INTERNATIONAL CIVIL AVIATION ORGANIZATION

TWELFTH MEETING ON THE IMPROVEMENT OF THE AIR TRAFFIC SERVICES IN THE SOUTH ATLANTIC

(Sal, Cape Verde, 15 – 17 December 2004)

Agenda Item 5: CNS/ATM Systems Implementation.

(Presented by the Secretariat)

Summary

This working paper presents CNS/ATM Systems Evolution Tables for en - route operations in the AFI Region in respect of AR-1 and AR-2, for necessary review by the meeting and amendment as required to ensure harmonization with CAR/SAM requirements for AH1 and AH8.

1 Introduction

1.1 Appendices A and B to this paper contains CNS/ATM Systems Evolution Tables from the AFI CNS/ATM Implementation Plan (Doc 003) as amended by the Secretariat taking due account of last developments.

2 Action by the meeting

2.1 The meeting is invited to review and amend (as necessary) the information contained in Appendices A and B hereto with the objective to harmonize AFI and CAR/SAM plans for Routing Areas AR-1/AH-1 and AR-2/AH-8.

APPENDIX A

Area of Routing	FIRs	Systems Evolution 1995-2010				
		Airspace and Traffic Management	Communications		Navigation	Surveillance
			Mobile Service	Fixed Service		
1	2	3	4	5	6	7
Europe - South Atlantic (Oceanic routes) **AR-1/HA-1**	Atlantico Canarias Casablanca Dakar Oceanic Lisboa Sal	Fixed RNAV routes (1995) Full random RNAV environment (Dec.2006) Reduction of longitudinal separation to 10 minutes using Mach Number Technique (1998); Distance based separation 80 NM (2006) 50NM (2007 - onwards); Reduction of lateral separation to 50 NM (2005). Further reduction of lateral separation to 30NM (2007 - onwards); RVSM (2002)	DCPC (data) by participating aircraft (Bpa) (2005); Full VHF coverage on all ATS routes above FL300, and 150 NM from international airports (2000) CPDLC (2005)	Gradual introduction of ATN compatible bit-oriented procedures (BOP) between AFTN main centres (2005-onwards) AIDC AMHS (2005-onwards)	RNP 5: Casablanca and Canarias FIRs (1998); RNP 10: Other FIRs (1999-2004); RNP 5: (2005 - onwards) Other FIRs GNSS as primary-means	Automatic Position Reporting (APR) Bpa trials (2000); Automatic Dependent Surveillance (ADS) on RNP airspace Bpa (from 2005)

Area of Routing	FIRs	Systems Evolution 1995-2010				
		Airspace and Traffic Management	Communications		Navigation	Surveillance
			Mobile Service	Fixed Service		
1	2	3	4	5	6	7
Atlantic Ocean (AFI-NAT/SAM interface) **AR-2/HA-8**	Accra Dakar Oceanic Johannesburg Oceanic Luanda Sal	Random routing (2005) Reduction of longitudinal separation to 10 minutes (2000) RVSM (Jan.2006)	DCPC (data) by participating aircraft (Bpa) (2005); HF (voice)	Gradual introduction of ATN compatible bit-oriented procedures (BOP) between main AFTN Centres (2005); AFTN and ATS/DS (1999)	RNP 10 (2005) GNSS as primary-means	ADS (2000)

APPENDIX B

Activity Reference

A sequence of letters identifying the sub-domain, followed by a serial number unique to each activity. The derivation of identifiers is shown in the following Table:

Domains	Areas	Sub-domains	Identifiers
Communications			C
	Mobile Service		C-M
		Voice - HF	**C-MVH**
		Voice - VHF	**C-MVV**
		Data - VHF	**C-MDV**
		Data - Satellite	**C-MDS**
		Data - HF DL	**C-MDH**
	Fixed service		C-F
		Character oriented - AFTN	**C-FC**
		BIT oriented - ATN	**C-FB**
		Voice - ATS/DS	**C-FV**
		Interfacility	**C-FI**
Navigation			N
	En-route/TMA		N-R
		VOR/DME	**N-RV**
		RNP	**N-RNP**
	Approach and landing		N-A
		ILS	**N-AI**
		MLS	**N-AM**
		GNSS	**N-AS**
Surveillance			S
	Radar		S-R
		Primary Radar - PSR	**S-RP**
		Secondary Radar - SSR	**S-RS**
	Dependent		S-D
		Automatic - ADS	**S-ADS**
Air Traffic Management			M
	RNAV		M-R
		Fixed	**M-RF**
		Random	**M-RR**
	Conventional routes		**M-C**
	RNP		**M-RNP**
	Separation		M-S
		Longitudinal	M-SG
		Lateral	M-SL
		Vertical	M-SV

1. **Activity Reference**	2. **Domain**	3. **Sub-Domain**	4. **Coordinator**
M-SG EUR/SAT AR-1	ATM	Separation longitudinal	SAT/Group

5. **Title**	Reduction of longitudinal separation minima applying Mach Number Technique (MNT)
6. **Description**	Present longitudinal separation minima is 10 minutes. Will also include ATS route UA302
7. **Shortcoming or Objective Addressed**	Present longitudinal separation minima lead to unavailability of economic flight trajectories during peak periods
8. **Expected benefits**	Increased airspace capacity and reduced delays
Required elements	
9. **Airborne**	RNAV Voice/Data communications, MNT
10. **Ground**	Availability of ATS/DS circuits between ATS units, extended VHF coverage MNT, Voice/data communications

11. **Cost benefit assessment:** High

12. **Area of applicability**	13. **States concerned**
Selected volume of airspace in FIRs: Casablanca, Canarias, Dakar Oceanic, Recife and Sal	Brazil, Cape Verde, Morocco, Senegal and Spain .
14. **Phases**	15. **Target dates**
Extended VHF coverage Operational application Operational application UA302	1996 1998 1999

16. **Related Activities** (*all other related Activities*)

17. **Additional requirements which would increase the benefits**

Common application date by NOTAM
Implemented since 23 April 98 (except for UA302)

1. **Activity Reference**	2. **Domain**	3. **Sub-Domain**	4. **Coordinator**
M-SL EUR/SAT **AR-1**	ATM	Separation lateral	SAT/Group

5. **Title**	Reduction of lateral separation minima
6. **Description**	Lateral separation minima will be reduced from the present 100NM to 50NM. Second phase from 50 NM to 25 NM
7. **Shortcoming or Objective Addressed**	System capacity constraints
8. **Expected benefits**	Increase system capacity to provide optimum flight profiles to aircraft.
Required elements	
9. **Airborne**	RNP 10 approval/certification; RNP 5 for 2004 - 2nd phase. Voice/Data communications
10. **Ground**	Voice/Data communications Pilot position reports.
11. **Cost benefit assessment:** Estimated high. To be quantified.	

12. **Area of applicability**	13. **States concerned**
Oceanic airspace to be specified in FIRs: Casablanca, Canarias, Dakar Oceanic, Recife and Sal	Brazil, Cape Verde, Morocco, Senegal and Spain .
14. **Phases**	15. **Target dates**
50 NM 30 NM RNP 5 RNP 10	1999 - 2004 : *implemented 2002* 2007 - onwards 1998 Casablanca and Canarias FIRS 1999 - 2004: Other FIRs: *Implemented 2002*

16. **Related Activities** (*all other related Activities*)
Amendment to the SUPPS Doc 7030 M-RNP EUR/SAT
17. **Additional requirements which would increase the benefits**
WGS-84 datum

1. **Activity Reference**	2. **Domain**	3. **Sub-Domain**	4. **Coordinator**
M-RR EUR/SAT AR-1	ATM	Random Routing	SAT/Group

5. **Title**	Random routing EUR/SAT
6. **Description**	Availability of random routing in a defined volume of airspace along the EUR/SAT traffic flows.
7. **Shortcoming or Objective Addressed**	Present fixed route system results in less than optimum flight profiles.
8. **Expected benefits**	Availability of more economic routings.
Required elements	
9. **Airborne**	DCPC (Voice/Data) RNP approval/certification FMS; AOC data link; Direct flight plan uploads
10. **Ground**	DCPC (Voice/Data) AOC data link Flight plan generation AOC/ATS data communications
11. **Cost benefit assessment:** Estimated high. To be quantified.	

12. **Area of applicability**	13. **States concerned**
Oceanic airspace to be specified within FIRs: Casablanca, Canarias, Dakar Oceanic, Recife and Sal	Brazil, Cape Verde, Morocco, Senegal and Spain .
14. **Phases**	15. **Target dates**
Progressive elimination of fixed ATS route system from West to East	2000 -2006

16. **Related Activities** (all other related Activities)
Amendment to Doc. 7030 S-ADS EUR/SAT C-MD(V/S/H) EUR/SAT
17. **Additional requirements which would increase the benefits**
ADS DCPC FDPS

1. **Activity Reference**	2. **Domain**	3. **Sub-Domain**	4. **Coordinator**
M-SV EUR/SAT AR-1	ATM	Vertical separation	SAT/Group

5. **Title**	Reduced vertical separation minimum above FL290
6. **Description**	Vertical separation minimum of 2000 ft above FL 290 lead to unavailability of economic/preferred flight levels during peak periods
7. **Shortcoming or Objective Addressed**	Present fixed route system results in less than optimum flight profiles.
8. **Expected benefits**	Increased airspace capacity and reduced delays
Required elements	
9. **Airborne**	RVSM certification/Operational approval Voice/Data communications
10. **Ground**	Availability of reliable ATS/DS circuits between ATS units, extended VHF coverage and trained personnel Height monitoring sampling Voice/data communications
11. **Cost benefit assessment:** Estimated high. To be quantified.	

12. **Area of applicability**	13. **States concerned**
Oceanic airspace to be specified within FIRs: Casablanca, Canarias, Dakar Oceanic, Recife and Sal	Brazil, Cape Verde, Morocco, Senegal and Spain .
14. **Phases**	15. **Target dates**
Extended VHF Progressive evolution towards RVSM	1996 2000 – 2002 (Implemented)

16. **Related Activities** (all other related Activities)
Amendment proposal to Doc. 7030
17. **Additional requirements which would increase the benefits**
Common application date by NOTAM *Implemented 24 January 2002.*

1. **Activity Reference**	2. **Domain**	3. **Sub-Domain**	4. **Coordinator**
C-MD(V/S/H) EUR/SAT AR-1	Communications	Data link	SAT/Group
5. **Title**	DCPC (data) via VHF, satellite and/or HF data link along the Europe to South America routes.		
6. **Description**	This capability allows aircraft operating in the EUR/SAT routes to exchange ATS messages with ATS units using data link.		
7. **Shortcoming or Objective Addressed**	Present exchanges of ATS messages via HF are inherently unreliable resulting in need for increased longitudinal separation minima and reduced freedom of flight.		
8. **Expected benefits**	RNP along specific itineraries as a result of improved communications(2000), reduced longitudinal separation minima (1995) and random routings in selected portions of the airspace starting in year 2000.		
Required elements			
9. **Airborne**	Satellite and VHF air/ground data communications capability. HF data link communications capability		
10. **Ground**	Satellite and/or VHF air/ground data communications capability Flight data processing system (FDPS). HF data communications capability		
11. **Cost benefit assessment:** High benefits expected from improved communications. To be quantified.			
12. **Area of applicability**	13. **States concerned**		
FIRs: Canarias, Casablanca, Dakar Oceanic, Recife and Sal.	Brazil, Cape Verde, Morocco, Senegal and Spain (Canarias).		
14. **Phases**	15. **Target dates**		
Trials and demonstrations Limited Operational service	1999 2000 - onwards		
16. **Related Activities** (all other related Activities)			
Coordination with the SAM Region . Coordination with service providers			
17. **Additional requirements which would increase the benefits**			
Standardized message formats and contents			

1. **Activity Reference**	2. **Domain**	3. **Sub-Domain**	4. **Coordinator**
N-RNP EUR/SAT **AR - 1**	Navigation	RNP 10	SAT/Group

5. **Title**	Required Navigation Performance
6. **Description**	Definition and publication of a navigation performance value to be attained by traffic operating in a specified volume of airspace between Europe and South America.
7. **Shortcoming or Objective Addressed**	Reduction of present 100NM lateral separation minima to 50NM (RNP 10) Second phase: 25 NM (RNP 5)
8. **Expected benefits**	Lower lateral separation minima will allow for the more frequent availability of user preferred profiles.
Required elements	
9. **Airborne**	RNP 10 approval/certification DCPC (Voice/data)
10. **Ground**	Amendment to Doc. 7030.

11. **Cost benefit assessment:** Estimated to be high. To be quantified.

12. **Area of applicability**	13. **States concerned**
Oceanic airspace to be specified within FIRs: Canarias, Casablanca, Dakar Oceanic, Recife and Sal	Brazil, Cape Verde, Morocco, Senegal and Spain .
14. **Phases**	15. **Target dates**
Publication Operational Application RNP 5 RNP 10 RNP 5	2000 2000 1998 Casablanca and Canarias FIRs 2000 Other FIRs Upper airspace : *Implemented 2002* 2005 - onwards Other FIRs

16. **Related Activities** (all other related Activities)

Amendment to Doc 7030

17. **Additional requirements which would increase the benefits**

1. **Activity Reference**	2. **Domain**	3. **Sub-Domain**	4. **Coordinator**
S-ADS EUR/SAT AR-1	Surveillance	Dependent	SAT/Group

5. **Title**	Automatic Dependent Surveillance EUR/SAT
6. **Description**	To establish a capability in which aircraft automatically provide, via a data link, data derived from on-board navigation and position-fixing systems, including aircraft identification, four-dimensional position, and additional data as appropriate to ATS units.
7. **Shortcoming or Objective Addressed**	Lack of displays at ATS units of air traffic situation outside radar coverage lead to increased separation minima and constrained freedom of flight, both of which impact negatively on airspace users.
8. **Expected benefits**	Better accommodation of user preferred trajectories, resulting in more economic flight profiles.
Required elements	
9. **Airborne**	ADS avionics capability. DCPC (voice/data)
10. **Ground**	DCPC (voice/data) ADS workstation Software: Capability to process and display ADS messages and eventually Current Flight Plan derived flight profiles.

11. **Cost benefit assessment:** Estimated to be high. To be quantified.

12. **Area of applicability**	13. **States concerned**
Oceanic airspace to be specified within FIRs: Casablanca, Canarias, Dakar Oceanic, Recife and Sal	Brazil, Cape Verde, Morocco, Senegal and Spain .
14. **Phases**	15. **Target dates**
*Trials and demonstrations Limited functionality Full Operational functionality	2000 2001 - 2004 2005

16. **Related Activities** (all other related Activities)

C-MD(V/S/H) EUR/SAT
Coordination with the SAM Region.

**Note: ADS already available in Canarias ACC. Trials with full system capability to start soon*

17. **Additional requirements which would increase the benefits**

(CPDLC).

1. **Activity Reference**	2. **Domain**	3. **Sub-Domain**	4. **Coordinator**
M-SG Atlantic Ocean(AFI/NAT/SAM) AR-2	ATM	Separation longitudinal	SAT/Group

5. **Title**	Reduction of longitudinal separation minima
6. **Description**	Present longitudinal separation minima of 20 minutes will be reduced to 10 minutes.
7. **Shortcoming or Objective Addressed**	Present longitudinal separation minima lead to unavailability of economic flight trajectories during peak periods
8. **Expected benefits**	Increased airspace capacity and reduced delays
Required elements	
9. **Airborne**	RNAV Voice/data communications
10. **Ground**	Availability of ATS/DS circuits between ATS units, extended VHF coverage MNT, Voice/data communications
11. **Cost benefit assessment:** High	

12. **Area of applicability**	13. **States concerned**
Selected volume of airspace in FIRs: Accra, Johannesburg Oceanic, Dakar Oceanic, Luanda and Sal.	Angola, Cape Verde, Ghana, Senegal and South Africa.
14. **Phases**	15. **Target dates**
ATS/DS circuits Extended VHF coverage Operational application	June 1999 June 1999 2000 (Implemented)

16. **Related Activities** (*all other related Activities*)
17. **Additional requirements which would increase the benefits**
Common application date by NOTAM

1. **Activity Reference**	2. **Domain**	3. **Sub-Domain**	4. **Coordinator**
M-RR Atlantic Ocean (AFI/NAT/SAM) interface AR-2	ATM	Random routing	SAT/Group

5. **Title**	Random routing along the Atlantic Ocean (AFI/NAT/SAM) interface
6. **Description**	Availability of random routing in a defined volume of airspace along the Atlantic Ocean (AFI/NAT/SAM) interface traffic flows
7. **Shortcoming or Objective Addressed**	Present fixed route system results in less than optimum flight profiles
8. **Expected benefits**	Flexible track structures provide more economic routings
Required elements	
9. **Airborne**	DCPC (Voice/data) RNP approval/certification FMS AOC data link Direct flight plan profiles
10. **Ground**	DCPC (voice/ data) AOC data link Flight plan generation. AOC/ATS data communications
11. **Cost benefit assessment:** Estimated high	

12. **Area of applicability**	13. **States concerned**
Oceanic airspace to specified in FIRs: Accra, Dakar Oceanic, Johannesburg, Luanda and Sal.	Angola, Cape Verde, Ghana, Senegal and South Africa.
14. **Phases**	15. **Target dates**
Operational application	2005

16. **Related Activities** (*all other related Activities*)
S-ADS Atlantic Ocean (AFI/NAT/SAM) C-MD(V/S/H) Atlantic Ocean (AFI/NAT/SAM) Amendment to Doc 7030
17. **Additional requirements which would increase the benefits**
ADS/CPDLC, FDPS, WGS-84 datum

1. **Activity Reference**	2. **Domain**	3. **Sub-Domain**	4. **Coordinator**
C-MDS AFI/NAT/SAM interface AR-2	Communications	Data- link	SAT/Group

5. **Title**	DCPC data via satellite and/or HF datalink along the AFI/NAT/SAM interface.
6. **Description**	This capability allows aircraft operating in the AFI/NAT/SAM interface to exchange ATS messages with ATS units using AMSS/HFDL data link.
7. **Shortcoming or Objective Addressed**	Present exchanges of ATS messages via HF are inherently unreliable resulting in need for increased longitudinal separation minima and reduced freedom of flight.
8. **Expected benefits**	Random routing as a result of improved communications, reduced longitudinal separation minima.
Required elements	
9. **Airborne**	Satellite air/ground data communications capability. HF data link
10. **Ground**	Satellite/HFDL air/ground data communications capability Flight data processing system (FDPS).
11. **Cost benefit assessment:** High benefits expected from improved communications. To be quantified.	

12. **Area of applicability**	13. **States concerned**
Oceanic portions of FIRs: Accra, Johannesburg Oceanic, Dakar Oceanic, Luanda and Sal.	Angola, Cape Verde, Ghana, Senegal and South Africa.
14. **Phases**	15. **Target dates**
Trials and demonstrations Operational service	June 1999 2000 - 2005

16. **Related Activities** (all other related Activities)
Coordination with service providers Coordination with adjacent NAT and SAM States.
17. **Additional requirements which would increase the benefits**
Standardized message formats and contents

1. **Activity Reference**	2. **Domain**	3. **Sub-Domain**	4. **Coordinator**
N-RNP AFI/NAT/SAM interface **AR-2**	Navigation	RNP 10	SAT/7 Group
5. **Title**	Required Navigation Performance		
6. **Description**	Definition and publication of a navigation performance value to be attained by traffic operating in a specified volume of airspace between Africa and South America.		
7. **Shortcoming or Objective Addressed**	Reduction of present 100NM lateral separation minima to 50NM .		
8. **Expected benefits**	Lower lateral separation minima will allow for the more frequent availability of user preferred trajectories.		
Required elements			
9. **Airborne**	RNP 10 approval/certification DCPC (Voice/data)		
10. **Ground**	Amendment to Doc. 7030.		
11. **Cost benefit assessment:** Estimated to be high. To be quantified.			
12. **Area of applicability**	13. **States concerned**		
Oceanic airspace to be specified within FIRs: Accra, Dakar Oceanic, Johannesburg Oceanic, Luanda, and Sal	Angola, Cape Verde, Ghana, Senegal and South Africa.		
14. **Phases**	15. **Target dates**		
Studies Publication Operational Application	1996 1999 2000 2005		
16. **Related Activities** (all other related Activities)			
Amendment to Doc 7030			
17. **Additional requirements which would increase the benefits**			

1. **Activity Reference**	2. **Domain**	3. **Sub-Domain**	4. **Coordinator**
S-ADS AFI/NAT/SAM interface AR-2	Surveillance	Dependent	SAT/Group

5. **Title**	Automatic Dependent Surveillance AFI/NAT/SAM interface routes
6. **Description**	To establish a capability in which aircraft automatically provide, via a data link, data derived from on-board navigation and position-fixing systems, including aircraft identification, four-dimensional position, and additional data as appropriate to ATS units.
7. **Shortcoming or Objective Addressed**	Present imprecise displays at ATS units of air traffic situation lead to increased separation minima and constrained freedom of flight, both of which impact negatively on airspace users.
8. **Expected benefits**	Better accommodation of user preferred trajectories, resulting in more economic flight profiles.
Required elements	
9. **Airborne**	ADS avionics capability. DCPC (voice/data)
10. **Ground**	DCPC (voice/data) ADS workstation Software: Capability to process and display ADS messages and eventually Current Flight Plan derived flight profiles.

11. **Cost benefit assessment:** Estimated to be high. To be quantified.

12. **Area of applicability**	13. **States concerned**
Oceanic portions of FIRs: Accra, Johannesburg Oceanic, Dakar Oceanic, Luanda and Sal.	Angola, Cape Verde, Ghana, Senegal and South Africa.
14. **Phases**	15. **Target dates**
Trials and demonstrations Operational Application	1999 2001

16. **Related Activities** (all other related Activities)

C-MD(S/H) AFI/NAT/SAM interface
Coordination with adjacent NAT and SAM States.

17. **Additional requirements which would increase the benefits**

CPDLC
