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**SECOND WORKSHOP/MEETING OF THE SAM IMPLEMENTATION GROUP (SAM IG/2)
REGIONAL PROJECT RLA/06/901**

Lima, Peru, 3 to 7 November 2008

**Agenda Item 5: Assessment of operational requirements in order to determine the
implementation of communications and surveillance (CNS) capabilities
improvement for en-route and terminal area operations**

**GUIDELINES FOR THE IMPROVEMENT OF COMMUNICATIONS,
NAVIGATION AND SURVEILLANCE SYSTEMS**

(Paper presented by the Secretariat)

Summary

This working paper presents information regarding the work carried out by Project RLA/06/901 in correspondence with Immediate Objective No 1, activity 1.3. This work has been oriented to develop guidance material for States regarding CNS improvements that could be implemented in the short/medium term, in order to support mainly the PBN, ATFM and service automation implementation plans for the inter-operation of applications in the areas of ATM, MET and AIS.

References:

- Project document RLA/06/901
- SAM/IG/1 Meeting Report
- Regional PBN Route Map
- ATFM operational concept
- GREPECAS/14 and GREPECAS/15 Meetings

1 Background

1.1 The region, within the global ATM multinational planning approach being presently followed, has started to develop tasks with the support of Project RLA/06/901, within an ample scope of operational requirements derived from performance objectives already identified by GREPECAS. The implementation of these operational requirements should be co-related to possibilities and availability of different CNS/ATM technologies for the inter-operation of applications in the areas of the specific services and systems.

1.2 SAM/IG/1 Meeting held in April 2008 worked on CNS aspects contemplated in activity 1.3 of immediate objective No. 3 of project RLA/06/901. Tasks executed by this meeting were oriented to collect information from States in order to update the Air Navigation Plan, likewise plan of actions projects were elaborated to improve Communications and Surveillance, and tasks were defined to achieve progress in the development of works addressed to programme referred improvements in the short- and medium-term. In WP/02 prepared for this meeting, Conclusions formulated are presented and, in this Working paper the initial works developed by Project RLA/06/901 on this issued are being described.

2 Discussion

2.1 In relation to ICAO plans to develop an integrated and inter-operable Global ATM System in the SAM Region following GREPECAS recommendations, principally those formulated by GREPECAS/14 and GREPECAS/15, and with the support of Project RLA/06/901, plans have been formulated for the development of several navigation application based on PBN concept, as well as the need to start implementing ATFM based on ATFM operational concept developed by GREPECAS. These short- and medium-term plans consider as their integral part the need to achieve a development level with respect to aeronautical communications, navigation and surveillance for the implementation of operational requirements at short/medium term. In this regard, current CNS/ATM technologies or available in the short/medium term should be studied and proposed for a homogeneous and evolved implementation of the region's required infrastructure.

2.2 Agenda Items 1, 2 , 3 and 4 are referred to the progress achieved on operational issues associated to performance objectives established by GREPECAS, and examine, principally, progress achieved in the navigation applications Action Plan, such as RNAV-5 and Plans for strategic ATFM in airports.

2.3 Project RLA/06/901, continuing with works planned during SAM/IG/1 meeting, and considering present and future situation with the implementation of performance objectives/operational requirements presently under development, carried out a study on technical/operational aspects that would be necessary for the evolution towards required improvements in the short/medium term. In this regard, this study emphasized issues of importance with relation to ATC functions automation and the implementation of applications related to communications, navigation and surveillance to be used in en-route and terminal area navigation up to year 2015.

2.4 Considering the above, **Appendix A** to this working paper presents the study carried out by project RLA/06/901 in relation to guidelines for States regarding the implementation of CNS systems improvements to comply with operational requirements in the short and medium-term for en-route and terminal area operations.

3 Suggested action

3.1 The meeting is invited to consider the information presented in this Working Paper and to review Appendix A to this, in order to recommend that the referred guidance material prepared by Project RLA/06/901 be considered by the States in planning CNS improvements at the short- and medium term.

APPENDIX A

Guideline for the improvement of Communications, Navigation and Surveillance systems for satisfying operational requirement in the short- and medium-term for En-route and Terminal Area operations

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Final Version

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Preliminary Guideline for the improvement of Communications, Navigation and Surveillance systems for satisfying operational requirement in the short- and medium-term for En-route and Terminal Area operations

1 Objective

1.1 Within the frame of the Global Air Navigation Plan, these guidelines has been prepared as an initial document for orienting States in the implementation of the improvement of CNS systems for En-route and Terminal Area operations.

1.2 In order to achieve this objective, the following has been carried out:

1.2.1 Analysis of current CNS situation and diagnosis

1.2.2 General recommendations for action to be executed by States in the ATM operational environment

1.2.3 Identification of operational requirements for en route and terminal area in thee short- and medium-term

1.2.4 Identification of certain requirements for Aerodrome Operations from the perspective of door-to-door operations, with high density traffic or with mobile complex operations (vehicles and aircrafts) and,

1.2.5 Proposal of CNS improvements in the short- and medium-term.

2 Scope

2.1 This document is addressed to SAM States and it considers implementations at short- and medium-term, up to 2010 and in between 2011 and 2015 respectively, such as indicated in guidelines contained in the Global Air Navigation Plan within this work frame.

3 Analysis of current CNS situation and diagnosis

3.1 Communications

3.1.1 Aeronautical fixed service

3.1.1.1 *Conventional services*

3.1.1.1.1 AFTN service: circuits supplied have been totally implemented. However, and due to the average life period, maintenance of existing centres results today in a problem to be considered.

3.1.1.1.2 ATS oral service: circuits supplied have been totally implemented. Circuits are analogic and operate without inconveniences.

3.1.1.2 *Services under CNS/ATM concept*

3.1.1.2.1 AMHS service: this service has already been implemented nationwide in two States and locally in one State. Up to date other States are spreading out their systems.

3.1.1.2.2 Bi- or multilateral AMHS integration: this has not yet been started, initial arrangement exist to begin with the interconnections.

3.1.1.2.3 ATFM Units' interconnection: not implemented between States.

3.1.1.2.4 Flight plans transference

3.1.1.2.4.1 OLDI: although this service does not respond exactly to CNS/ATM concept, it is available in several States, though only one uses it operationally within the same administration environment.

3.1.1.2.4.2 AIDC: only one State has this capacity available, though not operational up to date.

3.1.1.3 *Information Transportation Network*: conventional satellite or ground means of communication is available in States without the availability of "national operative networks environments". At international level, REDDIG has the conditions to provide this support.

3.1.2 Aeronautical mobile service

3.1.2.1 *Conventional services*

3.1.2.1.1 En-route:

3.1.2.1.1.1 Continental:

3.1.2.1.1.1.1 VHF (local and remote): services have been implemented according to described in the respective CNS table, ensuring coverage in most of selected areas, existing inconveniences in selected low level spaces. Available equipment is conventional, and most have at least ten years of life cycle consumed.

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3.1.2.1.1.2 HF: use only as an alternative mean. Equipment is conventional and, in general, life cycle has been exceeded at length.

3.1.2.1.1.2 Oceanic:

3.1.2.1.1.2.1 HF: this service is not available in all oceanic ACCs. Equipment is conventional and, in general, nominal life cycle has been exceeded at length.

3.1.2.1.2 In Terminal Area and Aerodromes

3.1.2.1.2.1.1 VHF Services: implemented according the corresponding CNS table. Many units do not comply with the recommendation of counting with different frequencies for App and TWR services. PDC service has been implemented below required.

3.1.2.2 *Services under CNS concept*

3.1.2.2.1 En route:

3.1.2.2.1.1 Continental

3.1.2.2.1.1.1 VDL/CPDLC: it has not been implemented yet.

3.1.2.2.1.2 Oceanic

3.1.2.2.1.2.1 HFDDL/CPDLC: it has not been implemented yet.

3.1.2.2.1.2.2 Satellite/CPDLC: service implemented in some oceanic FIR for aircrafts equipped with FANS.

3.1.2.2.2 In Terminal Area and Aerodromes

3.1.2.2.2.1.1 VDL/CPDLC: it has not been implemented yet.

3.1.2.2.2.1.2 VDL/PDC: implemented in very few airports.

3.1.3 Broadcasting service

3.1.3.1 *Conventional service*

3.1.3.1.1 ATIS: implemented according to CNS tables, in an amount below required. Conventional audio recorders and analogic VHF transmitters are used.

3.1.3.1.2 VOLMET: idem above.

3.1.3.2 *Services under CNS/ATAM concept:*

3.1.3.2.1 Digital ATIS (synthesized voice – analogic transmission): although this service does not exactly respond to the concept, there are available in some airports. The option “synthesized voice – digital data is not used.

3.1.3.2.2 D-ATIS: implemented in very few airports.

3.2 **Navigation**

3.2.1 Conventional services

3.2.1.1 *Radio navigation aids:* installed according to CNS tables.

3.2.2 Services under CNS/ATM concept

3.2.2.1 GPS: extensive use

3.3 **Surveillance**

3.3.1 Conventional services

3.3.1.1 SSR: implemented according to Table CNS. Being these installations insufficient, the necessary coverage has not been ensured for all selected spaces. Serious problems exist in spares reposition.

3.3.1.2 Radar data exchange (State 1 radar – State 2 centre and viceversa): only exists between two States.

3.3.1.3 Inter-centre radar data exchange: only between two Sates, on ICD owner.

3.3.2 Services under CNS/ATM concept

3.3.2.1 Continental area

3.3.2.1.1 ADS-B: no services in operation are available up to date.

3.3.2.1.2 Multilateration: idem above.

3.3.2.2 Oceanic area

3.3.2.2.1 ADS-C: service provided by some oceanic FIRs with FANS equipped aircrafts.

3.3.2.3 Exchange of inter-centre radar data:

3.3.2.3.1 Asterix 62 and 63: only in one State

3.4 **Diagnosis**

3.4.1 *Conventional services*

- 3.4.1.1 Inexistence of national ATN makes impossible the harmonic implementation of services according to CNS/ATM concept.
- 3.4.1.2 AFTN service is not guaranteed for long term due to increasing difficulty to obtain spare parts.
- 3.4.1.3 Not enough Voice Communication Switching System (VCSS) in ACCs as well as in TWRs with sufficient number of services that merit the installation of this service.
- 3.4.1.4 Not all Oceanic ACCs can render ground-air communications services through conventional HF or CPDLC rendered by a third party.
- 3.4.1.5 Coverage of VHF communications is not guaranteed for low flight levels. Regarding technology, a big amount of VHF (and HF) obsolete equipment is available.
- 3.4.1.6 No communications between adjacent ATFM units are available.
- 3.4.1.7 Practically no transference of flight plans data is executed.
- 3.4.1.8 An insufficient amount of ATIS and VOLMET has been installed.
- 3.4.1.9 Some selected areas do not have radar coverage.
- 3.4.1.10 Radar information exchange between States is extremely insufficient.
- 3.4.1.11 PDC service is practically inexistent.

3.4.2 *Services under CNS/ATM concept*

- 3.4.2.1 Flight plans exchange is not carried out by OLDI or by AIDC.
- 3.4.2.2 ADS-C service is not rendered to all oceanic FIRs.
- 3.4.2.3 ADS-B surveillance and multilateration are practically inexistent.
- 3.4.2.4 D-ATIS service is practically inexistent.
- 3.4.2.5 D-VOLMET service is not available.
- 3.4.2.6 Radar data exchange between centres is practically inexistent.

NOTE: In order to visualize the interrelation of the different Communications and Surveillance Services, the interconnection between them is being presented in “Diagram 1 - Current Situation”.

4 ATM general recommendations

4.1 In the SAM Region, to execute Global Plan objectives, SAM Region States should carry out, among others, the following actions:

- 4.1.1 Develop an airspace concept as a high level declaration in airspace planning or Master Plan, to satisfy specific strategic objectives such as Safety, Capacity, Efficiency, Environment, etc. in order to permit the application of an optimum, secure, efficient and flexible airspace structure.
- 4.1.2 Use in a systematic way cost-benefit analyses in the implementation of air navigation infrastructure for selection of implementation priorities.
- 4.1.3 Explore with adjacent States/Territories and International Organizations the possibility of joint action for the purchase of technology that will enable sharing functions and benefits.
- 4.1.4 Analyse the current navigation capacity of aircrafts actually available as well as cost-benefit relation regarding the use of better management systems.
- 4.1.5 Analyse airport and airspace management (Sectors, TMA) in terms of the equation capacity-demand-efficiency and the impact of this in traffic flow.
- 4.1.6 Evaluate ATM automation tools at local level and their interconnection with other systems of adjacent FIRSs for sharing of different systems data and the impact of changes to be introduced in the automated system with the corresponding cost-benefit analysis.
- 4.1.7 Analyse aerodrome operations surveillance tools for mobiles control (aircrafts and vehicles) and runway incursions.
- 4.1.8 Use tools application such as CDM (Collaborative Decision Making) for the optimum improvement of management general performance.
- 4.1.9 Plan and coordinate the ATS personnel training necessary for the management of the new systems and specifications.
- 4.1.10 Determine the methodology (Qualitative or Quantitative) to be used for evaluating TMA operational safety.
- 4.1.11 Elaborate a data collection programme for the evaluation of TMA operational safety.
- 4.1.12 Aeronautical information traditionally offered in paper should be substituted by reliable data central media for operational and strategical ATM applications, which will demand a high-quality aeronautical database.

Data link and ATM automation applications

4.2 ATS surveillance systems implementation and data link applications should consider the corresponding automation aspects, principally regarding the need of harmonizing applied systems, in order to guarantee systems inter-operability.

4.3 In the continental airspace, improved surveillance techniques application (ADS-B and/or Multilateration) will permit reducing horizontal separation minimas, improve operational safety, increase capacity and improve flight efficiency in a rentable way. The use of other data link applications instead of voice Communications will provide significant advantages regarding operational safety and workload of pilots and controllers.

4.4 ADS-C and CPDLC application in oceanic airspaces will favour the necessary conditions for the use of horizontal separation minimas of 30 NM and, in other oceanic airspaces of less air traffic density, it will provide reliable means for surveillance and communication, reducing workload of controllers and pilots.

4.5 Regarding ATM automation, the following documents have been elaborated up to this moment:

4.5.1 *Preliminary Document of the CAR/SAM Regions ACC Interconnection System Interface Control.*

4.5.2 *System/Subsystem Referential Specifications for Air Traffic Control Automation Systems.*

4.5.3 *CAR/SAM Plan for the Automated ACC Interconnection.*

MET data link

4.6 The access to global operational meteorological information (OPMET) on real time assists ATM in tactic decision making for aircrafts surveillance, ATFM, aircrafts dynamic en-routing and to contribute to optimization of airspace and airports.

4.7 The increment of data link use to download and upload meteorological information through Systems such as D-ATIS and D-VOLMET will facilitate the ATC task.

4.8 Other information accessed on real time, such as alerts on low level wind vertical biting and automatic systems on tail turbulence in runway, will timely contribute with OPMET automated information that will maximize runway capacity.

ATFM

4.9 To develop ATFM first phase, SAM Region States should develop a methodology to calculate airport capacity and a database in order to analyse clue airports demand, considering per hour, daily, monthly and annual movements, with special attention to high season periods particular to each place..

4.10 Likewise, this en-route and terminal area (TMA) sectors capacity-demand calculation is complementary to airport capacity-demand calculation, and both should be jointly analyzed.

4.11 These studies will determine the total capacity of the system for different periods or time bands being considered, and will provide authorities with the possibility to study measures to optimize equation capacity-demand.

4.12 Two draft documents have been elaborated: CAR/SAM ATFM Route Map that will provide for guidelines for the implementation of national plans and for regional projects, and the ATFM Manual for the CAR/SAM Regions that will be presented in the SAM/IG/2 Meeting.

En-route and TMA operations

4.13 ATM homogeneous areas and principal traffic flows are specially related to en-route airspace. However, the improvement of the capacity and efficiency of the terminal control area (TMA) and aerodromes is an important complement to achieve a homogeneous, harmonic and global ATM system.

4.14 The implementation of en-route or terminal area operations implies that States carry out, first, an assessment of the characteristics of airspace under their jurisdiction and of existing CNS infrastructure, since this is affected by different strategic objectives that determine airspace concept.

4.15 Implement new RNAV routes or eliminate conventional or RNAV routes that are no longer used could cause not only minor changes but considerable modifications in the airspace and its infrastructure, depending of the amount of affected routes. Even some existing routes could be optimize being used for contingencies or “by pass” to facilitate certain traffic conditions.

4.16 The implementation of performance/based navigation (PBN) for en-route operations will require the application of excluding airspaces, having inconsideration that this would offer the conditions to execute the necessary changes in airspace structure. In order to not excluding a significant amount of users, the vertical limits of airspace where this will be implemented should be deeply analysed.

5 Operational requirements

5.1 Short-term en-Route Operations (up to 2010)

5.1.1 RNAV-5 specification

5.1.1.1 This application is expected to be executed in airspaces where is possible to obtain operational benefits and that the available CNS infrastructure can support it. Each State should analyse communications, navigation (VOR, DME) and ground surveillance infrastructure to make possible the application of this navigation specification.

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5.1.1.2 The use of ATS surveillance systems (Radar, ADS) can mitigate the requirement of a larger routes spacing with the purpose of overcoming eventual faults in navigation systems not detected by the flight crew since onboard systems for RNAV-5 do not require of an alert in case of occurrence of an important navigation error.

5.1.1.3 Due to the existence of airspace blocks having poor VHF communications and of airspace blocks in remote continental areas in low level traffic flows areas, direct communications between pilot and controller should be ensured in compliance with this operational requirement.

5.1.2 RNAV-5 specific requirements

5.1.2.1 *Communications:* direct communications between pilot and controller is required.

5.1.2.2 *Navigation:* alternate navigation sources are required:

5.1.2.2.1 VOR/DME

5.1.2.2.2 DME/DME

5.1.2.2.3 INS or IRS

5.1.2.2.4 GNSS

NOTE: The service supplier should carry out an assessment of navigation infrastructure, which should be adequate for proposed operations. “Gaps” in the navigation coverage can be accepted having in consideration route spacing and surfaces cleared of obstacles due to a possible error increase with lateral en route deviation while navigation phase takes place.

5.1.2.3 *Surveillance:* Do not require ATS surveillance.

NOTE: For the en-route spacing optimization, RADAR/ADS B ATS surveillance can be implemented. A cost-benefit analysis should be carried out.

5.1.3 RNP-10 specification

5.1.3.1 RNP-10 is applied in Corridor EUR-SAM, Lima Santiago Route and AORRA in South Atlantic.

5.1.4 RNP-10 specific requirements

5.1.4.1 Ground-Air communications: VHF or HF in remote areas.

NOTE: CPDLC implementation is desirable to eliminate understanding difficulties between Controller and Pilot. Aircrafts equipment should be evaluated.

5.1.4.2 Ground-ground communications:

5.1.4.2.1 Oral ATS

5.1.4.2.2 AFTN

NOTE: OLDI /AIDC system implementation is desirable since this decreases controller workload and avoids interpretation difficulties that contribute to diminish LHD.

5.1.4.3 Navigation: GNSS or INS

5.1.4.4 Surveillance: ADS-C for AORRA. The application is desirable if cost-benefit analysis can support it.

5.2 **Short-term TMA operations (up to 2010)**

5.2.1 In the first phase up to 2010, equipped and non-equipped aircrafts will be admitted in the TMA, and RNAV-1 and RNP-1 operations will be initiated after achieving an adequate rate of approved air operations.

5.2.2 RNAV-1 specifications: RNAV-1 navigations specification can be implemented in terminal areas with accuracy, continuity and adequate availability radar service, and with adequate ground navigation infrastructure, such as DME/DME and DME/DME/IRU. Pilot-Controller direct communications requirement.

5.2.3 RNAV-1 specific requirements

5.2.3.1 *Communications:* direct communication pilot-controller is required.

5.2.3.2 *Navigation:*

5.2.3.2.1 DME/DME

5.2.3.2.2 DME/DME/IRU

5.2.3.2.3 GNSS

NOTE: Radio navigation aids considered critical for this navigation specification need of a rigorous monitoring and of an on-time NOTAM issuance in case of failure of this service delivery. .

5.2.3.3 *Surveillance:*

5.2.3.3.1 Radar

5.2.3.3.2 Multilateration

5.2.3.3.3 ADS B

5.2.4 Basic RNP-1 specification: In no-radar environments or in those having inadequate ground infrastructure, basic RNP-1 application is expected in TMA selected by States, with the condition that an adequate percentage of air operations has been approved for GNSS exclusive application.

5.2.5 Basic RNP-1 specific requirements

5.2.5.1 Direct communications between pilot-controller. Improve communications in selected spaces.

5.2.5.2 Navigation: GNSS.

5.2.5.3 Surveillance: low density traffic surveillance requirement is not necessary, but desirable in high density traffic.

5.3 **RNP approaches and Baro-VNAV procedures**

5.3.1 The procedures based in navigation performance should be vertical guide approach procedure (APV) using Baro-VNAV for runways as primary approach or as final approach backup based in RNP APCH or RNP AR APCH in selected airports.

5.3.2 Baro-VNAV navigation specification is referred to those systems in the use of barometric altitude and RNAV information on vertical glide path.

5.3.3 RNP APCH can be implemented in most possible airports and in all international airports, and frustrated approach segment can be based on conventional aids. Procedures up to RNP 0.3 can be established.

5.3.4 RNP AR APCH can be implemented in those airports where operational benefits exist due to significant obstacles. Procedures of this type have been already applied in the airports of Quito (Ecuador) and La Serena (Chile) with satisfactory results, and in trial phase in Cuzco (Peru). These are procedures that can have precision RNP 0.3 and RNP 0.1.

5.3.5 Specific requirements for RNP APCH and RNP AR APCH with Baro-VNAV

5.3.5.1 Communications: direct between pilot-controller.

NOTE 1: For these Baro-VNAV approaches, altitude and temperature updated information is required in order to be supplied timely to the aircraft.

NOTE 2: ATIS D-VOLMET radio broadcasting desirable

5.3.5.2 GNSS/Baro VNAV for RNP APCH and RNP AR APCH supported navigation.

NOTA: RNP AR APCH application cannot be used in areas with interference known to GNSS signal.

5.3.5.3 Surveillance: No special requirements are needed.

5.4 **Short-term aerodrome operations**

5.4.1 Pre-departure dispatch: In selected international aerodromes, it is expected, according to Air Navigation Plan, to implement PDC (pre-departure dispatch) by voice or data.

5.4.2 Detection of mobiles and aircrafts in high density traffic aerodromes.

5.4.2.1 Up to year 2010, it is planned that the principal technology for calculation of mobiles position (aircrafts and vehicles) would be Surface Movement Radar (primary) and Multilateration systems, using transponder Mode S SSR answers and Mode S Squitter messages.

5.4.2.2 An improvement in this sense in this phase would be the application of Levels I and II of Surface movement guide and control system (A-SMGCS).

5.4.3 Surveillance:

5.4.3.1 Surface radar

5.4.3.2 Multilateration

5.4.3.3 Level I, Level II A- SMGCS

Level I: provides localization and identification of an aircraft or vehicle (Including Package I ADS-B-APT application)

Level II: provides a conflict prediction function to aircrafts and vehicles to alert controller of potential collisions or entrance on restricted or protected areas (it can be used with SMR and Multilateration).

5.5 **Medium-Term en-route operations (2011-2015)**

5.5.1 Oceanic and remote continental airspaces

5.5.1.1 In corridor EUR/SAM and in route segment Santiago de Chile/Lima RNP 4 application is expected, with utilization of ADS/CPDLC, in order to permit the use of lateral and longitudinal separation of 30 NM. Traffic increase in Corridor EUR/SAM has been very significant, and RNP 4 application can help to a better distribution of traffic and to increase the number of available routes in the Corridor.

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- 5.5.1.2 In AORRA air traffic density is less, and it is possible that not all aircrafts are equipped with necessary equipment for RNP-4. This issue could be studied more deeply in SAT meetings.
- 5.5.1.3 RNP-4 specification: This is desirable especially in ADS-C/CPDLC high density traffic in order to watch lateral and longitudinal separation of 30 nautical miles and communications via data link.
- 5.5.1.4 RNP-2 specification: in this phase this application is expected in selected continental airspaces, with GNSS exclusive application. A back-up system of GNSS will be necessary as well as the development of contingency procedures in case of GNSS failure. RNP-2 application will facilitate performance based navigation in aircrafts operating in airspaces without ATS surveillance service. With the exclusive application of GNSS more information on GNSS signal will be necessary. However, further development of operational requirements should be expected for the RNP 2.

5.6 Medium-Term TMA operations (2011-2015)

5.6.1 Approach (SIDs & STARs)

- 5.6.1.1 The application of RNAV1 and RNP 1 specifications established for the short-term will be extended according to ground complementary infrastructure and to aircrafts navigation capacity.
- 5.6.1.2 RNAV1 and RNP 1 will be mandatory for aircrafts operating in high density traffic TMAs. However, some procedures are already being applied in certain excluding airports of the SAM Region.
- 5.6.1.3 In this phase, the extension of application of RNP 0.3 and RNP AR to selected airports is expected. Likewise, it is expected to start with the application of GLS procedure, which will make better transition period between TMA and approach phases, using basically GNSS for the two phases.
- 5.6.1.4 These procedures will permit achieving strategic objective of accessibility in airports with bad weather conditions when conventional procedures do not support lower minimas.
- 5.6.1.5 *Planned NAV improvement*: GLS system (GBAS Landing System)
- 5.6.1.6 RNP 2 specification: This specification is being developed by ICAO RNPSORSG Panel.

5.7. **Medium-term aerodrome operations**

5.7.1 In aerodromes selected due to complexity and traffic density

5.7.1.1 *Improvement:* Surface Movement Guide and Control System (A-SMGCS Levels III and IV))

Level III: Provides defined specific functions in airport following contributions of pilots and drivers of mobiles and introduces automated en-routing function optimized by graphical maps containing details of taxiways, obstacles runways and mobiles position for crew and drivers. It also provides dynamic maps with updated runway conditions (in use, interdicted, etc.) and automatic display of signalling on ground (stop bar, centerline, etc.) according to the route used by the controller. (Includes ADS-B Package I, ATSA SURF application.)

Level IV: Contains the functions described for Level III plus control function, which is complemented by a conflict resolution function in the aircraft or vehicle cabin.

5.7.1.2 *Surveillance:* A-SMGSC and, in Level IV, Traffic Information Service (TIS-B) could be required for a complete airport situational photography, only in those airports having very high complexity and traffic.

6. **Improvements to be introduced in Communications, Navigation and Surveillance (CNS/ATM concept)**

6.1 **In the short-term**

6.1.1 Transportation networks:

6.1.1.1 In order to make possible a harmonized implementation of all the new services, the Aeronautical Telecommunications Network should be the **first communications component to be implemented**, over which the different applications contained in CNS/ATM concept will be set up, being AMHS the first. **Table 1** presents a diagram where it can be seen how the transportation network overlaps with, at least, the communications and surveillance services.

6.1.1.2 With this purpose, the Regional Office has developed and Orientation Guide in order to assist States to start this national effort as soon as possible.

6.1.2 Communications

6.1.2.1 *AMHS:*

6.1.2.1.1 No improvement should be done in AFTN centres, all efforts should be addressed to the early implementation of AMHS in total territory of each State.

- 6.1.2.1.2 Those States that have available this service should make the necessary arrangements to connect their MTA between them, using the REDDIG for this purpose.
- 6.1.2.2 *VCSS*: those States that do not have available the Voice Communication Switching System (VCSS) in ACCs and TWR and have an important amount of services to deliver should make their best effort to implement this system.
- 6.1.2.3 *OLDI*: States that have available Automated Processing Centres with OLDI facility
 - 6.1.2.3.1 Should use this service between their national centres, and
 - 6.1.2.3.2 Make bilateral arrangements that are necessary for its implementation between States.
- 6.1.2.4 *AIDC*: those States that do not have Automated Processing Centres should make the necessary provisions to have available, at least, OLDI facilities and, if possible, AIDC..
- 6.1.2.5 *CPDLC*: States with Oceanic FIR should make their best efforts to render CPDLC service to aircrafts equipped with FANS. If this service is not available, at least HF conventional communications should be guaranteed.
- 6.1.2.6 *ATIS*: States should make efforts to deliver these services in all international airports.
- 6.1.2.7 *VOLMET*: States should make their best efforts to render these services in all FIRs.
- 6.1.2.8 *VHF Coverage*: coverage of continental communications in VHF should be ensured for low level flights.
- 6.1.3 Navigation:
 - 6.1.3.1 States should ensure an adequate DME/DME navigation infrastructure in ground.
- 6.1.4 Surveillance:
 - 6.1.4.1 *Radar coverage in selected airspace*: States should make efforts to ensure radar coverage in their corresponding selected spaces.

- 6.1.4.2 *ADS-C*: States with Oceanic FIR should make their best efforts in order to facilitate ADS-C service to aircrafts equipped with FANS.
- 6.1.4.3 *ADS-B / multilateration*: Those States that could not comply with what is indicated in paragraph 6.1.4.1 (radar coverage), should make efforts to substitute it with ADS-B or multilateration coverage.
- 6.1.4.4 *Radar information exchange*: States should make the necessary bilateral arrangements to share radar data between adjacent ACCs, under modality allowed by technology installed in respective centres.

6.2 In the medium-term

- 6.2.1 Transportation networks: The Regional Office will coordinate with the ACP (Aeronautic Telecommunications Panel) the Regional IP addressing diagram and will make the necessary arrangements to establish the same diagram in the whole Region.

6.2.2 Communications

6.2.2.1 *AMHS*:

- 6.2.2.1.1 It is expected that in this period AFTN within the Region have practically disappeared and that all States have AMHS available.
- 6.2.2.1.2 Bi- and multilateral integrations between each State AMHS should be continued.
- 6.2.2.1.3 The Regional Office will coordinate the necessary tasks for interregional connectivity (CARSAM – EURSAM – NANSAM, etc.), while that all individual efforts of each State in this respect will be welcomed.

- 6.2.2.2 *AIDC*: States should make efforts to have Automated Centres in all their ACCs. If this are already available, and the count with OLDI facilities, they should also have AIDC. If Automated Centres are not available, States should get them directly with AIDC capacity.

6.2.2.3 *CPDLC*:

- 6.2.2.3.1 *Oceanic Area*: States should render CPDLC services in corresponding ACC, through HF DL or third party services.
- 6.2.2.3.2 *Continental Area*: those States that have decided to renew existing VHF equipment should make the

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necessary efforts to replace them by equipment having VDL capacity. However, this hypothetical situation should not be interpreted as a requirement, since administrations are invited to initiate pre-operational trials at any time.

6.2.2.4 *DATIS and DVOLMET*: States should start rendering DATIS and DVOLMET services, replacing similar conventional services or implementing the service where it is not available.

6.2.3 Navigation:

6.2.3.1 *Augmentation*: GBAS.

6.2.4 Surveillance:

6.2.4.1 *ADS-C*: all States having responsibility over an Oceanic FIR should facilitate ADS-C service to FANS-equipped aircrafts.

6.2.4.2 *Radar coverage /ADS-B / multilateration*: States should ensure that all the corresponding selected areas render an efficient radar and/or ADS-B/multilateration coverage.

6.2.4.3 *Radar information exchange*: States should make necessary efforts and bilateral arrangements to share radar data between adjacent Automated Centres, in Asterix 62 and 63 categories.

6.2.4.4 *Surface movement guide and control system (A-SMGCS Levels III and IV) and Traffic Information Service(TIS-B) in Level IV*, only in those airports of very high complexity and traffic.

NOTA: In Diagram 2 “Medium-Term Improvements” a future interrelation between different services under CNS/ATM concept is presented. In this diagram, affected services are marked in dark grey, and, in dashed line, which of the interrelation links have been modified.

Table 1: Transportation network of the information[illegible]

Diagram 1 – Current Situation

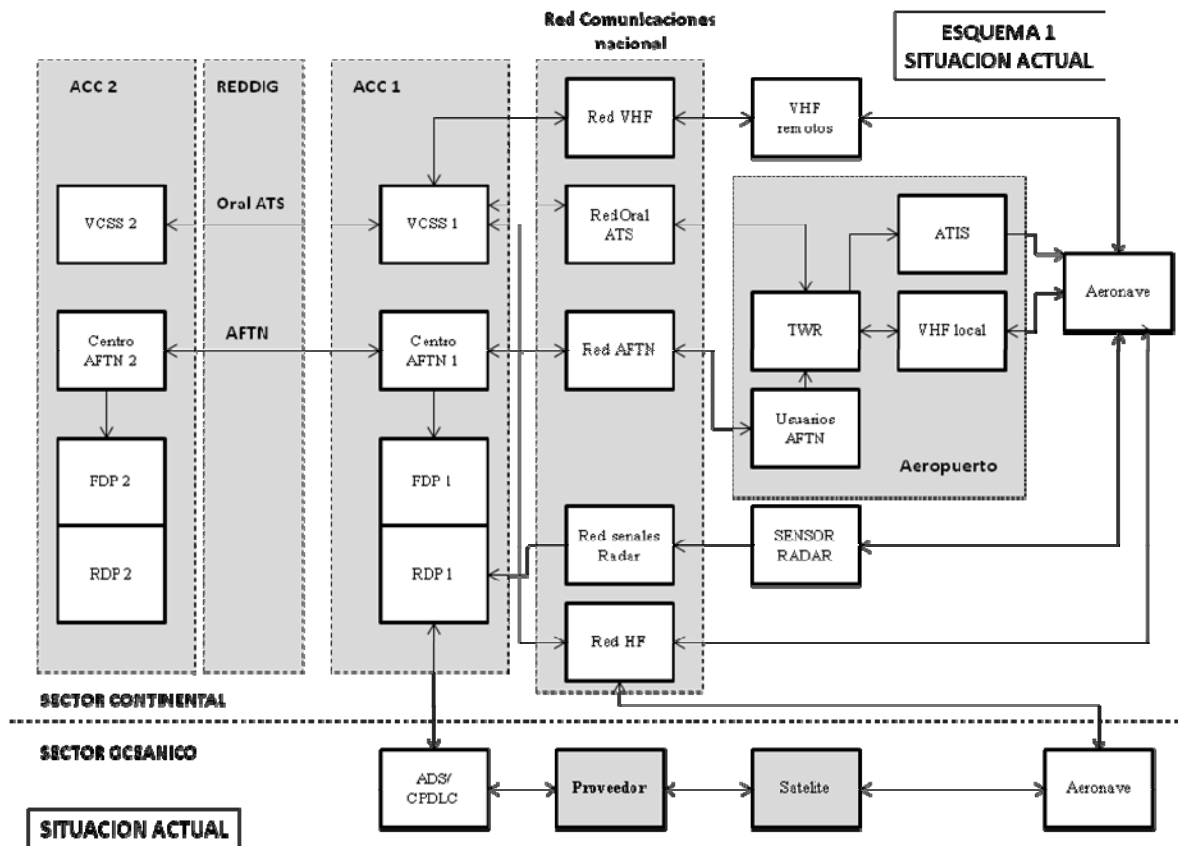


Diagram 2 – Medium-Term Improvements

