from Chile (OPS/AIR/WG). As regards RNAV/RNP issues, the meeting counted with the presence of Mr. Julio Cesar Pereira, GREPECAS ATM/CNS Subgroup, ATM Committee RNAV/RNP Task Force Rapporteur, and Mr. Roberto Arca, President of the mentioned Committee. The Secretariat was also conformed by Messrs. Víctor Hernández, RO/ATM from the ICAO NACC Regional Office, Roberto Cardoso, RO/SO from the ICAO SAM Regional Office; Alberto Orero, RO/ATM/SAR from the ICAO SAM Office; and José Moreno, ATM Consultant, RLA/98/003 Project.

#### ii-4 **WORKING LANGUAGES**

The working languages of the Meeting and its relevant documentation were English and Spanish.

#### ii-5 **AGENDA**

The following agenda was adopted:

Agenda Item 1: RNAV Routes Implementation Programme in the CAR/SAM Regions

- a) Follow up of the status of Implementation Phase II-a
- b) Review of the Action Plan of Phases II-b
- c) RNAV Routes Implementation in the TMAs of the CAR/SAM Regions

Agenda Item 2: Evaluation of RNP 10 Pre-Operational Implementation in the Santiago de Chile-Lima segment of parallel routes UL 780 and UL 302

Agenda Item 3: Review of RVSM issues in the CAR/SAM Regions

- a) ATC Operations Working Group (ATC/WG)
- b) Aircraft Operation and Airworthiness Working Group (OPS/AIR/WG)
- c) Safety and Airspace Monitoring Working Group (SAM/WG)
- d) Scrutiny Working Group (S/WG)

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

Agenda Item 5: ATFM Implementation in the CAR/SAM Regions

Agenda Item 6: Other matters

#### ii-6 **ATTENDANCE**

The meeting was attended by 8 States of the CAR Region and 13 States of the SAM Region, as well as by 6 International Organizations: AITAL, ARINC, COCESNA, IATA, IFALPA and IFATCA, totalling 89 participants. The list of participants is shown in pages iii-1 to iii-15.

#### ii-7 **LIST OF WORKING PAPERS AND INFORMATION PAPERS**

N°	Subject	Title	Prepared by
WP/01	-	Agenda, Schedule and Working Methods	Secretariat
WP/02	1 b)	Agenda Item 1: RNAV Routes Implementation b) Review of the Action Plan of Phases II-b	Secretariat
WP/03	1	RNAV Routes Implementation Programme in the CAR/SAM Regions	Dominican Republic

<b>N°</b>	<b>Subject</b>	<b>Title</b>	<b>Prepared by</b>
WP/04	1 c)	Agenda Item 1: RNAV Routes Implementation c) RNAV Routes Implementation in the TMAs of the CAR/SAM Regions	Secretariat
WP/05	1 c)	Agenda Item 1: RNAV Routes Implementation c) RNAV Routes Implementation in the TMAs of the CAR/SAM Regions	RNAV/RN P/TF Rapporteur
WP/06	2	Evaluation of RNP 10 Pre-Operational Implementation in the Santiago de Chile-Lima segment of parallel routes UL 780 and UL 302	Chile-Peru
WP/07	3	Review of RVSM issues in the CAR/SAM Regions	Secretariat
WP/08	3 b)	Review of RVSM issues in the CAR/SAM Regions b) Aircraft Operation and Airworthiness Working Group (OPS/AIR/WG)	Secretariat
WP/09	3 c)	Review of RVSM issues in the CAR/SAM Regions c) Safety and Airspace Monitoring Working Group (SAM/WG)	SAM/WG Rapporteur
WP/10	3 d)	Review of RVSM issues in the CAR/SAM Regions d) Scrutiny Working Group (S/WG)	Secretariat
WP/11	4	ATM Automation in the CAR/SAM Regions	Secretariat
WP/12	5	ATFM Implementation in the CAR/SAM Regions	Secretariat
WP/13	5	ATFM Implementation in the CAR/SAM Regions	ATM Committee Chairman
WP/14	1 b)	Agenda Item 1: RNAV Routes Implementation b) Review of the Action Plan of Phases II-b	Ecuador
WP/15	4	ATM Automation in the CAR/SAM Regions	United States
WP/16	3 d)	Review of RVSM issues in the CAR/SAM Regions d) Scrutiny Working Group (S/WG)	United States
WP/17	6	Other matters	Paraguay
WP/18	3	Agenda Item 3: Review of RVSM issues in the CAR/SAM Regions a) ATC Operations Working Group (ATC/WG) Regional criteria for aircraft acceptance – RVSM operations	Argentina
WP/19	1	RNAV Routes Implementation Programme in the CAR/SAM Regions	Argentina
WP/20	1	Agenda Item 1: RNAV Routes Implementation	Brazil
WP/21	3	Agenda Item 3: Review of RVSM issues in the CAR/SAM Regions b) Aircraft Operation and Airworthiness Working Group (OPS/AIR/WG)	Aldo Escóbar
WP/22	1	Agenda Item 1: RNAV Routes Implementation in the CAR/SAM Region - Overview of the U.S. Performance-Based National Airspace System	United States
WP/23	2	Agenda Item 2: Evaluation of RNP 10 Pre-Operational Implementation in the Santiago de Chile-Lima segment of parallel routes UL 780 and UL 302 – Feasibility analysis for application of 50 NM longitudinal separation minimum in the Santiago de Chile-Lima segment of routes UL780 and UL302	Chile-Peru
WP/24	1	Review of the RNAV Routes Implementation Programme in the CAR/SAM Regions- Implementation of an RNAV route from Viru Viru VOR to NADIR Intersection	Bolivia- IATA

N°	Subject	Title	Prepared by
WP/25	5	Agenda Item 5: ATFM Implementation in the CAR/SAM Regions	COCESNA
WP/26	3 c)	Review of RVSM issues in the CAR/SAM Regions c) Safety and Airspace Monitoring Working Group (SAM/WG)	CARSAM MA
WP/27	2	Evaluation of RNP 10 Pre-Operational Implementation in the Santiago de Chile-Lima segment of parallel routes UL 780 and UL 302	Chile
WP/28	2	Evaluation of RNP 10 Pre-Operational Implementation in the Santiago de Chile-Lima segment of parallel routes UL 780 and UL 302	Chile
WP/29	3	Review of RVSM issues in the CAR/SAM Regions	Chile
WP/30	5	ATFM Implementation in the CAR/SAM Regions	Brazil
WP/31	3 c)	An Update to the Summary of the Reduced Vertical Separation Minimum (RVSM) Safety Assessment to reflect the Operations Safety after the RVSM Implementation in CAR/SAM airspace in January 20 <sup>th</sup> .	CARSAM MA
WP/32	2	Evaluation of RNP 10 Pre-Operational Implementation in the Santiago de Chile-Lima segment of parallel routes UL 780 and UL 302 – Follow up on monitoring of the RNP 10 operation	CARSAM MA
WP/33	3 a)	Review of RVSM issues in the CAR/SAM Regions ATS Operations Working Group (ATC/WG) RVSM Operations Follow-up Programme	CARSAM MA
WP/34	5	ATFM Implementation in the CAR/SAM Regions	Secretariat
WP/35	1	Review of the RNAV Routes Implementation Programme in the CAR/SAM Regions (available in English version only)	AITAL
WP/36	1 b)	RNAV Routes Implementation Programme in the CAR/SAM Regions b) Review of the Action Plan of Phases II-b	Chile
IP/01	-	General Information of the Meeting	Secretariat
IP/02	-	List of working papers and information papers	Secretariat
IP/03	1 a)	RNAV Routes Implementation Programme in the CAR/SAM Regions a) Follow up of the status of Implementation Phase II-a	Secretariat
IP/04	3	Review of RVSM issues in the CAR/SAM Regions (Available in Spanish version only)	Paraguay
IP/05	3	Review of RVSM issues in the CAR/SAM Regions	Bolivia
IP/06	3	Review of RVSM issues in the CAR/SAM Regions – Status of implementation at the Rochambeau FIR (Available in English version only)	French Guyana
IP/08	5	ATFM Implementation in the CAR/SAM Regions (in Spanish version only)	Colombia

ii-8

**LIST OF CONCLUSIONS AND DECISIONS OF THE AP/ATM/10 MEETING**

<b>N° of Conclusion or Decision</b>	<b>Title</b>	<b>Page</b>
AP/ATM/10/1	Compliance with the Action Plan for the Implementation of the RNAV routes	1-1
AP/ATM/10/2	RNAV Route VOR FRM/POLAN/VUMPI – RNAV Route VORVAGAN/TAROP/VOR PSN	1-2
AP/ATM/10/3	RNAV Route VOR BVI/TAROP/VOR PSN	1-2
AP/ATM/10/4	RNAV Route VOR REC/VOR CYR	1-2
AP/ATM/10/5	RNAV Route VOR FOZ/ARGOS/VOR PVH	1-2
AP/ATM/10/6	RNAV Route VOR TIM/VOR MAN	1-2
AP/ATM/10/7	Lower and upper limit within RNAV routes	1-2
AP/ATM/10/8	Collection of traffic data in the upper airspace	1-9
AP/ATM/10/9	RNP 10 definitive operational implementation in the Santiago de Chile/Lima segment of parallel routes UL 780 and UL 302	2-1
AP/ATM/10/10	Reports on lateral deviations larger than 10 NM and LHD	2-1
AP/ATM/10/11	Delay in the studies for the 50 NM of longitudinal separation implementation in the segment Santiago Chile/Lima routes UL 302 and UL 780	2-2
AP/ATM/10/12	Compliance with international agreements on RVSM	3-2
AP/ATM/10/13	Follow-up of RVSM operations	3-3
AP/ATM/10/14	Use of the Term “Confirm RVSM approved”	3-4
AP/ATM/10/15	Improvement of RVSM-related training	3-5
AP/ATM/10/16	RVSM approval of State aircraft	3-5
AP/ATM/10/17	Establishment of State RVSM data base (SDB)	3-6
AP/ATM/10/18	Update of operation specifications (OpSpecs) and other RVSM approval documents	3-6
AP/ATM/10/19	Issuance of a RVSM Letter of Approval (LOA)	3-6
AP/ATM/10/20	Evaluation of lateral navigation performance	3-8
AP/ATM/10/21	MMR chart	3-8
AP/ATM/10/22	Measures to reduce operational errors in the ATC coordination loop between adjacent ACCs	3-10
AP/ATM/10/23	Large height deviation (LHD) reports	3-10
AP/ATM/10/24	Information contained in large height deviation (LHD) reports	3-10
AP/ATM/10/25	SAM and GTE reports	3-11
AP/ATM/10/26	Estimate of the time spent by an aircraft in a wrong flight level	3-11
AP/ATM/10/27	Updated Information of ATM Automated Systems in CAR/SAM Regions	4-2
AP/ATM/10/28	Preparatory meeting of the ATM/TF of the ATM Committee	5-4

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**Agenda Item 1: RNAV Routes Implementation Programme in the CAR/SAM Regions****a) Follow up of the Status of Implementation Phase II - a**

1.1. The meeting noted that RNAV Routes Implementation Phase II - a, had been carried out without major inconveniences in the planned date, 17 March 2005.

**b) Review of the Action Plan of Phase II - b**

1.2. The meeting reviewed the status of co-ordinations for the implementation of RNAV Routes Phase II – b, and took note that there were some routes that had not been agreed yet. In view of this, it deemed pertinent to form Ad-hoc Groups to complete the information required. The results and agreements reached are shown in **Appendix A** to this part of the report.

**Implementation of other RNAV routes**

1.3. Also, the Ad-hoc Groups analysed and agreed other routes that are not part of Phase II – a of the RNAV routes implementation programme. These routes are shown in **Appendix B** to this part of the report.

1.4. In view of the above, the meeting approved the following conclusion:

**Conclusion AP/ATM/10/1 Compliance with the Action Plan for the Implementation of the RNAV routes**

That the Secretariat initiates the process of amendment to the CAR/SAM Air Navigation Plan (ANP), Basic Vol., according to what is indicated in **Appendixes A and B**.

**Implementation of Phase II-b**

1.5. **Appendix C** shows the state of Phase II-b after its revision is done, having in consideration de agreements reached by ad-hoc Groups.

**Extension, elimination, changes of designators of RNAV routes, and new significant points**

1.6. The meeting reviewed the new RNAV routes proposed by Brazil, in order to make necessary modifications in the RNAV Routes Network, to allow the reduction of some trajectories that will lead to a compatible transition between the flight phase in route and in the Terminal Management Areas (TMA). To treat this issue, several ad-hoc Groups were conformed by the delegations of the FIRs involved, analysing the feasibility of their implementation. After the report of the ad-hoc Group, the meeting agreed the following:

**Conclusion AP/ATM/10/2      RNAV Route VOR FRM/POLAN/VUMPI – RNAV Route VOR VAGAN/TAROP/VOR PSN**

That, the Administrations of Brazil, Venezuela and IATA carry out the necessary studies for the implementation of the RNAV routes VOR FRM/POLAN/VUMPI and RNAV route VOR VAGAN/TAROP/VOR PSN, and present their results to the AP/ATM/11 Meeting.

**Conclusion AP/ATM/10/3      RNAV Route VOR BVI/TAROP/VOR PSN**

That, the Administration of Brazil and IATA carry out the necessary studies for the implementation of the RNAV routes VOR BVI/TAROP/VOR PSN and RNAV route VOR SVD/VOR PTL/VOR BEL, and present their results to the AP/ATM/11 Meeting.

**Conclusion AP/ATM/10/4      RNAV Route VOR REC/VOR CYR**

That, the administrations of Brazil, France and IATA carry out the necessary studies for the implementation of the RNAV route VOR REC/VOR CYR, and present their results at the AP/ATM/11 Meeting.

**Conclusion AP/ATM/10/5      RNAV Route VOR FOZ/ARGOS/VOR PVH**

That, the Administrations of Bolivia, Brazil, Paraguay and IATA carry out the necessary studies for the implementation of the RNAV Route VOR FOZ/ARGOS/VOR PVH, and present their results to the AP/ATM/11 Meeting.

**Conclusion AP/ATM/10/6      RNAV Route VOR TIM/VOR MAN**

That, the administrations of Guyana, Brazil and IATA carry out the necessary studies for the implementation of the RNAV route VOR TIM/VOR MAN, and present their results at the AP/ATM/11 Meeting.

**Lower and upper limit for RNAV routes within the upper airspace**

1.7            The meeting took note that presently some RNAV routes in the CAR/SAM Regions have established FL 290 as the lower limit and FL410 as the upper limit.

1.8            In this regard, the meeting considered that these limits represent a negative impact for the upper airspace users, which, although having available on board the RNAV equipment, could not use these routes since they do not count with a RVSM approval. This situation did not allow the use of more direct trajectories established beyond FL 290 and/or above FL 410, agreed on the following:

**Conclusion APATM 10/7                      Lower and upper limit within RNAV routes**

That the States, Territories and International Organizations of the CAR/SAM Regions that have not done it yet, consider to establish and publish not later than 27 September 2005 the lower limit of the RNAV routes in order to coincide with the lower limit of the upper airspace established for the FIR, and to extend it above FL 410.

### **Use of the RNAV routes by operators**

1.9 The meeting analysed in detail and through an ample discussion the problem presented due to the lack of use of some RNAV routes by the operators. In this respect, the RNAV routes implemented during Phase I and Phase II of the RNAV routes regional plan implementation in the CAR/SAM Regions, identifying RNAV routes that have not yet been used by operators.

1.10 The meeting agreed on the need to rationalize not only the planned RNAV routes recently implemented but also the existing conventional routes. IATA agreed to carry out the dissemination of all those routes already implemented and a joint assessment by the users and the States, Territories and International Organizations.

1.11 On the other hand, the meeting took note on the low level of implementation of RNAV SIDs/STARs in both regions, and recalled that sufficient documentation and regional agreements are available on this matter to allow those CAR/SAM States/Territories and International Organizations that have not done so yet, to implement said procedures.

1.12 The meeting considered that the guidelines for the implementation of RNAV routes in the CAR/SAM Regions contain useful and detailed information for planning the implementation of RNAV routes and of RNAV SIDs/STARs.

### **Implementation of routes to/from the NAM Region**

1.13 The meeting took note of the request by United States to separate route segments within the NAM and NAT Regions from the segment in the CAR and SAM Regions. The United States request was based on the different use of RNAV in their controlled airspace and the density and complexity of traffic. The NAM/SAT segments will be addressed in NAM meetings.

1.14 Following a fruitful discussion, IATA informed that it had agreed with the United States to hold a bilateral meeting, with the participation of ICAO, in order to decide how to proceed with the cited routes and that the results of this coordination would be reported to the ATM/CNS/SG meeting.

### **c) Implementation of RNAV Routes in the TMAs of the CAR/SAM Regions**

1.15 In dealing with this matter, the meeting deemed it pertinent to analyse all aspects related to the new RNAV and RNP concepts, and not only focus the attention in the implementation of RNAV routes in terminal areas.

1.16 In this connection, it took note of the activities carried out in the CAR/SAM Regions by the RNAV/RNP Task Force and on the conclusions formulated under the scope of GREPECAS on the implementation of RNAV SIDs/STARs in order to link RNAV routes to the corresponding airports of both regions.

1.17 Note was also taken of the information on RNAV/RNP implementation in United States, whose goal of implementing performance-based navigation is to deliver operational benefits, manage service provider costs, maximize use of aircraft equipment capabilities, and leverage new navigation sources such as GPS and its augmentation systems, which already meet many proposed performance requirements. The whole presentation on this matter is shown in **Appendix D** to this part of the Report.

### New Concepts on RNAV and RNP

1.18 The meeting took note that the ICAO Air Navigation Commission (ANC), recognising the importance and high priority assigned to the study of RNP, has created a new Required Navigation Performance and Special Operational Requirements Study Group (RNPSORSG), whose objectives are to review the RNP concept and, if appropriate, its use as single means to express navigation requirements for each flight phase, and to reach a consensus on the functional requirements associated with the various precision levels. Moreover, the discussions of the group will carry out a new strategy of RNAV/RNP global implementation, which will avoid the need to multiple operational approvals for the flight in airspaces with similar requirements.

1.19 Also it noted that the revised RNP Concept distinguishes the navigation standards that do **not** require containment integrity and continuity and the ones that require these kinds of containment. Those that do **not** require containment integrity and continuity will be designated as “X-RNAV”, whence “X” is a letter of the Roman alphabet. The ones that require containment integrity and continuity will be designated as RNP-x, whence “x” is a navigation precision value. **Appendix E** of this part of the Report shows the memorandum sent by ATM Section of ICAO for the Regional Offices, which contains the guidelines of the new RNP concept.

1.20 Other aspect considered by RNPSORSG is that the RNAV Implementation will take into consideration the precision values of the navigation system, as nowadays employed by RNP (95% of the total flight time). On the other hand, RNP will keep that precision requirement of the navigation system and will add other requirements, such as the containment integrity and continuity.

1.21 Nevertheless, the meeting recalled that there are exceptions to the new application criteria of RNAV/RNP: RNP 10 and RNP 4, in oceanic or remote airspaces, already implemented or in implementation phase, in order to avoid the need of modification of already existent documentation.

1.22 On the other hand, it is possible to notice that there will be a clear distinction between RNAV/RNP concepts, from the application or not of containment integrity and continuity requirements. From the Airspace Planner point of view, it is important to point out that RNP shall only be applied in airspaces where it is not possible to attend to the users' requirements with RNAV operations, taking into account the on board aircraft requirements for RNP applications will demand more modern equipment, which, for example, are able to monitor the Actual Navigation Performance (ANP) of the aircraft. The RNP application in airspaces without very well defined requirements, mostly due to air traffic demand, will exclude, without need, some users of the airspace (exclusionary airspaces) or turn the operations more complex (non-exclusionary airspaces).

1.23 Taking into consideration that the requirements for the RNAV Implementation do not demand the Actual Navigation Performance (ANP) monitoring by the on board aircraft system, the implementation of these types of RNAV will oblige the use of a Surveillance tool (Radar or ADS), which shows to the air traffic controller the visualization of an eventual deviation of an aircraft due to problems in the navigation system. The only exception is RNP10. Thus, in principle, the use of the RNAV types proposed would be applicable only for radar environments.

1.24 It also noted that it is still important to notice that the precision values, applied to RNAV operations, will have as aim the definition of separation standards and parameters to the aircraft and operator approval.

1.25 A summary of the RNAV Types and RNP Values can be observed in the following tables:

<b>RNAV</b>			
<b>Airspace</b>	<b>RNAV Types</b>	<b>Document of Aircraft and Operators Approval</b>	<b>Associated Precision Value</b>
Oceanic/Remote	RNP 10	Doc. 9613 (FAA Order 8400.12A)	10 NM
	RNP 4	Doc. 9613	4 NM
Continental/Terminal	BRNAV*	EUROCONTROL TGL 02	5 NM
	CRNAV*	FAA AC 90-100 (USRNAV Type A)	2 NM
	TRNAV*	*Advanced RNAV (EUROCONTROL TGL 10 or FAA AC 90-100 – USRNAV Type B)	1 NM

BRNAV = Basic RNAV, CRNAV = Continental RNAV, TRNAV = Terminal RNAV

\* Advanced RNAV = PRNAV + USRNAV Type B

<b>RNP</b>	
<b>Airspace</b>	<b>RNP Values</b>
Continental/Terminal	RNP 2
	RNP 1
Approach	RNP 0.3/0.2/0.1

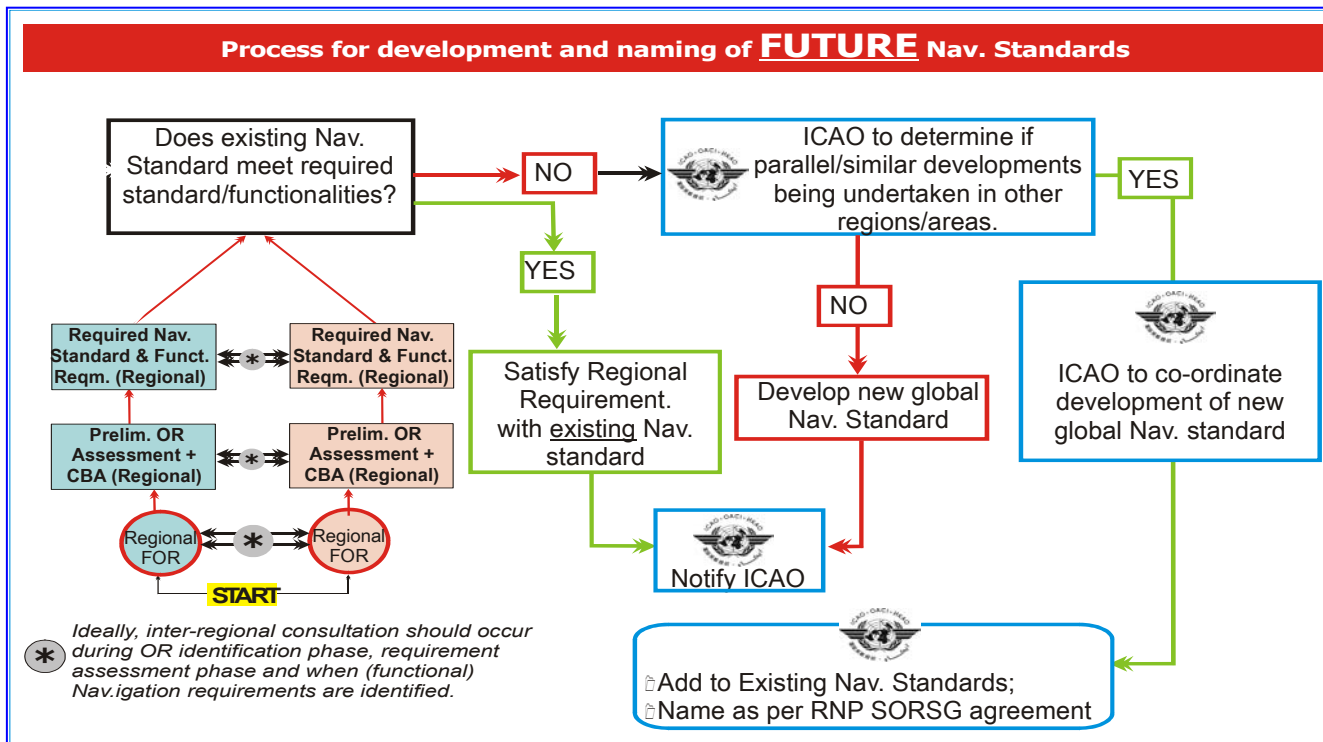
### **Process for Global Harmonization of the Navigation Standards**

1.26 The meeting was informed that during the RNPSORSG's Meetings a proposal for the harmonization of the navigation standards was presented, with the goal of reducing the number of operator and aircraft approvals/certificates, through an only criterion/document application to the airspaces with similar requirements. Thus, for example, the BRNAV application in Brasilia, Curitiba, and Montevideo FIR should employ the document TGL 02 of EUROCONTROL. In a certain way, it will be possible to employ the same process used in Europe, avoiding the need of two approvals for the aircraft that fly from Brazil/Uruguay to Europe.

1.27 Moreover, it was noticed that this strategy stimulates the harmonized application of documentation proceeding from FAA/EUROCONTROL in other airspaces. Such application is common all over the world, as it was observed in the RVSM Implementations (Interim Guidance 91- FAA), RNP 10 implementation (Order 8400.12 – FAA) and BRNAV in Asia (TGL 02 – EUROCONTROL).

1.28 Nevertheless, it was pointed out that the implementation strategy mentioned includes only the harmonization of approvals/certification criteria of the aircraft and operators. Moreover, other exigencies should be analyzed to verify if it is possible the application of certain navigation standard to a specific airspace, such as: CNS infrastructure, Air Traffic Service, Flight Plan requirements, Safety Operational Assessment, etc.

1.29 In this sense and although there is not an adequate RNAV or RNP application criterion for the application in certain airspace, the application strategy of these concepts, suggested by RNPSORSG, offers the possibility of the development of a new criterion. That would be, for example, the development of a RNAV type applicable in no radar environments. The figure below presents the summary of the RNAV RNP application strategy proposed by RNPSORSG.



### RNAV/RNP for Approach Operations

1.30 The meeting took note that RNPSORSG concluded that approach procedures always require containment integrity and continuity. Thus, RNP is the adequate concept to the application for the approach procedures.

1.31 The RNPSORSG group, however, did not get to definite conclusions about precision approach procedures. However, the group came up with some preliminary conclusions that can offer guides to the employment in the CAR/SAM regions. The first aspect is that the probable non-application of the RNP concept for the final track of the precision approach procedures, taking into account that, at the present, there have only two equipments been applied in this track: ILS and MLS. MLS have limited application to some Europe airports. In a predictable horizon, GNSS will be the main navigation system applicable to the precision approach procedures. There's no application foresight of other equipment/technologies to attend the requirements of such procedures which justify the RNP application.

1.32 With regard to the non-precision approach procedures, one of the main problems discussed by the RNPSORSG was that the present Doc. 8168 (PANS-OPS) format foresees lots of different criteria for RNAV operations, based on the several existent equipment types, such as Basic GNSS, VOR/DME, DME/DME, including new criteria in development for GBAS and SBAS. Even so, the advantage of the RNP concept application is obvious, precisely because other application must be inserted in the ICAO Documents, such as IRU/DME, IRU/GNSS and others, becoming impracticable the elaboration of a criterion and a corresponding chapter in such document for each possible combination. Thus, the group recommended the RNP application to these cases, including in the existent GNSS procedures the possibility of its utilization per aircraft RNP 0.3.

1.33 The meeting agreed that future discussions should be determined by the need of flexibility of the RNP concept for approach through the application of design criteria that allows the airspace planner an enlarge series of options for each specific situation. This way, the RNP values will be applied with increments of 0.1 NM (RNP 0.1, 0.2, 0.3, etc), making it possible the application of a RNP value near the operational need of each specific airspace, according to the existent obstacle, the separation between aircraft, the navigation capacity of the fleet, the configuration of the runway of the airport, the existent CNS infrastructure, etc.

**RNAV and RNP Application in the CAR/SAM, based on the RNPSORSG conclusions**

1.34 Taking into consideration all the above, and the fact that there will be no change in the criteria applicable in the RNP 10, no alterations would be necessary in the application of the RNP 10 in the EUR/SAM Corridor and in the routes between Santiago de Chile and Lima.

1.35 In the Action Plan for RNP 5 implementation in the Brasilia, Curitiba and Montevideo FIRs, it shall be modified to the BRNAV application and its expansion to the most important TMA of these FIRs.

1.36 However, taking into account that the most important international traffic flow of the CAR/SAM Regions is from/to NAM Region, the feasibility of CRNAV application should be also analysed, in order to ensure the harmonization of the applicable criteria and to avoid the users to be obliged performing two types of different operational approval. This shall assist the progress of the RNAV routes implementation from CAR/SAM Region to the NAM Region. The navigation capacity of the fleet should already be considered and the possible application of the CRNAV, without radar coverage and navigation radio aids in some parts of the CAR/SAM Regions.

1.37 Another aspect that should be kept in mind is the need for establishing a precision value to the RNAV routes already implemented, and its expansion until the TMA, so that allowing the application of separation criteria between aircraft and the implementation of a harmonized criterion for aircraft and operator approval.

1.38 Considering the existent air traffic demand in the CAR/SAM Regions, it is not expected the application of RNP values to the route operations and in TMA. However, in some airports, where there is a special operational requirement for separation between aircraft and obstacles, the feasibility of application of a specific RNP values must be analysed.

1.39 After dynamic and productive discussions, and keeping in mind the evolution of RNAV and RNP concepts developed by the RNPSORSG Group and the need to implement an adequate working method of the RNAV/RNP task force it was concluded on the convenience to apply the same working methodology used for the RVSM implementation.

1.40 The meeting agreed on the need to count not only with experts on the ATM field for the development of implementation tasks but also the participation of experts in the field of operations and airworthiness would be necessary. Likewise, and considering that the implementation should comply with all aspects related with the safety assessment, the CAR/SAM Regional Monitoring Agency (CARSAMMA) should perform a predominant role in this implementation. The meeting also recalled that these responsibilities have already been assigned to CARSAMMA by GREPECAS.

1.41 One of the most highlighting aspects analysed during the discussions was referred to the need for establishing an implementation strategy as well as an operational concept, tasks which should be developed by the RNAV/RNP TF.

1.42 On the other hand, the meeting recognised the essential support provided by Project RLA/98/003, considering that this technical cooperation mechanism should continue providing the support either through this project or through any other project that CAR/SAM States and International Organizations may consider appropriate. This would permit to ensure the successful participation of all CAR/SAM States and International Organizations.

1.43 In view of the above, the meeting was informed that during the RAAC/9 Meeting held in Santiago de Chile on April 2005, the Civil Aviation Directors of the South American Region formulated a conclusion where ICAO was requested to submit to the States consideration a new regional project for the implementation of the ATM global concept and the corresponding CNS support.

1.44 Then, the meeting analysed other aspects that should be considered to carry out this regional implementation.

1.45 In this regard, and considering that it is necessary to know the real CNS infrastructure in the CAR/SAM Regions, it would be necessary to carry out a survey in order that the States in both Regions report on the quantity and coverage of the referred infrastructure.

1.46 With the aim to initiate the survey on the fleet capacity, OPS/AIR experts, with IATA collaboration should analyse the composition and navigation capacity of the fleet operating in each CAR/SAM State, based on the following documents:

- a) Eurocontrol BRNAV – TGL 2
- b) CRNAV (USRNAV Type A) – FAA AC90 – 100.

1.47 In this connection, it was considered necessary that the GREPECAS ATM/CNS Sub-Group ATM Committee RNAV/RNP Task Force should take the following pertinent actions in the light of the new concepts:

- a) Review the terms of reference and work programme of the RNAV/RNP Task Force;
- b) Review the composition of the Task Force, in order to conform three working groups as follows:
  - i) ATC Operations Working Group (ATC/WG)
  - ii) Operations and Airworthiness Working Group (OPS/AIR/WG)
  - iii) Safety and Airspace Monitoring Working Group (SAM/WG)
- c) Prepare and action plan for RNAV/RNP implementation for the CAR/SAM Regions, which considers among other aspects:
  - i) En-route and in terminal area operations, separately
  - ii) WGS-84 implementation
  - iii) Cost-benefit analysis as indicated by GREPECAS for the implementation of new ATM functions.

- d) Prepare a survey including:
  - i) CNS infrastructure also taking into account the information available at a regional level
  - ii) The navigation capacity of the fleet operating in the CAR/SAM Regions
  - iii) Airports which might obtain operational benefits with the use of the RNAV and/or RNP for approach and instrument exit and those airports that already have these procedures; and
  - iv) WGS-84 status of implementation.
  - v) Routes connected with SID and STARs

1.48 In order to coordinate the information obtained through OPS/AIR personnel, the updating of the OPS/AIR points of contact would be necessary.

1.49 It will also be necessary that CAR/SAM States update as soon as possible the ATC points of contact.

1.50 The meeting also agreed that ICAO establish a link within its website related with RNAV/RNP issues, with access for CAR/SAM States and International Organizations.

#### **Collection of Traffic Data**

1.51 The meeting agreed to carry out a collection of traffic data from 1 to 15 July 2005 to be sent to CARSAMMA on 1 August 2005, formulating the following conclusion:

#### **Conclusion AP/ATM/10/8**

#### **Collection of traffic data in the upper airspace**

That the CAR/SAM States and International Organizations carry out a collection of all flights data in their respective upper airspace, between 1 and 15 July 2005, to be sent to CARSAMMA not later than 1 August 2005, using the form attached in **Appendix F** to this part of the Report.

**APÉNDICE A / APPENDIX A****Fase II b) / Phase II b)**

Los grupos ad-hoc consideraron lo siguiente / Ad-hoc Groups considered the following:

**Ruta/Route Panamá – La Habana (L/UL 465)**

Grupo ad-hoc conformado por / Ad-hoc Groups conformed by: Panamá, Jamaica, Haití, Cuba:

- 1) Eliminar ruta / Eliminate route ATS G/UG 435 – Taboga / Nueva Gerona /
- 2) Insertar Ruta / Insert Route RNAV L/UL 465 Taboga / Gran Caiman / Dutan

**L/UL 465**

<b>FIR y/o PUNTOS SIGNIFICATIVOS FIR and/or Significant Points</b>	<b>LATITUD LATITUDE</b>	<b>LONGITUD LONGITUDE</b>	<b>DESIGNADOR / DESIGNATOR</b>
TABOGA VOR	08° 47' 12''N	079° 33' 42''W	TBG VOR
PANAMA FIR – KINGSTON FIR	15° 00' 00''N	080° 36' 42''W	ARNAL
GRAN CAYMAN VOR-DME	19° 17' 21''N	081° 22' 19''W	GCM VOR-DME
KINGSTON FIR – HABANA FIR	20° 00' 00''N	081° 36' 51''W	TULEV
HABANA FIR	22° 40' 18''N	082° 13' 34''W	DUTAN

**Ruta/Route Caracas – La Habana**

Grupo ad-hoc conformado por / Ad-hoc Groups conformed by: Jamaica, Cuba y Venezuela:

No proceder a su implantación y utilizar la ruta UL 674 (Caracas – Houston) y otras rutas ATS existentes.  
Not proceed to the implementation and use route UL 674 (Caracas – Houston) and other ATS routes existing

**Ruta/Route Santiago de Chile – Buenos Aires (sentido único) (one way) (M/UM 424)**

Grupo ad-hoc conformado por / Ad-hoc Groups conformed by: Argentina y Chile:

- a) Eliminar la actual ruta UA 305/A 305 en el tramo Santiago de Chile – Ezeiza  
Delete route UA 305/A 305 in the segment Santiago de Chile – Ezeiza
- b) Implantar la ruta RNAV UM/M 424 (espacio aéreo inferior y superior), en el tramo Santiago de Chile – Ezeiza, de acuerdo a lo siguiente / Implement route RNAV UM/M 424 (upper and lower airspace) in the segment Santiago de Chile – Ezeiza accordingly the following:

**M/UM 424**

<b>FIR y/o PUNTOS SIGNIFICATIVOS FIR and/or Significant Points</b>	<b>LATITUD LATITUDE</b>	<b>LONGITUD LONGITUDE</b>	<b>DESIGNADOR / DESIGNATOR</b>
SANTIAGO VOR/DME	33° 25' 11''S	070° 47' 04''W	AMB VOR/DME
SANTIAGO FIR – MENDOZA FIR	34° 11' 00''S	069° 49' 00''W	ALBAL
MENDOZA FIR	34° 35' 22''S	068° 23' 41''W	SRA VOR
MENDOZA FIR – EZEIZA FIR	34° 50' 24''S	064° 39' 47''W	RODIK
EZEIZA VOR/DME	34° 49' 27''S	058° 32' 07''W	EZE VOR/DME

**Ruta/Route Buenos Aires – Balmaceda**

No se implantará / It will be not implemented.

**Ruta/Route Buenos Aires – Santiago de Chile**

No se implantará; debido a que la ruta UA 306 satisface el flujo de tránsito  
It will not be implemented, due to UA 306 route satisfies the traffic flow

**Ruta/Route Buenos Aires – Puerto Montt**

No se implantará / It will be not implemented.

**Ruta/Route México – San Pedro Sula**

Grupo ad-hoc conformado por / Ad-hoc Groups conformed by: México y COCESNA  
No se implantará / It will be not implemented.

**Rut/Route a La Paz – Lima**

Grupo ad-hoc conformado por / Ad-hoc Groups conformed by: Bolivia y Perú

No se implantará debido a que la ruta UM 415 satisface el flujo de tránsito

It will be not implemented, due to UM 415 route satisfies the traffic flow

**Ruta/Route Guayaquil – Lima**

Grupo ad-hoc conformado por / Ad-hoc Groups conformed by: Ecuador y Perú

No se implantará debido a que la ruta UL 780 satisface el flujo de tránsito.

It will be not implemented, due to UL 780 route satisfies the traffic flow.

**Ruta/Route Cancún – Panamá**

Grupo ad-hoc conformado por / Ad-hoc Groups conformed by: COCESNA, México y Panamá

Eliminar de la Fase II b), debido a que las rutas UJ 52, UM 782 y UA 321 satisfacen el flujo de tránsito.

Delete of Phase II b), due to UJ 52, UM 782 and UA 321 routes satisfy the traffic flow.

**Ruta/Route Panama – Port-Au-Prince (UL 474)**

<b>FIR y/o PUNTOS SIGNIFICATIVOS FIR and/or Significant Points</b>	<b>LATITUD LATITUDE</b>	<b>LONGITUD LONGITUDE</b>	<b>DESIGNADOR / DESIGNATOR</b>
TABOGA VOR/DME	08° 47' 15'' N	079° 33' 43'' W	TBG VOR/DME
PANAMA FIR – BARRANQUILLA FIR	11° 43' 28''N	077° 25' 00''W	ROKIN
BARRANQUILLA FIR / KINGSTON FIR	15° 00' 00''N	074° 57' 40''W	TOMEK
KINGSTON FIR – PORT-AU-PRINCE FIR	17° 11' 48''N	073° 15' 32''W	ETMUV
OBLEON VOR	34° 49' 27'' N	058° 32' 07'' W	OBN VOR

**APÉNDICE B / APPENDIX B****Ruta/Route Carrasco VOR/DME - San Fernando VOR/DME**

Grupo ad-hoc conformado por / Ad-hoc Groups composed by: Argentina, AITAL y Uruguay:

Argentina informó que actualmente se encuentra en evaluación una modificación de SIDs/STAR con entorno RNAV, lo cual permitirá trayectorias más directas, por lo que evaluará lo solicitado por AITAL al respecto, antes de finales de 2005.

Argentina informed that a modification of the RNAV SIDs/STAR is currently under evaluation, which shall enable more direct trajectories, reason for which it will evaluate the request of AITAL on this regard, before the end of 2005.

Por su parte, Uruguay analizará la necesaria adecuación a estos cambios y para ello mantendrá coordinación con la administración de Argentina y efectuará con AITAL y los usuarios, los arreglos que sean necesarios con el menor impacto posible en la red de rutas o procedimientos operacionales.

On the other hand, Uruguay shall analyze the necessary adequacy to these changes, to this end it will maintain coordination with the Argentinean administration and shall carry out with AITAL and users the necessary arrangements with the least possible impact in the routes network and operational procedures.

**Ruta/Route RNAV Viru – Viru VOR/DME / Ceres VOR/DME (UL 404)**

Grupo ad-hoc conformado por / Ad-hoc Groups composed by: Argentina y Bolivia:

- a) Anular ruta UB 686, en el tramo Viru-Viru VOR/DME – Ceres VOR/DME;  
Delete UB 686 route, in the segment Viru-Viru VOR/DME – Ceres VOR/DME
- b) Insertar la ruta RNAV UL 404, en el tramo Viru-Viru VOR/DME – Ceres VOR/DME, de acuerdo a lo siguiente:  
Insert RNAV UL 404 route, in the segment Viru-Viru VOR/DME – Ceres VOR/DME, accordingly the following:

<b>FIR y/o PUNTOS SIGNIFICATIVOS FIR and/or Significant Points</b>	<b>LATITUD LATITUDE</b>	<b>LONGITUD LONGITUDE</b>	<b>DESIGNADOR / DESIGNATOR</b>
CERES VOR/DME	29° 51' 52''S	061° 52' 20''W	ERE VOR/DME
CORDOBA FIR	25° 44' 58''S	062° 52' 03''W	UBRIX
CORDOBA FIR– LA PAZ FIR	22° 00' 00''S	063° 00' 00''W	MARIA
VIRU-VIRU VOR/DME	17° 37' 42''S	053° 08' 59''W	VIR VOR/DME

**Rutas/Routes UA 303 UL 550**

Grupo ad-hoc conformado por / Ad-hoc Groups composed by: Argentina y Chile:

- a) Anular la ruta UA 303, en el tramo Calama VOR/DME - PEDRO;  
Delete UA 303 route, in the segment Calama VOR/DME – PEDRO
- b) Realinear la ruta RNAV UL 550, en el tramo ROSARIO VOR/DME – KONRI, de acuerdo a lo siguiente:  
Realign UL 550 route, in the segment ROSARIO VOR/DME – KONRI, accordingly the following:

<b>FIR y/o PUNTOS SIGNIFICATIVOS FIR and/or Significant Points</b>	<b>LATITUD LATITUDE</b>	<b>LONGITUD LONGITUDE</b>	<b>DESIGNADOR / DESIGNATOR</b>
ROSARIO VOR/DME	32° 54' 18''S	060° 46' 52''W	ROS VOR/DME
EZEIZA FIR / CORDOBA FIR	31° 53' 11''S	061° 33' 37''W	ROKER
TUCUMAN VOR/DME	26° 50' 45''S	065° 06' 30''W	TUC VOR/DME
CORDOBA FIR / ANTOFAGASTA FIR	24° 07' 00''S	067° 32' 00''W	KONRI

**Ruta/Route UL 650**

Grupo ad-hoc conformado por / Ad-hoc Groups composed by: Argentina y Chile:

- a) Realinear la ruta G 550, en el tramo Punta Arenas VOR/DME - Puerto Montt VOR/DME  
Realign G 550 route, in the segment Punta Arenas VOR/DME - Puerto Montt VOR/DME
- b) Realinear la ruta RNAV UL 650, en el tramo GEKAL - Atacama VOR/DME (DAT – 27°16'46''S – 070°46'49''W), de acuerdo a lo siguiente:  
Realign UL 650 route, in the segment GEKAL - Atacama VOR/DME (DAT – 27°16'46''S – 070°46'49''W), accordingly the following:

**UL 650**

<b>FIR y/o PUNTOS SIGNIFICATIVOS FIR and/or Significant Points</b>	<b>LATITUD LATITUDE</b>	<b>LONGITUD LONGITUDE</b>	<b>DESIGNADOR / DESIGNATOR</b>
CATAMARCA VOR-DME	28° 35' 01''S	065° 44' 48''W	CAT VOR-DME
FIR CORDOBA	28° 07' 28'' S	067° 42' 21''W	MUKIS
FIR CORDOBA – FIR ANTOFAGASTA	27° 46' 50''S	069° 05' 30''W	GEKAL
CALDERA VOR			CALDERA
<b>ATACAMA VOR-DME</b>	<b>27°16'46''S</b>	<b>070°46'49''W</b>	<b>DAT VOR-DME</b>

**Ruta/Route G 675**

Grupo ad-hoc conformado por / Ad-hoc Groups composed by: Argentina, Chile y Perú:

Eliminar la ruta G 675, en el tramo Lima VOR - Punta Arenas VOR/DME  
Delete G 675 route, in the segment Lima VOR - Punta Arenas VOR/DME

**Ruta/Route Viru Viru VOR – NADIR (UL 540)**

Grupo ad-hoc conformado por / Ad-hoc Groups composed by: Bolivia, Brasil e IATA

Insertar la ruta RNAV UL 540, en el tramo Viru-Viru VOR/DME – NADIR, de acuerdo a lo siguiente:  
Insert RNAV UL 540 route, in the segment Viru-Viru VOR/DME – NADIR, accordingly the following:

**UL 540**

<b>FIR y/o PUNTOS SIGNIFICATIVOS FIR and/or Significant Points</b>	<b>LATITUD LATITUDE</b>	<b>LONGITUD LONGITUDE</b>	<b>DESIGNADOR / DESIGNATOR</b>
VIRU VIRU VOR	17° 37' 42''S	053° 08' 59''W	VIR VOR
LA PAZ FIR/ AMAZONICA FIR	15° 27' 51''S -	60° 14' 45.6''W	ERVEL
AMAZONICA FIR	14° 23' 30''S	058° 50' 12''W	ABATE
AMAZONICA FIR	12° 48' 18''S	057° 03' 12''W	CANON
EMPERATRIZ VOR	05° 32' 06''S	047° 27' 24''W	YTZ VOR
AMAZONICA FIR	02° 39' 24''S	043° 54' 48''W	NADIR

**Ruta/Route Manley – Santiago de Cuba (L/UL 347)**

<b>FIR y/o PUNTOS SIGNIFICATIVOS FIR and/or Significant Points</b>	<b>LATITUD LATITUDE</b>	<b>LONGITUD LONGITUDE</b>	<b>DESIGNADOR / DESIGNATOR</b>
MANLEY VOR	17° 55' 48''N	076° 46' 42''W	MLY VOR
KINGSTON FIR – HABANA FIR	19° 00' 56''N	076° 16' 28''W	VIKRO
SANTIAGO DE CUBA VOR	19° 58' 40''N	075° 49' 21''W	UCU VOR

**UL 210**

<b>FIR y/o PUNTOS SIGNIFICATIVOS FIR and/or Significant Points</b>	<b>LATITUD LATITUDE</b>	<b>LONGITUD LONGITUDE</b>	<b>DESIGNADOR / DESIGNATOR</b>
KINGSTON FIR – HABANA FIR	18° 33' 42''N	075° 10' 42''W	GELOG
HABANA FIR – MIAMI UIR	24° 00' 00''N	077° 55' 24''W	BORDO

**L/UL 341**

<b>FIR y/o PUNTOS SIGNIFICATIVOS FIR and/or Significant Points</b>	<b>LATITUD LATITUDE</b>	<b>LONGITUD LONGITUDE</b>	<b>DESIGNADOR / DESIGNATOR</b>
MIAMI FIR – HABANA FIR	24° 01' 48''N	079° 31' 42''W	TANIA
HABANA FIR – KINGSTON FIR	20° 00' 00N	078° 57' 54''W	GONIS
SANGSTER VOR	18° 30' 00''N	077° 55' 24''W	SIA VOR

**Extensión/Extension R/UR 628**

<b>FIR y/o PUNTOS SIGNIFICATIVOS FIR and/or Significant Points</b>	<b>LATITUD LATITUDE</b>	<b>LONGITUD LONGITUDE</b>	<b>DESIGNADOR / DESIGNATOR</b>
NASSAU VOR	25° 01' 30''N	077° 26' 48''W	ZQA VOR
MIAMI OCEANIC – MIAMI UIR	24° 27' 12''N	078° 40' 42''W	MENDL
MIAMI UIR – HABANA FIR	24° 01' 48''N	079° 31' 42''W	TANIA
VARDER VOR	25° 05' 24''N	081° 22' 00''W	UVA VOR
<b>ZARAGO NDB</b>	22° 56' 06''N	082° 02' 18''W	UZG NDB
<b>LA HABANA VOR</b>	22° 58' 42''N	082° 25' 36''W	UHA VOR
<b>CAYABO VOR</b>	22° 51' 30''N	082° 51' 12''W	UCY VOR

**Elorza – Sao Gabriel da Cachoeira (M/UM 778)**

<b>FIR y/o PUNTOS SIGNIFICATIVOS FIR and/or Significant Points</b>	<b>LATITUD LATITUDE</b>	<b>LONGITUD LONGITUDE</b>	<b>DESIGNADOR / DESIGNATOR</b>
ELORZA NDB	07° 35' 30''N	069° 29' 30''W	EZA NDB
MAIQUETÍA FIR – BOGOTA FIR	06° 07' 42''N	069° 10' 03''W	PALIR
BOGOTA FIR – AMAZONICA FIR	02° 02' 01''N	067° 44' 40''W	ATATU
SAO GABRIEL DA CACHOEIRA VOR	00° 09' 00''S	066° 59' 06''W	SGC VOR

**Apéndice C/Appendix C**

**Programa de Implantación de rutas RNAV en las Regiones CAR/SAM (Fase II- b) /  
RNAV Routes Implementation Program in the CAR/SAM Regions (Phase II-b)**

**Pendientes / Pending:**

<b>Bonaire/Quito (1)</b>				
<b>Bonaire/Guayaquil (1)</b>				
	<b>Netherlands Antilles</b>	<b>Venezuela</b>	<b>Colombia</b>	<b>Ecuador</b>
Inicio/Fin Start/End	ALCOT	Santa Barbara del Zulia (STB VOR/DME) (2)	BOGOTA (BOG VOR/DME) (1)	GUAYAQUIL (GYV VOR/DME)
Límite FIR FIR Limit	ALCOT (2) (Curacao-Maiquetia)	Por determinar To be determined (Maiquetia-Bogota)	Por determinar To be determined (Bogota-Guayaquil)	
<p>(1) Colombia y Ecuador proponen unir las rutas Bonaire/Quito y Bonaire/Guayaquil en una sola ruta <b>Bonaire/Bogota/Guayaquil</b>.</p> <p>(1) Colombia and Ecuador propose to join the routes Bonaire/Quito and Bonaire/Guayaquil in only one route <b>Bonaire/Bogota/Guayaquil</b>.</p> <p>(2) Venezuela propone unir las rutas Bonaire/Quito y Bonaire/Guayaquil en una sola ruta, ingresando a la FIR Maiquetia por <b>ALCOT</b> siguiendo la actual trayectoria de la ruta <b>UG 431</b> hasta <b>STB VOR/DME</b> y continuando hacia Guayaquil.</p> <p>(2) Venezuela proposes to join the routes Bonaire/Quito and Bonaire/Guayaquil in only one route, entering to Maiquetia FIR by <b>ALCOT</b>, following the current trajectory of route <b>UG 431</b> until <b>STB VOR/DME</b> and continue to Guayaquil.</p>				

<b>Bonaire/Lima (UM 414) (1) (3)</b>				
	<b>Netherland Antilles</b>	<b>Venezuela</b>	<b>Colombia</b>	<b>Peru</b>
Inicio/Fin Start/End	ALCOT (2)	ELORZA (1) (3) (EZA NDB)	No Aplicable Not Applicable	LIMA (1) (LIM VOR/DME)
Límite FIR FIR Boundary	ALCOT (2) (3) (Curacao-Maiquetia)	OPRUS (1) (Maiquetia-Bogota)	ILMUX (1) (Bogota-Lima)	
<p>(1) Peru y Venezuela proponen mantener la actual trayectoria de la ruta <b>UM 414</b> y extenderla desde <b>ESKIT</b> hasta <b>PBL VOR/DME</b> y continuar directo hacia Bonaire.</p> <p>(1) Peru and Venezuela propose to keep the current trajectory of route <b>UM 414</b> and extend it from <b>ESKIT</b> until <b>PBL VOR/DME</b> and continue direct to Bonaire.</p> <p>(2) Propuesta por Netherlands Antilles.</p> <p>(2) As proposed by Netherlands Antilles.</p> <p>(3) Pareciera que no existiera compatibilidad entre estas dos propuestas.</p> <p>(3) It seems that there is no compatibility between these two proposals.</p>				

<b>Buenos Aires/Asunción</b>		
	<b>Argentina</b>	<b>Paraguay</b>
Inicio/Fin Start/End	(1)	No ha informado No information provided
Límite FIR FIR boundary	Por determinar To be determined (Resistencia-Asuncion)	
(1) Argentina ha informado que esta ruta RNAV no es necesaria por el momento. (1) Argentina has informed that this route is not necessary at this time.		

<b>Aruba/San Juan de Puerto Rico</b>		
	<b>Netherlands Antilles</b>	<b>United States</b>
Inicio/Fin Start/End	SCAPA	No ha informado No information provided
Límite FIR FIR boundary	SCAPA (1) (Curacao-San Juan Oceanic)	
(1) Propuesta por Antillas Neerlandesas (1) As proposed by Netherland Antilles.		

<b>Cap Haitien/Puerto Plata</b>		
	<b>Haiti</b>	<b>Republica Dominicana</b>
Inicio/Fin Start/End	No ha informado No information provided	No ha informado No information provided
Límite FIR FIR boundary	Por determinar To be determined (Port-au-Prince-Santo Domingo)	

<b>Cap Haitien/Santiago de Cuba</b>		
	<b>Haiti</b>	<b>Cuba</b>
Inicio/Fin Start/End	No ha informado No information provided	(1)
<p>(1) Cuba ha informado que, en coordinación con Haití, han acordado no implantar esta ruta RNAV por el momento.</p> <p>(1) Cuba has informed that, in coordinations with Haiti, they have agreed not to implement this RNAV route by now.</p>		



# **General Vision of the National System of the United States Airspace based in performance**



**ato**

AIR TRAFFIC ORGANIZATION

# **Overview of the U.S. Performance-Based National Airspace System**

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

10-14 May 2005

Lima, Peru

Barbara Cassidy

Required Navigation Performance Division  
Federal Aviation Administration



# Overview

- What is Performance-Based Navigation?
- FAA Roadmap for Performance-Based Navigation
  - Concepts, Implementation Considerations
  - Implementation Activities
    - Enroute
    - Terminal
    - Approach
- International Harmonization Activities



# What Is “Performance-Based” Navigation?

- An end-to-end system of concepts and applications based on performance standards and metrics rather than specific technologies and equipment
  - Aviation authorities specify the ***aircraft capabilities*** and ***performance requirements*** necessary to operate in a given airspace or use a given procedure
    - Instead of specifying required technologies or specific avionics
- Recognizes the ability of aircraft to operate safely and efficiently using a variety of on-board systems
  - In conjunction with a variety of external signals provided by ground-based, space-based, and other aircraft-based systems



# What Is “Performance-Based” Navigation? **continued**

- Performance-based Navigation includes
  - Area Navigation (RNAV)
  - Required Navigation Performance (RNP)
- Specified navigation standards for
  - Performance
  - Functionality
  - Capability
- Standards allow the flexibility to develop more efficient airspace and instrument procedure designs
- Benefits
  - Improved safety
  - Increased Access
  - Additional Capacity
  - Better Flight Path Predictability
  - Operational efficiency
  - Reduced environmental impacts



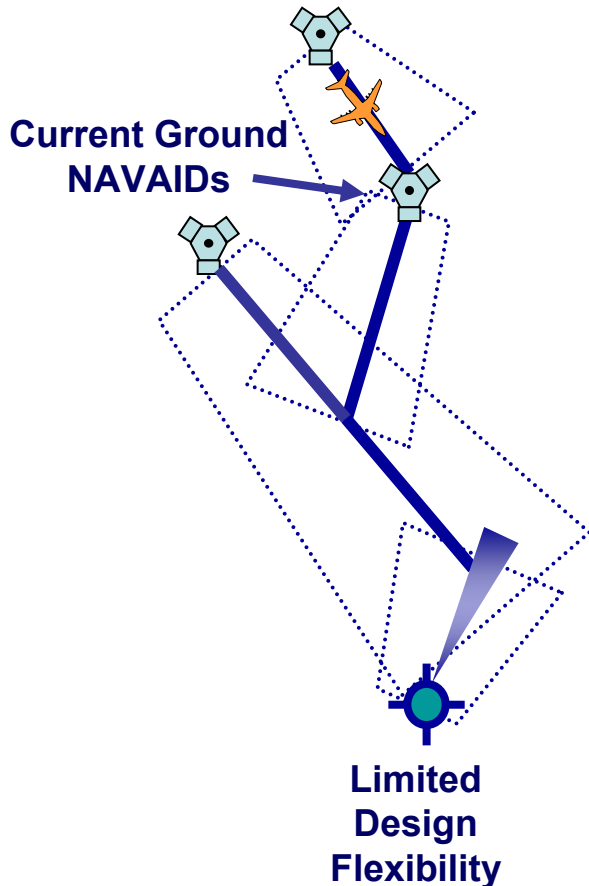
# Objectives for Performance-Based Navigation

- **Cost-effective navigation services with the necessary performance and operational capabilities to provide:**
  - RNAV and RNP where beneficial
  - Vertically guided approaches where appropriate for safety and improved access
- **Cost-effective performance-based navigation to produce measurable improvements in:**
  - Safety
  - Airport and airspace access
  - Capacity
  - Efficiency
  - Environment

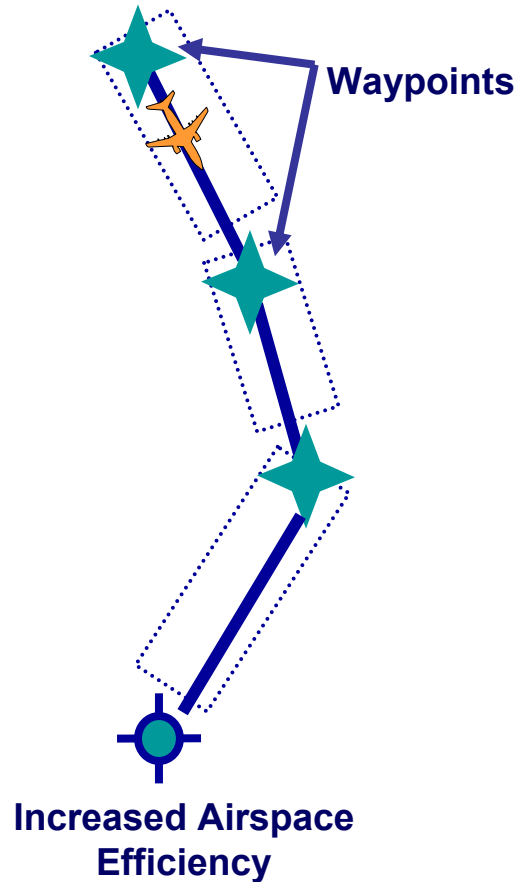


# Moving To Performance-Based Navigation

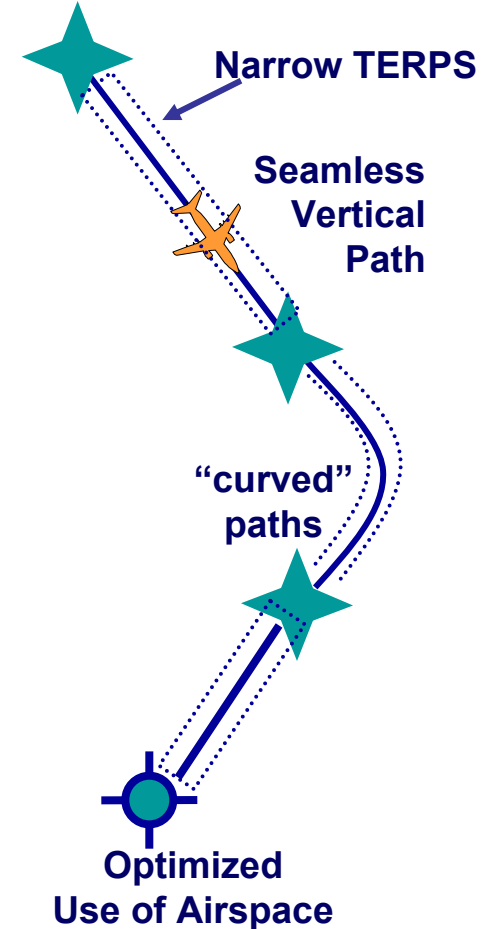
**Conventional Routes**



**RNAV**



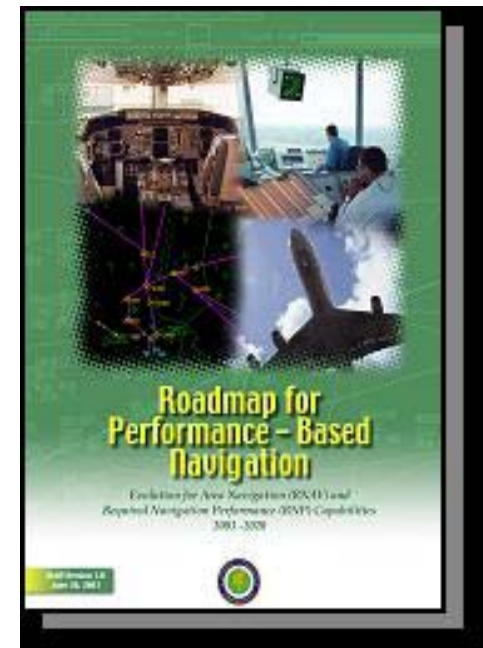
**RNP**





# FAA's Roadmap for Performance-Based Navigation

- **Collaborative effort among aviation industry stakeholders**
  - Performance-based Operations Aviation Rulemaking Committee (PARC)
- **Aligned with the Operational Evolution Plan (OEP) and FAA *Flight Plan***
  - Near-term 2003 to 2006
  - Mid-term 2007 to 2012
  - Far-term 2013 to 2020
- **Focuses on operational capabilities in:**
  - En route domain
  - Terminal domain
    - Standard Terminal Arrivals (STARs)
    - Standard Instrument Departures (SIDs)
  - Approach domain



<http://www.faa.gov/ats/atp/rnp/roadmap.pdf>



# Definition: RNAV

- RNAV is a method of navigation that enables aircraft to fly on any desired flight path within the coverage of referenced NAVAIDS or within the limits of the capability of self-contained systems, or a combination of these capabilities
- Routes and procedures using RNAV provide improved access and flexibility through point-to-point navigation and are not restricted to the location of ground-based NAVAIDS
- The overall safety of the RNAV operation is achieved through a combined use of aircraft navigation accuracy, air traffic control intervention (via radar monitoring, automatic dependent surveillance (ADS), multilateration, communications) and/or increased route separation



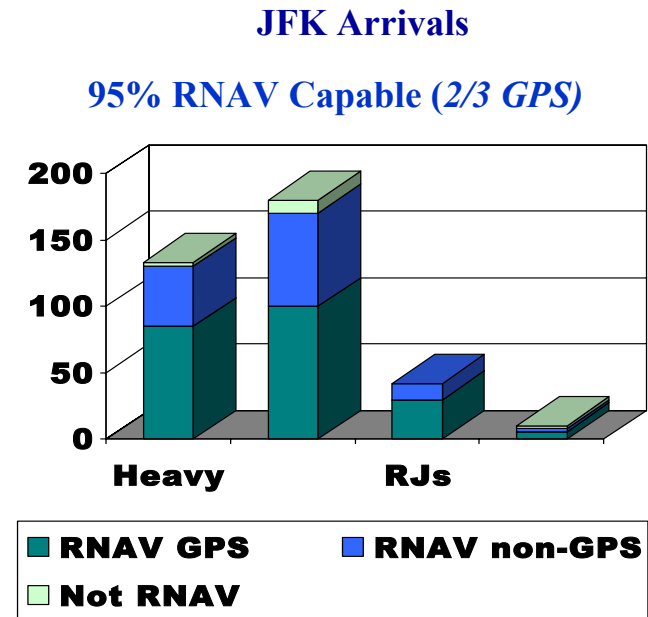
# Definition: RNP

- RNP is RNAV operations with on-board navigation containment and monitoring
- A critical component of RNP is the *ability of the aircraft navigation system to monitor its achieved navigation performance, and to identify for the pilot whether the operational requirement is, or is not being met during an operation*
- This on-board monitoring and alerting capability therefore allows a lessened reliance on air traffic control intervention (via radar monitoring, automatic dependent surveillance (ADS), multilateration, communications) and/or increased route separation to achieve the overall safety of the operation
- RNP capability of the aircraft is a major component in determining the separation criteria to ensure that the overall containment of the operation is met
  - This is a distinguishing feature of RNP



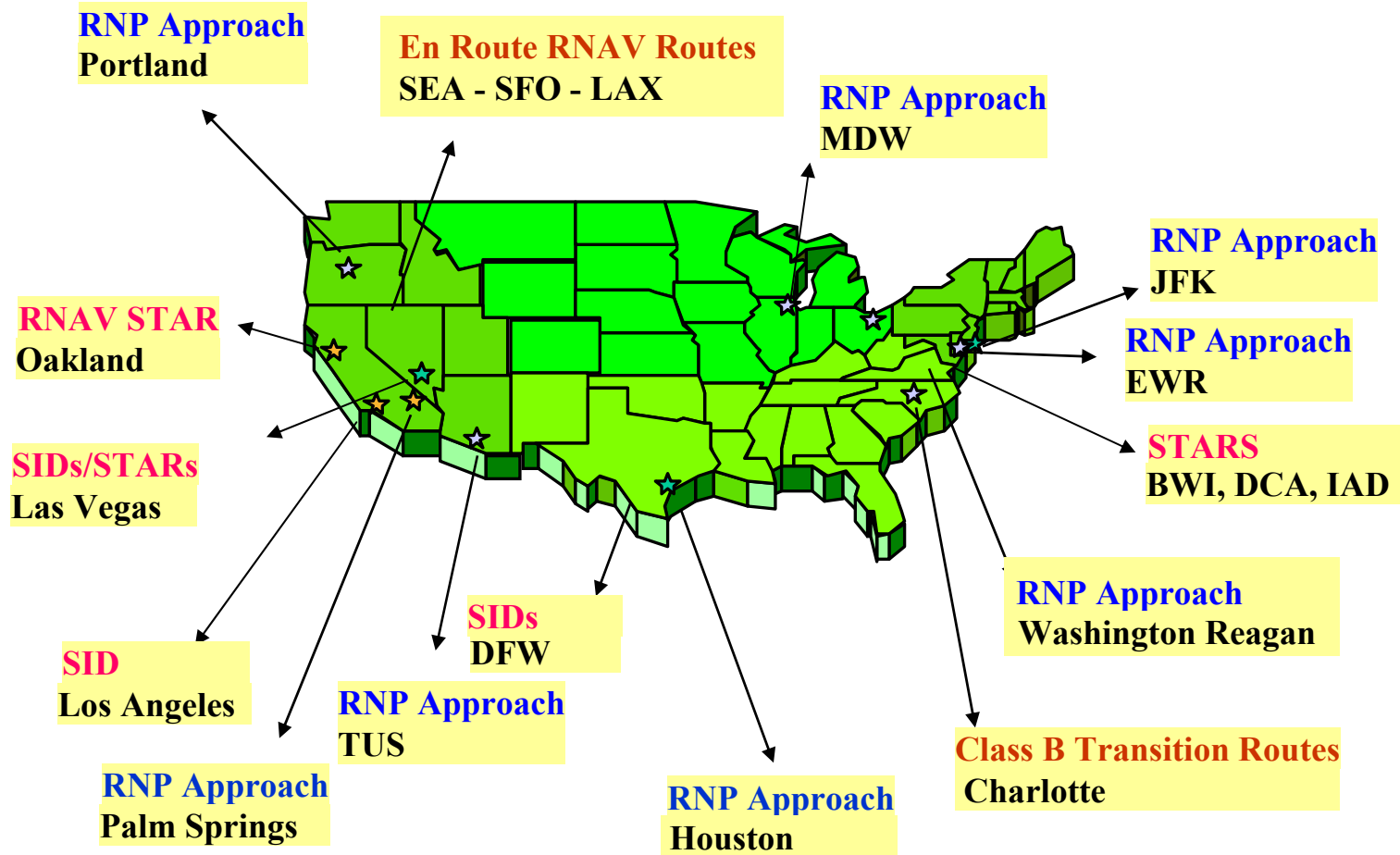
# Implement RNAV or RNP?

- Fleet Equipage Mix
  - Current
  - Projected
- Airspace Infrastructure
  - Radar Coverage
  - Communications Coverage
  - Route Density
- NAVAID Infrastructure
  - GPS only?
  - DME/DME?
  - DME/DME/IRU?
- Controller Workload





# RNAV and RNP Procedures Implementation (2004-2005)

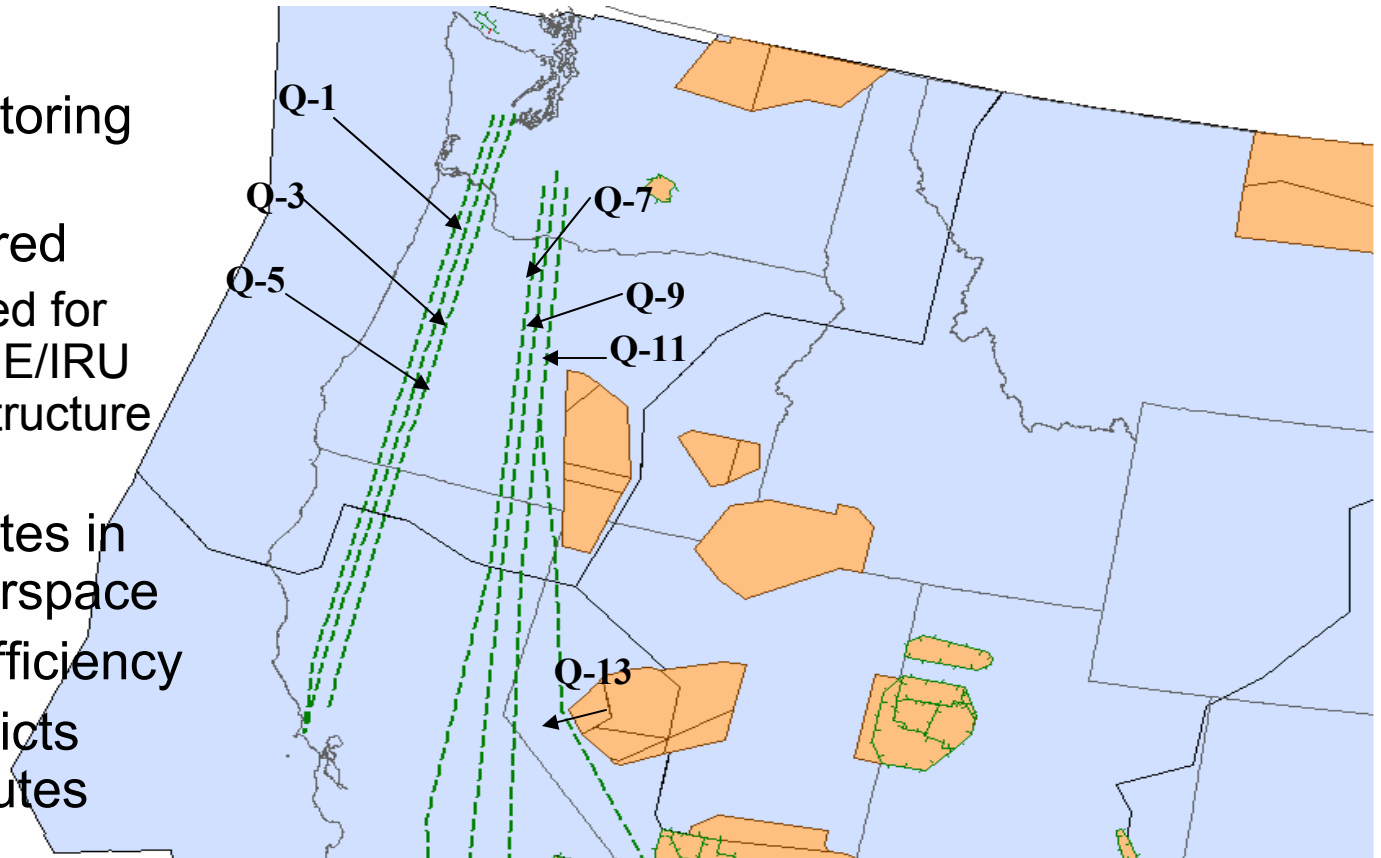




# Q-Routes

(RNAV routes FL 180 and above)

- Radar monitoring required
- GPS Required
  - Authorized for DME/DME/IRU as infrastructure supports
- Multiple routes in the same airspace
- Improved efficiency
- Fewer conflicts between routes





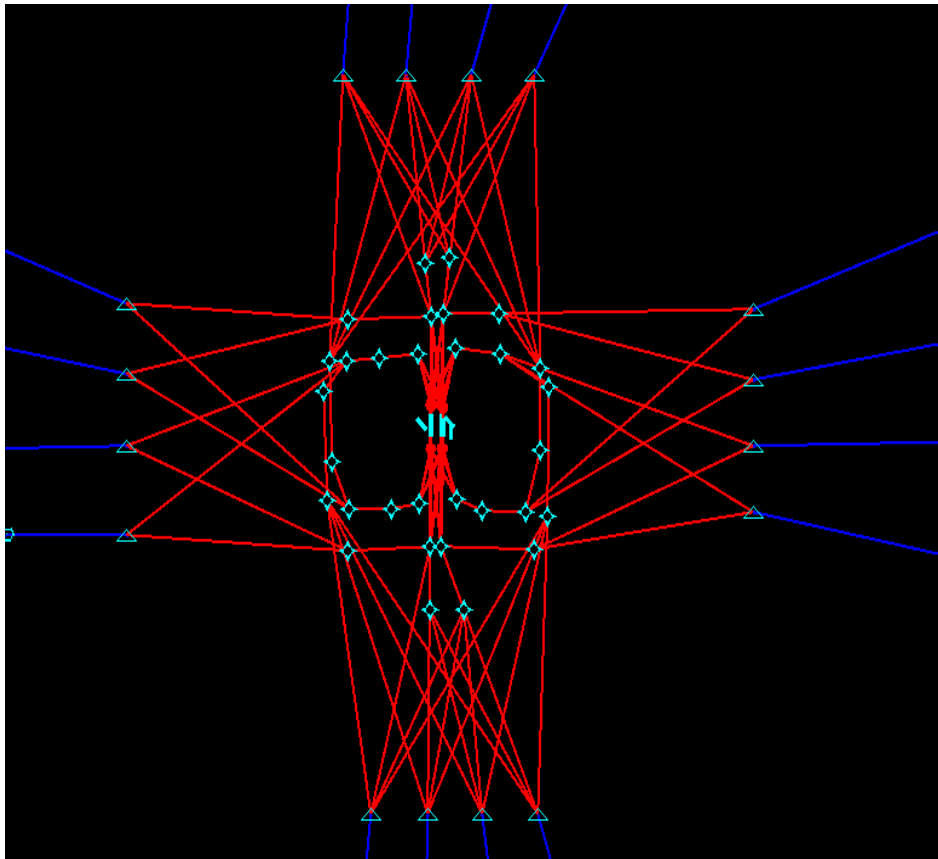
<b>Q-Routes</b>	<b>Status</b>	<b>Publication Date</b>
<b>Q 1, 3, 5 – FL 290</b>	<b>Published</b>	<b>9/30/04</b>
<b>Q 7, 9, 11 – FL 290</b>	<b>Published</b>	<b>11/25/04</b>
<b>Canadian Routes 500, 502, 503, 504 – FL240</b>	<b>Published</b>	<b>11/25/04</b>
<b>Q 1, 3, 7, 9 – FL 240</b>	<b>Scheduled for publication</b>	<b>5/12/05</b>
<b>Q 5, 11 – FL 260</b>	<b>Scheduled for publication</b>	<b>5/12/05</b>
<b>New Florida Routes Q 104, 105, 106, 108, 110, 112, 116, 118</b>	<b>Comment period closed 3/24/05, Awaiting Final Rule</b>	<b>9/1/05</b>
<b>Q 13 Q 15</b>	<b>Redesigned GPS Required GPS Required</b>	<b>TBD</b>
<b>7 New Southwest/Texas Q-Routes</b>	<b>Under initial development</b>	<b>TBD</b>

<b>T-Routes</b>	<b>Status</b>	<b>Publication Date</b>
<b>Charlotte (CLT)</b> - 4 Routes (T 200, 201, 202, 203)	<b>Final Rule expected 06/05</b>	<b>9/1/05</b>
<b>Jacksonville (JAX)</b> - 7 Routes (T 204, 205, 206, 207, 208, 210, 211)	<b>NPRM in pre- publication legal review</b>	<b>Early FY-06</b>
<b>Cincinnati (CVG)</b> - 4 Routes (T 212, 213, 215, 217)	<b>NPRM in pre- publication legal review</b>	<b>Early FY-06</b>

- RNAV IFR Terminal Transition Routes (RITTRs)
  - Will be published on low-altitude en route charts as T-Routes
    - Routes will be identified as T200-500
- FAA Orders for RITTR development to be published in 2005



# Terminal Procedures (STARs, SIDs)



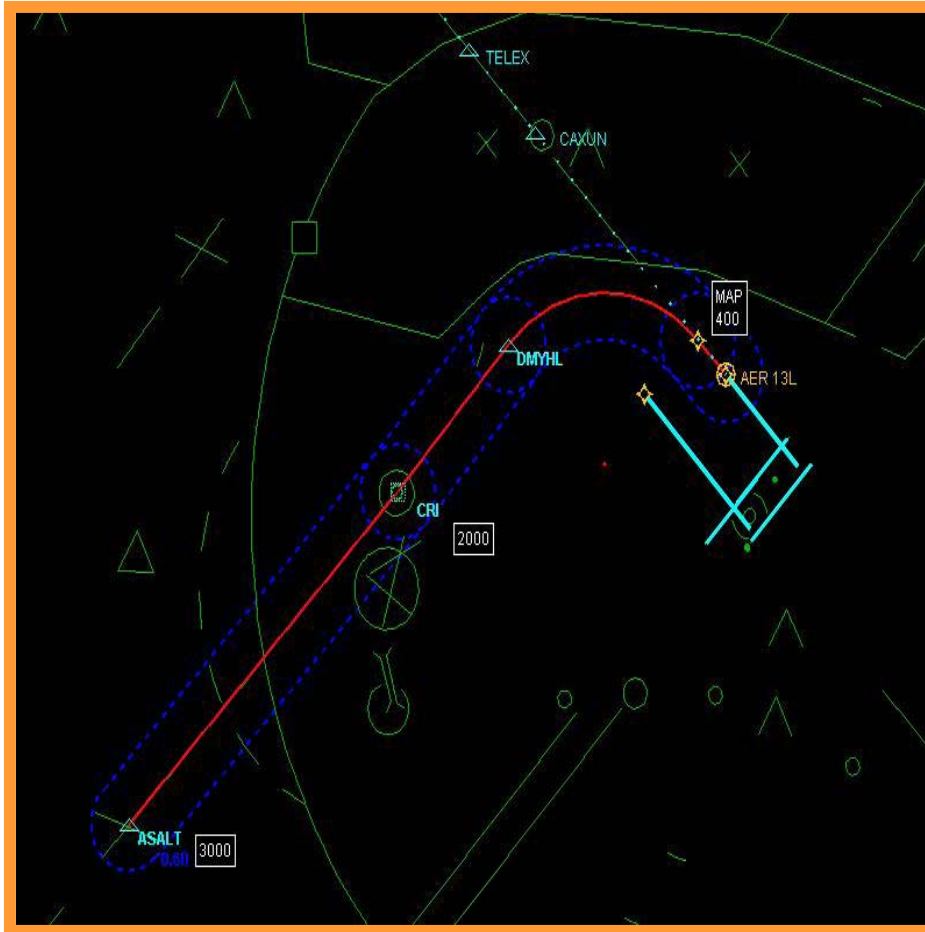
## Benefits

- Increased arrival/departure throughput and efficiency
- Increased predictability
- Decreased departure delays
- Decreased taxi-times
- Reduced track distances
- Reduced voice communications & vectoring
- More efficient vertical profiles
- Reduced fuel consumption

<b>Terminal Procedures</b>	<b>Status</b>	<b>Publication Date</b>
<b>Dulles (IAD)</b> - 4 RNAV STARs	<b>Published</b>	<b>1/20/05</b>
<b>Portland (PDX)</b> - 2 GPS SIDs	<b>Published</b>	<b>1/20/05</b>
<b>Atlanta (ATL)</b> - 4 RNAV STARs/13 RNAV SIDs	<b>Published</b>	<b>3/17/05</b>
<b>Las Vegas (LAS)</b> - 5 RNAV SIDs	<b>Published</b>	<b>3/17/05</b>
<b>Philadelphia (PHL)</b> - 2 RNAV STARs	<b>Published</b>	<b>3/17/05</b>
<b>Providence, RI (PVD)</b> - 1 RNAV STAR	<b>Scheduled for publication</b>	<b>7/7/05</b>
<b>Anchorage (ANC)</b> - 2 GPS STARs	<b>Scheduled for publication</b>	<b>7/7/05</b>
<b>Dallas/Fort Worth (DFW)</b> - 16 RNAV SIDs	<b>Scheduled for publication</b>	<b>7/7/05</b>
<b>Minneapolis (ZMP)</b> - 1 RNAV STAR	<b>Scheduled for publication</b>	<b>9/1/05</b>
<b>San Francisco (SFO)</b> - 1 RNAV STAR	<b>Scheduled for publication</b>	<b>9/1/05</b>
<b>Houston (IAH)</b> - 1 RNAV STAR	<b>Scheduled for publication</b>	<b>9/1/05</b>



# Approach Procedures (RNP SAAAR\*)



## Benefits

- Better access to runways with terrain/airspace conflicts
- De-conflicting traffic flows (e.g., converging runways, adjacent procedures)
- Improving safety by eliminating circling maneuvers
- Simplifying training by eliminating NPAs without sacrificing access
- To solve problems not solvable with other approach surfaces

**\*Special Aircraft and Aircrew Authorization Required**



# RNP (SAAAR)

- SAAAR: **S**pecial **A**ircraft and **A**ircrew **A**uthorization **R**equired
- SAAAR procedures are typically public procedures
  - ILS CAT II/III
- FAA is implementing convertible *special* RNP SAAAR procedures to provide initial operational capability for participating air carriers



# **Operational Attributes of RNP SAAAR Approaches**

**(not all attributes required for every procedure)**

## **SAAAR Attributes**

**Narrower lateral TERPS**  
(e.g., RNP-0.3 or less, no secondary)

**Guided turns/Lower RNP on  
missed approaches**  
(RF and RNP-0.3 or less)

**Curved segments anywhere  
along the approach**  
(RF legs)

**Reduced obstacle clearance**  
(VEB – Vertical Error Budget)



# RNP SAAAR Implementation: An FAA National Initiative

- Implementation of the “Top Ten” RNP SAAAR projects is considered a national initiative
- Implementation concept
  - Initial 10 projects implemented as “Special” procedures using FAA Notice 8000.287
  - FAA Notice 8000.287 provides
    - Procedure development criteria (TERPS)
    - Aircraft evaluation requirements
    - Operator approval requirements
- Top Ten Specials to be converted to public procedures when “public criteria” agreed & published in 8260-series Orders
  - Public criteria expected May 2005
  - Once public, procedures remain SAAAR (similar to ILS CAT II/III)
  - Aiming for public RNP SAAAR procedures in CY 2006

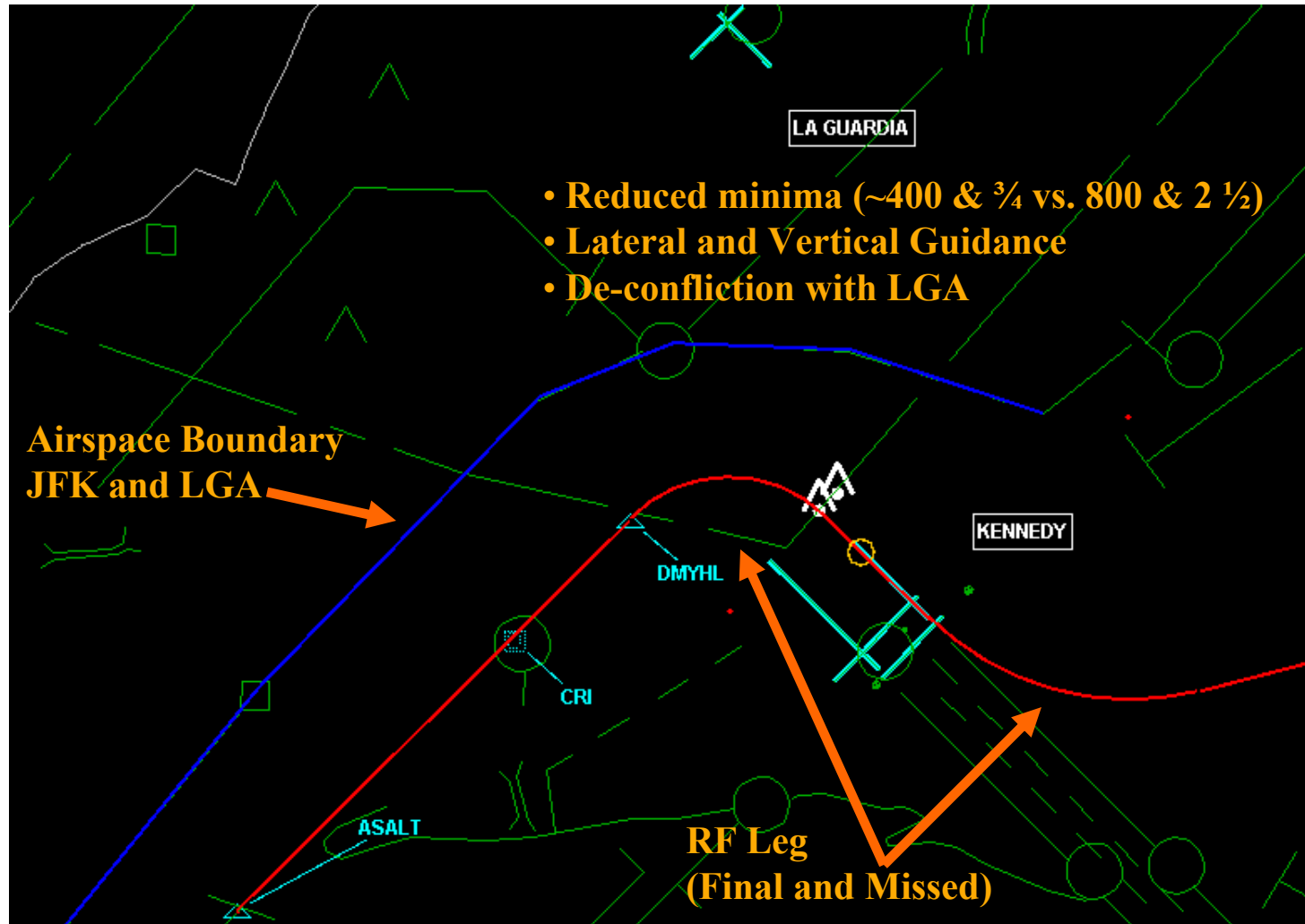


# RNP SAAAR “Top Ten” Initial Implementation Projects

RNP SAAAR Sites			
Site	Runway	Proponent	Package Status
Palm Springs CA (PSP)	31L, 13R	Alaska Airlines	In review
Houston, TX (IAH)	08R, 27	Continental Airlines	In review
NY Kennedy (JFK)	31L, 31R	JetBlue	Submission expected 31 Mar 05
Portland, OR (PDX)	28L, 28R	Horizon Air	Submission expected 31 Mar 05
Reagan National (DCA)	19	Alaska Airlines	Awaiting design resources
Newark, NJ (EWR)	29	Continental Airlines	Kickoff meeting 22 Feb 05
Chicago Midway (MDW)	13C, 22L	FAA	Procedure designs in progress
Newark, NJ (EWR)	04R, 22L	Continental Airlines	Kickoff meeting 22 Feb 05
Philadelphia, PA (PHL)	09	US Airways	Kickoff meeting June 2005
Tucson, AZ (TUS)	11	Alaska Airlines	Kickoff meeting June 2005



# RNP SAAAR - JFK Example





# Basis for Harmonization Activities

- The ultimate aim of the aviation community is the seamless transition of aircraft through global airspace
  - Via RNAV and RNP implementations that optimize aircraft capabilities
  - To realize benefits for both aircraft operators and service providers
- Different needs in each State may result in different priorities for implementation
- Harmonization of standards is the key to ensuring that differing implementation priorities are accommodated within a joint effort



# U.S. Harmonization Activities

## (with ICAO Headquarters)

- ICAO RNP Special Operational Requirements Study Group
  - To consider RNAV (no on-board containment) and RNP (on-board containment with alerting)
  - 8 April 2005 Secretariat letter to ICAO Regional Offices on revision to RNP concept (i.e. new implementations to include containment / alerting)
  - Rewrite ICAO Doc 9613, *RNP Manual*
- Key FY05 FAA objective: FAA & Eurocontrol will harmonize TGL-10 and AC 90-100 (USRNAV)
  - 95% harmonized; working to near 100%
  - FAA/Eurocontrol will develop proposed ICAO RNAV Standard by May 05 for submission to RNPSORSG Secretariat
    - To be formally reviewed by appropriate Panel(s)



# AC 90-100 Expands Upon TGL-10

## TGL-10

- Requires specific approval for operations listed
- Where radar is used the requirement for radar service is identified in the AIP
- Specific points for operators and manufacturers to demonstrate compliance with requirements
- Permits use of Fix to Altitude (FA)
- RNAV System failure indicator, including associated sensors, in pilot's primary field of view
- Defines aircraft characteristics to ensure Navigation Service Provider assessment of infrastructure is valid
- Requires use of an approved database supplier

## AC 90-100

- FAA does not require specific approval for operations listed
- Radar is required for all RNAV operations unless the procedure specifically requires GPS or GNSS
- Provides greater detail for operators and manufacturers on how to comply with requirements
- FA legs are not allowed
  - Use Heading to Altitude (VA) legs instead
- Does not require the pilot to monitor conventional ground—based NAVAIDs (unless required by AFM)
- Defines aircraft characteristics to ensure Navigation Service Provider assessment of infrastructure is valid
- FAA does not require approved data suppliers

**NOTE: FAA AC 90-96A (13 Jan 05) specifies requirements for US operators to receive FAA approval to fly B-RNAV and P-RNAV procedures in Europe**



# U.S. Harmonization Activities

## (with ICAO Headquarters) continued

- Harmonized criteria for RNP 0.3- 0.1 approaches
  - US will propose its RNP SAAAR public procedure criteria for possible ICAO adoption
    - Via Obstacle Clearance Panel (OCP) and
    - For Regional adoption via ICAO GREPECAS
  - US public criteria is being developed in TERPS
    - FAA will draft in PANS-OPS for submission to ICAO groups



# U.S. Harmonization Activities (Region)

- Drafting a proposed Canada-Mexico-U.S. Joint *Strategy for Performance Based Navigation* document
  - Emphasis will be primarily on Standards, vice site-specific implementations
  - Agreed strategy to be embodied in update to existing CANADA-MEXICO-USA CNS/ATM IMPLEMENTATION AND TRANSITION PLAN”
- Intent to pursue harmonization with CAR/SAM Region, primarily via ICAO GREPECAS
  - CAR/SAM Region CNS/ATM Implementation Plan



# Further Discussion



Visit our website at:  
<http://www.faa.gov/ats/atp/rnp/rnav.cfm>



# Back Up Slides



# Applications of RNP Criteria

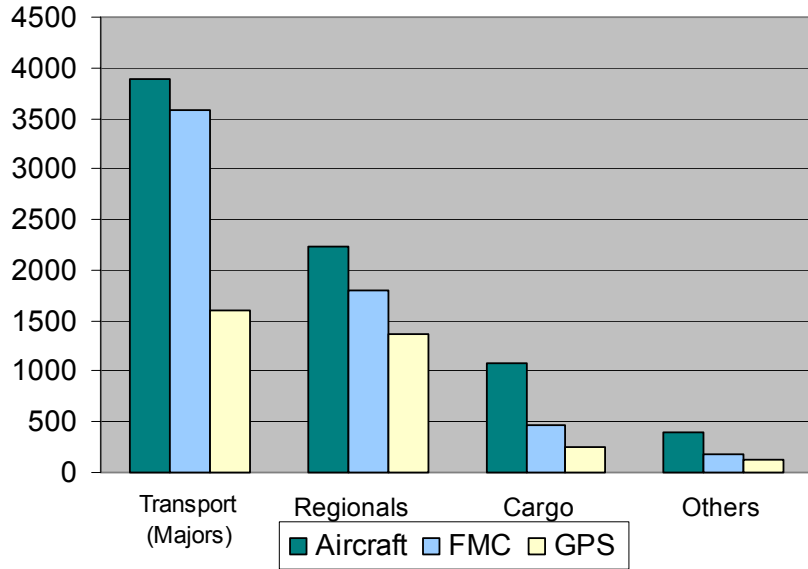
## Preliminary Analysis at Top 100+ Airports

Parallel Operations	Converging Operations	Adjacent Airport Operations	Single Runway Access
<p>10 to 15 Top Airports</p>	<p>15 to 20 Top Airports</p>	<p>10 to 15 Top Airports</p>	<p>Several hundred runway ends</p>
<p>Arrival capacity gains up to 60% over single runway operations</p>	<p>Arrival capacity gains up to 50% over single runway operations</p>	<p>Increased arrival and departure rates for adjacent airports involved</p>	<p>Approach minimums lower than existing minima</p>



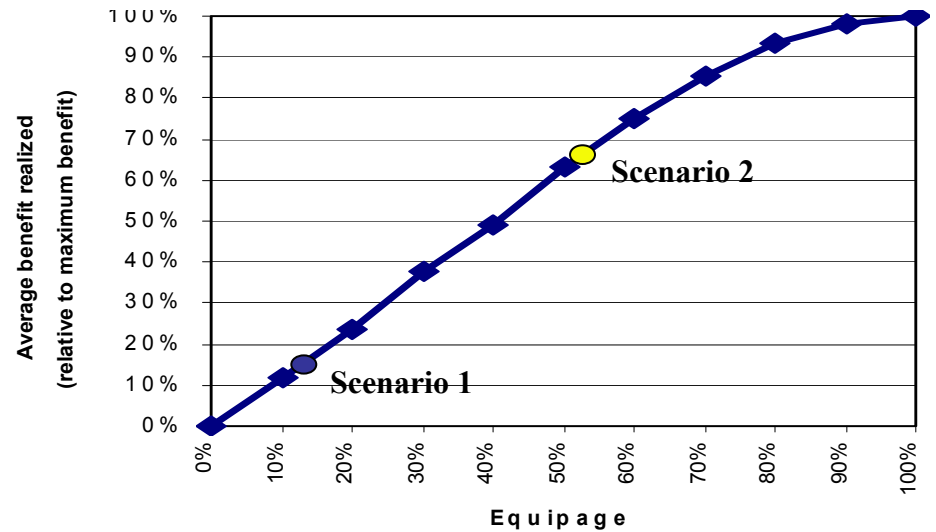
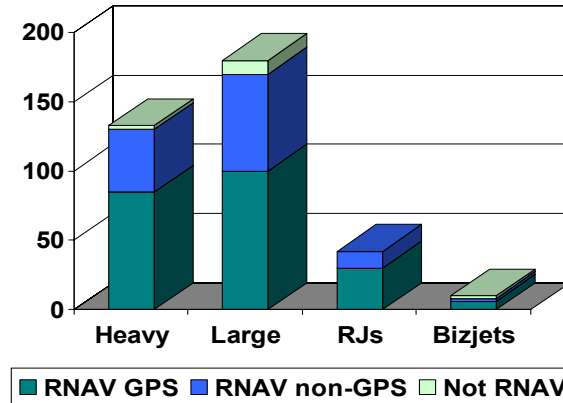
# Analysis of Equipage Levels

**NAS: Approximately 7600 Registered Transport and Regional Aircraft in U.S.**



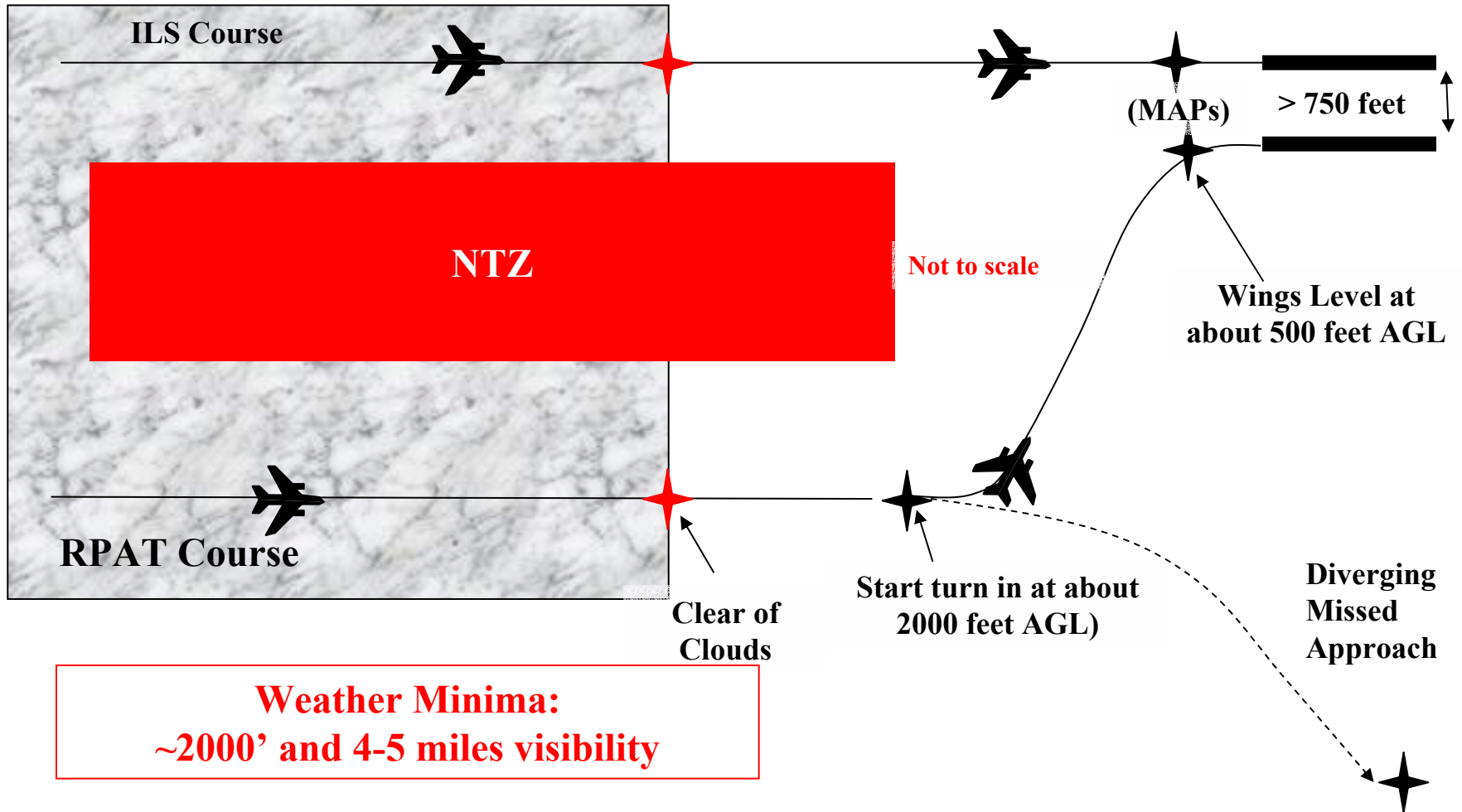
## JFK Arrivals

**95% RNAV Capable (2/3 GPS)**





# RNP Parallel Approach Transition (RPAT)



## APPENDIX E

### GUIDELINES FOR UNIFORM IMPLEMENTATION OF RNP OPERATIONS

#### 1. Introduction

Many different perspectives within the international civil aviation community and among individual States on several aspects of required navigation performance (RNP) and, in particular, the naming convention associated with it, have led to some confusion regarding concepts, terminology and definitions. Consequently, a divergence of implementation resulted in a lack of harmonization between RNP applications. Without immediate action, the danger exists that increasing disparity with implementation will continue.

Therefore, the Secretariat, with the assistance of a study group, developed these guidelines in order to ensure a common understanding of RNP and the relationship between RNP and area navigation (RNAV) system functionality, thereby facilitating global harmonization of existing implementations and creating a basis for harmonization of future operations. The guidelines still need to be further developed for the approach phase of flight.

Development of amendment proposals to relevant ICAO provisions will be accomplished later in the year with an applicability date of November 2006. The RNP Manual (Doc 9613) is also being updated by the Secretariat with the assistance of the study group. In the meantime, these guidelines may be used with States and within the planning and implementation regional groups (PIRGs) in anticipation of expected approval so as to avoid further proliferation of RNP implementation.

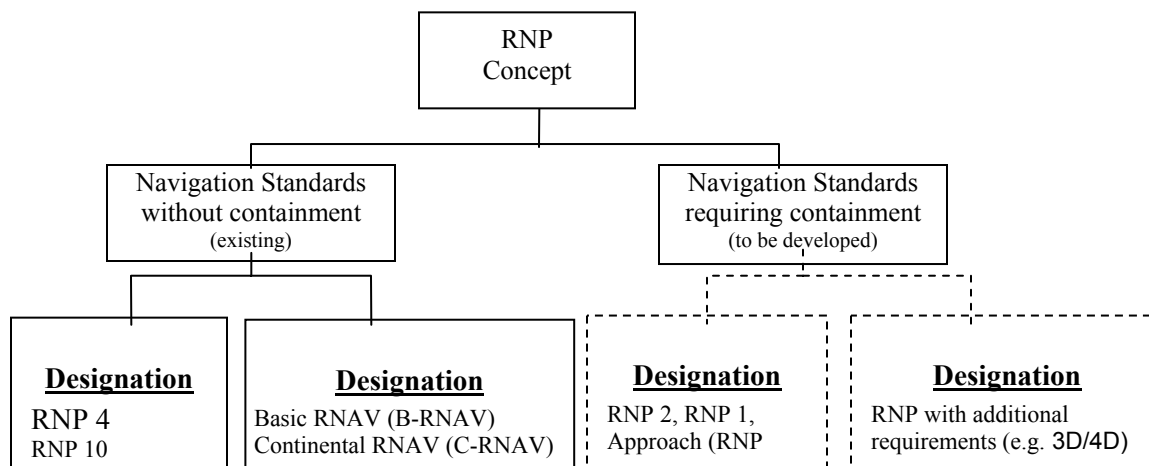
#### 2. Description

At its highest level, RNP refers to the definition of navigation performance and functional requirements for an operation and thus applies to and affects both the airspace and the aircraft. This concept is realized and used in clearly defined navigation applications. A navigation application consists of a navigation standard and an associated operating environment.

While the differences between the existing RNP Concept and its present implementation in demanding operating environments are significant, these differences are not as apparent in less demanding operating environments. Mindful that most existing continental area navigation applications are currently used in demanding operating environments and that it is reasonable to assume that such environments will need to be addressed in many of the expected future en-route and terminal airspace applications, the existing RNP Concept has been elaborated upon with a view to ensuring the maximum coherence between existing navigation standards and future navigation applications.

As such, the revised RNP Concept distinguishes between navigation standards that **do not** require containment integrity and continuity, which are to be designated as “X-RNAV” where “X” is a letter of the Roman alphabet, and those navigation standards requiring containment integrity and continuity, which are to be designated as “RNP-x”, where “x” corresponds to the navigation accuracy.

There will be an increasing demand for navigation applications that take advantage of the higher performance capabilities of aircraft (including containment continuity and integrity requirements), and that will allow for future developments, including the ability to rely upon such navigation capability for critical applications such as reduced separation minima in high-density airspace and for approach procedures.



**Figure 1. Overview of revised ICAO RNP Concept**

### 3. Areas of Application of the revised approach to RNP

*En route-oceanic or En Route-Remote Continental.* For these areas of application, existing RNP-10 and RNP-4 navigation standards, requiring long-range navigation functionalities, fulfill operational requirements. Currently, it is not anticipated that new navigation standards for this area of application will be required.

*En Route-Continental.* Currently, two regional navigation applications without containment requirements have been established, one in Europe, called Basic-RNAV and one in the Middle East, called RNP-5. As RNP-5 is fully based on Basic-RNAV, and taking into consideration the agreement by the group that operations without containment should not be designated RNP, continental navigation applications requiring 5 NM accuracy should be designated Basic-RNAV.

The navigation application in the Middle East will therefore be revised. It is envisaged that this will have little impact on operations.

*Terminal - Arrivals and departures.* To satisfy terminal airspace requirements, several regional implementations of navigation standards are currently in existence or under development (USRNAV type B and European P-RNAV). In order to ensure global interoperability, the study group agreed to harmonize these regional navigation standards under one global standard to be called Terminal-RNAV (T-RNAV). Aircraft certified to this T-RNAV navigation standard will be able to operate in airspace currently requiring either P-RNAV or US RNAV Type B. Similarly, a new navigation standard to be known as Continental RNAV (C-RNAV) is being developed for applications requiring 2 NM accuracy, that may be applied in continental en-route as well as in terminal airspace. It is expected that this navigation standard will be based on US RNAV type A.

Table 1. Operations under current situation and under new RNP concept.

<b>Area of Application</b>	<b>RNP value</b>	<b>Designation of navigation standard: Current situation</b>	<b>Designation of navigation standard: new RNP concept</b>
Oceanic/Remote	10	RNP 10	RNP 10
	4	RNP 4	RNP 4
En-Route/Continental	5	RNP 5 Basic RNAV	Basic RNAV
En-Route Continental and Terminal	2	USRNAV type A	Continental RNAV
Terminal	1	USRNAV type B P-RNAV	Terminal RNAV

The United States and Eurocontrol have agreed to identify ways by which it will be possible to migrate over time towards the T-RNAV standard. With immediate effect, however, any State excluding the United States or one of the ECAC member states that seeks to implement operations in their airspace using the equivalent of either the United States or European Terminal navigation standard as described in Table 1 should use the T-RNAV navigation standard which will be published in the revised RNP manual (Doc 9613). The United States and Eurocontrol have agreed that aircraft and operators approved for T-RNAV operations by their State of registry will also meet the requirements for operation in the United States USRNAV type B and European P-RNAV airspace.

*Terminal - Approach operations.* To date, approach navigation applications are sensor specific, requiring separate design for an increasing number of RNAV applications (VOR/DME, DME/DME, Basic Global Navigation Satellite System (GNSS), Satellite-Based Augmentation System (SBAS), Ground-Based Augmentation System (GBAS), etc.). This is not desirable, as it requires extensive commitment of resources for procedure development and publication, and results in operational inflexibility. Therefore, it will be required to apply the RNP concept to the approach phase of flight. Considering the criticality of this phase of flight these types of navigation applications will all require containment if operational benefits are to be achieved. The RNPSORSG is in the process of developing relevant operational requirements.



**Agenda Item 2: Evaluation of RNP 10 Pre-Operational Implementation in the Santiago de Chile-Lima segment of parallel routes UL 780 and UL 302**

**RNP 10 definitive operational implementation in the Santiago de Chile/Lima segment of parallel routes UL 780 and UL 302**

2.1 The meeting took note of the results obtained during the successful RNP 10 pre-operational implementation in the Santiago de Chile/Lima segment of parallel routes UL 780 and UL 302, carried out on 22 January 2004, as well as the results of the assessment made by CARSAMMA on the air traffic sample collected between 15 March and 14 April 2005, through which it can be observed that in spite of the 12.86% of air traffic increase in such route segment, no deviations larger than 10 NM have been recorded in lateral navigation, and that referred airspace continue to be operationally safe, in view of which, the meeting considered convenient its definitive operational implementation, formulating the following conclusions:

**Conclusion AP/ATM/10/9 RNP 10 definitive operational implementation in the Santiago de Chile/Lima segment of parallel routes UL 780 and UL 302**

That Chilean and Peruvian Administrations, publish their corresponding AIP Supplements with effective date 25 November 2005, minimal anticipation of three AIRAC cycles, in order to definitely implement RNP 10 in the Santiago de Chile/Lima segment of parallel routes UL 302 and UL 780.

**Conclusion AP/ATM/10/10 Reports on lateral deviations larger than 10 NM and LHD**

That Chile and Peru Administrations continue sending to CARSAMMA their reports on lateral deviations larger than 10 NM as well as Large Height Deviations (LHD), in order to continue with airspace operational safety monitoring in the Santiago de Chile/Lima segment of parallel routes UL302 and UL780.

**Minimal Longitudinal Separation of 50 NM**

2.2 Likewise, the meeting took note that, although operational advantages obtained with the RNP 10 implementation in this segment of routes, when analyzing feasibility for the implementation of the minimal longitudinal separation of 50 NM, it has been identified that to the North of Lima the expected operational advantages decrease, since from these two routes, indistinctly the Caribbean and North America, only one is available from Lima. Therefore, the independent and exclusive utilization of this separation, in one of these segment routes, would result in delay for the users and in a larger workload for air traffic controllers.

2.3 In attention to the limited benefits of the 50 NM longitudinal separation reduction, in the segment Santiago de Chile/Lima, in parallel routes UL302 and UL 780, the meeting formulated the following conclusion:

**Conclusion AP/ATM/10/11**

**Delay in the studies for the 50 NM of longitudinal separation implementation in the segment Santiago Chile/Lima routes UL 302 and UL 780**

That, in view of the reduced operational advantages that would be obtained, the studies for the 50 NM of longitudinal separation implementation in the segment Santiago Chile/Lima routes UL 302 and UL 780 be delayed until agreements are established for its application on the basis of a CAR/SAM regional implementation.

**Agenda Item 3: Review of RVSM issues in the CAR/SAM Regions****a) ATC Operations Working Group (ATC/WG)**

3.1 The meeting noted that the RVSM had been successfully implemented at 09:01 UTC of 20 January 2005, according to the guidelines established in each of the stages of the Action Plan for the RVSM Implementation in the CAR/SAM Regions. Information was provided on the various tasks related to the national programmes implemented by the States/Territories/International Organizations. The ICAO Council, recognising the effort made by all the parties involved, addressed a letter of congratulations for the success obtained, highlighting regional cooperation in this implementation programme. **Appendix A** contains the aforementioned letter.

**Relevant aspects during implementation**

3.2 According to the information provided by the Administrations, some inconveniences and lack of coordination could be noticed at the beginning; however, up to date no notification has been received on similar situations, and the coordination between the adjacent ACCs and other ATS dependencies is being carried out normally and without major problems.

3.3 The meeting recognised and emphasized that the success obtained in the RVSM implementation in the CAR/SAM Regions is due to the intense work, effort and regional collaboration carried out during four years between the Administrations, air navigation service providers, aircraft operators and airspace users, as well as to the support provided by Regional Project RLA/98/003 “Transition to CNS/ATM Systems in the CAR/SAM Regions”.

3.4 The meeting noted that the implementation in Argentina was carried out keeping with the RVSM implementation criteria and forecasts unanimously agreed by the CAR/SAM Regions.

3.5 It was recalled that these regional criteria stipulate that only RVSM-approved aircraft on international flights will be allowed to operate in flight levels 290 to 410.

3.6 Since the beginning of RVSM operations to date, there have been no significant problems calling for modifications to the procedures originally established. In general, it is foreseen that the results will meet the expectations in terms of operational improvement and efficiency.

3.7 In light of the advantages of having new flight levels available, the airlines, together with the aeronautical authority, made great efforts to obtain RVSM approval for most of the aircraft fleet.

3.8 The progress made to date and the incentive of new technological advantages might be hindered by the adoption of measures, which might defeat what has been regionally agreed and established in the Regional Supplementary Procedures.

3.9 In view of the above, the meeting agreed that it is appropriate to insist on the application of procedures related to the use of RVSM airspace by RVSM-approved aircraft on international flights, maintaining the exceptions related to State aircraft, maintenance and humanitarian flights, formulating the following conclusion:

**Conclusion AP/ATM/10/12****Compliance with international agreements on RVSM**

States are encouraged to comply with international agreements regarding the use of RVSM airspace, informing on any abnormal situation to ICAO.

3.10 The Meeting was informed that during the first month of application of the RVSM in Chilean FIRs, Santiago ACC performed an evaluation of RVSM operations conducted, selecting one day of each week, considering the following aspects:

- Flight Plan Completion
- Phraseologies
- Number of RVSM approved/ Non –Approved aircraft
- Occupation of flight levels.
- Large height deviations. (LHD)
- Compliance with Letters of Agreement with adjacent international ACCs and FIRs.

3.11 With regard to the information related to flight plan completion, the main remarks refers to the duality of information concerning the certification status indicated in this document, by some international non-scheduled operators who file two or more flight plans for the same flight indicating a different certification status.

3.12 Considering that, in general, there is no information exchange between the Administrations for verifying the certification status of aircraft using the RVSM air space and that this information relies on information provided by the operator on the flight plan, it is essential to establish mechanisms that make it possible to know in advance and opportunely the RVSM approval status of these flights. This dual information produces confusion and uncertainty since when the ATC requests confirmation to the pilot, he usually answers that it is RVSM approved.

3.13 Among the measures taken to solve this situation it is proposed to activate the regional data base according to the information provided by each State to CARSAMMA. As an additional supplementary measure, considering that many States require previous notice of operation or overflight or arrival authorization it is proposed to require specification of the RVSM approval status in this application for operation.

3.14 The infrequent or almost inexistent use of required phraseologies by the pilots of non RVSM approved aircraft is something that must be improved. In this connection, the meeting agreed to again encourage users operating domestic flights in RVSM airspace with non-RVSM approved aircraft, to provide training to flight crews.

3.15 The meeting noted that Brazil in choosing a non exclusive RVSM airspace lead to the necessity of a close follow-up of the RVSM operations, with the objective to identify failures in the several elements of the Air Traffic Control that could cause a reduction in the safety in the Brazilian Airspace.

3.16 Thus, the Brazilian Administration developed a RVSM Operations Follow-up Program, trough the establishment of periodic reports to be fulfilled by the ACC, with the objective of obtaining information allowing for the adoption of early action, in order to avoid the reduction in safety. Thus, the meeting agreed to formulate the following conclusion:

**Conclusion AP/ATM/10/13****Follow-up of RVSM operations**

CAR/SAM States and International Organizations are encouraged to closely follow-up RVSM operations, mainly those which did not adopt a non-exclusionary RVSM airspace.

3.17 Besides, the RVSM Operations Program was established with the objective of opening a communication channel between the Air Traffic Controller and the group responsible by RVSM implementation, in order to obtain suggestion for the improvement of the RVSM Operations. The follow-up programme of Brazil is shown in **Appendix B** to this part of the report.

3.18 The meeting took note that, with the intention of carrying out a post-implementation assessment of RVSM in the Asuncion FIR, and with the purpose of observing the development of the technical personnel involved, as well as of the application of operational procedures and concepts inherent to RVSM, a survey has been carried out in order to observe and evaluate the results obtained up to date.

3.19 The results obtained made possible to carry out an ample analysis oriented towards two different aspects:

- a) In the first place, the availability of guidance and information material about the RVSM in the CAR/SAM Regions that are available in different units of the ATC services involved can be observed.
- b) The second place, the application of operational concepts, standards, methods and recommended practices in the rendering of ATS services within the different ATS bodies in the Asuncion FIR and in the coordination processes with adjacent control centers, making possible the continuity of the services, can also be observed.

3.20 **Appendix C** presents the summary of answers obtained to the survey carried out by Paraguay, as well as its respective analysis.

3.21 The meeting was informed that the implementation in Rochambeau FIR was carried out successfully at 09:01 UTC of 20 January 2005, following the guidelines established in each of the stages of the Action Plan for the RVSM Implementation in the CAR/SAM Regions. Also the meeting noted the valuable information regarding the distribution of air traffic in the Rochambeau FIR since the RVSM implementation, which is attached as **Appendix D**.

3.22 The meeting noted that Uruguay implemented successfully RVSM in spite of the doubts presented during the AP/ATM/9 Meeting by the delegation of IFATCA at that time. In this connection, IFATCA recognised the work carried out in this implementation programme.

3.23 Mexico and COCESNA also informed the meeting that the RVSM implementation was carried out without difficulties or inconveniences with domestic or international flight, informing that the air traffic controllers are very satisfied with this programme.

### **Aeronautical Phraseology related with RVSM**

3.24 The United States presented to the meeting a problem identified with the use of the term: “Confirm RVSM approved” in which the word “approved” is used as an affirmative response by ATC to a request pilot action such as approval for deviation around weather.

3.25 Air Traffic Controllers in the United States have reported cases in which pilots have inadvertently believed a request action has been approved by ATC and manoeuvred the aircraft accordingly. This poses a potential safety issue requiring action by FAA. The United States informed to the meeting that a definitive solution has not been identified.

3.26 The meeting felt that while this difficulty had not affected other States in the CAR/SAM Regions, and therefore this matter should be more thoroughly investigated. In this sense, the meeting agreed to formulate the following conclusion:

#### **Conclusion AP/ATM/10/14**

#### **Use of the Term “Confirm RVSM approved”**

That ICAO evaluate if the term “confirm RVSM approved”, which has caused confusion among pilots in the United States, be modified or replaced by a different term.

3.27 The meeting noted that IFATCA, among other matters, shall analyse the issue of RVSM phraseology during the 16<sup>th</sup> Regional Meeting of the Federation (16<sup>th</sup> IFATCA RM/AMA/PANAMA 2005) to be carried out in Panama from 20 to 22 October 2005.

#### **b) Aircraft Operation and Airworthiness Working Group (OPS/AIR/WG)**

3.28 As a result of the comments made during the discussion of the respective documents, the following agreements and conclusions were reached.

#### **OPS/AIR aspects related to RVSM implementation in the CAR/SAM Regions**

3.29 Regarding OPS/AIR aspects related to RVSM implementation, the meeting analysed the various characteristics involved in the occurrence of different events and made the comments shown in the following paragraphs.

3.29.1 Regarding differences in the application of the requirements for RVSM operations, the participants recognised that these discrepancies could be due to lack of knowledge, insufficient training of the personnel working in the different areas involved not only in the approval process but also in operations and maintenance activities. They also considered that training efforts should continue to be made in order to improve the level of knowledge about the various aspects involved in RVSM operations.

3.29.2 The meeting recalled that the AP/ATM/7 report had stressed the need for States to establish special requirements to extend the application of training programmes to the crews of aircraft which could occasionally be accommodated in RVSM airspace. A similar concern is expressed in

paragraph 3.14 of this report, reason why the participants were informed that, in January 2005, the International Federation of Airline Pilots Association (IFALPA) had published Safety Bulletin N° 05SAB009, containing relevant information on RVSM implementation in the CAR/SAM Regions, and which is available at web page [www.globalpilot.org](http://www.globalpilot.org).

3.29.3 The meeting also took note of the information presented by Bolivia, which could be used by civil aviation authorities in the Region to improve the process of approval of training programmes for maintenance personnel, civil aviation operators and general aviation users. It was also noted that the Appendix to this paper could even be used for establishing the appropriate requirements for the issuance by the authorities of the corresponding licenses for technical maintenance personnel, and, for this reason, **Appendix E** is included in this part of the report. In view of the above, the meeting adopted the following conclusion:

#### **Conclusion AP/ATM/10/15**

#### **Improvement of RVSM-related training**

That the civil aviation authorities of the CAR/SAM Regions continue carrying out RVSM training activities aimed at improving the knowledge by operators, crew members, aircraft maintenance and flight plan processing personnel about the requirements to be met in the different areas for the conduction of operations in the cited airspace.

3.29.4 In order to respond to the requirements of various government institutions regarding RVSM approval of State aircraft, some criteria were analysed. The meeting agreed to profit from the experience gained by the authorities of Brazil and the United States, which, depending on the number of aircraft, involved the same approval process as the one used for commercial operators that have aircraft fleets, or, in the case of an individual aircraft, the letter of RVSM approval (LOA) process. In both cases, special attention should be paid to maintenance, monitoring and training aspects. With regard to maintenance requirements, these should the participation of an approved maintenance organization. Accordingly, the meeting agreed that said approval was possible, and adopted the following conclusion:

#### **Conclusion AP/ATM/10/16**

#### **RVSM approval of State aircraft**

That the civil aviation authorities of the CAR/SAM Regions, for purposes of RVSM approval of State aircraft and when responding to requests made by government bodies, initially, and until the appropriate provisions will be available, advise said bodies to apply the approval procedures used for civil aviation operators, stressing the need to comply with maintenance and training requirements.

3.29.5 Regarding the difficulties faced by various users to learn about the RVSM approval status of aircraft, as reflected in paragraphs 3.11, 3.12 and 3.13 of this report, the meeting recalled that one of the requirements contained in various RVSM implementation guidance documents was the creation of a State data bank (SDB), in which each aeronautical authority could register the approvals granted. Accordingly, the meeting formulated the following conclusion:

**Conclusion AP/ATM/10/17****Establishment of State RVSM data base (SDB)**

That the civil aviation authorities of the CAR/SAM Regions establish their own State data base (SDB) to facilitate the identification of the RVSM approval status of aircraft registered in the State, and, inasmuch as possible, make the information available through the internet.

3.29.6 The meeting went on to discuss the occasional request for documents showing the approval status of aircraft. Since a difference exists in the international requirements due that they do not call for the issuance of certifications to be carried on board by certified aero-commercial operators, although in the case of the general aviation a Letter of RVSM Approval (LOA) should be issued, the meeting agreed on the need for the operators to keep updated the Operation Specifications (OpSpecs), and, in the case of a general aviation operator, to have available a copy of the document granted by the civil aviation authority. Consequently, the meeting formulated the following conclusion:

**Conclusion AP/ATM/10/18****Update of operation specifications (OpSpecs) and other RVSM approval documents**

That the civil aviation authorities of the CAR/SAM Regions instruct their operators and users as to the convenience of keeping their operation specifications (OpSpecs) updated and, where appropriate, to have a letter of RVSM approval (LOA), suggesting that a copy of these documents be shown at the request of the civil aviation authorities of other States.

3.29.7 The participants took note that some aeronautical authorities had not contemplated the issuance of letters of RVSM approval (LOAs) for operations by general aviation aircraft. Consequently, they formulated the following conclusion:

**Conclusion AP/ATM/10/19****Issuance of a RVSM Letter of Approval (LOA)**

That the civil aviation authorities that have not yet incorporated the issuance of a RVSM Letter of Approval (LOA) into their regulations, consider the issuance of such letter to civil aviation operators using RVSM airspace, according to the model proposed in Advisory Circular AC 6.425 – RVSM.

3.29.8 Regarding the need to establish a common criterion for authorising maintenance flights, the meeting agreed that these flights referred to aircraft flying in an RVSM airspace sector with the purpose of obtaining or recovering the RVSM capability, during a period of time, without affecting the safety of aircraft already flying between FL290 and FL410. In this regard, the meeting took note of guidance documents that reflected the criterion adopted by the meeting on this topic, for use by the inspectors of the United States Federal Aviation Administration (FAA).

3.29.9 When discussing the need to establish a process for amending the minimum monitoring requirements (MMR) table to include aircraft that have recently obtained their type certificate (TC), the

meeting reviewed the information presented by CARSAMMA. In this regard, the meeting stated the following:

- a) the proposed MMR table, included in **Appendix F** to this part of the report, should be revised to include aircraft types which have been withdrawn or omitted, matching these data with the description by the monitoring group, and
- b) the monitoring period shown in the aforementioned table corresponds to the date of the monitoring flight and not to the date in which the monitoring results should be received.

3.29.10 It was also recalled that the aforementioned document stipulated that the monitoring activities conducted in one region can be used to meet the monitoring requirements of the CAR/SAM Regions, where there is no requirement for repeating the initial monitoring on a periodic basis. It was also highlighted that the renewal date of the RVSM Letter of Approval (LOA) should not be confused with the date of the next monitoring flight.

#### **Future work of the OPS/AIR group**

3.30 Regarding the next meeting, the meeting was informed that the announcement of the AP/ATM/11 meeting, scheduled for September, would be sent to the authorities three months prior to the date of the meeting, and that a seminar would be conducted to disseminate basic knowledge on RNAV/RNP implementation, in which the participation of speakers from CAR/SAM civil aviation authorities was expected, under the sponsorship of Regional Project RLA/98/003. In this sense, the members of the OPS/AIR group expressed their interest in participating in said event, given the need to be involved in RNAV/RNP implementation from its initial stages.

#### **Establishment of the scrutiny group**

3.31 The meeting approved the inclusion of operations (OPS) and airworthiness (AIR) experts in the composition of the scrutiny group, since the LHD code table includes aspects related to airworthiness and aircraft operations.

#### **c) Safety and Airspace Monitoring Working Group (SAM/WG)**

##### **Safety assessment**

3.32 The summary of the safety assessment was analyzed by the group and all the parameters verified.

3.33 It was verified that the values of the parameters after the RVSM implementation in January 2005, went down and the technical collision risk remains below the Target Level of Safety (TLS) of  $2.5 \times 10^{-9}$  fatal accidents per flying hours. Its value is  $0.098 \times 10^{-9}$ .

3.34 Analyzing the operational collision risk, the group took note of the methodology used and verified that the biggest part of the collision risk in the CARSAM Region still comes from the errors that cause deviations from the cleared flight level of 1000ft or more, having the coordination errors between ATC Units as the major reason for the risk.

3.35 The group remarked that to solve the main cause of the risk it is necessary that States/Territories/International Organizations take effective actions to reduce the errors in coordination messages between ATC Units as a matter of urgency.

3.36 It was informed to the group that the methodology used to evaluate the risk due to an aircraft levelling in wrong flight level took into consideration the direction of the flow. Thus the group conducted two different analyses resulting in different collision risk results for aircraft levelling at the wrong flight level in the same direction of the flow and at the wrong flight level in the opposite direction of the flow. The final results for the technical and operational risks are expressed in the table below and confirm that the risks remain below the TLS after the implementation.

Technical Risk	Operational Risk	Total Risk
$0.098 \times 10^{-9}$	$1.9 \times 10^{-9}$	$2.0 \times 10^{-9}$

3.37 The group analyzed the method used to calculate the probability of lateral overlap and considering the influence of lateral performance navigation of the aircraft in this parameter and in the collision risk, and the value assumed in the safety assessment. Considering this, the Group agreed that CARSAMMA should evaluate the possibility to carry out that task and agreed with the following conclusion:

#### **Conclusion AP/ATM/10/20**

#### **Evaluation of lateral navigation performance**

That CARSAMMA evaluates the possibility to verify the lateral performance navigation of the aircraft flying in the CARSAM Region using radar data.

#### **Minimum Monitoring Requirements (MMR) chart**

3.38 The Group analyzed the MMR chart presented by CARSAMMA and prepared by CARSAMMA, EUROCONTROL and NAARMO.

3.39 The idea was to present to the authorities the MMR chart updated according to the new types of aircraft produced by the industry and to include some missing aircraft. In the same way and considering the coordination with the industry, some aircraft had their status changed, e.g A30B, A306, that now are considered separate groups.

3.40 The update table is in Appendix F to this part of the report and the group agreed with the following conclusion.

#### **Conclusion AP/ATM/10/21**

#### **MMR chart**

That States/Territories/International Organizations update their Minimum Monitoring Requirements according to the chart presented in Appendix F to this part of the report.

#### d) Scrutiny Working Group (GTE)

3.41 The SAM-WG, together with the CAR/SAM Scrutiny Working Group (SWG), analysed LHD-related matters and their impact on the collision risk, as well as the work programme for the Scrutiny working group. The members attending this first Scrutiny Working Group session received a general briefing on the work process of other regional scrutiny groups.

3.42 After the briefing, the members made many comments and suggestions to begin adapting the operation of this Scrutiny Working Group to the CAR/SAM Regions.

3.43 Then, the Scrutiny Working Group took note of the information provided by CARSAMMA regarding the relationship between LHDs and the operational risk. A review of the data revealed that errors in ATC-unit-to-ATC-unit traffic messages generated 86% of the large height deviations in excess of 1000 feet reported in the Regions. The group agreed that some remedial action had to be taken to reduce the number of LHDs caused by errors in ATC-unit-to-ATC-unit coordination messages.

3.44 Several remedial measures to reduce this type of error were discussed. The group examined a solution proposed by the IFALPA representative, which consisted in requiring all pilots to notify the air traffic unit of the receiving FIR 10 minutes before crossing the FIR boundary, indicating their estimated time of arrival at the FIR boundary and their flight level. Likewise, in special cases where the departure aerodrome was located close to the FIR boundary, pilots should notify the receiving ATS unit as soon as possible after take-off.

3.45 The meeting discussed this proposal at length, analysing the advisability and the advantages and disadvantages of such a measure. The meeting recognised that LHD caused by *errors in ATC-unit-to-ATC-unit coordination messages* during the process of traffic coordination required urgent action by ATS service providers, and that this topic had been discussed at previous meetings, especially at the AP/ATM/9 meeting, which formulated Conclusion AP/ATM/9/4 (AP/ATM/9 report, paragraph 1.7), requesting the States/Territories/International Organisations to adopt short- and medium-term preventive and corrective measures to reduce operational errors in the ATS coordination loop.

3.46 The meeting felt that, since these errors in the ATS coordination loop had a direct impact on safety, the CAR/SAM States/Territories/International Organisations should commit to the urgent adoption of the measures referred to in said conclusion, in order to drastically and significantly reduce the occurrence of this type of errors. For ease of reference, the aforementioned conclusion and the associated appendix appear in **Appendix G** to this part of the report.

3.47 In view of the above, the meeting agreed to formulate the following conclusion:

**Conclusion AP/ATM/10/22****Measures to reduce operational errors in the ATC coordination loop between adjacent ACCs**

That, taking into account the impact that operational errors in the ATC coordination loop between adjacent ACCs have on safety:

- a) the CAR/SAM States/Territories/International Organisations agree to adopt, as a matter of urgency, the appropriate measures described in **Appendix G**, in order to reduce LHDs caused by *errors in ATC-unit-to-ATC-unit coordination messages* during the process of traffic coordination by at least fifty percent by December 2005; and
- b) ICAO coordinate, assist in, and follow-up the implementation of such remedial action and report to AP-ATM-12 the results of the effort to reduce this error.

3.48 Considering the importance of LHDs, both the SAM-WG and the SWG agreed that States/Territories/International Organizations should do their utmost to send to CARSAMMA the LHD reports, and formulated the following conclusions:

**Conclusion AP/ATM/10/23****Large height deviation (LHD) reports**

That States/Territories/International Organizations do their utmost to send to CARSAMMA the LHD reports by the 10<sup>th</sup> of each month, even if no deviations have occurred.

**Conclusion AP/ATM/10/24****Information contained in large height deviation (LHD) reports**

That States/Territories/International Organizations, when completing the LHD form, fill in all the fields in order to permit an adequate analysis and the determination of the time spent by the aircraft in a wrong flight level or altitude.

3.49 Upon analysing the codes used by CARSAMMA to classify LHDs, the Scrutiny working group agreed to add a new code to take into account those LHDs whose cause could not be determined. The new classification should be Code P and the description UNKNOWN.

3.50 Likewise, in order to make it clear that LHDs would only be collected between flight levels 290 and 410, inclusive, the group agreed to introduce a minor change in the form used to report LHDs, as shown in **Appendix H** to this part of the report.

3.51 The groups discussed the need to keep confidential the LHD reports submitted to CARSAMMA, and formulated the following conclusion:

**Conclusion AP/ATM/10/25****SAM and SWG reports**

That all future SAM and SWG reports contain only de-identified data.

3.52 The groups, with the participation of the States/Territories/International Organizations listed in the terms of reference of the CAR/SAM RVSM Scrutiny Working Group approved by GREPECAS (see **Appendix I**), analysed the best way of classifying LHDs and of estimating the time spent by an aircraft in a wrong flight level, as well as the number of flight levels crossed without ATC clearance. The groups agreed to the proposal contained in **Appendix J** to this part of the report, and formulated the following conclusion:

**Conclusion AP/ATM/10/26**  
**level****Estimate of the time spent by an aircraft in a wrong flight**

That CAR/SAM States/Territories/International Organizations, when estimating the time spent by an aircraft in a wrong flight level for purposes of informing CARSAMMA, consider the diagram and the definitions shown in **Appendix J** to this part of the report.

3.53 The group examined the proposal contained in WP/16 to change the Spanish name of the Scrutiny working group. After formulating the necessary considerations and consultations, the group agreed to keep the name “Grupo de Trabajo de Escrutinio”, using the abbreviation GTE.

Ref.: SWG 16/1

18 February 2005

Representatives of Argentina, Austria\*, Brazil, Canada, Chile, Colombia, France\*, Honduras, Mexico, Peru, Saint Lucia, United Kingdom\*, United States on the Council of ICAO

Resident Non-Council Members: Antigua and Barbuda, Belize, Costa Rica, Cuba, Ecuador, Uruguay

Dear Sir/Madam,

Please allow me to congratulate you and the respective civil aviation authorities on supporting and participating in the implementation of reduced vertical separation minimum (RVSM) in the airspace of South America, the Caribbean, Central America and North America effective 20 January 2005. This RVSM project, which was a part of the overall regional vision, was successfully implemented thanks to the well functioning regional and interregional planning and implementation mechanism. It is also a significant step in global cooperation with Contracting States and airspace users to maximize operational benefits as well as to reinforce safety as a high priority.

I take this opportunity to acknowledge with thanks the unstinting support provided by your State in furthering the development of the regional air navigation infrastructure, which has resulted in increased safety, efficiency and regularity of air transport operations. This support has been greatly appreciated by the ICAO Regional Offices in Lima and Mexico.

Yours sincerely,



Tajeb Chérif

bcc: ICAORDs Lima and Mexico ✓  
C/RAO

\*With regard to the Territories located in the Caribbean and South American Regions

## APPENDIX B

### 1. RVSM Operations Follow-up Program

1.1 The RVSM Operations Follow-up Program was constituted by periodic reports, that involve the following items:

1.2 Mistakes made by Air Traffic Controllers, due to RVSM application, particularly for the accommodation of non RVSM approved aircraft.

1.3 ATC incidents occurred due to RVSM application, particularly for the accommodation of non RVSM approved aircraft.

1.4 Specific situation of accommodation of non RVSM approved aircraft, that must be analyzed by ATC.

1.5 Non RVSM approved aircraft that couldn't be accommodated in the RVSM Airspace.

1.6 Suggestion of:

- Changing in the Rules and Procedures
- Changing in the Letters of Agreement.
- Changing in the ACCs Standard Procedures.
- New Requirements for the ATC Systems.

1.7 So far, Department of Airspace Control (DECEA) has received the reports of the following periods:

- 20/21 January 2005 (Transition Report)
- 22 to 27 January 2005
- 28 January to 04 February 2005
- 05 February to 20 February 2005
- 21 February to 20 March 2005
- 21 March to 20 April 2005

### 2. Summary of data obtained through the ACCs Reports

2.1.1 Mistakes made by Air Traffic Controllers

2.1.2 The only mistake made by Air Traffic Controller was the no individual coordination of non RVSM approved aircraft in the RVSM Airspace, independently of the automatic transfer of the aircraft between adjacent sector/ATC facilities. This error was corrected in the first's days of RVSM Implementation.

2.2 **ATC incidents occurred due to RVSM application**

2.2.1 There was no ATC incidents occurred due to RVSM application

2.3 **Specific situation of accommodation of non RVSM approved aircraft, that must be analyzed by ATC**

2.3.1 In some boundaries between FIRs (FIR AZ/FIR RE and FIR AZ/FIR BS) were detected some problems in the accommodation of non RVSM approved Aircraft, due to lack of radar coverage. The applicable procedures were adjusted in the first's days of implementation, mainly to maintain the flight level allocated to the non RVSM approved aircraft, trough areas without radar coverage.

2.4 **Non RVSM approved aircraft that couldn't be accommodated in the RVSM Airspace.**

2.4.1 Almost all non RVSM approved aircraft were accommodated in the RVSM Airspace. Few exceptions occurred in the airspace mentioned in item 3.3.1

2.5 **Air Traffic Controllers Suggestions**

2.5.1 **Rules and Procedures**

2.5.1.1 Due to the lack of radar coverage in some areas of Brazilian Airspace, that obliged the changing in the flight level allocated to the non RVSM approved aircraft, trough areas without radar coverage, the air traffic controllers made a suggestion of changing the requirement of radar coverage to clear the entrance of non RVSM approved aircraft into RVSM Airspace.

2.5.1.2 It was observed the uncorrected use of phraseology by the pilots, mainly when informing the RVSM approval status of the aircraft. It was taken all the measures by the Brazilian Civil Aviation Authority in order to ask actions from the main Brazilian aircraft operators.

2.5.1.3 At the beginning of implementation some non RVSM Aircraft, performing international flights, were cleared to fly in the RVSM airspace, inside Brazilian Airspace. This problem was corrected and non RVSM Aircraft, performing international flights, is not being cleared to fly in the RVSM airspace.

2.5.2 **New Requirements for the ATC Systems**

2.5.2.1 The Air Traffic Controllers made a suggestion of changing the color applied to Non RVSM approved aircrafts, in the presentation on the radar screen.

2.5.2.2 Some failures in the tools already installed were detected. These failures were already corrected.

## APPENDIX C

### Summary of replies

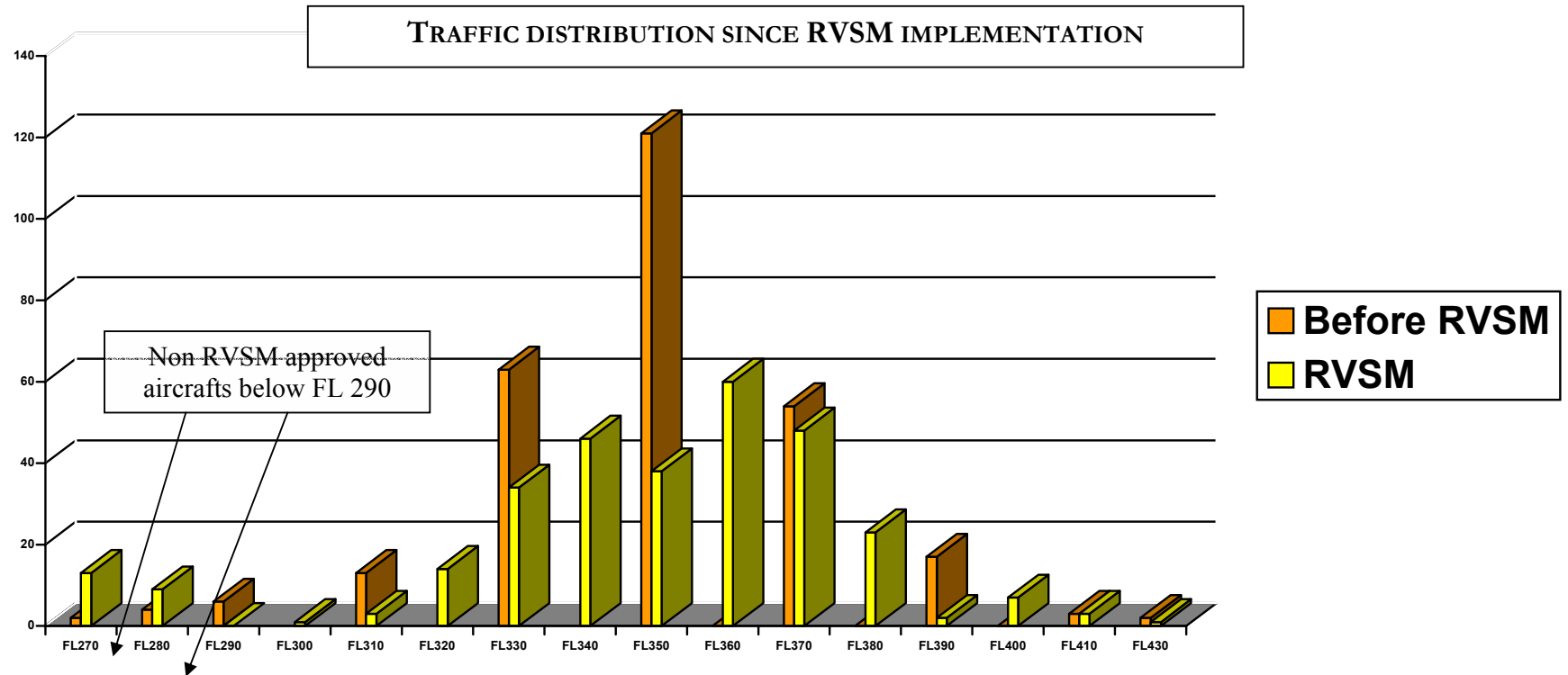
#### RVSM Post-implementation assessment in Asuncion FIR

QUESTIONS		ANSWERS				
N°	SUBJECT	YES	NO	NOT APPLICABLE	NOT REPLIED	TOTAL
1	Does your unit have copies of standards and documents regulating RVSM?	16	0	0	0	16
2	Does your unit have copies of the AIC/ NOTAM/ AIP Supplement / Letters of Operational Agreement RVSM operations Contingency Plan?	16	0	0	0	16
3	Do you need more reference documents at your unit? If the answer is yes, indicate which document/s you need.	04	12	0	0	16

QUESTIONS		ANSWERS				
SUBJECT	YES	NO	NOT APPLICABLE	NOT REPLIED	TOTAL	
4	Are RVSM aircraft adequately identified in flight plans?	14	01	0	01	15
5	Is setter "W" used in FPV?	14	02	0	0	16
6	Does phraseology used enable a clear understanding in both sides? If the answer is no, please clarify the disagreement providing an alternate phraseology in your clarification.	16	0	0	0	16

QUESTIONS		ANSWERS				
SUBJECT	YES	NO	NOT APPLICABLE	NOT REPLIED	TOTAL	
7	Have you experienced any operational problem? If the answer is yes, briefly describe	01	15	0	0	16
8	Do you have any difficulty identified in coordination processes between units of your working environment? If the answer is yes, please indicate which ones.	03	13	0	0	16
9	Do you have any difficulty identified in the coordination processes between adjacent control centers? If the answer is yes, briefly indicate which ones.	01	15	0	0	16
10	Has the preparation received been adequate?	16	0	0	0	16
11	Do you think updating courses related with RVSM are appropriate? If the answer is yes, indicate which aspects do you think should be dealt with.	04	12	0	0	16

# RVSM



## APPENDIX E

### Proposal of amendment to Section J, item f, of AC 6.425

- f. Initial theoretical training – Maintenance personnel - In addition to that specified in item b of this section, training must take into account the analysis of the use of the knowledge acquired in the course, and the analysis of the group to be trained.
1. In the analysis of the use of the knowledge acquired, note should be taken of the work, function or position of the individuals receiving the training. This will be important at the time of assessing the depth at which certain issues must be discussed.
    - i. When the course is addressed to maintenance and/or dispatch personnel, emphasis should be placed on the changes made to the MEL, policies and procedures, allowable skin distortion in critical areas (for conducting visual inspections), etc.
    - ii. If the course is addressed to aircraft and operator certification personnel (generally avionics engineering personnel), it should include more detailed discussions on RVSM equipment tolerances, SB and SL interpretation, STC details applied to meet RVSM requirements, etc.
  2. In the analysis of the group to be trained, consideration should be given to instruction and training received, on-the-job experience, and acquired skills. The minimum content included in this proposal has been prepared in the understanding that the group receiving training is required to have the knowledge of an average aeronautical technician, with knowledge on aircraft inspection, its systems, maintenance programs, use and application of maintenance data, record keeping, use of test equipment, etc.
  3. Section J, item b, deals with the general aspects to be covered. In addition to this, when defining the national regulatory requirements, there should be a more in-depth discussion of RVSM definitions, the details of the required equipment and its tolerances, and aircraft and operator approval aspects.
  4. The policies and procedures developed by the operator (generally included in the MGM) must be part of the training material.
  5. In the case of private aviation, many countries have regulations that exempt these aircraft from the development of maintenance programs, but at the time of RVSM certification, they must all present an RVSM maintenance program. That is why the maintenance personnel of these private aircraft generally do not know how to apply continued airworthiness maintenance programmes. Consequently, the issue of continued airworthiness training should be discussed in depth. It is also advisable to have a thorough discussion on the aspects related to test equipment calibration (ramp-testers).
  6. The instruction should include geometric inspection techniques and the use of special tools (for instance, skin smoothness measurement tool), only if the operator is thinking of repairing dents or bulges in RVSM critical areas which exceed SRM tolerances, also taking into account the assessment of structural repairs made in these critical areas. However, irrespective of this, the concept of skin waviness must be clearly explained.

7. For all passenger transport aircraft operating in RVSM levels, there are service bulletins/letters or other documentation issued by the manufacturer which detail all aspects to be considered when certifying these aircraft. The content of this documentation must be explained in this course.
8. Frequently, when modifications are made, all the new information incorporated into the manuals is included in the form of appendices. The changes made should be explained in these courses, so that the maintenance data that has been amended/added can be used in the appropriate manner.
9. If there are restrictions at the time of certifying the aircraft, these should be explained in the training course.
10. Many manufacturers present dent or bulge size allowances in the form of graphs (in function of dent/bulge size and distance to the static head), and, sometimes, they are not well interpreted by the technicians. Therefore, this issue should be included in the curriculum (if applicable).
11. In the event the operator has an approved training program, the inclusion of RVSM training courses should be considered as an amendment to said program. The request for amendment should include, at least, the content of the course, documentation accrediting the instructor (depending on the licensing regulations applicable in the country), duly substantiated frequency (the duration of recurrent courses may be reduced), and a tentative date for initial training (the attendance of the CAA is recommended in order to assess the depth at which each curriculum item is discussed, and the possibility of covering all the items in the time proposed).
12. For the dispatch of maintenance flights, the MEL is commonly used. For that reason, RVSM-related amendments to this document must be covered in the training courses.
13. A course can be given that includes different aircraft models, provided the differences between the various types of aircraft are clearly explained in order to avoid confusion among the personnel attending the course.
14. For assessing computer-based training (CBT) or on-the-job training (OJT) courses, the procedures already established by each CAA must be applied.

**APPENDIX F****CARIBBEAN AND SOUTH AMERICAN RVSM  
MINIMUM MONITORING REQUIREMENTS****EFFECTIVE APRIL 27, 2005**

Changes from the April 21, 2003 edition: E170 and AVRO group [RJ70, RJ85, RJ1H] are added to Monitoring Category 2 on the chart. See yellow highlight.

1. UPDATE OF MONITORING REQUIREMENTS CHART AND WEBSITE. The Minimum Monitoring Requirements Chart is a living document. As significant performance data is obtained on specific aircraft groups or types, the CARSAMMA will update the minimum monitoring requirements for those types or groups. Experience has shown that performance data will normally justify reducing the requirements. Updates to the Minimum Monitoring Requirements chart, will be posted on the CARSAMMA RVSM Documentation webpage. The RVSM Documentation page can be accessed from the CARSAMMA RVSM Homepage:

<http://www.cgna.gov.br/carsamma>

2. INITIAL MONITORING. All operators that operate or intend to operate in airspace where RVSM is applied are required to participate in the RVSM monitoring program. The attached chart of monitoring requirements establishes requirements for initial monitoring associated with the RVSM approval process. In their application to the appropriate civil aviation authority for RVSM approval, operators must show a plan for meeting the applicable initial monitoring requirements.

3. AIRCRAFT STATUS FOR MONITORING. Aircraft engineering work that is required to bring aircraft into compliance with RVSM standards must be completed prior to the aircraft being monitored. Any exception to this rule will be coordinated with the responsible civil aviation authority.

4. APPLICABILITY OF MONITORING FROM OTHER REGIONS. Monitoring data obtained in conjunction with RVSM monitoring programs from other regions can be used to meet Caribbean and South American RVSM monitoring requirements. The Caribbean and South American Monitoring Agency (CARSAMMA), which is responsible for administering the Caribbean and South American RVSM monitoring program, has access to monitoring data from other regions and will inform other civil aviation authorities and operators concerning satisfaction of Caribbean and South American monitoring requirements.

5. **MONITORING PRIOR TO THE ISSUE OF RVSM OPERATIONAL APPROVAL IS NOT A REQUIREMENT.** Operators should submit monitoring plans to the responsible civil aviation authority that show how they intend to meet the requirements specified in the table below. Monitoring will be carried out in accordance with this table.

6. AIRCRAFT GROUPS NOT LISTED ON THE CHART. Contact the CARSAMMA for clarification if an aircraft group is not listed on the Minimum Monitoring Requirements chart or for clarification of other monitoring related issues. An aircraft group not listed in the table below will probably be subject to Category 2 monitoring requirements.

7. TABLE OF MONITORING GROUPS. A table of monitoring groups is provided in the pages following the Minimum Monitoring Requirements Chart. The table shows the aircraft types and series that are grouped together for operator monitoring purposes.

8. TRAILING CONE DATA. Altimetry System Error estimations developed using Trailing Cone data collected during RVSM certification flights can be used to fulfill monitoring requirements. It must be documented, however, that aircraft RVSM systems were in the approved RVSM configuration for the flight.

9. MONITORING OF AIRFRAMES THAT ARE RVSM COMPLIANT ON DELIVERY. If an operator adds new RVSM compliant airframes of a type for which it already has RVSM operational approval and has completed monitoring requirements for the type in accordance with the attached chart, the new airframes are not required to be monitored. If an operator adds new RVSM compliant airframes of an aircraft type for which it has NOT previously received RVSM operational approval, then the operator should complete monitoring in accordance with the attached chart.

10. FOLLOW-ON MONITORING. Monitoring is an on-going program that will continue after RVSM implementation. **The CARSAMMA will coordinate a follow-on monitoring program with industry after implementation.**

**CARIBBEAN AND SOUTH AMERICAN RVSM  
MINIMUM MONITORING REQUIREMENTS CHART**

**EFFECTIVE APRIL 27, 2005**

**MONITORING IS REQUIRED IN ACCORDANCE WITH THIS CHART, HOWEVER, IT IS NOT  
REQUIRED TO BE COMPLETED PRIOR TO OPERATIONAL APPROVAL**

MONITORING CATEGORY	AIRCRAFT TYPE	MINIMUM OPERATOR MONITORING FOR EACH AIRCRAFT GROUP
<p><b>1</b></p> <p>Group approved <u>and</u> monitoring data indicates performance in accordance with RVSM standards.</p> <p><b>Group Definition:</b> aircraft have been manufactured to a nominally identical design and build and for RVSM airworthiness approval fall into a group established in an RVSM certification document (e.g., Service Bulletin, Supplemental Type Certificate, Type Certificate Data Sheet).</p>	<p>A30B, A306, [A312 (GE), A313 (GE)], [A312 (PW), A313 (PW)], A318, [A319, A320, A321], [A332, A333], [A342, A343], A345, A346</p> <p>B712, [B721, B722], [B733, B734, B735], B737 (Cargo) [B736, B737/BBJ, B738/BBJ, B739], [B741, B742, B743], B74S, B744 (5" Probe), B744 (10" Probe), B752, B753, [B762, B763], B764, B772, B773</p> <p>CL60 (600/601), CL60 (604), C560, [CRJ1, CRJ2], CRJ7, DC10, [E135, E145], F100, GLF4, GLF5, LJ60,</p> <p>L101, MD10, MD11, MD80 (All series), MD90</p>	<p>Two airframes from each fleet* of an operator to be monitored as soon as possible but <b>not later than 6 months after the issue of RVSM operational approval or not later than 6 months after the start of Caribbean and South American RVSM operations, whichever occurs later.</b></p> <p>* <i>Note. For the purposes of monitoring, aircraft within parenthesis [ ] may be considered as belonging to the same monitoring group. For example, an operator with six A332 and four A333 aircraft may monitor one A332 and one A333 or two A332 aircraft or two A333 aircraft.</i></p>
<p><b>2</b></p> <p>Group approved but insufficient monitoring data collected to move aircraft to Monitoring Category 1. Group definition applies.</p>	<p>Other group aircraft other than those listed above including:</p> <p>A124, ASTR, B703, B731, B732, BE20, BE40, C500, [C25A, C25B], C525, C550**, C56X, C650, C750, CRJ9, D328, [DC86, DC87], DC93, DC94, DC95, <b>E170</b>, F2TH, [FA50 FA50EX], F70, [F900, F900EX], FA20, GLF2(II), GLF2(IIB), GLF3, GALX, GLEX, H25B(700), H25B(800), H25C, IL62, IL76, IL86, IL96, J328, L29B(2), L29B(731), LJ31, [LJ35, LJ36], LJ45, LJ55, <b>RJ70, RJ85, RJ1H</b>, SBR1, T134, T154, T204, TBM7, P180, PRM1, WW24, YK42</p>	<p>60% of airframes from each fleet of an operator (round up if fractional), as soon as possible but <b>not later than 6 months after the issue of RVSM operational approval or not later than 6 months after the start of Caribbean and South American RVSM operations, whichever occurs later.</b></p> <p>**Refer to aircraft group table for detail on C550 monitoring</p>
		100% of aircraft shall be

<b>3</b>	Non-Group  <b><u>Non-group Definition:</u></b> aircraft that do not fall under the group definition <u>and</u> for RVSM airworthiness approval are presented as an individual airframe.	Non-group approved aircraft	monitored as soon as possible but <b>not later than 6 months after the issue of RVSM operational approval <u>or</u> not later than 6 months after the start of Caribbean and South American RVSM operations, <u>whichever occurs later.</u></b>
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### Monitoring Groups for Aircraft Certified under Group Approval Requirements

Monitoring Group	ICAO Designator	A/C Type	A/C Series
A124	A124	AN-124 RUSLAN	ALL SERIES
A300	A306 A30B	A300 A300	600, 600F, 600R, 620, 620R, 620RF B2-100, B2-200, B4-100, B4-100F, B4-120, B4-200, B4-200F, B4-220, C4-200
A310-GE	A310	A310	200, 200F, 300, 300F
A310-PW	A310	A310	220, 220F, 320
A318	A318	A318	ALL SERIES
A320	A319 A320 A321	A319 A320 A321	CJ, 110, 130 110, 210, 230 110, 130, 210, 230
A330	A332, A333	A330	200, 220, 240, 300, 320, 340
A340	A342, A343,	A340	210, 310
A345	A345	A340	540
A346	A346	A340	640
A3ST	A3ST	A300	600R ST BELUGA
AN72	AN72	AN-74, AN-72	ALL SERIES
ASTR	ASTR	1125 ASTRA	ALL SERIES
ASTR-SPX	ASTR	ASTR SPX	ALL SERIES
AVRO	RJ70, RJ85, RJ1H	AVRO	RJ70, RJ85, RJ100
B712	B712	B717	200
B727	B721 B722	B727	100, 100C, 100F, 100QF, 200, 200F
B732	B732	B737	200, 200C
B737 (Classic)	B733 B734 B735	B737	300, 400, 500
B737 New Generation (NG)	B736 B737 B738 B739	B737 B737 B737 B737	600 700, 700BBJ 800 900

Monitoring Group	ICAO Designator	A/C Type	A/C Series
B737 (Cargo)	B737	B737	700C
B747Classic (CL)	B741 B742 B743	B747	100, 100B, 100F, 200B, 200C, 200F, 200SF, 300
B74S	B74S	B747	SR, SP
B744-5	B744	B747	400, 400D, 400F (With 5 inch Probes)
B744-10	B744	B747	400, 400D, 400F (With 10 inch Probes)
B752	B752	B757	200, 200PF
B753	B753	B757	300
B767	B762 B763	B767	200, 200EM, 200ER, 200ERM, 300, 300ER, 300ERF
B764	B764	B767	400ER
B772	B772	B777	200, 200ER, 300, 300ER
B773	B773	B777	300, 300ER
BE40	BE40	BEECHJET 400A	ALL SERIES
BE20	BE20	BEECH 200 -KINGAIR	ALL SERIES
C500	C500	500 CITATION, 500 CITATION I, 501 CITATION I SINGLE PILOT	ALL SERIES
C525	C525	525 CITATIONJET, 525 CITATIONJET I	ALL SERIES
C525-II	C25A	525A CITATIONJET II	ALL SERIES
C525 CJ3	C25B	CITATIONJET III	ALL SERIES
C550-552	C550	552 CITATION II	ALL SERIES
C550-B	C550	550 CITATION BRAVO	ALL SERIES
C550-II	C550	550 CITATION II, 551 CITATION II SINGLE PILOT	ALL SERIES
C550-SII	C550	S550 CITATION SUPER II	ALL SERIES
C560	C560	560 CITATION V, 560 CITATION V ULTRA, 560 CITATION V ULTRA ENCORE	ALL SERIES
C56X	C56X	560 CITATION EXCEL	ALL SERIES
C650	C650	650 CITATION III , 650 CITATION VI , 650 CITATION VII	ALL SERIES
C750	C750	750 CITATION X	ALL SERIES
CARJ	CRJ1, CRJ2	REGIONALJET	100, 200, 200ER, 200LR

Monitoring Group	ICAO Designator	A/C Type	A/C Series
CRJ-700	CRJ7	REGIONALJET	700
CRJ-900	CRJ9	REGIONALJET	900
CL600	CL60	CL-600 CL-601	CL-600-1A11 CL-600-2A12, CL-600-2B16
CL604	CL60	CL-604	CL-600-2B16
BD100	CL30	CHALLENGER 300	ALL SERIES
BD700	GL5T	GLOBAL 5000	ALL SERIES
CONC	CONC	CONCORDE	ALL SERIES
DC10	DC10	DC-10	10, 10F, 15, 30, 30F, 40, 40F
DC86-7	DC86, DC87	DC-8	62, 62F, 72, 72F
DC93	DC93	DC-9	30, 30F
DC94	DC94	DC-9	
DC95	DC95	DC-9	SERIES 51
E135-145	E135, E145	EMB-135, EMB-145	ALL SERIES
<b>E170</b>	<b>E170</b>	<b>EMB-170</b>	
F100	F100	FOKKER 100	ALL SERIES
F2TH	F2TH	FALCON 2000	ALL SERIES
F70	F70	FOKKER 70	ALL SERIES
F900	F900	FALCON 900, FALCON 900EX	ALL SERIES
FA10	FA10	FALCON 10	ALL SERIES
FA20	FA20	FALCON 20 FALCON 200	ALL SERIES
FA50	FA50	FALCON 50, FALCON 50EX	ALL SERIES
GALX	GALX	1126 GALAXY	ALL SERIES
GLEX	GLEX	BD-700 GLOBAL EXPRESS	ALL SERIES
GLF2	GLF2	GULFSTREAM II (G- 1159),	ALL SERIES
GLF2B	GLF2	GULFSTREAM IIB (G- 1159B)	ALL SERIES
GLF3	GLF3	GULFSTREAM III (G- 1159A)	ALL SERIES
GLF4	GLF4	GULFSTREAM IV (G- 1159C)	ALL SERIES
GLF5	GLF5	GULFSTREAM V (G- 1159D)	ALL SERIES
H25B-700	H25B	BAE 125 / HS125	700B
H25B-800	H25B	BAE 125 / HAWKER 800XP, BAE 125 /	ALL SERIES/A, B/800

Monitoring Group	ICAO Designator	A/C Type	A/C Series
		HAWKER 800, BAE 125 / HS125	
H25C	H25C	BAE 125 / HAWKER 1000	A , B
IL86	IL86	IL-86	NO SERIES
IL96	IL96	IL-96	M , T, 300
J328	J328	328JET	ALL SERIES
L101	L101	L-1011 TRISTAR	1 (385-1), 40 (385-1), 50 (385-1), 100, 150 (385-1-14), 200, 250 (385-1-15), 500 (385-3)
L29B-2	L29B	L-1329 JETSTAR 2	ALL SERIES
L29B-731	L29B	L-1329 JETSTAR 731	ALL SERIES
LJ31	LJ31	LEARJET 31	NO SERIES, A
LJ35/6	LJ35 LJ36	LEARJET 35 LEARJET 36	NO SERIES, A
LJ40	LJ40	LEARJET 40	ALL SERIES
LJ45	LJ45	LEARJET 45	ALL SERIES
LJ55	LJ55	LEARJET 55	NO SERIES B, C
LJ60	LJ60	LEARJET 60	ALL SERIES
MD10	MD10	MD-10	ALL SERIES
MD11	MD11	MD-11	COMBI, ER, FREIGHTER, PASSENGER
MD80	MD81, MD82, MD83, MD87, MD88	MD-80	81, 82, 83, 87, 88
MD90	MD90	MD-90	30, 30ER
P180	P180	P-180 AVANTI	ALL SERIES
PRM1	PRM1	PREMIER 1	ALL SERIES
T134	T134	TU-134	A, B
T154	T154	TU-154	A , B, M, S
T204	T204, T224, T234	TU-204, TU-224, TU-234	100, 100C, 120RR, 200, C
TBM7	TBM7		
WW24	WW24		
YK42	YK42	YAK-42	ALL SERIES

**Conclusion AP/ATM/9/4****Measures to be adopted to reduce operational errors in the coordination loop between adjacent control centres**

That States/Territories/International Organizations, in order to reduce operational errors in the coordination loop between adjacent ATS units, urgently adopt, inter-alia:

- a) the preventive and corrective measures shown in **Appendix D** to this part of the report; and
- b) additionally, the following short term measures, inter-alia: meetings to emphasize the importance of coordinations and accurate communications; review of the current coordination procedures; increase the supervision and monitoring of operational positions; and any other measure particularly required.

**ERROR PREVENTION PROGRAMME IN THE COMMUNICATIONS BETWEEN ADJACENT ACCs**

There are many initiatives that can be pursued to prevent operational errors from occurring. However, there are five primary areas, which can directly contribute to its prevention: **communications, phraseology, supervision, teamwork, and ATC proficiency**. In an effort to accomplish the goal of reducing communication errors between adjacent Area Control Centres and thus reduce or minimize the occurrence of large-height deviations, the following objectives should be included in the prevention programme:

The authority shall:

- a) identify individual, procedural, and/or equipment deficiencies used in air traffic services;
- b) promptly correct individual, procedural, and/or equipment deficiencies which affect coordinations with adjacent and ATS units. This can be achieved through:
  - guidance on procedures to be followed;
  - implementation of read-back/hear-back programmes;
  - training in the filling of LHD forms;
  - increase and/or closer monitoring of ATCOs performance;
  - immediate coordination programme after a re-authorization or change in flight level;

- changes in procedures and/or corrections/amendments of equipment.
- c) communicate performance expectations to ATS supervisors and controllers;
- d) ensure the ATS unit maintains a summary of and have information letters on operational errors, causal factors and trends, and incorporate them into training;
- e) monitor and evaluate voice recordings (all ATS operational personnel);
- f) take initiatives to improve communications among all ATS personnel to create an atmosphere conducive to sharing information;
- g) exercise strict monitoring in ATC units;
- h) ATS supervisors should:
  - communicate performance expectations to controllers, stressing the importance of operational control position discipline, awareness, teamwork, the use of proper phraseology, proper coordination procedures, control position relief briefings and utilization of a position relief checklist;
  - take prompt follow-up actions when controller performance does not meet with expectations;
  - inform on individual and team accountability, and the consequences for not meeting expectations;
  - provide efficient and consistent oversight of the ATS unit operation, and use effective resource management to ensure proper and timely assignment of personnel to promote the safe, orderly, and expeditious handling of air traffic;
  - ensure that distractions and noise levels in the ATS unit are kept at a minimum;
  - require all personnel to maintain a high degree of professionalism, teamwork, control position discipline, and awareness at all times in the ATS unit environment; and require that each controller knows, applies, and adheres to the appropriate requirements in the performance of his/her operational duties and responsibilities;
  - promote an open flow of communications with all ATS personnel, allowing them to provide input to programme;
  - place emphasis on hear-back/read-back errors during team meetings.
- i) ATC personnel should:
  - apply read-back/hear-back procedures when carrying out ATC coordinations;

- keep ATS supervisors advised of traffic problems and equipment limitations;
- make suggestions for ATS unit improvements and/or prevention of operational errors;
- maintain situational awareness;
- extend the extra effort to assist busier control position(s);
- continuously review their own operating techniques and ATS unit procedures to effect the highest quality of performance;
- promptly report all ATS incidents to the operational supervisor or other appropriate ATS authority for proper follow-up investigation;
- utilize memory aids.

#### **VOICE RECORDING EVALUATIONS**

Voice recording reviews should be conducted to ensure proper phraseology, good operating practices, and adherence to the standards set forth in ICAO provisions, and national/local directives and practices. Voice recording reviews should be conducted as follows:

- a) the ATS unit should ensure that voice recording reviews are conducted at least semi-annually on all ATS operational personnel;
- b) the ATS supervisor should review the voice recording, document comments and develop an action plan for documenting performance deficiencies; and
- c) the ATS supervisor and the controller should review and discuss the voice recording.

**APPENDIX H****CARIBBEAN AND SOUTH AMERICAN  
MONITORING AGENCY (CARSAMMA)****Report of Large Altitude Deviation for aircraft cleared at or above FL290 and at or below  
FL410**

Report to the Caribbean and South American Monitoring Agency (CARSAMMA) of an altitude deviation of 300ft or more, including:

- 1) those due to TCAS
- 2) turbulence and contingency events and
- 3) operational errors resulting in operation at flight levels other than cleared by ATC or coordinated by ATC units.

Name of FIR: \_\_\_\_\_

Please complete Section I or II as appropriate

**SECTION I:**

There were no reports of large altitude deviation for the month of \_\_\_\_\_

**SECTION II:**

There was/were \_\_\_\_\_ report(s) of an altitude deviation of 300 ft or more for aircraft cleared at or above FL290. Details of the altitude deviation are attached (Form A).

(Please use a separate form for each report of altitude deviation).

**SECTION III:**

When complete please forward the report(s) to:

Management Center Of Air Navigation  
Caribbean and South American Monitoring Agency (CARSAMMA)  
Av. Brig. Faria Lima, 1941  
São José dos Campos, SP  
Cep: 12227-000  
Brazil  
Telephone: (55-12) 3904-5004 or 3904-5010  
Fax: (55-12) 3941-7055  
E-Mail: carsamma@cgna.gov.br

**FORM A****REPORT OF AN ALTITUDE DEVIATION OF 300 FT OR MORE FOR AIRCRAFT  
CLEARED AT OR ABOVE FL 290 AND AT OR BELOW 410**

- (1) Reporting unit
- (2) Location of deviation (lat/long or fix)
- (3) Date and time of occurrence (UTC)
- (4) Airway or portion of airspace
- (5) Flight identification (optional) and type of aircraft (mandatory)
- (6) Flight level assigned
- (7) Observed or reported final flight level or altitude

Note : Please provide the source of information - Mode C/Pilot report

- (8) Duration at incorrect flight level or at incorrect altitude reported in (7)
- (9) Cause of deviation
- (10) Other traffic in conflict
- (11) Crew comments, if any, when notified
- (12) Remarks

**APPENDIX I****TERMS OF REFERENCE OF THE CAR/SAM RVSM SCRUTINY GROUP (RVSM/GTE)**

- a) To assemble subject matter experts, as needed, in air traffic control, aircraft operations and maintenance, regulation and certification, data analysis and risk modeling;
- b) To analyze and evaluate large height deviations of 300 ft or greater as defined by ICAO Doc 9574;
- c) To coordinate the assembly and review of large height deviation data with the Regional Monitoring Agency;
- d) To produce an estimate of flight time away from the cleared flying level to be used a primary input in the preparation of an estimate of risk by the Regional Monitoring Agency;
- e) To identify large height deviation trends and to recommend remedial actions in order to improve safety;
- f) To report results to GREPECAS through the ATM/CNS subgroup;
- g) To accomplish other tasks as directed by GREPECAS.

Composition: 1 State/Organization from the CAR Region, 1 State/from the SAM Region, United States, CARSAMMA, COCESNA, IATA, IFALPA, IFATCA.

## APPENDIX J

*Note: The following terms, expressions and definitions are not approved by the ICAO's Council and should be used for analysis of Large Height Deviation purpose only.*

**Event Flight Level** – the flight level of error, the incorrect altitude of operation for an identifiable period of time without having received an ATC clearance

**Height Deviation** – any altitude variation of 300ft or greater from the assigned altitude or as planned by ATC, these variations can be the result of turbulence, equipment malfunction, ATC loop errors, etc.

**ATC Loop Errors** – any incident where there is a misunderstanding between the pilot and the controller, failure to properly coordinate altitude information or unable to maintain situational awareness

**Total Deviation** – the total amount of feet between the altitudes of current operation prior to the deviation and the point at which the aircraft is once again under ATC supervision, a deviation that resulted in an increase of altitude will be recorded as a positive number, a deviation that resulted in a decrease of altitude will be recorded as a negative number

**Hazard Zone** – 300ft buffer zone above and below each flight level (Diagram A).

**Duration** - length of time that an aircraft was level at an altitude that was not cleared by air traffic control, duration will be recorded in one second increments (Diagram A).

**Levels Crossed** – the total number of flight levels between the point that the aircraft exits the cleared flight level and is once again under ATC supervision (Diagram A).

**Levels Final** – the cleared flight level after the error/deviation.

## Large Height Deviation Database Contents and Analysis

### Description of Criteria

*Note: The following terms, expressions and definitions are not approved by the ICAO's Council and should be used for analysis of Large Height Deviation purpose only.*

**Cleared Flight Level** – the flight level at which the pilot was cleared or currently operating (e.g. Aircrew accepts a clearance intended for another aircraft and ATC fails to capture the read back error or aircrew conforms to a flawed clearance delivered by ATC)

**Reference Flight Level** – The altitude that would have provided at least the minimum separation (vertical or horizontal) required

That flight level from which the Height Deviation is calculated; this level may be different from the Cleared Flight Level and must often be determined by the Scrutiny Group operational experts from the data in the Large Height Deviation report

**Event Flight Level** – the flight level of error, the incorrect altitude of operation for an identifiable period of time without having received an ATC clearance

**Height Deviation** – any altitude variation of 300ft or greater from the assigned altitude or as planned by ATC, these variations can be the result of turbulence, equipment malfunction, ATC loop errors, etc.

**ATC Loop Errors** – any incident where there is a misunderstanding between the pilot and the controller, failure to properly coordinate altitude information or unable to maintain situational awareness

**Total Deviation** – the total amount of feet between the altitudes of current operation prior to the deviation and the point at which the aircraft is once again under ATC supervision, a deviation that resulted in an increase of altitude will be recorded as a positive number, a deviation that resulted in a decrease of altitude will be recorded as a negative number

**Hazard Zone** – 300ft buffer zone above and below each flight level (Diagram B-1).

**Duration** - length of time that an aircraft was level at an altitude that was not cleared by air traffic control, duration will be recorded in one second increments (Diagram B-1).

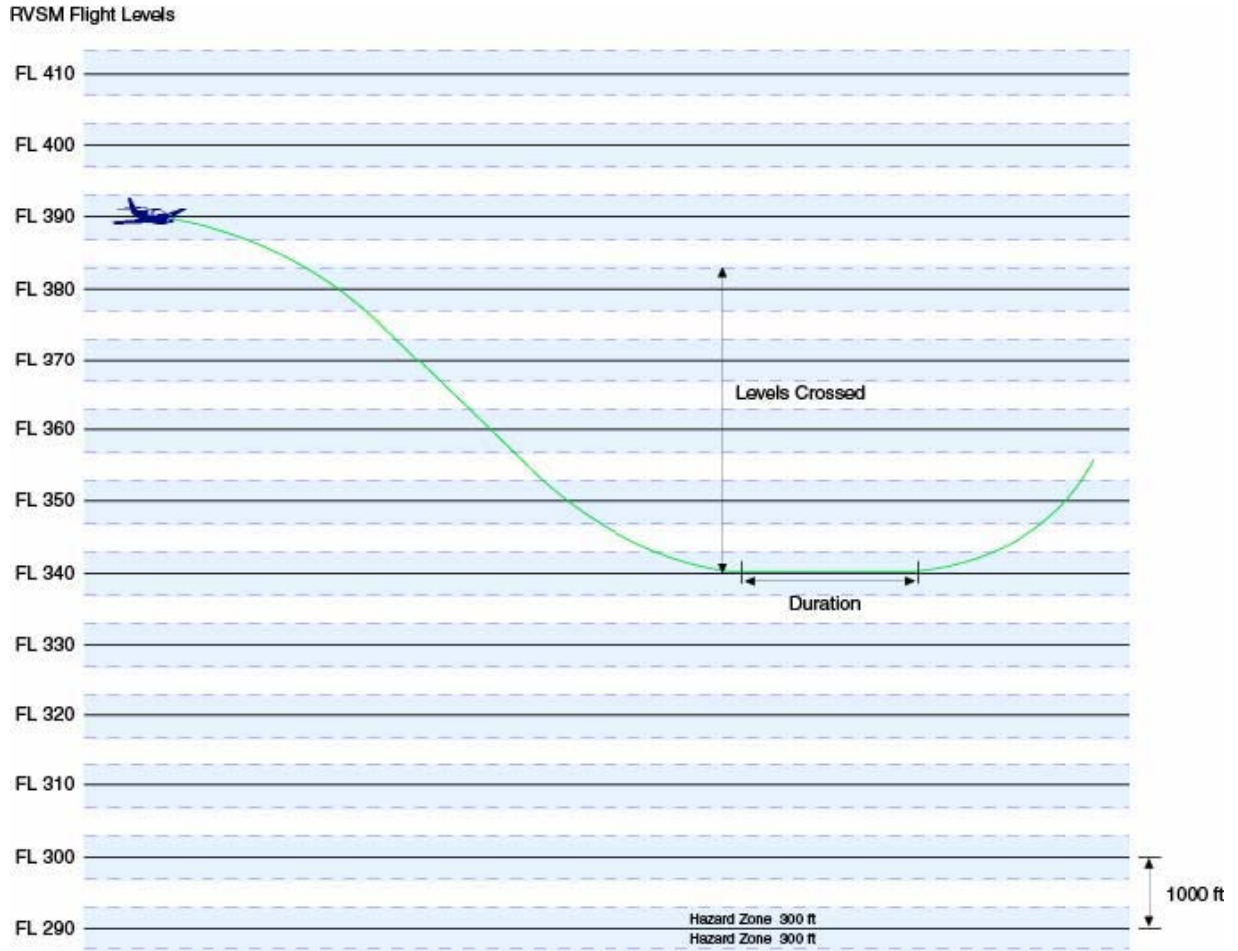
**Levels Crossed** – the total number of flight levels between the point that the aircraft exits the cleared flight level and is once again under ATC supervision (Diagram B-1).

**Levels Final** – the cleared flight level after the error/deviation.

**Code** – a category and a subcategory assigned to each event (Diagram B-2).

Rate of Descent		Rate of Climb	
Drift	1000 ft per minute	Minimum	500 ft per minute
Normal	1500+ ft per minute	Normal	750 ft per minute
Rapid	2500+ ft per minute	Expedite	1250 ft per minute

### Diagram B



## Diagram B – 2

**Codes for Vertical Errors**

<b>Category</b>	<b>Description</b>
<b>1</b>	Final level within RVSM airspace
<b>2</b>	Final level above RVSM airspace
<b>3</b>	Final level below RVSM airspace
<b>Subcategory</b>	<b>Description</b>
<b>A</b>	Contingency action due to engine fault
<b>B</b>	Contingency action due to pressurization failure
<b>C</b>	Contingency action due to other cause
<b>D</b>	Failure to climb/descend as cleared
<b>E</b>	Climb/descent without ATC clearance
<b>F</b>	Entry to RVSM airspace at an incorrect level
<b>G</b>	ATC FL re-clearance resulting in a loss of lateral or longitudinal separation
<b>H</b>	Deviation due to ACAS
<b>I</b>	Aircraft unable to maintain level
<b>J</b>	ATC failure to correctly record, coordinate, or follow through on FL changes and/or other clearances
<b>K</b>	Aircrew not maintaining level as cleared
<b>L</b>	ATC failure to capture incorrect read back of control instructions, fails to maintain situational awareness, or fails to resolve transposed call signs
<b>M</b>	Actions taken due to mechanical or equipment failure
<b>O</b>	Other
<b>W</b>	Weather

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

4.1 The Seventh Meeting of the Coordination Committee of Regional Project RLA/98/003 – Transition to CNS/ATM Systems in the CAR/SAM Regions, Lima, Peru, on 18 November 2004, as part of its activities for year 2005, approved to carry out a study up dated information on the resources available in automated systems in both regions considering progress for operational and interconnection requirements.

4.2 As reply to ICAO survey Argentina, Bolivia, Brazil, Chile, Cuba, Mexico, Nicaragua, and Uruguay and COCESNA sent related information, which is included in the **Appendix A** to this part of this report.

4.3 The United States presented information about the status of works of integration of automated systems made with Canada and Mexico, shown as **Appendix B** to this part of this report, and informed on preliminary agreements for the integration of other automated systems with other adjacent States.

4.4 The meeting discussed the relevant impact that automated systems have for the global ATM and agreed continue working in the strategy approved by GREPECAS, attached in **Appendix C**, and other related information attached in **Appendix D** to this part of this report, through ATM points of contact in each State/Territories/International Organizations for the coordination looking for the integration of ATM automated systems of CAR/SAM Regions.

4.5 The meeting also recognised that other aspects which should be taken into consideration for the study and development of the future work of the GREPECAS ATM Committee such as:

- a) Carry out the integration of the automated systems through the use ICAO standards for operational applications;
- b) Establish harmonized integration using an interface control document (ICD) for data communication and the coordination between ATS centers, based in the ICAO SARPs, which revision is presently being done by the CNS Committee;
- c) Foster the planning and development of human resources applied to the ATM automated systems.

4.6 Keeping in mind a global ATM States/Territories/International Organizations shall continue working through 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, the meeting agreed to encourage Sates/Territories/International Organizations to continue working for the integration of automated systems and formulated the following conclusion:

**Conclusion AP/ATM/10/27****Updated Information of ATM Automated Systems in CAR/SAM Regions**

- a) The States, Territories and International Organizations of CAR SAM Regions that have not yet done so, submit as soon as possible the corresponding information of operational and interconnection requirements to ICAO NACC and SAM Regional Offices, and
- b) That the ICAO NACC and SAM Regional Offices take measures appropriate actions to obtain up dated information of ATM automated systems installed in CAR/SAM Regions,;

**Digital communication systems in support to the ATM automation**

4.7 The meeting recognised that CAR/SAM Regions had implemented at regional level, modern digital networks which represent a future platform for the support of current air navigation services and the future CNS/ATM Systems. A survey has been initiated for the implementation of an electronic message system AMHS, in order to count with a modern message system, with high-speed transmission capability, low errors rate, bit-oriented and with a high availability.

4.8 Many of the CAR/SAM States have implemented or are in the process of implementing digital networks as a replacement of the analogue communication networks which, even though could support the current air navigation services, its current availability did not meet the requirements to ensure optimum communications.

4.9 In the SAM Region, the REDDIG, has been designed to support all aeronautical fixed services (AFTN and ATS speech circuits) established in the air navigation plan, the data communications to support radar and GNSS applications, as well as future ATN applications. (AMHS, AIDC, ADS, CPDLC).

4.10 Based on the same advanced technology, the Eastern Caribbean network was implemented in the CAR Region, as well as the Central American digital network, and soon will be implemented the MEVA II.

4.11 In order to interconnect all regional networks aforementioned, the ATM/CNS Subgroup has established the guidelines for the interconnection, with other geographical locations taking into consideration NAM and AFI Regions.

## 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) Integración 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 Altitude 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 Digital Network	AMS					AFS	
	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  
SURVEY ON ATM AUTOMATED SYSTEMS IN THE CAR/SAM REGIONS**

**BRASIL**

ACC	Sensores Radar					Procesamiento Automatizado de Datos Automated Data Processing							COMUNICACIONES COMMUNICATIONS								
	PSR		SSR			RDP			FDP		MET	AIS	Red Digital Nacional Digital Network	AMS				AFS			
	1	2	3	4	5	6	7	8	9	10	11(a)	11b		VDL					HFDL	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**

- (c) Un banco de datos central con informaciones meteorológicas disponibles para consulta general.
- (d) Un banco de datos con informaciones disponibles NOTAM con distribución regional.
- (e) En fase de prueba.
- (f) 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  
SURVEY ON ATM AUTOMATED SYSTEMS IN THE CAR/SAM REGIONS**

**CHILE**

ACC/FIR	Sensores Radar					Procesamiento Automatizado de Datos Automated Data Processing							COMUNICACIONES COMMUNICATIONS							
	PSR		SSR			RDP			FDP		MET	AIS	Red Digital Nacional Digital Network	AMS				AFS		
	1	2	3	4	5	6	7	8	9	10	11	12		VDL			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.



ADJUNTO A

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

(PAIS/COUNTRY)

ACE	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		
	1	2	3	4	5	6	7	8	9	10	11	12		13	14	15	16		17	18	19
MEXICO	2	X	12	X	A/C	X	STCA	MSAW	P	E	DB	DB	X		X	X	X	X	X	X	X
MAZATLAN		X	8	X	A/C	X	STCA	MSAW	P	E	DB	DB	X		X	X	X		X	X	X
MONTERREY	1	X	7	X	A/C	X	STCA	MSAW	P	E	DB	DB	X		X	X	X		X	X	X
MERIDA	1	X	4	X	A/C	X	STCA	MSAW	P	E	DB	DB	X	18	X	X	X		X	X	X

Observaciones/Remarks

✕

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

**NICARAGUA**

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

**Observaciones/Remarks**

- (c) No se encuentra disponible, pero el sistema lo soporta.  
 (d) 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									
	PSR		SSR			RDP			FDP		MET	AIS	Red Digital Nacional Digital Network	AMS					AFS		
	1	2	3	4	5	6	7	8	9	10	11	12		VDL				17			18
MUDO	(a)	60	(b)	250	AC		STCA	MSAW	P	E	DB		(c)							(d)	

**Observaciones/Remarks**

- (e) TA10M M.970 PSR.  
 (f) MSSR M.970 PSR Carrasco  
 MSSR INDRA DURAZNO  
 MSSR THALES EZEIZA  
 (g) Se posee una Red Digital entre todos los Aeródromos y Aeropuertos del País.  
 (h) Se posee una Central Distribuidora de Mensajes AFTN.

Nota: No se posee diagramas.

**AP/ATM/10**  
**Appendix/Apéndice B**  
**al Informe sobre el Asunto 4/**  
**to the Report on Agenda Item 4**



**ato**

AIR TRAFFIC ORGANIZATION

# **CAN/MEX/USA**

## **Automation Systems Interface**

Leslie Cary  
Air Traffic Organization  
Federal Aviation Administration

# Background

- At the Fifth North American Aviation Trilateral (NAAT/5) in June 1998, Canada, Mexico, and U.S. agreed to cooperate on development of a seamless interface between automation systems, focusing on automated exchange of flight data
- Trilateral Automation Systems Interface Task Force (ASI/TF) created to develop and implement interfaces to support:
  - Automated flight plan exchange
  - Automated radar hand-offs
  - Ultimately, seamless cross-border ATC operations that provide efficiencies similar to those achieved between FAA facilities

# Need

- Largely manual method of exchanging flight data information with Canada and Mexico decreases ability to efficiently support increasing cross-border traffic



# Operational Benefits

- Reduced controller manual coordination at border sectors
  - Less phone time = more time separating aircraft
  - Provides direct benefit to U.S. border Air Route Traffic Control Centers (ARTCC)
- Increased Safety
  - Coordination more reliable with standard terms in standard formats with reduced human factor errors
  - Flight data automation will reduce manual cross-border coordination and allow automation benefits currently associated with domestic US operations

# Operational Benefits (Continued)

- Capability to utilize ICAO Flight Plan format benefits
  - More comprehensive description of aircraft equipment to support automation and decision making to include supporting RVSM, RNP and preferential route processing
  - Defines type of flight, e.g., GA, military, commercial, etc.
  - Provides airframe-unique 24-bit address (CPDLC/ADS requirement)

# Harmonization

- ASI/TF has developed a North American Common Coordination Interface Control Document (NAM ICD) which defines the message formats for the interfaces between automation systems of the United States and Canada and of the United States and Mexico
  - NAM ICD based on ICAO 4444, North Atlantic Common Coordination ICD and Pacific Common Coordination ICD
  - ICD outlines current and long-term guidelines for harmonized development of automation systems
  - ICD is designed as a living document that will be updated to reflect the needs of the three ATS Providers

# ICD Features

- ICD prescribes common message sets by which the three ATS Providers will exchange control information
- ICD provisions include: core messages to be used by ATC facilities, communications requirements, interface protocols
- The phased functionality of the core messages include :
  - Passing/receiving Current Flight Plan and Logical Acceptance messages
  - Passing/receiving Filed, Change, Modify, Estimate, Cancel and Reject messages needed for full automated exchange of flight plans
  - Messages needed to support automated radar handoff capability

# Automation Systems

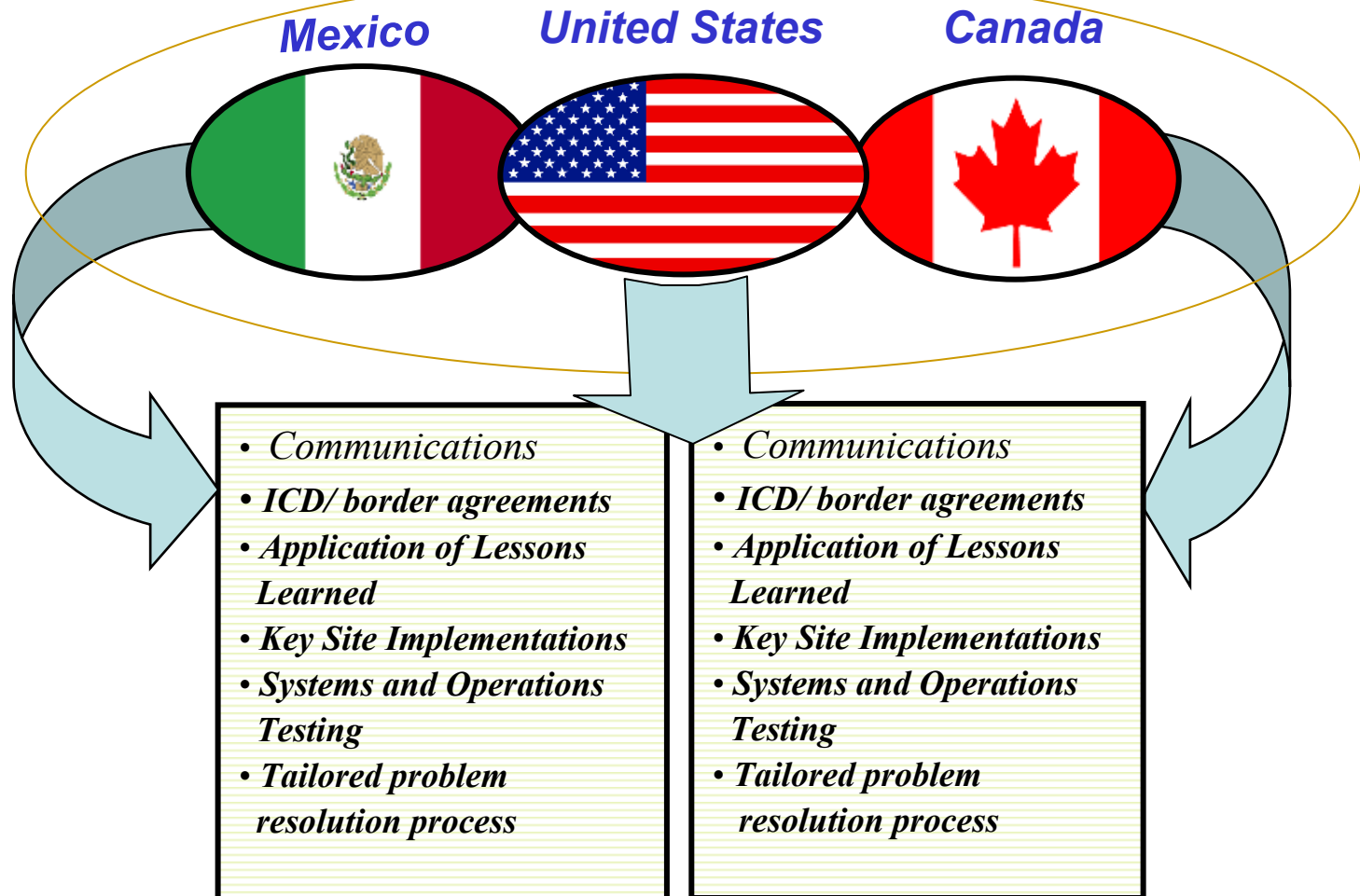
- FAA's Host En Route Automation Systems modified to process, store and forward ICAO flight plan information
- Mexican JADE system operational; Initial cross-border automation interfaces established
- Canadian Automated Air Traffic System (CAATS) to be fielded in 2005-2006. Testing is being conducted between U.S. and Canadian Technical Centers

# Telecommunications

- Communications used to support the automation interface between U.S. – Mexico and U.S. - Canada is the Aeronautical Fixed Telecommunications Network (AFTN)
- Legacy communications systems such as AFTN may be the choice because of availability and cost but experience has shown they come with problems
  - Store and forward system not optimal for ATC data
  - Bandwidth had to be upgraded to support projected volume of traffic
  - Embedded characters in the message processing such as carriage return / line feed for teletype use has caused an inordinate amount of processing problems

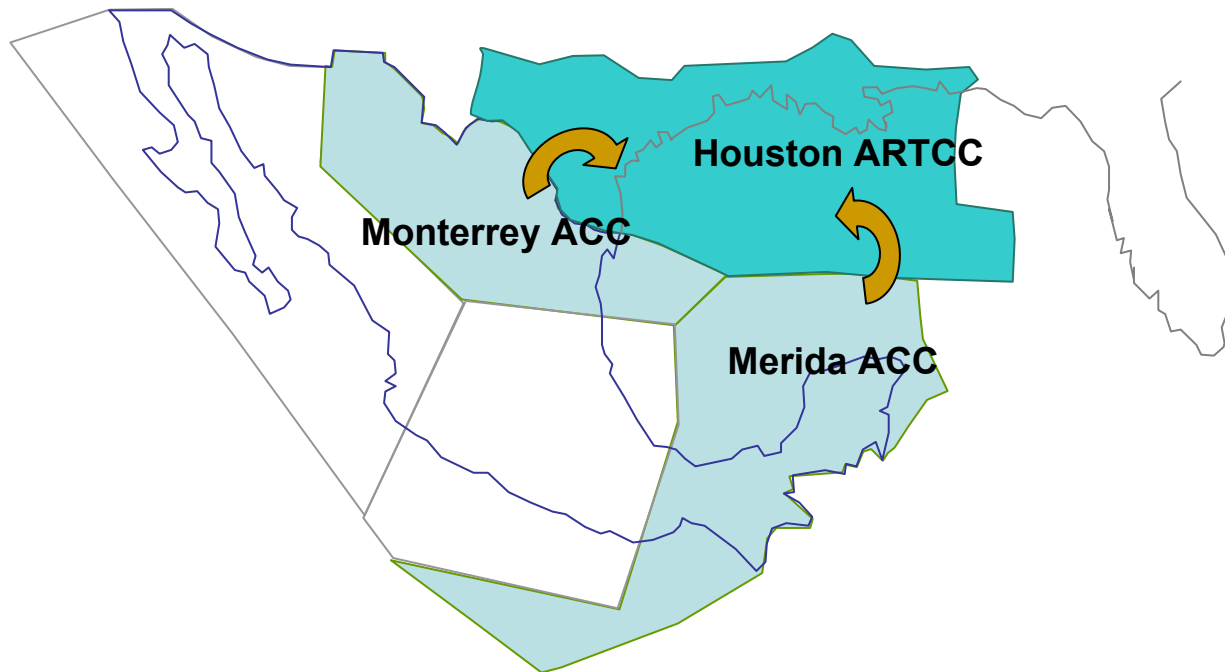
# Cross-border Collaboration

## ICAO Compatibility



# Current FAA - SENEAM Cooperation

- Interface between FAA Host and SENEAM JADE automation systems was implemented in November 2004



- Current Flight Plan and Logical Acceptance messages are being processed between Houston ARTCC and Merida and Monterrey ACCs

# Current FAA - SENEAM Cooperation (Continued)

- Problems encountered with southbound continental flights, resolution being developed
  - RVSM Status (solved 20/01/05)
  - Direct routes / Reroutes
  - Time parameters
- FAA / SENEAM technical discussions continue with goal of extending interface to the other facilities across the border between U.S and Mexico
  - Albuquerque ARTCC – Monterrey and Mazatlan ACCs
  - Los Angeles ARTCC – Mazatlan ACC

# FAA - SENEAM Interim Next Steps

- Extending flight data capabilities of interface to include ability to modify active data and support near-border departures
- Continuation of successful implementation of seamless interface between FAA Host and SENEAM JADE automation systems requires continued high-level support in terms of:
  - Resources and timelines for implementation and enhancements to FAA Host (e.g. Host software builds)
  - Compliance with NAM ICD standards
  - Controller impact and user concerns

# Current FAA - NAV CANADA Cooperation

- The interim capability to interface between Anchorage ARTCC and the NAV CANADA Flight Data Processing Network (FDPN) has been successfully tested.
  - Current Flight Plan and Logical Acceptance messages were processed between Anchorage ARTCC and Vancouver ACC
  - Operational implementation of the cross-border flight data processing between Anchorage ARTCC and Vancouver ACC is to be determined
- Interface implementation between the FAA Host and Canadian flight data automation is based on NAM ICD
  - CAATS is the target automation system for Canada
  - Implementation scheduled for the 2005/2006 timeframe
  - FAA / NAV CANADA testing and technical discussions on-going
  - Preliminary Technical Center testing between FAA Host and NAV CANADA CAATS has been successful.
  - Additional testing in 2005 being scheduled

# FAA - NAV CANADA – Interim/ Next Steps

- In an effort to derive cross-border automation benefits before the implementation of CAATS, the FAA and NAV CANADA are working to include border interfaces between FAA Host and the NAV CANADA FDPN
- Cooperative planning for automation interfaces, including investments in interim solutions are beneficial and useable in the interface with CAATS
  - Operational benefits are derived
  - Technical benefits are derived
  - Interim technical work is not throw-away, much can be applied to CAATS interface

# Testing

- Technical Center to Technical Centre testing
  - Used in interface implementation with both Canada and Mexico
- Non-operational testing
  - Non-operational testing conducted onsite but offline for communications and flight data processing
- Operational Testing
  - Online tests employed verification of data
  - Operational Test Plans were customized for local use
  - Letters of Agreement were modified to incorporate new automation procedures
  - Analysis of test results was conducted, issues were identified and solutions implemented

# Operational Testing - Mexico

- Houston ARTCC was used as the key site in development and testing of flight data exchange with Mexico
  - Knowledge base was built at initial site by personnel working the automation and operational issues
  - Developed expertise is being used to help other border sites implement their interfaces
- Non-operational testing conducted with interface sites
  - Functionality tested in offline environment
  - Non-operational testing conducted individually between Houston and each site, Merida and Monterrey prior to combined test
- Operational tests were conducted with live data. Post-test analysis of results coordinated between FAA and SENEAM

# SENEAM - FAA - NAV CANADA

- Fostering cooperative work environment is imperative to success of project
  - Regularly scheduled discussions with operational and technical representatives from the other States are essential
  - Issues associated with flight data messaging, route adaptation, cross-border procedures and parameter interaction require cooperative solutions

# Lessons Learned

- NAM ICD standards do not address all issues to the level of detail needed
  - Boundary Agreements provide method of addressing unique interface differences
  - Flexibility and innovation on both sides of the interface are needed to resolve the issues
- Resource Limitation Challenges
  - Funding
  - Technology
  - Implementation schedules
- Trilateral established as formal structure but many issues require bilateral solutions
  - Problem resolution requires mutual activity to achieve best solution
  - As the common denominator, the U.S. needs to be able to apply bilateral technical solutions to the other border as well

# Lessons Learned (Continued)

- Strategies may need to be modified due to schedule, resource or funding changes to keep initiatives moving forward
  - Example: Canada FDPN to Anchorage FDP interface
- Issue coordination during development can result in fewer problems in implementation
  - Many but not all issues can be identified
  - Airspace and parameter adaptation is a continual process
  - Letters of Agreement address operational changes needed to support automation changes
  - Automation change will require educating users
  - Requires closer adherence to proper route filings, proper use of fields in flight plans

# Lessons Learned (Continued)

- Operational Experience: Demonstrated reduction in Operational Deviations despite doubling of traffic in the Gulf of Mexico

# Summary

- ASI/TF was created to develop and implement interfaces to support seamless cross-border ATC operations that provide efficiencies similar to those achieved between FAA facilities.
- ASI/TF developed a NAM ICD which defines the standard message formats for the interfaces between the automation systems while recognizing the differences within the ICD boundary agreements
- An incremental approach to implementing the flight data automation has been adopted by ASI/TF with the U.S. and Mexico achieving initial success with flight data exchange between Houston ARTCC and Monterrey and Merida ACCs
- A similar incremental approach is being used with the U.S. interface with Canada first exchanging data between the Host and the FDPN which will evolve to the Host to CAATS interface
- The cross-border automated flight plan exchange will evolve to include automated radar hand-offs and eventual seamless cross border ATC operations

## APPENDIX C

### 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	- <b>Flight plan processing</b> (FDPS/Flight Data Processing System)
Stage II	- <b>Radar data processing</b> and ATS surveillance (RDPS/Radar Data Processing System, ADS and exchange of radar information); - <b>Monoradar</b> ; - <b>Multiradar</b> ; - <b>Radar data sharing</b> .
Stage III	- <b>Automated</b> 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,							

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

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

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

## APPENDIX D

### 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).

**Agenda Item 5:       ATFM Implementation in the CAR/SAM Regions**

5.1.           The meeting was informed that the ICAO 11th Air Navigation Conference (AN-Conf/11) concluded (Recommendation 1/1 – Endorsement of the global ATM operational concept) that ICAO, the States and the regional planning and implementation groups (PIRGs) should consider the global ATM operational concept as the common global framework for planning the implementation of ATM systems and to concentrate all ATM development work; use this global ATM operational concept as high-level guidance for development of ICAO CNS/ATM related provisions; and develop transition strategies for implementation of ATM systems based on the global ATM operational concept.

5.2.           Regarding the above, the AN-Conf/11 also agreed that the operational concept provided a vision that would allow States and Regions to align their planning processes, allow system solution engineering to be directed toward a harmonised and interoperable outcome, allow airspace users and service providers to share data and information to best mutual outcome, and enhance levels of safety, economy and efficiency, for the good of members of the ATM community.

5.3.           Likewise, the Conference unanimously agreed that the harmonised implementation of air navigation systems would increase airspace capacity while producing additional benefits, such as more efficient flight profiles and higher safety levels. Therefore, it was agreed that States should implement the regional air navigation plans, recognizing the longer-term vision of the operational concept and the Global Plan, in order to ensure convergence towards a uniform “gate-to-gate” ATM system, and that any implementation plans should fully consider the needs of airspace users.

5.4.           Accordingly, the meeting was informed that, in the last few years, the CAR/SAM States, in close coordination with the CAR/SAM Regional Planning and Implementation Group (GREPECAS) and ICAO, have planned and developed an intense programme of activities for the implementation of various ATM functions through the application of CNS/ATM systems, with emphasis on the application of the ATM global operational concept, and using the recommendations formulated by the Eleventh Air Navigation Conference as the frame of reference for future activities.

5.5.           In this respect, and in keeping with the analysis of main traffic flows carried out under Project RLA/98/003, Transition to the CNS/ATM Systems in the CAR/SAM Regions, there are airspace sectors that are already having traffic congestion, especially on special and peak periods, basically due to the different capacities of the various ATC systems, or some of them are being affected by traffic congestion, inadequate operation planning at some airports, and airport infrastructure limitations.

5.6.           According to the information provided by the Administrations and the analysis carried out under Project RLA/98/003, in view of the foreseen air traffic growth, these measure might not be sufficient to increase airspace capacity and the availability of optimum flight levels to meet the demand in both Regions, despite the improvements made through the implementation of 40 RNAV routes and the restructuring of the ATS route network, the application of longitudinal separation minima of 10 minutes MNT and 80 RNAV, as well as the successful implementation of RVSM and plans to implement RNP in the CAR/SAM Regions.

5.7. The meeting noted that the amendment to the CAR/SAM CNS/ATM Regional Plan, approved by GREPECAS/12, which, in turn, will permit the amendment of the CAR/SAM Air Navigation Plan (ANP) (Basic Vol. and FASID), the implementation of national traffic Flow Management Units (FMUs) in most of the traffic flows of both Regions contained in ATM Evolution Tables by 2008, and of the centralised regional ATFM by 2010.

#### **National traffic flow management units (FMU) and centralised regional ATFM unit**

5.8. The meeting recognised that the implementation of national FMUs and of a Centralised Regional ATFM would ensure an optimum air traffic flow in given areas or airspaces in periods when the demand might exceed the available capacity of the ATC system, thus reducing both in-flight and ground delays and avoiding system saturation. This implementation will guarantee a more effective use of the available capacity of airspace and airports, without the need to apply unnecessary restrictions to air operations. **Appendix A** to this part of the Report contains the proposed functions of the centralised regional ATFM unit.

#### **Aspects to consider for ATFM implementation**

5.9. The meeting recognised that the regional implementation of ATFM will be a complicated and painstaking process, and will require the active participation of all stakeholders. In this respect, in order to expedite the ATFM planning and implementation process, the ATFM Task Force (ATFM/TF) of the ATM Committee of the GREPECAS ATM/CNS Subgroup, when developing its Work Programme, should consider and redefine, *inter alia*, those aspects shown in Appendix A already mentioned and **Appendix B** to this part of the report and in the guidelines for regional ATFM implementation proposed by Uruguay, which appear in **Appendix C** to this part of the report.

5.10. The meeting also felt that the Terms of Reference and Work Programme of the ATFM/TF, shown in **Appendix D** to this part of the report, shall be redefined, taking into account that item d) of the work programme of the ATFM/TF, would be reviewed by the Institutional Aspects Task Force of GREPECAS.

5.11. Notwithstanding the above, the meeting considered that it would be advisable for members of the ATFM/TF to attend the meetings of the Institutional Aspects Task Force as observers, to coordinate as necessary, planning to carry out the meeting of the referred Task Force from 19 to 21 September 2005 in Caracas, Venezuela.

5.12. The meeting was informed by COCESNA that, due to its geographical location near important poles of industrial, commercial and tourist development within the CAR Region, Central America is experiencing a continuous growth in commercial aviation, which brings, besides economic benefits, a strong impact in the efficiency of the ATS services, also in services and airports facilities, this is more evident during certain months, days and hours, in specific geographical areas, routes and airports of the Central America FIR.

5.13. The meeting recognized that, just like in other areas, ATFM implementation in the Central American Region demands, *inter alia*, economic resources, ATM/CNS infrastructure, project management capacity, as well as an adequate environment where the collaboration of air operators, ATS providers and other similar entities is necessary.

5.14. In this regard, COCESNA considered that it was an advantageous situation, since the resources available in COCESNA and the Central American States, as well as the currently being implemented by COCESNA, would give the necessary support for achieving the ATFM operation in the short term, considering the horizon established in the ATM Evolution Tables for the CAR/SAM regions, as approved by GREPECAS.

5.15. The meeting took note of the financial and human resources that the organization has available, as well as of the strategy for ATFM implementation in the Central America FIR. Detailed information on these matters is contained in **Appendix E** to this part of the Report.

5.16. The meeting took note of the current air traffic flow management capabilities of the air navigation management centre (CGNA) located in Sao José Dos Campos, Brazil, and of the action taken for ATFM purposes through the CGNA operational system.

5.17. The meeting considered that the information presented was very valuable and decided that it should be included in **Appendix F** to this part of the report for consideration by the ATFM/TF.

5.18. Likewise, the meeting took note of the ATFM plans of Colombia, which considered that the establishment of technical and operational standards to permit the inter-operability between air traffic control units was important.

5.19. The meeting took note of the points of view expressed at the RAAC/9 Meeting (Santiago de Chile, April 2005) by the Directors of Civil Aviation of the South American Region regarding the institutional aspects for the management and control of multinational systems and facilities, and particularly on ATFM implementation.

5.20. When discussing this matter, it was noted that, given the nature of AFTM implementation, the institutional aspects for the management and control of multinational systems and facilities, were important for the planning, development and implementation process of this service.

5.21. In this sense, the meeting agreed that air traffic flow management (ATFM) could be considered as an initial system/service for this purpose, since:

- a) ATFM is directly related to the component of the ATM operational concept that corresponds to airspace organisation and management;
- b) it is related to other components of the concept; and
- c) the technology for ATFM implementation is already available in the Region.

5.22. The meeting took note that, in the opinion of the Directors of Civil Aviation of the SAM Region, the following scenarios could be foreseen in the CAR/SAM/NAM Regions for the establishment of institutional arrangements, and which could be considered within the programming for ATFM implementation:

- a) Sub-region integrated by Canada, Mexico and United States of America;
- b) Central America with COCESNA, its regional mechanism;
- c) The Caribbean; and
- d) South America.

#### **Preparatory meeting of the GREPECAS ATFM/TF**

5.23. Following an extensive and fruitful debate on this matter, the States felt that it would be highly convenient for the ATFM/TF of the ATM Committee to hold a preparatory meeting prior to the meeting of the GREPECAS ATM/CNS Subgroup, to be held in August, in Mexico City, with the purpose of ensuring the availability of sufficient documentation for the discussion of this topic during the aforementioned meeting. In this sense, Brazil offered to sponsor this important event, which would be coordinated by the Secretariat. Accordingly, the meeting formulated the following conclusion:

#### **Conclusion AP/ATM/10/28**

#### **Preparatory meeting of the ATM/TF of the ATM Committee**

That ICAO coordinate with the members of the ATFM/TF the possibility of holding a preparatory meeting of this task force, prior to the meeting of the GREPECAS ATM/CNS Subgroup.

5.24. The United States communicated to the meeting that, based on the experience obtained and in view of the important benefits of the ATFM for users and ATS providers, they will decidedly support and collaborate by bilaterally and multilaterally agreements with the States/Territories and International Organizations of the CAR/SAM Regions that are planning ATFM implementation, in which corresponding contacts for agreements with COCESNA, Dominican Republic and other civil aviation administrations have already been initiated.

## APPENDIX A

### LIKELY FUNCTIONS OF A CENTRALIZED REGIONAL ATFM

- Provide Air Traffic Flow Management (ATFM) services in the Caribbean and South American Regions;
- Collect and compare data on air navigation infrastructure, air traffic control (ATC) capacity in the Caribbean and South American Regions, and on aerodromes used by international air transport, including runway, taxiway, and gateway capacities in both Regions.
- Collect and analyze data on forecast air traffic (controlled flights) in the Caribbean and South American Regions;
- Establish a consistent table of foreseen traffic demand, including *ad hoc* traffic forecasts, a comparison with the available capacity, and the identification of the areas and duration of foreseen critical traffic overloads;
- Coordinate with air traffic service (ATS) authorities/providers and national traffic flow management units (FMU) in order to make all possible efforts to increase the available ATC capacity when necessary.
- When the deficiencies in terms of available ATC capacity cannot be eliminated, determine and apply, in a timely manner, the appropriate tactical measures in coordination with air traffic service (ATS) authorities/providers and national traffic flow management units (FMU), as required, and with the aircraft and aerodrome operators involved.

## APPENDIX B

### Aspects that could be considered for ATFM Implementation

#### 1. Identification of the operational requirement

- Traffic congestion during “peak” periods and hours;
- Aircraft not operating at their optimum flight levels;
- Fuel burn.

#### 2. Impact on airspace

- Optimization of the current structure of the CAR/SAM ATS Routes Network (if necessary);
- Flexible utilization of the airspace (prohibited, restricted and special-use airspaces) and civil/military coordination;
- Mixed operations (aircraft with different performances) in the same airspace;
- Availability of optimum flight levels;
- Need for a better airspace sectorization.

#### 3. Impact on Air Traffic Services

- ATS standard and contingency Procedures;
- Automation level of the ACC, including the integration level and interoperability;
- Appropriate amended to the CAR/SAM Regional Supplementary Procedures;
- Training of the ATC personnel;
- ATC workload;
- Surveillance and communications coverage in some FIRs.

#### 4. Impact on operations and airport services

- Delays in apron before to start the towing/taxing for departure;
- Delays for taxi and take off;
- Delays for taxi after landing and for the apron allocation.

#### 5. Cost/Benefit analysis.

- Air traffic forecast;
- Traffic congestion reduction;
- Reduction in delays;
- Reduction of ATC workload;
- Increment of air operations safety;
- Greater availability of optimum flight levels;
- Fuel and time of flight savings;
- Financial feasibility.

**6. Impact on Civil Aviation Administrations**

- Implementation planning;
- Establishment of a method for air space safety assessment;
- Operational implementation.

## APPENDIX C

### Orientation guidelines for the ATFM implementation in the CAR/SAM Regions

#### 1. ATFM objectives, principles and functions

1.1. The ATFM service had to be provided as a supplement to ATC, and should guarantee an optimum traffic flow to or through areas where traffic demand might exceed the available ATC capacity at some point in time. This optimum flow could be attained by maintaining a balance between traffic demand and capacity, in close coordination with operators and the ATCs involved.

1.2. Thus, the ATFM should meet the following objectives:

- Overload protection for the ATC.
- Integrated use of the existing ATC capacity.
- Maximum flexibility in the management of the different traffic flows.
- Rationalisation of traffic flows.
- Operate at the minimum level required so as not to affect the cost-benefit ratio.

1.3. In order to meet these objectives, the ATFM should be based on the following principles:

- Be at the disposal of all the States in the Region, adjusting to the requirements of Operators, ATC Units in the region and adjacent Units.
- Use traffic demand data obtained from a common and permanently updated database.
- The integrated database (IDB) must provide information based on operator plans (PFDs), constantly updated RPLs, and sporadic traffic and historical data, and be able to incorporate FPLs immediately upon receipt.
- Take measures sufficiently in advance to prevent overloads and minimise their effect on operators.
- Maintain close and continuous coordination with Flow Control Units (FMUs), Operators, and adjacent ATC Units.
- Must be handled by highly qualified and trained personnel.
- Must be available 24 hours a day to ensure proper distribution of ATC capacity.

1.4. The ATFM should be designed to fulfil the following functions:

- Obtain data on ATC infrastructure and the capacity of its systems.
- Obtain and analyse data on all scheduled flights within its area or region of influence.
- Have a consistent picture of traffic demand, compare it with the available capacity, and identify conflicting areas and periods.
- Coordinate capacity upgrades with ATS authorities, when appropriate.
- Define suitable measures for those areas where a capacity upgrade is not feasible.
- Periodically study the results of ATFM measures, for continuous improvement purposes.
- Apply a strict quality assurance control of the service provided.
- Have and secure the best means of communication among the different elements of the ATFM service, in order to ensure an efficient and effective performance of the system in terms of information distribution and reception.

## 2. ATFM activities

2.1. ATFM activities must be addressed to traffic flows or flight series, and to concrete flights and days. To that end, planning, strategy development, and day-to-day monitoring should be provided for.

2.2. Regarding the above, ATFM activities can be developed in three phases:

- Strategic: up to 48 hours before the day of operation
- Pre-tactical: within 48 hours prior to the day of operation
- Tactical: during the day of operation

### 2.3. Strategic phase

2.4. The strategic planning phase can be broken down into two parts:

- A continuous data collection and interpretation process, and a systematic and regular review of procedures and measures.
- An international coordination process to ensure the compatibility and efficiency of national and international requirements

2.4.1. Strategic planning has two main objectives:

- To identify imbalances between demand and capacity in ATC systems, whether in underutilised or saturated areas.
- To use said information to recommend measures leading to increased capacity or effective use of the existing capacity.

2.4.2. Regarding the above, a method that could be used for identifying imbalances between demand and capacity is comparing available traffic forecasts with known capacity data.

2.4.3. DEMAND data are obtained from different sources:

- Forecasts based on the integrated database (IDB) and adjusted to demand.
- Recent historical traffic data comparable to the one to be analysed (*e.g.*, the same day of the previous week or of some vacation period).
- Traffic trends provided by national authorities, user organisations (*e.g.*, IATA), etc.
- RPLs.
- Other related information (*e.g.*, air shows, major sport events, military manoeuvres, and, in general, extreme events or situations which might generate additional or an extraordinary demand which affects the available ATC capacity).

2.4.4. CAPACITY data are provided by the various ATCs. However, there should be close coordination between the Flow Control Units of each ATC and the centralised ATFM, to ensure that the available capacity is distributed in such a way as to meet the existing demand.

2.4.5. Regarding the above, consideration should be given to factors such as personnel availability forecasts, possible medium-term changes in ATC procedures, installation of new equipment, airport infrastructure works affecting runways or parking stands, etc.

## 2.5. **Pre-tactical phase**

2.5.1. Basically, the pre-tactical phase comprises the study of the demand for the day of operation (starting 48 hours before), and its comparison with the capacity available on that day, adjusting the Strategic Plan or adopting different measures when necessary.

2.5.2. At the end of the process, the agreed measures should be disseminated in a bulletin (ATFM Reporting Message) containing the restrictions, and which can be distributed through the AFTN, SITA, etc.

2.5.3. The tasks in this phase may include the following:

- Determining ATC capacity of the different areas, based on the particular situation that day.
- Estimating the existing demand.
- Preparing a demand/capacity comparative study.
- Studying those sectors where saturation is expected and the flows affected, estimating acceptance quotas to be applied according to the capacity of the system.
- Preparing a summary of the ATFM measures to be proposed.
- Making a last review on the day before the operation, and, in consultation with the affected ACCs, determining definitive ATFM measures, which will be published in the bulletin 12 hours before the affected operations take place.

2.5.4. Acceptance quotas may be established bearing in mind the following:

- They should be expressed as the number of flights over a given point, on a given period of time.
- At the points of entry of a given area, they should be in proportion to the demand foreseen for those same points during the period in question.
- Quotas established for long periods of time must be estimated periodically, preferably every day.
- It is advisable to conduct a study afterwards, to assess the impact of the measures and to adjust them inasmuch as possible, according to the information received by the different units making up the system, and to make the necessary tactical adjustments.

## 2.6. **Tactical phase**

2.6.1. The tactical activity is aimed at ensuring that the measures taken during the strategic and pre-tactical phases resolve the demand/capacity problems in the flows or areas of application, that the measures imposed are the minimum required and that the unnecessary measures have been eliminated, that ATC resources are used properly, and that maximum use is made of the existing capacity, without compromising safety.

2.6.2. It should also be noted that the existing delays are equitably distributed among operators.

2.6.3. In order to meet these objectives and comply with the above, the ATFM plan should be monitored in real time, in close contact with the ATC operation underway, where real-time access to data is critical.

2.6.4. At present, the main ATFM measures being applied in this tactical phase are the use of SLOTS and REROUTINGS, trying to avoid significant penalties to operators.

**APPENDIX D****ATFM TASK FORCE**

**ATM-ATFM/400: Develop an Air Traffic Flow Management (ATFM) system for its future Implementation in the CAR/SAM Regions**

**ATFM Task Force****1. Terms of reference**

Carry out specific studies in order to determine and elaborate guidance material on an Air Traffic Flow Management (ATFM) system to ensure an optimum air traffic flow in the CAR/SAM Regions.

**2. Work Programme**

- a) **Review the documentation on air traffic flow management and the policies globally established;**
- b) **Review the ATFM regional plans of other regions;**
- c) **Review the existing ATFM national plans;**
- d) **Review the institutional aspects involved in a multinational environment;**
- e) **Review the ATFM technical and operational aspects;**
- f) **Identify the minimum requirements to implement ATFM;**
- g) **Define the principles in which the ATFM CAR/SAM service will be based;**
- h) **Evaluate different alternatives and strategies that may satisfy the future air traffic flow management in the CAR/SAM Regions;**
- i) **Prepare a draft of ATFM guidance material for the CAR/SAM Regions; and**
- j) **Present not later than ATM/6 Committee the guidance material for their approval.**

**3. Composition**

Argentina, Brazil\*, Chile, Colombia, Costa Rica, Mexico, Peru, United States, Uruguay and COCESNA

\* Rapporteur: Rolim Higinio

**4. Task termination date**

ATMC/6 Meeting.

## APPENDIX E

### Resources available and ATFM implementation strategy in the Central American FIR

1. Among these resources, COCESNA mentioned the following:
  - Economic resources for the execution of the project
  - Support to COCESNA from the Central America States.
  - ATC Automated systems in the entire region and in COCESNA.
  - Implementation and operation of a PRE-ATN network in Central America.
  - Central America Satellite network to support ATC, radar and AFTN services.
  - Satellite links with others CAR ATC centres using the MEVA network with voice, radar data and AFTN capability (radar data, AFTN, etc).
  - Agreements and current operative systems for the sharing and exchange of Radar data among Central America countries and COCESNA, and between COCESNA and USA.
  - Enough highly qualified personnel in the ATM/CNS Fields.
  - Solid office automation infrastructure with wide experience in the development of similar projects.
  - Collaboration of air operators outside Central America, ICAO and other similar organizations.
  
2. The meeting was informed that the AFTM implementation in the Central America FIR involves several considerations to achieve the objective in the time limit, with the consequent benefits to all parties related with the same.
  
3. Some of the considerations are as follows:
  - a. To develop the project in an integral way, involving the Central America States, COCESNA, ICAO, operators and states outside the region.
  - b. To establish the Terms of Reference for the execution of the project complying with the ICAO's guidelines and regional agreements, in such a way that guarantees the achievement of a product compatible with the actions that are carried out in the CAR/SAM regions.
  - c. Exploitation of available technological means in the marked, oriented towards aeronautical field and other areas,, in order to develop and implement a ATFM system, not limited to the needs of the Central American FIR, but able to enlarge its action field of action and of service to the CAR Region.
  - d. Establishment of bilateral or multilateral cooperation agreements with countries or organizations with experience in similar systems, in order to achieve the implementation of an efficient, reliable and dynamic and evolutionary system, based in a state-of-the art technology, supporting the current demand at short, mid and long-term.
  - e. Clearly identify the negative points that can affect the development of the project in order to correct them. These points could be related with ATC strategies to get an optimal flow of the air traffic, incompetence of the ATC system to manage an excessive flight volume, due to exceed the declared capacity, airport congestion due limited infrastructure, etc.

## APPENDIX F

### OPERATIONAL CONCEPT AND ATFM CAPACITY ALREADY IMPLEMENTED AT CGNA

1. In general lines, the Brazilian ATM Operational Concept foresees that the CGNA will be able to carry out the following activities:

- a) Make a follow-up of Air Navigation Services provided by the Department of Airspace Control (DECEA);
- b) Evaluate the operational impact of outages on the aeronautical and airport infrastructures capacity.
- c) Adopt coordination operational measures in order to adjust air traffic movements to the aeronautical and airport infrastructures capacity.
- d) Verify the air traffic flow management measures;
- e) Adopt measures addressed to the flexible use of airspace, including the necessary coordination to activate airspaces of special use.
- f) Conduct the Collaborative Decision Making process to the providers and aircraft operators;
- g) Coordinate the reestablishment of aeronautical and airport infrastructure elements, considering the operational criteria.
- h) Monitor safety in new structures of airspace, according to ICAO standards.
- i) Coordinate the establishment of capacity values related to the aeronautical and airport infrastructures.
- j) Analyze the proposed regular flights, evaluating their impact on the established capacities.

2. The Brazilian ATM Operational Concept preconizes that the operational implementation be accomplished by Phases taking into consideration all CGNA activities. Nevertheless, it considers the following training sequence:

- a) 1st. Priority - Acquire Capacity of Air Traffic Flow Management;
- b) 2nd. Priority - Acquire Capacity of Airspace Management; and
- c) 3rd. Priority - Acquire Capacity of Safety Operational Monitoring

3. The Brazilian ATM Operational Concept indicates that each phase will be implemented based on Technical Configurations, Descriptive Documents of Operational Models and Systems set up as required to materialize the established strategy.

4. In general, the Phases were established as follows:

- a) Phase 1 – To make it possible to adjust air traffic movements to the available infrastructure capacity;
- b) Phase 2 – To make it possible to attend the demand of air movements by means of improving capacity.

## **5. Already installed capacity at the CGNA**

5.1 Phase 1 of CGNA's implementation, that should be concluded in June 2005, has involved the following activities:

- a) Civil Constructions in the Building;
- b) Installation of energy, air conditioning and communications;
- c) Definition of functional "Lay-Out";
- d) "Hardware" Installation (CGNA and CARSAMMA);
- e) Networks definition and installation (operational and administrative);
- f) Implementation of the Slot Integrated Central (SIS) with the referred support system (ASIS) Airport Slot Integrated System);
- g) Implementation of the Repetitive Flight Plans Central (RPLC);
- h) Implementation of Flow Management Cells (FMC) at Curitiba and Brasilia ACCs and at Belo Horizonte, São Paulo and Rio de Janeiro APPs;
- i) Implementation of the Visualization and Treatment System for Air Navigation Management, named "SYNCROMAX", composed by the following Subsystems:
  - Flight Intention Data Treatment Subsystem – FPS;
  - Airport and Geographic Data Subsystem – GDS;
  - Situation Analysis Subsystem – SAS;
  - HOTRAN Management Subsystem – HMS;
  - Outages Management Subsystem – SGI;
  - System General Parameters;
  - Regulated Elements; and
  - Aircraft Performance;
- j) "Software" Validation with National Radar Synthesis Visualization (ASD module);
- k) SISNOTAM Integration;
- l) Delivery of the "Software" Documentation
- m) Personnel Training and assisted operation.

## **6. Operational Capacity after implementation of phase 1:**

6.1 Once the implementation of the functionalities and systems mentioned in item 3.1 is concluded, the following services can be provided:

- a) Routine analysis of Air Traffic Demand and Aeronautical Infrastructure Capacity, comprising their several elements, allowing to know, strategically and all over the country, the impacts caused by air traffic movements on airports and on control sectors. Then, it will be possible to determine when, where and how airspace users can operate and to estimate the eventual restrictions to the operations in a specific portion of airspace or airport.
- b) Use of anticipated information about the load in the system, scenario situation and available resources, viabilizing efficient air traffic flow management, being this the first step to implement the collaborative decision making processes. (CDM).
- c) In specific cases, by the previous knowledge of capacity and demand, it will be possible to increase the capacity of a critical element to attend the demand.

- d) Users affected by situations in which the system has no sufficient capacity to attend the demand will be warned with a minimum anticipation of 3 hours, including in this information details about the restrictions to be applied.
- e) There will be a continuous register of reasons that originated flow control, as well as an evaluation of the impacts occurred, in order to provide due information for necessary actions, avoiding this event keeps occurring indefinitely. Besides that, it will be possible, as from the radar synthesis visualization, the verification of the quality related to the services provided and of the adopted flow measures efficacy.
- f) From the available data on airport and aeronautical infrastructure elements, it will be possible to execute the System Operational Monitoring, aiming at evaluating the unavailability impact, partial or total, of any of these elements on the airport and aeronautical infrastructure capacity.

## **7. General Aspects of CGNA implementation - Phase 2**

7.1 The requirements specification of CGNA implementation – Phase 2 has already been initiated based on the knowledge acquired in Phase 1 and shall be improved based on the operational experience derived from the supply of the services mentioned on item 3.2.1. The new requirements established for the CGNA, so far, and that will be gradually implemented till 2008 are:

- a) Integration of the Air Situation Presentation System to SYNCROMAX.
- b) Centralized initial processing of flight plans.
- c) Integration of the Control Tower Management System (CTMS) to SYNCROMAX.
- d) Automation and integration of the Flow Management Cells (FLMC) to SYNCROMAX.
- e) Monitoring of the system operation through the identification and control of outages.
- f) Implementation of the military operation coordination cell, aiming at a flexible use of airspace.
- g) Integration of meteorological information to SYNCROMAX, including the definition of the meteorological information recollection means, the evaluation of the impact caused by meteorological phenomena in the Airport and Aeronautical infrastructure capacity.
- h) Development and integration of new tools designed for Airspace Management.
- i) Development and integration of new tools designed for air operations safety monitoring.
- j) Integration of the Slot System to SINCROMAX.

**Agenda Item 6: Other matters****Coordination and harmonization of ATS contingency plans of Argentina, Bolivia, Brazil and Paraguay**

6.1 Paraguay presented its contingency plan approved for FIR Asuncion, which is based in ICAO guidelines to ensure the safe, orderly and uninterrupted flow of international air traffic in the event of interruption of the air navigation services provided to international civil aviation.

6.2 The meeting considered that, in case that certain inconveniences occurred in the application of the contingency plans, these issues should be agreed between parties involved, with assistance of ICAO, so as to achieve an effective coordination and harmonization that contribute with the updating of the CAR/SAM Regional Plan.

6.3 As the result of the Ad-hoc group, composed by the States involved: Argentina, Bolivia, Brazil and Paraguay, concluded in continuing the coordinations to harmonize their ATS contingency plans. To this end, they shall meet in a parallel way during the AP/ATM/11 Meeting, in order to finalize the corresponding contingency plans.

**RNAV/RNP Seminars and Course on ATS safety assessment**

6.4 The meeting was informed on the forthcoming RNAV/RNP seminars, to be carried out in Mexico City from 11 to 13 August 2005, and the second, in connection with the AP/ATM/11 Meeting, in Lima, Peru, from 26 to 27 September 2005. Also the meeting was informed on the next course on ATS safety assessment, which will take place in Lima, Peru in December 2005.

6.5 The meeting understood that these events would be beneficial for implementation purposes and are being sought in the CAR/SAM Regions, and agreed that ICAO take the necessary actions to foster participation to this events of adequate personnel.