

**INTERNATIONAL CIVIL AVIATION ORGANIZATION**  
**REGIONAL COORDINATION MEETING IN PREPARATION OF THE ITU WRC-2003**

(Lima, 27 to 28 March 2001)

**Agenda Item 4: Frequency planning for aeronautical systems**

- a) **Aircraft FM immunity requirements**
- b) **Frequency planning for conventional systems in the CAR/SAM and other regions**
- c) **Current and future frequency allocations for GNSS**
- d) **VDL**
- e) **HFDL Review of the ICAO position for ITU WRC-2003**

(Presented by the Secretariat)

**1. CAR/SAM Regional frequency planning**

1.1 This information paper presents the attached documentation on which the regional frequency planning is supported. This documentation was developed by the CAR/SAM/3 RAN Meeting and is applicable in the CAR/SAM regions with the corresponding ICAO SARPs. The attached documentation contains:

- a) As **Appendix A**, the list of related Recommendations/Conclusions for the Aeronautical Mobile Service en Route (AMS(R)) and the radionavigation service;
- b) As **Appendix B**, frequency planning documentation related with the AMS(R)); and
- c) As **Appendix C**, frequency planning documentation related with the radionavigation service.

1.2 This information paper has also the purpose to provide support for a presentation to be made during the meeting in relation with Agenda Item 4 b).

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**Recommendation 9/19 – AM(R)S planning principles**

That the principles outlined in Attachment E of Appendix 9-A be considered for the planning of the AM(R)S in the CAR/SAM Regions.

*Note. – The essence of this recommendation is to be incorporated in the Basic ANP as shown in Appendix 9-A*

**Recommendation 9/21 – AM(R)S Plan**

That Tables CNS 2A, CNS 2B and Chart CNS 5, constitute the new aeronautical mobile (R) service for the CAR/SAM Regions and be included in the FASID as shown in Appendix 9-B.

*Note. – Pending the implementation of the airspace re-organization to be carried out by Brazil in 2003, as shown in Table CNS 2A and Chart CNS 5, Table CNS 2A\* and Chart CNS 5\*, also attached in Appendix 9-B, reflect the current operational and technical requirements of the AM (R) S Plan.*

**Recommendation 9/22 – Geographical separation criteria for VHF air-ground communications**

That geographical separation criteria shown in Attachment F of Appendix 9-A be used for international VHF frequency assignment in the CAR/SAM Regions.

*Note. – The essence of this recommendation is to be incorporated in the Basic ANP as shown in Appendix 9-A*

**Recommendation 9/23 – VHF frequency allocations for ATS Functions in the CAR/SAM Regions**

That CAR/SAM States, to the extent possible, select frequencies from the VHF sub-bands indicated in Appendix 9-A, Part IV, Section 2.3.6 for their AM(R)S allocations.

*Note. – The essence of this recommendation is to be incorporated in the Basic ANP as shown in Appendix 9-A.*

**Recommendation 9/24 – Channel spacing plan for assignable VHF air-ground communications**

That States in the CAR/SAM Regions complete their transition to the new 25 KHz VHF channel spacing environment by the end of the year 2000.

**Recommendation 10/2 – Aeronautical Radio Navigation Aids Plan**

That table CNS 3 constitute the Aeronautical Radio Navigation Aids Plan for the CAR/SAM Regions and be included in the FASID as shown in Appendix 10-B.

**Conclusion 9/25 – Maintenance of ICAO COM List 3 – “Frequency Assignments in the Band 117.975 - 137.000 kHz”**

That States:

- a) in order to support the frequency management functions of the ICAO Regional Offices (including the publication of the COM List No. 3), expeditiously notify the appropriate ICAO Regional Office of any changes to their VHF AM(R)S frequency assignments; and
- b) release any assigned VHF AM(R)S frequency which is not intended for operational use in the near future and notify the appropriate ICAO Regional Office accordingly.

*Note. – The essence of this conclusion is to be incorporated in the Basic ANP as shown in Appendix 9-A*

**Conclusion 10/1 – Planning principles for radio navigation aids**

That States, in planning the implementation of radio navigation services, consider the principles shown in Attachment A of Appendix 10-A.

*Note. – The essence of this conclusion is to be incorporated in the Basic ANP as shown in Appendix 10-A.*

**Conclusion 10/3 – Maintenance of ICAO COM List No. 1 “List of Facilities Operating on Frequencies in the LF/MF Band (190 - 1750 kHz)” and ICAO COM List No. 2 “Record of VHF Frequencies Assignments to Caribbean and South American VOR and ILS Radio Navigation Aids”.**

That States:

- a) in order to support the frequency management functions of the ICAO Regional Offices (including the publication of the COM Lists Nos. 1 and 2), notify the relevant Regional Office of all changes to their frequency assignments; and
- b) release any assigned frequency which is not included in firm plans for operational use in the near future and notify accordingly the relevant ICAO Regional Office.

*Note. – The essence of this conclusion is to be incorporated in the Basic ANP as shown in Appendix 10-A.*

### **AM(R)S PLANNING PRINCIPLES**

In the planning of the AM(R)S the following principles should be taken into account:

- a) based on the ATS providers and aircraft operators plans, the implementation of air-ground data link communications in the CAR/SAM Regions should be carried out in a progressive manner taking into account cost-benefit considerations;
- b) communications data links, when implemented, should be used for routine air-ground communications. Voice communications capability should be maintained for emergency purposes at the ATM units;
- c) VHF communications, supported by extended range facilities where required, should be used to cover ATS routes to the maximum extent possible;
- d) VHF planning should be based on channel spacing of 25 KHz and assignment of frequencies in the band 117.975 to 137 MHz should be based on the principles set out in Annex 10, Volume V;
- e) in coordination with States, VHF frequency channels assignment for planned and operational air-to-ground communications should be recorded and published by the ICAO Regional Offices;
- f) where full VHF coverage is provided, the requirements of HF should be withdrawn;
- g) where full VHF RTF coverage is not practicable, or cannot be guaranteed at all times, HF RTF communications should be provided;
- h) the assignments of HF/SSB frequencies for voice communications should be made in accordance with the allotment Plan and technical principles for the AM(R)S contained in Appendix S27 of the ITU-R Radio Regulations. The assignments for HF data communications should be made based on the agreement to be made in this respect between the ICAO and the ITU;
- i) satellite voice communications must be capable of providing a quality equivalent to that of VHF voice and priority must be available for satellite ATS voice communications in both “to” and “from” aircraft direction;
- j) in planning the AMS(R)S, proliferation of AMSS ground earth stations (GES) should be avoided; and
- k) for the remote and oceanic areas without VHF coverage, satellite air-ground data links of the AMSS should be planned and complemented as necessary with HF DL services.

## GEOGRAPHICAL SEPARATION CRITERIA

Air/ground Communication for	Symbol	Designated Operational Coverage		Minimum Geographical Separation (NM)	Adjacent Channel Separation (NM)
		NM	up to m (ft)		
Aerodrome control	TWR	25	1200 (4000)	175	50
Surface movement control	SMC	Limits of the aerodrome	Surface	25	25
Approach control up to fl450	APP/U	150	13700 (45000)	820	180
Approach control up to fl250	APP/I	75	7600 (25000)	550	95
Approach control up to fl120	APP/L	50	3650 (12000)	370	60
Area control up to fl450	AC/U	Within the area plus 50 NM	13700 (45000)	520 between limits of service areas	180 between limits of service areas
Area control up to FL250	AC/L	Within the area plus 50 NM	7600 (25000)	390 between limits of service areas	95 between limits of service areas
SST high level operations or VHF/ER	AC/R	To be specified	20000 (66000)	1300	350
VOLMET up to FL450	V	Maximum omni- directional available	13700 (45000)	520	180

## AM(R)S VHF SUB-BANDS ALLOTMENT TABLE

Frequency Sub-band (MHz)	World-wide Utilization	CAR/SAM Application	Remarks
118.00-118.925	National/International	TWR	
119.00-121.375	National/International	APP	
121.5	Emergency frequency	Emergency frequency	
121.60-121.975	National/International	SMC	
122.00-123.05	National	-	
123.1	Aux. frequency SAR	Aux. frequency SAR	
123.15-123.675	National	-	Note 1
123.45	Air-to-air communications	Air-to-air communications	
123.70-126.675	National/International	ACC	
126.70-127.575	National/International	General purpose (GP)	
127.60-127.90	National/International	VOLMET/ATIS	
127.950-128.80	National/International	ACC	
128.850-129.850	National/International	APP	
129.90-132.025	National/International	AOC	
132.050-132.950	National/International	VOLMET/ATIS	
133.00-135.950	National/International	ACC	
136.00-136.875	National/International	-	
136.90-136.975	National/International	Reserved for VDL	

**Note 1:** With the exception of 123.45 MHz which is also used as the world-wide air-to-air communications channel.

## **PLANNING PRINCIPLES FOR THE AERONAUTICAL RADIO NAVIGATION AIDS**

The current CAR/SAM aeronautical radio navigation plan is based on certain planning principles which have been developed through the years. An updated list of such planning principles, which incorporates the latest developments, especially with regard to satellite navigation matters, is presented below:

a) **NDB:**

- 1) an NDB should be implemented where the provision of a VOR is not feasible. Guidance material for NDBs is contained in Annex 10, Volume I, Attachment C, Section 6;
- 2) radio frequencies assigned to NDBs shall be selected from those available in the portion of the spectrum between 190 to 1 750 kHz. A minimum ratio of 15 dB between wanted and unwanted signals shall be used;
- 3) between 30° S and 30° N, the minimum value of field strength at the limit of the rated NDBs coverage shall be 120 microvolts/m. Otherwise, 70 microvolts/m shall be provided; and
- 4) in selecting frequencies for modulation tones of NDBs, the 1 020 Hz tone should be used unless interference on adjacent carrier frequencies is experienced, in which case 400 Hz may be used;

b) **VOR:**

- 1) for VORs located in the CAR/SAM Regions required to serve flights up to FL450 (using 100 kHz channel spacing in odd tenths of a megahertz in the band 111.975 - 117.975 MHz), a geographical separation of 550 NM for co-channel and 220 NM for adjacent channel frequency assignment should be used;
- 2) for VORs in congested areas where older receivers (with a 100 kHz spacing operate in a mixed 100 kHz - 50 kHz channel spacing environment, geographical separation for adjacent channel should be greater than 500 NM;
- 3) in that part of the North America (NAM) Region bordering the CAR Region, as well as in certain parts of the CAR Region, there is a congestion of VOR facilities, and it has become increasingly difficult to assign new VOR frequencies that are not in conflict with other assignments. Where there is congestion of VOR facilities, consideration should be given to reducing the service volume to what is actually required operational use. In such cases, the reduced service volumes and geographical separations used are:

<b>CLASS OF FACILITY</b>	<b>FREQUENCY-PROTECTED VOLUME OF AIRSPACE</b>	<b>MINIMUM CO-CHANNEL</b>	<b>MINIMUM ADJACENT CHANNEL SEPARATION</b>
Terminal	25 NM (46 km) radius, up to 12 000 ft (3 658 m) mean sea level (MSL)	130 NM (241 km)	30 NM (56 km)
Low	40 NM (74 km) radius, up to 18 000 ft (5 486 m) MSL	185 NM (343 km)	50 NM (83 km)
High	130 NM (241 km) radius up to 45 000 ft (13 716 m) MSL	390 NM (722 km)	150 NM (275 km)

- 4) it is recognized that in applying the concept of reduced service volumes to overcome difficulties in VOR frequency deployment in any given area of congestion, there may be a special requirement to exceed the minimally set service volume to accommodate a certain portion of airspace or certain operational procedures. In such case, an “expanded service volume” covering the airspace or operational procedure in question could be established and provided with special frequency protection. This could be done, in general, on a case-by-case basis;

c) **non-visual aids for final approach and landing:**

- 1) a regional strategy for the introduction of final approach and landing was developed by GREPECAS as part of the CAR/SAM Regional Plan for the Implementation of the CNS/ATM Systems. This strategy is presented in the attachment ;
- 2) in the CAR/SAM Regions, the majority of aircraft carry ILS localizer and glide path receivers with channel spacing of 100 kHz and 300 kHz, respectively. Moreover, it is considered that the density of ILS facilities in the CAR/SAM Regions is such that localizer and glide path frequencies can be assigned, in accordance with the provisions of Annex 10, Volume I, paragraph 3.1.6.1.1. The minimum geographical separation between ILS facilities would be 105 NM for co-channel and 31 NM for adjacent channel. Guidance material on this matter is provided in Annex 10, Volume I, Attachment C, paragraph 2.6; and
- 3) GBAS carrier frequencies will have to be selected in accordance with applicable GNSS SARPs. ILS/GBAS and COM (VHF)/GBAS geographical separation criteria are currently under development. Until this criteria are defined and included in the SARPs, GBAS frequencies can be selected from the band 112.050 - 117.900 MHz;

d) **DME:**

- 1) for most DME facilities which operate in association with VORs, the same geographical separation criteria established for the VOR are equally applicable. Guidance material on geographical separation criteria for different DME types is provided in Annex 10, Volume I, Attachment C, paragraph 7.1.7; and

e) **guidelines for transition to satellite navigation systems:**

- 1) the GNSS should be introduced in an evolutionary manner;
- 2) the ground infrastructure for current navigation systems must be available during the transition period;
- 3) States/regions should consider segregating traffic according to navigation capability and granting preferred routes to aircraft with better navigation performance;
- 4) States/regions should coordinate to ensure that separation standards and procedures for appropriately equipped aircraft are introduced approximately simultaneously in all flight information regions (FIRs) along major traffic routes; and
- 5) in planning the transition to GNSS, the following issues must be considered:
  - schedule for availability and approval of GNSS-based service;
  - extent of existing ground-based radio navigation service;
  - level of user equipage;
  - provision of other systems required for air traffic services (i.e. surveillance and communication);
  - density of traffic/frequency of operations; and
  - mitigation of risks associated with radio frequency interference.

**REGIONAL STRATEGY FOR THE INTRODUCTION AND APPLICATION OF  
NON-VISUAL AIDS FOR APPROACH, LANDING AND DEPARTURE**

- 1.1 maintain the ILS as the ICAO standard precision approach and landing system as long as necessary and as long as it remains operationally acceptable and economically beneficial;
- 1.2 promote, in the short term, the use of GNSS in support of non-precision approach operations and the augmented GNSS for CAT I precision approaches and landing in accordance with the available SARPs and guidance material of ICAO;
- 1.3 promote and monitor the studies on the viability of CAT II and CAT III GNSS operations with the corresponding necessary augmentations, to apply those capabilities in operationally acceptable and economically beneficial cases;
- 1.4 taking into consideration the projected availability of SARPs and guidance material of ICAO, in regard to GNSS operations, States/territories requiring implementation of these systems for approach, landing and departure operations, conduct, as soon as possible, studies for the implementation of local ground stations for complementary data link systems and for GNSS avionics equipment;
- 1.5 support the application of the required navigation performance (RNP) for approach, landing and departure operations in accordance with ICAO provisions when applicable; and
- 1.6 promote the development and validate the use of a multi-mode receiver (MMR) or the use of an on-board capability based on the operation, that allows the maximum transition flexibility in the future, in order to facilitate the transition and maintain the inter-functionability of air navigation systems and services.