International Civil Aviation Organization
CAR/SAM Regional Planning and Implementation Group (GREPECAS)
Sixteenth Meeting of the CAR/SAM Regional Planning and Implementation Group CAR/SAM (GREPECAS/16)
Punta Cana, Dominican Republic, 28 March - 1 April 2011

Agenda Item 3: Performance framework for regional planning and implementation of air navigation

3.5 CNS/ATM/SG/1and CNS/ATM/SG/2 meeting reports

REPORTS OF THE FIRST AND SECOND MEETINGS OF THECNS/ATM SUBGROUP

(Presented by the Secretariat)

SUMMARY	
This working paper presents the results of the first and second meetings of the CNS/ATM Subgroup, and the performance-based project structure implemented in its work programme. The action required from the GREPECAS/16meeting appears in section 4of this working paper.	
References: • CNS/ATM/SG/1 meeting report (Lima, Peru, 15-19 March 2010); • Notes EMX0709 of 6 August 2010 (NACC) and LT 2/8.0.16-SA501 of 20 July 2010 (SAM) on the approval of CNS/ATM/SG/1 conclusions; and • CNS/ATM/SG/2meeting report (Mexico City, Mexico, 16-19 November 2010).	
ICAO Strategic Objectives:	*A – Safety; and* *C–Environmental protection and sustainable development of air transport*

1. Introduction

1.1 The CNS/ATM Subgroup was reformulated pursuant to GREPECAS Decision15/34, to ensure a better coordination on ATM and CNS matters and to develop a performance-based CAR/SAM plan with a view to the implementation of the global ATM concept.

1.2 In this regard, the GREPECAS/15meeting considered that, in order to launch the mechanism of the new subgroup, at least two meetings prior to GREPECAS/16 would be needed: one to develop the required work programmes and to identify the task forces needed, and the other to supervise and make adjustments to the operation of the work programme established at its first meeting.

1.3 The first meeting of the Communications, Navigation, Surveillance and Air Traffic Management Subgroup (CNS/ATM/SG/1) was held in Lima, Peru, on 15-18 March 2010, with the participation of 62 delegates from 18 States and 4 International Organisations members of the CNS/ATM Subgroup.

1.4 The second meeting of the Communications, Navigation, Surveillance and Air Traffic Management Subgroup (CNS/ATM/SG/2)was held in Mexico City, Mexico, on 16-19 November 2010, with the participation of 43 delegates from 13 States and 3 International Organisations members of the GREPECAS CNS/ATM Subgroup.

1.5 The CNS/ATM/SG/1meeting examined the development of CNS/ATM systems worldwide and in the CAR/SAM Regions, the matters still pending from the former ATM/CNS Subgroup and its ATM and CNS Committees, with their respective task forces, and the work structure for the new CNS/ATM Subgroup. The meeting formulated 11 draft conclusions and 2 draft decisions, which were approved through the GREPECAS fast-track procedure on 20 July 2010. **Appendix A** to this working paper contains a list of the draft conclusions presented at the CNS/ATM/SG/1 meeting.

1.6 The CNS/ATM/SG/2 meeting did the follow-up on the status of implementation of air navigation support systems, and reviewed the progress made in the implementation of the work programmes of the CNS/ATM/SG. The meeting formulated three draft conclusions, which are submitted to the approval of this GREPECAS meeting in **Appendix B** to this working paper.

2. First meeting of the CNS/ATM Subgroup

2.1 Review of CNS/ATM developments at global and CAR/SAM level

Drafting of a regional performance-based ATM implementation plan proposal for the CAR/SAM Regions

2.1.1 The CNS/ATM Subgroup analysed the regional performance-based air navigation implementation plan of the NAM/CAR Regions (NAM/CAR RPBANIP), the plan for the transition to the ATM operational concept in the CAR/SAM Regions, as well as the tasks and activities already initiated in both Regions for the drafting of a preliminary version of a CAR and SAM regional plan to orient air navigation implementation towards the achievement of the ATM operational concept, reflecting the performance objectives to be achieved.

2.1.2 In view of the fact that the Directors of Civil Aviation of the NAM/CAR Regions had already approved the NAM/CAR RPBANIP, and considering that the SAM Region was implementing some of the performance objectives approved by GREPECAS, the meeting considered that the SAM Region should develop a performance-based implementation plan that included all the areas of air navigation, as well as metrics to measure the achievement of performance objectives. Accordingly, it formulated draft decision **CNS/ATM/1-1 - Regional Performance-Based Implementation Plan for the South American Region.**

2.1.3 Taking into account the need to have a clearly-defined common approach to performance monitoring and measurement, and the need to agree on a uniform set of metrics for the CAR/SAM Regions, the meeting adopted draft conclusion **CNS/ATM/1-2 –Adoption of a performance-based monitoring and measurement programme for the CAR/SAM Regions.**

Navigation systems

2.1.4 The meeting took note of the progress made by the GBAS implementation project in Brazil, and the action taken by the DGCA of Chile to conduct a ionosphere assessment for the GBAS system implementation project. The meeting also took note of the need to identify the mechanisms required for international cooperation to ensure a new collection of ionosphere data at regional level during 2011-2014.

2.1.5 The meeting took note of the activities that Project RLA/03/902–Transition to the GNSS in the CAR/SAM Regions –Augmentation solution for the Caribbean, Central America and South America (SACCSA) would carry out in phase III, and highlighted that one of the most important activities was the collection of ionosphere data, part of which would be obtained during solar maximum periods. This data will be useful for the implementation of an SBAS and other GNSS components. It also agreed on the critical nature and extreme importance of follow-up, cooperation, and participation by CAR/SAM States, international organisations, GNSS users and other State sectors that require more advanced GNSS services. In this regard, it formulated draft conclusion **CNS/ATM/1-3 - Follow-up, participation and cooperation to ICAO RLA/03/902regional project.**

2.2 **Review of the terms of reference and work methodology of the CNS/ATM Subgroup**

2.2.1 The structure of the CNS/ATM Subgroup and the work methodology approved by the Subgroup are shown in **AppendixC** to this working paper. The work programme is executed through nine projects, distributed in four programmes, identified as:

a) PBN,
b) ATFM
c) ATM automation and situational awareness, and
d) Ground-ground and ground-air communication infrastructure

2.2.2 The ATM and CNS Officers of the ICAO NACC and SAM Regional Offices will coordinate the programmes, and project coordination will be the responsibility of the members of the Subgroup. The aeronautical administrations of the member States of the Subgroup shall give all the necessary support to the personnel in charge of coordinating project tasks.

2.3 **Review of outstanding matters of the ATM/CNS, ATM/COMM, CNS/COMM Subgroups and their respective Task Forces, for consideration in the work programme of the CNS/ATM Subgroup**

ATM matters

2.3.1 The meeting reviewed the ATM operational implementation scenarios, taking into account regional performance objectives (RPOs) adopted by GREPECAS to reorganise the CNS/ATM/SG work programmes.

2.3.2 The traffic growth foreseen for the next few years, the significant demand for direct off-airway paths and the possible implementation of additional routes could lead to saturation in the various airspaces, thus complicating airspace management. The meeting deemed it advisable to conduct an overall review of the upper airspace with a view to the possible implementation of new RNAV routes and the elimination of scarcely-used conventional routes whose path coincides with, or is similar to, fixed RNAV routes or random routes.

2.3.3 It was recalled that GREPECAS had recommended the implementation of trunk routes to link upper airspace RNAV routes with incoming and outgoing routes implemented in terminal areas. However, considering the current navigation capacity of aircraft, it is necessary to assess other alternatives to link the upper airspace route structure with the routes in terminal areas; one of these alternatives is the implementation of continuous descent operations (CDO).

2.3.4 The meeting deemed it necessary to develop an airspace concept in accordance with the PBN Manual, Doc 9613, which could be gradually adopted by CAR and SAM States, Territories and International Organisations in the short and medium, in order to determine and justify future implementations to improve airspace organisation and management (AOM).

2.3.5 With a view to harmonising ATFM implementation in the CAR/SAM Regions, the meeting analysed and approved the adoption of the CAR/SAM ATFM Manual, and formulated draft conclusion **CNS/ATM/1-4 –Adoption of the CAR/SAM ATFM Manual.**

2.3.6 In order to achieve a successful implementation of the 5LNC database system, the meeting agreed to coordinate with its respective ICAO NACC and SAM Regional Offices to make sure that the 5LNCs contained in their national publications coincided with the 5LNCslisted in the ICARD. A list of ICARD authorised users was provided for its updating and future coordination.

CNS matters

2.3.7 The meeting approved the document entitled *Strategy for the evolution of air navigation systems in the CAR/SAM Regions* to support the implementation of performance-based navigation (PBN),prepared by the fourth meeting of the GNSS task force(GNSS/TF/4). The document is contained in **Appendix D** to this working paper for approval by GREPECAS.

2.3.8 The meeting saw the need to collect information on existing and future avionics in the CAR/SAM Regions for purposes of planning and cost-benefit analysis for the implementation of air navigation systems, and formulated draft conclusion **CNS/ATM/1-5–Collection of information on existing and future avionics in the CAR/SAM Regions.**

2.3.9 Upon examining the ATN planning/implementation activities in the CAR/SAM Regions, the meeting approved an IP addressing scheme for inter- and intra-regional communication links to support ATN ground-ground applications, which had been prepared by the fifth meeting of the ATN Task Force (ATN/TF/5). In this sense, the Meeting formulated draft conclusion **CNS/ATM/1-6–Proposed addressing scheme for IPv4 for inter- and intra-regional communication links for ATN ground-to-ground applications.**

2.3.10 The meeting approved the document entitled *Unified Surveillance Strategy for the CAR/SAM Regions*, prepared by the surveillance task force, and which appears as **Appendix E** to this working paper. This document is submitted to the consideration of GREPECAS for its approval.

2.3.11 Likewise, in order for CAR/SAM States/Territories/International Organisations that are conducting ADS-B trials to make improvements in said activities, the meeting formulated draft conclusion **CNS/ATM/1-7–Improvementsto the activities related to ADS-B trials.**

2.3.12 The meeting was informed of the activities carried out to support the ICAO position at the ITU WRC-2012 meeting, and of the updated list of focal points of CAR/SAM States/Territories for purposes of coordinating aspects related to ICAO position at theWRC-2012, and urged the States/Territories/International Organisations to participate at the events organised by ICAO in this regard during 2010.

Implementation of the new ICAO flight plan (FPL) format

2.3.13 In order to support the States/Territories/International Organisations in the implementation of Amendment 1 to Edition 15 of Document4444, the meeting reviewed and approved a CAR/SAM regional strategy, and adopted draft conclusion **CNS/ATM/1-8–Implementation of the new flight plan format in the CAR/SAM Regions.**

2.4 **Review of the work structure of the new CNS/ATM Subgroup, taking into account the performance-based project methodology for the execution of the work programme**

2.4.1 Taking into account the NAM/CAR regional plan for the implementation of performance-based air navigation, the SAM CNS/ATM implementation plans, the status of implementation of GREPECAS outstanding conclusions, outstanding deficiencies, and new and outstanding activities in the CNS and ATM areas, the meeting reviewed the work programme.

2.4.2 In this sense, the meeting considered that the project coordinator, together with the ICAO regional officer in charge of coordinating the associated programme, would review the tasks initially contemplated in the work programme, identify the person responsible for task implementation once the States sent information about the experts who would be available for the project, define the deliverables of each task for better follow-up of the progress/achievement of each task, and considering that many of the tasks contemplated in the work programme are high-level activities, specify the tasks in a set of specific sub-tasks. Accordingly, it formulated draft decision **CNS/ATM/1-9 –Revision of the work programme of CNS/ATM Subgroup projects**

2.5 **Other matters**

Search and rescue service

2.5.1 The meeting considered that, for purposes of improving SAR systems in the CAR/SAM Regions, the States, Territories and International Organisations should assess their SAR capabilities and adopt the SAR performance objective guidance form approved by the SAR/NAM/CAR/SAM meeting (Punta Arena, Costa Rica, 18-22 May 2009).

2.5.2 The meeting analysed the search and rescue servicequality assurance manual and considered that it should be submitted to GREPECAS for its approval. This manual is contained in **AppendixF** to this working paper.

Training for competence building of aeronautical professionals

2.5.3 The meeting took note of the importance of providing aeronautical training under a performance-based approach to the next generation of aeronautical professionals, of the aeronautical training programme to be carried out by ICAO (Appendix H to Resolution A36/13), and of the aeronautical training activities carried out in the CAR/SAM Regions, and considered that CAR/SAM States/Territories/International Organisations, through their training centres, should continue making efforts to improve the training of aeronautical professionals, and draft medium-term plans concerning the structure and programmes required to respond to the new challenges. In this sense, the meeting agreed on the adoption of draft conclusion **CNS/ATM/1-10–Training for competence building of aeronautical professionals.**

2.5.4 The meeting was informed of a draft guide for the development of a GNSS training programme for the provision of technical training in GBAS and SBAS systems, prepared by the fourth meeting of the GNSS Task Force of the former ATM/CNS Subgroup. The meeting felt that it was important for the States/Territories/International Organisations to foster the implementation of GNSS systems training plans, and formulated draft conclusion **CNS/ATM/1-11 –GNSS training.**

3. Second meeting of the CNS/ATM Subgroup

3.1 Follow-up on the status of implementation of performance-based navigation systems plans for the CAR and SAM Regions and on the latest amendments to SARPs concerning ATM and CNS

Air navigation plans

3.1.1 The meeting took note of the progress made in the performance-based air navigation implementation plans for the NAM/CAR and SAM Regions and of the measures taken in terms of performance indicators and performance metrics.

3.1.2 It was noted that the 37thICAO Assembly approved the ICAO proposal to develop a global roadmap of CNS technology to assist States and other stakeholders in their implementation decisions. The benefits of this roadmap would be the inclusion of foreseeable implementation, with early achievement of operational benefits and return on investment, and extended introduction to facilitate the transition.

3.1.3 The meeting felt that, in view of the fact that CAR/SAM Regions had approved a strategy for the evolution of air navigation systems in the CAR/SAM Regions and a strategy for the evolution of surveillance systems in the CAR/SAM Regions, these should be sent to ICAO headquarters so as to contribute to the preparation of the CNS system roadmap.

Performance-based navigation (PBN)

3.1.4 The meeting took note that the 37th Session of the Assembly had adopted Resolution 37-12, recognising that not all airports had the infrastructure for conducting APV operations, that not all aircraft had the necessary capacity for APV operations, and that many States already had the required infrastructure and aircraft capable of conducting direct approaches with lateral guidance (LNAV approaches) based on RNP specifications and on the proven fact that direct approaches significantly improve safety in circling approaches.

3.1.5 The meeting noted that several RNAV routes and PBN procedures had been implemented in the NAM and CAR Regions, providing significant operational and economic benefits. Some examples were the implementation of RNP-10 in WATRS airspace, and the implementation, in the short term, of RNP-10 in the Gulf of Mexico. Nevertheless, the meeting felt that the States should continue reviewing and improving the ATS route network, focusing on the implementation of PBN. In terms of new routes, realignment, renaming and removal of unnecessary segments. In this sense, it considered that a proposed amendment to the CAR/SAM Air Navigation Plan (CAR/SAM ANP) should be drafted, to become effective no later than May2011.

3.1.6 The meeting took note of the first results of Phase III of Project RLA/03/902 –SACCSA, which, based on the results of Phase II, the studies of ionosphere data during the last eleven years, the development of a ionosphere algorithm prototype, demonstrations conducted recently on SBAS-SACCSA signal broadcast by a GEO satellite, and the magic SBAS demonstration, were encouraging with respect to the implementation of an SBAS system in the CAR/SAM Regions. In this regard, and in order to support the continuity of project activities, the meeting formulated draft conclusion **CNS/ATM/2/1 – Support to the completion of studies and participation in the implementation of a test platform under Project RLA/03/902 SACCSA**

ATFM

3.1.7 The meeting reviewed a version, with minor changes, of the ATFM manual approved by the CNS/ATM/SG/1 meeting. It also reviewed a manual on collaborative decision-making for the CAR/SAM Regions, and considered that it should be an inserted as an appendix to the ATFM manual. The updated version of the ATFM manual will be posted in the website of the NACC (http://www.mexico.icao.int/ATM.html) and SAM (http://www.lima.icao.int/) Regional Offices.

Civil/military coordination

3.1.8 The meeting was presented with the results of the Global Forum on Civil/Military Coordination in Air Traffic Management, held in Montreal in October 2009, and highlighted that the effective and efficient use of airspace for both civil and military operations would provide benefits in terms of more efficient aircraft operations and environmental improvements.

3.1.9 States were urged to work with air navigation service providers, and to take action for the establishment of policies, institutional arrangements, performance objectives, and the formulation of practical and operational measures to improve civil/military coordination, optimising the safe and efficient use of airspace for all users.

Implementation of the new flight plan format

3.1.10 The meeting took note of the activities carried out in the CAR/SAM Regions for the implementation of the new flight plan format, such as the results of the two workshops conducted by ICAO, one for the NAM/CAR Regions and the other for the SAM Region, the points of contact in the CAR/SAM Regions designated by the States for coordinating this implementation, and the progress made in assessing the impact of the implementation of the new flight plan format, carried out in the NAM/CAR and SAM Regions.

3.1.11 The meeting stressed the importance for States, air navigation service providers(ANSP) and international organisations to review the implementation activities scheduled in the strategy and the corresponding action plans, particularly the compliance with the critical deadlines in the transition phase, and to coordinate their implementation plans with the respective ICAO Regional Office with sufficient anticipation to the deadline so that airspace users and ANSPs may coordinate and resolve any unexpected operational problem.

3.1.12 The meeting also took note that the ICAO NACC and SAM Regional Offices had scheduled several implementation follow-up meetings and workshops to assist States in the compliance with the activities and deadlines specified in the CAR/SAM regional strategy.

Situational awareness

3.1.13 The meeting was informed about the progress made in the implementation of ADS-B for both air traffic control separation service (also known as ADS-B critical services) and the uplink of the traffic information service - broadcast (TIS-B) and flight information service - broadcast (FIS-B) for properly equipped aircraft(also known as essential ADS-B services)in the United States. United States intends to have ADS-B coverage at approximately the same level as the current (2010) radar coverage by 2013.

3.1.14 It was agreed that the information was very useful for the States that are exploring the ADS-B infrastructure and for possible regulatory efforts to require the use of ADS-B on aircraft within controlled airspace. Accordingly, the meeting invited CAR/SAM States to consider the possible benefits of ADS-B with a separation of 3 MN in terminal area operations, airport surface operations, and especially the many and highly beneficial “ADS-B” applications, and to take into account the safety and efficiency benefits derived from these operations.

Aspects concerning communications, frequency management, CNS SARPs

3.1.15 The meeting took note of the status of implementation of the interconnection between the MEVA II and REDDIG networks, and was informed that the installation works had been completed, and only AFTN circuits were pending implementation. In this regard, the meeting felt that, in view of the delays in the implementation of AFTN circuits in the MEVA II/REDDIG interconnection, ICAO should coordinate the commissioning of such circuits with the States involved and the MEVA II service providers.

Frequency management, CNS SARPs

3.1.16 The meeting took note of the results and recommendations of the ICAO NAM/CAR/SAM regional meeting in preparation (NCSRPM) for WRC-2012, held at the ICAO NACC Regional Office on21-22 April 2010, with the support of the ICAO Aeronautical Communications Panel (ACP).

Training

3.1.17 The meeting recognised the importance of having information available about existing training requirements and capabilities in the CAR/SAM Regions for the training of human resources, and agreed to formulate the following draft conclusion for the follow-up on training activities for competence-building of aeronautical professionals in the CAR/SAM Regions: **Draft Conclusion CNS/ATM/2/2– CNS/ATM training programmes for competence-building of aeronautical professionals in the CAR/SAM Regions.**

3.1.18 The meeting was informed of the new training policy for civil aviation adopted by ICAO, which includes a process to support organisations and training courses, covering all safety and security aspects, supplementing the work of the NGAP. This policy is explained in full detail in ICAO electronic bulletin No. EB 2010/40 of 28 September 2010. The meeting was also informed about the new ICAO TRAINAIR PLUS programme, which includes a significantly revised course development methodology, a new approach to the teaching material sharing network, and a self-sustaining budgetary mechanism (a full description is available in ICAO e-bulletin EB 2010/45 of 6 October 2010).

3.2 Review of the progress made in the implementation of CNS/ATM Subgroup work programmes

3.2.1 The meeting, as a follow up on Decision CNS/ATM/SG/1-9 *–Review of the work programme of CNS/ATM Subgroup projects,* took note of the name of the experts designated by the States/Territories/International Organisations for each project. It also examined the work programmes of projects defined at the first meeting of the CNS/ATM Subgroup, as reviewed jointly by project coordinators and programme coordinators in terms of scope, tasks, parties responsible for task implementation, completion dates, and definition of deliverables. This information is contained in WP/17.

3.2.2 The meeting expressed its concern for the failure of States to designate experts to support the work of the projects. It also recognised that State experts were essential for achieving project objectives, in keeping with the work methodology and structure of the CNS/ATM Subgroup approved by GREPECAS. The experts designated by the States/Territories/International Organisations should get full support from their entities in terms of resources. Accordingly, the meeting formulated draft conclusion **CNS/ATM/SG/2/3 –Support to experts designated for the CNS/ATM/SG projects.**

4. Suggested action

4.1 Based on the information provided in this working paper, the Meeting is invited to:

a) Take note of the work carried out by the CNS/ATM/SG/1 and/2 meetings and the formulation of performance-based projects to conduct the work;
b) Analyse the draft decisions and draft conclusions formulated by the CNS/ATM/SG/1meeting and approved through the GREPECAS fast-track procedure, as listed in Appendix A to this working paper;
c) Approve the draft conclusions formulated by the CNS/ATM/SG/2meeting, which appear in Appendix B to this working paper; and
d) Approve the documents shown in Appendices D, E, and F to this working paper.

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APPENDIX A

CNS/ATM/SG/1 DRAFT DECISIONS AND CONCLUSIONS

Decision CNS/ATM/1-1 Regional Performance-based implementation Plan for the South American Region

That SAM States, with the assistance of ICAO, taking as a basis the available documentation in the CAR and SAM Regions:

a) Prepare a performance-based regional implementation plan in compliance with the Global Air Navigation Plan and the Global ATM Operational Concept that includes the regional performance objectives, the performance framework forms (PFF) to be completed by all air navigation areas, such as ATM, CNS, AIM, MET and AGA/AOP, and the corresponding metrics that enable the implementation of performance objectives achievement not later than the end of 2010; and
b) Develop their performance-based national plans harmonized with the SAM Implementation Regional Plan, not later than June 2011.

Draft Conclusion CNS/ATM/1-2 Adoption of performance monitoring and measurement programme for the CAR/SAM regions

Considering the importance to monitor and measure the achievement of the performance objectives defined for the CAR/SAM Regions, that States, Territories and International Organizations of CAR/SAM Regions:

a) adopt the set of metrics related to key performance areas of access, capacity, cost effectiveness, efficiency, environment, flexibility, predictability and safety; described in **Appendix A** of this part of the report, to monitor and measure the implementation advances of the regional performance objectives;
b) incorporate these metrics into their performance monitoring programmes, collect relevant data and submit to the ICAO Lima and Mexico regional offices on a regular basis;
c) coordinate with ATM community members to promote information and data collection; and
d) inform ICAO Regional Offices of their advances by 30 November 2010.

Draft
Conclusion CNS/ATM/1-3 Follow-up, participation and cooperation to ICAO RLA/03/902 regional project

That, with the objective of concluding technical-financial viability studies of the SBAS implementation within the CAR/SAM Regions, under the ICAO RLA/03/902 regional project, the States, international organizations and users are invited to:

a) Participate in Phase III of the RLA/03/902 – SACCSA project and promote cooperation between national entities and make progress on development with support of educational institutions so as to provide scientific and technical support; and
b) Increase coordination and exchange of information on the results obtained and experience gained in RLA/03/902 project, GBAS national projects and other initiatives regarding GNSS implementation.

Draft
Conclusion CNS/ATM/1-4 Adoption of the CAR/SAM ATFM Manual

That, considering the importance to harmonize the implementation of ATFM in the CAR/SAM Regions, States, Territories and International Organizations of the CAR/AM Regions adopt the ATFM Manual shown in Appendix A to this part of the Report.

Draft
Conclusion CNS/ATM/1-5 Collection of information on existing and future avionics in the CAR/SAM Regions

Taking into account the importance of having information on avionics already installed and to be installed on user aircraft, for purposes of planning and cost/benefit analyses, it is urged that:

a) States/Territories and International Organisations are urged to collect information on avionics already installed and to be installed in non-IATA domestic fleets and other general aviation users, suggesting the adoption of a format similar to that of the IATA survey form (**Appendix D** to this part of the Report), the results to be sent to the respective ICAO Regional Office by **December 2010**;
b) IATA include the aforementioned information in the IATA database, informing the ICAO CAR/SAM Regional Offices about the response to this request; and
c) The information collected to date in the SAM and CAR Regions be included in the mentioned data base, as well as any information that can be provided by the avionics manufacturers.

Draft
Conclusion CNS/ATM/1-6 Proposed routing scheme for IPv4 for inter and intra regional communications links for ATN ground to ground applications

That, the CAR/SAM Regions use the IPv4 routing scheme for inter and intra regional communications links in ATN ground to ground applications for described in Appendix E to this part of the Report**.**

Draft
Conclusion CNS/ATM/1-7 Improvements to the activities referred in ADS-B trials

That, States/Territories/International Organizations who are carrying out ADS-B trials are urged to:

a) Continue with the data collection and analysis, in accordance with GREPECAS guidelines (GREPECAS/15 report, Appendix Q);
b) Search for the Exchange of data between States, particularly with regard to coverage superposition and analysis criteria;
c) Solve, with the respective airspace users, the duplicate or illegal 24-bit Address cases identified, and inform in this respect to the ICAO Regional Offices;
d) Inform airspace users on any anomaly in the received ADS-B messages, in preparation of future ADS-B implementation; and
e) Duly inform the ICAO Regional Offices on the trial results, for their publication.

Draft
Conclusion CNS/ATM/1-8 Implementation of the new flight plan format in the CAR/SAM Regions

That, considering the importance of the implementation of Amendment 1 to the Fifteenth Edition of Doc 4444, whose application is foreseen for 2012, CAR/SAM States/Territories/International Organizations:

a) Adopt the strategy for the implementation of Amendment 1 to Doc 4444 (PANS-ATM) (15th edition) shown in Appendix J to this Agenda Item;
b) Develop action plans, taking into account the regional strategy and the action plan based in a performance scope, which includes as Appendix J to this working paper, for the harmonious implementation of the new ICAO flight plan format and the ATS messages related;
c) Designate experts who participate as points of contact to coordinate with other air navigation services providers of States/Territories/International Organizations from adjacent flight information regions (FIRs), implementation matters of ATS messages related with the implementation of the new ICAO flight plan format (FPL); and
d) Send the result of this implementation to the ICAO NACC and SAM Regional Offices, not later than 30 November 2011.

Decision CNS/ATM/1-9 Revision of the work programme of CNS/ATM Subgroup projects

That the project coordinator, together with the corresponding programme coordinator, carry out before 30 June 2010, the following activities:

a) Revision of the tasks of projects work programmes presented in Appendix to this part of the report;
b) Definition of responsible officers for the carrying out of the tasks;
c) Identification of deliverables expected for each task;
d) Break down of tasks into sub-tasks; and
e) Remittance of the information corresponding pertaining to items a), b), c) and d) above to the ICAO NACC and SAM Regional Offices.

Draft
Conclusion CNS/ATM/1-10 Training for aeronautical professional competence

That CAR/SAM States/Territories and International Organizations, take into consideration the list of short and mid-term and training requirements shown in **Appendix D** to this part of the Report, so that CATCs, in coordination with civil that CAR/SAM States/Territories and International Organizations, aviation authorities, prepare aeronautical training programmes which contemplate regional air navigation and safety requirements.

Draft
Conclusion CNS/ATM/1-11 GNSS Training

That, taking into account that training of a larger number of experts is essential for the future implementation of GNSS systems in the CAR/SAM Regions, as well as the various ICAO recommendations for the provision of GNSS technical training, and the ICAO initiative on the next generation of aviation professionals:

a) States/Territories and International Organisations are urged to foster the training of national instructors, based, *inter alia*, on courses promoted by ICAO, as a way of supporting the internal dissemination of acquired knowledge;
b) The States/Territories and International Organisations that have not yet included GNSS in their training programmes, include this type of training in their plans as of 2010; and
c) ICAO is urged to include the necessary considerations on the technical training of professionals, *e.g. training on GNSS systems*, in the initiative on next generation aviation professionals and its corresponding instances.

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APPENDIX B

CNS/ATM/SG/2 DRAFT CONCLUSIONS

Draft
Conclusion CNS/ATM/SG/2-1 **Support in the completion of project RLA/03/902 SACCSA studies and participation in the test-bed implementation**

In view of the first results obtained by the SACCSA Project – Phase III-A, and its contribution to the implementation of PBN and in order to support the completion of this Project, CAR/SAM States/Territories/International Organizations are urged to:

a) facilitate/coordinate with their corresponding national authorities, the access and provision of data to the SACCSA Project from networks with 1-second GPS receiving stations with FTP or NTRIP access and RINEX files; and
b) taking into consideration the objectives indicated in Appendix B to this part of the report, consider participation in the SACCSA-SBAS test-bed implementation by notifying ICAO by **30 June 2011**.

Draft
Conclusion CNS/ATM/2-2 - **CNS/ATM fields training programme for the competency of aeronautical professionals for the CAR/SAM Regions**

That, to train aeronautical professionals with regards to necessary competencies, CAR/SAM States/Territories/International Organizations:

a) follow-up and take into consideration the recommendations of the Symposium on Next Generation Aeronautical Professionals (NGAP) and the results of the NGAP Task Force;
b) in coordination with the ICAO Regional Offices, establish a training programme that responds to the performance objectives identified in the CAR and SAM Regions performance based implementation plans for the 2012-2016 period; and
c) inform the ICAO Regional Offices on the progress made in the development of this Programme, by **30 September 2011**.

Draft
Conclusion CNS/ATM/SG/2-3 **Support to experts designated for the CNS/ATM Subgroup projects**

That the CAR/SAM States/Territories/International Organizations that have nominated experts for the CNS/ATM Subgroup projects provide them with total support of resources and time aimed at achieving the accomplishment of tasks assigned, as indicated in the CNS/ATM Subgroup work methodology and structure approved by GREPECAS.

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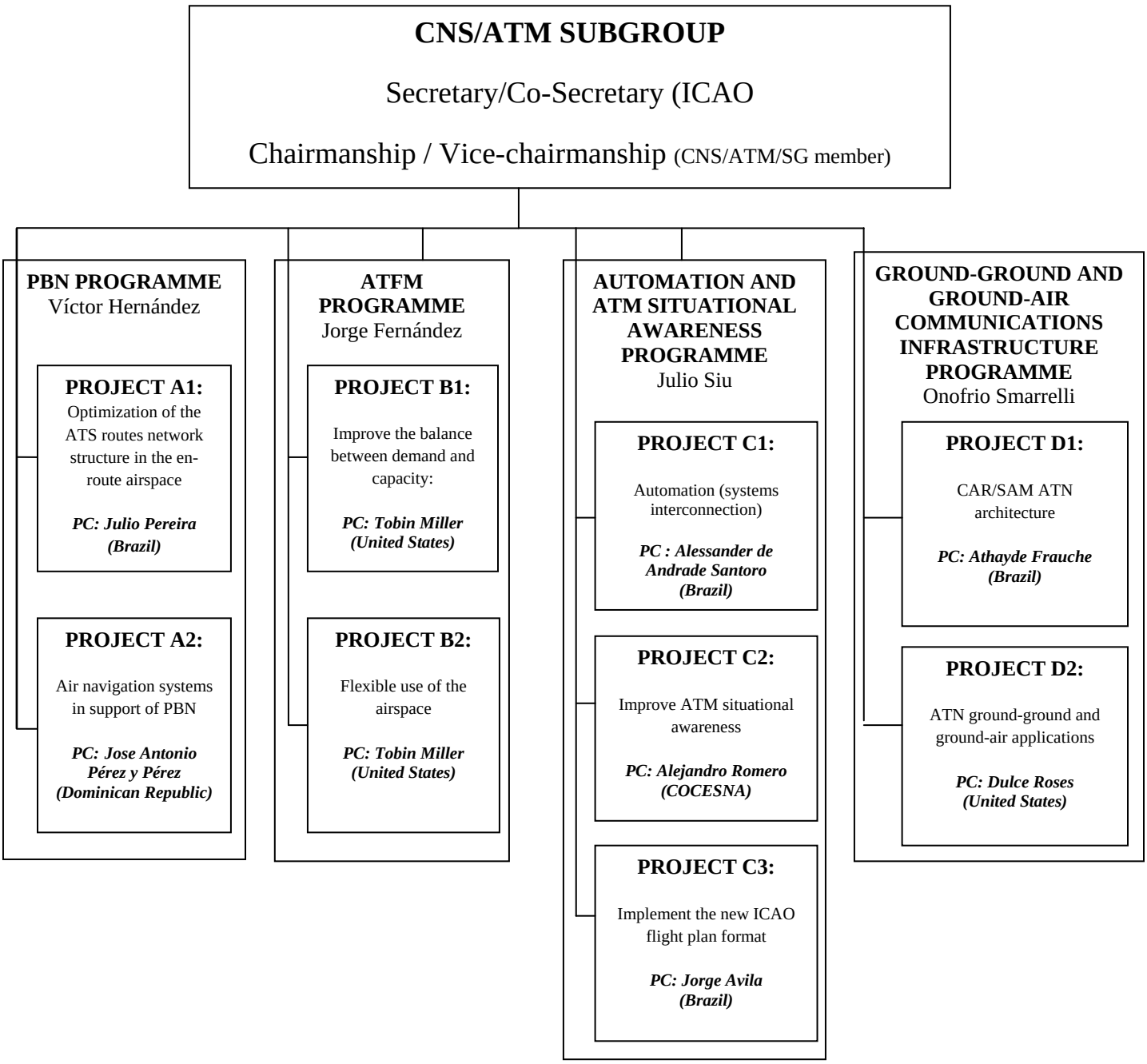
APPENDIX C

STRUCTURE OF THE CNS/ATM/SG



PC: Project Coordinator

WORKING METHODOLOGY AND STRUCTURE OF THE CNS/ATM SUBGROUP, ON THE BASIS OF PROJECTS IMPLEMENTATION

1. OBJECTIVE

1.1 Present a working methodology to define and carry out project plans that satisfy the implementation of tasks assigned by GREPECAS to the CNS/ATM Subgroup and taken under consideration within its terms of reference (TORs).

2. GENERAL CONSIDERATIONS

2.1 The terms of reference of the CNS/ATM Subgroup, as well as the tasks that should be carried out to comply with same are shown in **Appendix B** to this Agenda Item.

2.2 In the CNS/ATM Subgroup TORs, macro-tasks 3 a) and 3 b) represent permanent-type tasks. These tasks should be developed by the CNS/ATM Subgroup Secretariat, with the assistance of the Subgroup. During the meetings of the CNS/ATM Subgroup, the progress made on these macro-tasks would be reviewed. Some of the activities contemplated in macro-task 3 c) will also be carried out by the Secretariat.

2.3 As regards macro-task 3 c) of the CNS/ATM Subgroup TORs, which include the performance objectives indicated in **Attachment A** to this Appendix, as well as possible new performance objectives, detailed tasks should be drafted as well as identify products to deliver with target dates, and monitor the implementation of the following:

a) Performance based navigation;
b) Air traffic flow management;
c) Flexible use of the airspace;
d) Automation;
e) Situational awareness (surveillance);
f) Ground-ground and ground-air communications infrastructure; and
g) Implement the new ICAO flight plan model

3. WORKING METHODOLOGY

3.1 Development of TORs macro-tasks 3 a) and 3 b)

3.1.1 The review of the air navigation plan is a continuous task of the ICAO Secretariat, in coordination with States. The regional planning/implementation mechanisms examine the CAR/SAM Air Navigation Plan (CAR/SAM ANP), in correspondence to dynamic implementation processes. In addition, as consequence of the development of the TORs macro-task 3 c), amendments to the CAR/SAM ANP can originate. All these topics will be documented by the Secretariat and presented to the Subgroup for its consideration and later submission to the consideration of GREPECAS, with the aim of counting with CAR/SAM amendments consolidated in the ANP.

3.1.2 The dealing of deficiencies in the CNS/ATM area would be developed taking under consideration the application of the methodology approved by Council to that effect; this has been complemented with an additional procedure approved by the ASB at GREPECAS/15 meeting. The Secretariat will present at each Subgroup meeting the status in the dealing of deficiencies; the Subgroup, considering the comments of the Secretariat, will examine them and will be able to formulate measures, in the event necessary, to facilitate the solution of the deficiencies. The results of this analysis will be sent to GREPECAS through the ASB.

3.2 **Development of TORs macro-task 3 c)**

3.2.1 The work of the CNS/ATM Subgroup will be developed under a performance based approach, using the performance reference frameworks (PFFs), through the development of project management techniques where identification will be made of the ATM Operational Concept element, the deliverable or intermediate result with the associated Global Plan initiatives/strategies (GPI), the person responsible and the target date. It is important to note that the CAR and SAM Regions have implementation plans on most of these topics. The projects should take under consideration the particular plans of each region and, fundamentally, harmonize them in the inter-regional interphase, with the aim of carrying out a CAR/SAM development planning.

3.2.2 For the carrying out of TORs macro-task 3 c), the Subgroup should count with a structure such as the shown in **Attachment B** to this Appendix.

3.2.3 The tasks detailed in the TORs macro-task 3 c) would be developed through four initial programmes that would compose the main structure of the CNS/ATM Subgroup.

3.2.4 Each programme will have a group of projects assigned to it. The coordination of the programme will be in charge of an ICAO ATM or CNS Regional Officer from the NACC and SAM Offices.

3.2.5 Each project will have a project coordinator and a group of experts responsible for the carrying out of the activities scheduled in same. The people to form part of the project will come from States and Organizations members of the CNS/ATM Subgroup. The financing of the work of the experts in the project will be covered by the States from which they come from. In certain cases to be identified, the ICAO regional projects might provide specific assistance.

3.2.6 The general work would be developed as follows:

a) The coordinators of the programmes for the management in the development of the projects and assistance to the experts from the States in charge of carrying out the projects will be the ATM and CNS Regional Officers from the NACC and SAM Offices;

b) The projects will be carried out by experts that States/Territories/International Organizations name at meetings of the Subgroup, who should count with the total support in resources from their States/Territories/International Organizations, for the development of the activities required;

c) The Subgroup will define the number of programmes necessary, and of the associated projects. The implementation of new necessary projects or the conclusion of an existing project, will be decided upon by the Subgroup;

d) The coordinator of the project, under coordination with the coordinator of the programme, will be responsible for the carrying out of the assigned project. The experts assigned for the carrying out of the activities of a project should follow the guidelines of the coordinator of the project.

e) To harmonize CAR and SAM developments, the carrying out of activities might require the concurrence of experts from both regions, at a given moment.

f) The experts will work through the use of the Internet and will be able to coordinate their work amongst them and the Regional Officers, through electronic means and/or teleconferences.

g) In the event necessary, the coordinators of projects and the coordinator of the corresponding programme will be able to meet in order to coordinate the progress of their activities.

h) The experts will present their work at the dates required by the Subgroup, and indicated in the activities of the project.

i) The Regional Officers in charge of the programmes will be the focal points for any coordination necessary with the projects from the various programmes.

j) The Regional Officer in charge of the programme will document the progress made with regard to the associated projects at each meeting of the Subgroup, and will provide a report in that respect.

k) The Subgroup will examine the work developed by the projects and will inform GREPECAS on their progress and results.

l) Upon completing the scope of the work, the experts will end their assistance in the activities they were charged with.

3.2.7 Attachment B to this Appendix indicates the names of some of the coordinators of projects. ICAO, through the appropriate Regional Offices, will request the respective States, Territories and international organization for the nomination of the experts from the corresponding areas to assume the pending posts, as well as the support personnel necessary for the carrying out of the projects tasks.

4. FUNCTIONAL STRUCTURE OF THE CNS/ATM SUBGROUP

4.1 The functional structure of the Subgroup proposed here, considers a simple organization for the Subgroup. Attachment B to this Appendix presents the functional structure proposed for the Subgroup, which is explained hereunder:

4.2 The functional structure is divided into two levels, one of management and the other, of implementation.

Management level

4.2.1 Within the management level are the resources of the ICAO Secretariat which assists the Chairman and Vice-Chairman of the Subgroup, as well as the carrying out of the tasks related with 3 a), 3 b) y 3 c).

Implementation level

4.2.2 Within this level are the TORs macro-tasks 3a) y 3b). They are fundamentally developed by the ICAO Secretariat. Within the implementation of projects, a definition would have to be made of their implementation priorities, with the aim of obtaining a better efficiency in the works of the Subgroup. The deliverables (results) of these projects are achieved through the development of the activities established in the work programme, which will be implemented by the experts from the CAR/SAM States/Organizations providers and users. The number of experts to work in each project may vary, depending on the specialties and resources necessary to achieve the objectives and obtain the results in the scheduled period.

4.3 The Subgroup will count with a Chairman and Vice-Chairman, who will act in correspondence with the GREPECAS Handbook. The Chairman and Vice-Chairman will be elected by the CNS/ATM Subgroup.

4.4 The Secretariat will be appointed by the Secretary of GREPECAS, and would be composed by the Secretary from one of the areas (CNS or ATM) and a Co-secretary from the area or region opposite to the Secretary, who will be assisted by an ATM and a CNS Regional Officer, in a manner that the Secretariat will be composed by 4 Regional Officers: 2 CNS and 2 ATM.

4.5 The programmes initially considered will be the following:

a) PBN
b) ATFM
c) Automation and ATM situational awareness
d) Ground-ground and air-ground communications infrastructure

4.6 Each programme will have assigned an initial number of projects, based on performance objectives. Attachment B to this Appendix indicates the projects associated to each programme.

4.7 The Secretariat, together with the Chairman and Vice-Chairman, will form part of a Coordination Committee to periodically examine the operation of the Subgroup and the development of its activities. This Committee will work through electronic communications means to carry out coordination. The Chairman, Secretary and Co-Secretary of the Subgroup will be responsible for the operation of this Committee, as per the GREPECAS Procedural Handbook.

5. MEETINGS OF THE SUBGROUP

5.1 The meetings of the Subgroup will be organized and held in accordance with the GREPECAS Procedural Handbook.

5.2 All documentation will generate from the Work Programme of the Subgroup and will be examined in the plenary sessions of the Subgroup. The Chairman of the Subgroup will be able to establish the ad-hoc groups it deems necessary to deepen into the analysis of the documentation presented during the plenary session.

5.3 The ad-hoc groups should not be identified as permanent groups associated to the projects; these groups cease their existence upon the ending of the meeting.

5.4 The Secretariat, in coordination with the Chairman of the Subgroup, will give due follow-up to the actions formulated in each meeting of the Subgroup, and will prepare the documentation to be presented by same, to the meetings of GREPECAS.

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APPENDIX D

CAR/SAM STRATEGY FOR THE EVOLUTION OF AIR NAVIGATION SYSTEMS

First Edition
Rev 2.0

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INTRODUCTION

1.1 **Acronyms**

ABAS	Aircraft Based Augmentation System
ADS-B	Automatic Dependent Surveillance - Broadcast
ADS-C	Automatic Dependent Surveillance - Contract
ANSP	Air Navigation System Provider
APV	Approach with Vertical Guidance
ATC	Air Traffic Control
ATM	Air Traffic Management
ATS	Air Traffic Services
BARO-VNAV	Barometric Vertical Navigation
CAR/SAM	Caribbean and South American Regions
CAT-I	Category I Precision Approach
CAT-II	Category II Precision Approach
CAT-III	Category III precision Approach
CFIT	Controlled Flight Into Terrain
CNS/ATM	Communications, Navigation and Surveillance/Air Traffic Management
DME	Distance-Measuring Equipment
EGNOS	European Geostationary Navigation Overlay Service
FAA	Federal Aviation Administration - USA
GAGAN	GPS and Geostationary Earth Orbit Augmented Navigation - India
GALILEO	Europe's own global navigation satellite system
GBAS	Ground Based Augmentation System
GLONASS	Global Navigation Satellite System – Russia
GLS	GBAS Landing System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GREPECAS	Caribbean and South American (CAR/SAM) Regional Planning and Implementation Group
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IRS	Inertial Reference System
LAAS	Local Area Augmentation System (USA)
MSAS	Multi-functional Satellite Augmentation System - Japan
NAVAID	Navigation Aid
NSP	Navigation Systems Panel
NDB	Non-Directional Radio Beacon
PBN	Performance-Based Navigation
RAIM	Receiver Autonomous Integrity Monitoring
RNAV	Area Navigation
RNP	Required Navigation Performance
RNP APCH	Approach RNP
RNP AR	Approach RNP, with Authorization Required
SBAS	Satellite-Based Augmentation System
SID	Standard Instrument Departure
STAR	Standard Instrument Arrival
TMA	Terminal Control Area
VFR	Visual Flight Rules
VOR	VHF Omnidirectional Radio Range
WAAS	Wide Area Augmentation System
WGS-84	World Geodetic System -1984

1.2 Objective and general considerations

Pursuant to its terms of reference and work programme, as revised and approved by the CNS/COMM/6 meeting, the GNSS Task Force (GNSS/TF) of the CNS Committee of the GREPECAS ATM/CNS Subgroup was assigned, *inter alia*, the task of developing a draft document describing the evolution of the air navigation infrastructure required to support CAR/SAM PBN requirements.

This proposal has its origin in the initiatives of the "Global Air Navigation Plan" (Doc. 9750) and the "CAR/SAM Regional Air Navigation Plan" (Doc. 8733), based on the fact that technology is not a goal in itself, and that it must be based on operational requirements in order to attain the global ATM operational concept.

Accordingly, this proposal has been developed taking into account the following guidance and reference documents:

a) Annex 10, Volume I;

b) Strategies for the introduction and use of non-visual radio aids for approach, landing, and departure procedures in the CAR/SAM Regions (Appendix I to the CAR/SAM Air Navigation Plan, Doc 8733);

c) Guidance for the transition to satellite-based navigation systems in the CAR/SAM Regions (Appendix H to the CAR/SAM Air Navigation Plan, Doc 8733);

d) CAR/SAM PBN Roadmap, version 1.4 / July 2009;

e) GNSS Manual, Doc 9849 AN/457; and

f) Analysis of the navigation infrastructure in support of PBN.

The main objective of this strategy is to define a gradual implementation of the navigation infrastructure that will help to promote the safety, inter-functionality, and cost-effectiveness of the infrastructure needed to meet future ATM requirements, propose the activities and actions required so that the air navigation infrastructure will support the short- and medium-term PBN requirements established in the CAR/SAM PBN roadmap, and develop a long-term projection of activities and actions for air navigation infrastructure.

The CAR/SAM Strategy for the Evolution of Air Navigation Systems, hereinafter called "the Strategy", shall be considered a guiding document for all parties involved. This document does not contain regulatory or mandatory requirements. Air navigation authorities shall publish the corresponding regulations for the introduction and use of PBN.

This strategy is a living document that shall be reviewed and updated every two years or when major modifications to the base document are being considered.

1.3 Scope of the strategy

According to this proposal, the implementation of air navigation systems responds to a harmonised CAR/SAM strategy that takes into account operational requirements and the relevant cost-benefit analyses, based on which CAR/SAM States, Territories and International Organisations may draft their action plan for the implementation of the required navigation systems, in keeping with CAR/SAM implementation dates.

To better understand this air navigation strategy, the operational requirements, the required navigation infrastructure, the regional studies and trials proposed in this document are presented in chronological order. The timetable for this proposal is the same as that of the CAR/SAM PBN roadmap for the short (2006-2010), medium (2011-2015) and long term (2016+).

The dates indicated herein are tentative dates in which air navigation systems will be operational at regional level. However, some of the air navigation systems described in this strategy will be used for resolving local problems prior to the dates established in this document, so there will be a migration from these pioneering areas to broader regional areas.

The policy for the implementation of the new air navigation technologies in the CAR/SAM Regions should be based first on voluntary implementation in specific areas, using the existing certified equipment, followed by implementation in more extensive areas, supported by the respective regulations and updated equipment.

1.4 Structure of the document

This document is structured as follows:

- Section 1 (this section) lists the acronyms used, the purpose of the document, explains its scope and structure, and describes the target audience.

- Section 2 describes the evolution of the Air Navigation Operational Scenario, that is, the short- (2009-2010), medium- (2011-2015) and long-term (2016-2025) operational requirements for en route and terminal airspace, aerodrome operations, and on-board systems.

- Section 3 describes the evolution of the air navigation infrastructure required to support the envisaged operational scenario.

- Section 4 specifies a tentative action plan, whose timely implementation will promote the operational use of the new GNSS technologies.

1.5 Target audience

This strategy has been developed to assist States/Territories/International Organisations, as well as aviation community stakeholders, in the implementation of PBN, of the plan for the future transition, and of the corresponding investment strategies.

The main aviation community stakeholders in the CAR/SAM Regions that will benefit from this strategy are:

- Regulatory agencies, the national regulatory authorities of CAR/SAM States/Territories/International Organisations responsible for the verification of air navigation systems;

- Air navigation service providers (ANSPs). Civil and military air navigation service providers of CAR/SAM States/Territories/International Organisations responsible for the acquisition/design, acceptance, and maintenance of air navigation systems;

- Airport operators responsible for the acquisition/design, acceptance, and maintenance of navigation systems at the airports;

- Airspace users, who are the end users of air navigation systems; and

- International organisations.

2. EVOLUTION OF THE OPERATIONAL SCENARIO, ACCORDING TO THE CAR/SAM PBN ROADMAP

2.1 Oceanic airspace – En-route operations

a) Taking into account low air traffic density in oceanic airspaces, no significant short-term changes are expected in the existing airspace structure that would require changes in the applicable RNAV specifications. In airspaces where RNP-10 is applied (EUR/SAM corridor, Lima-Santiago de Chile and South Atlantic Random Route System), no changes are expected in the short term.

b) In oceanic airspace, it is expected that RNP 4 will be applied in the medium term, using ADS/CPDLC, to enable 30 NM lateral and longitudinal separations. This application will depend on the evolution of the aircraft fleet flying in the airspace.

2.2 Continental airspace – En-route operations

a) In the short term, RNAV-5 is envisaged in selected airspaces where operational benefits can be derived and where the available CNS infrastructure will support it.

b) In the medium term, RNP-2 is expected in selected high-density continental airspaces, using GNSS only, taking into account that the ground infrastructure will not support RNAV applications. The establishment of a backup system for GNSS will be required, as well as the development of contingency procedures in case of GNSS failure. The use of RNP-2 will facilitate the application of PBN in airspaces that lack surveillance. With the use of GNSS alone, it will be necessary to obtain more information from the GNSS signal through the use of GPS monitoring systems.

2.3 Continental airspace – Terminal control area (TMA)

a) In the short term, the implementation of RNAV-1 is expected in TMAs selected by the States, under radar coverage, and with the appropriate ground navigation infrastructure that allows for DME/DME and DME/DME/INS operations. During this phase, both equipped and non-equipped aircraft will be allowed to operate, and RNAV-1 operations shall begin once the appropriate percentage of approved air operations has been achieved.

b) In non-radar environments and/or where there is no appropriate ground navigation infrastructure, the implementation of RNP-1 in the short term is expected in TMAs selected by the States, using GNSS alone, provided there is an appropriate percentage of approved air operations. Both approved and non-approved aircraft will also be allowed to operate in these TMAs.

c) PBN approach procedures shall be implemented in the short term as approach procedures with vertical guidance (APV) using baro-VNAV for runways, be it as primary approach or as backup for all final approaches to the runway, based on RNP APCH or RNP AR APCH navigation specifications.

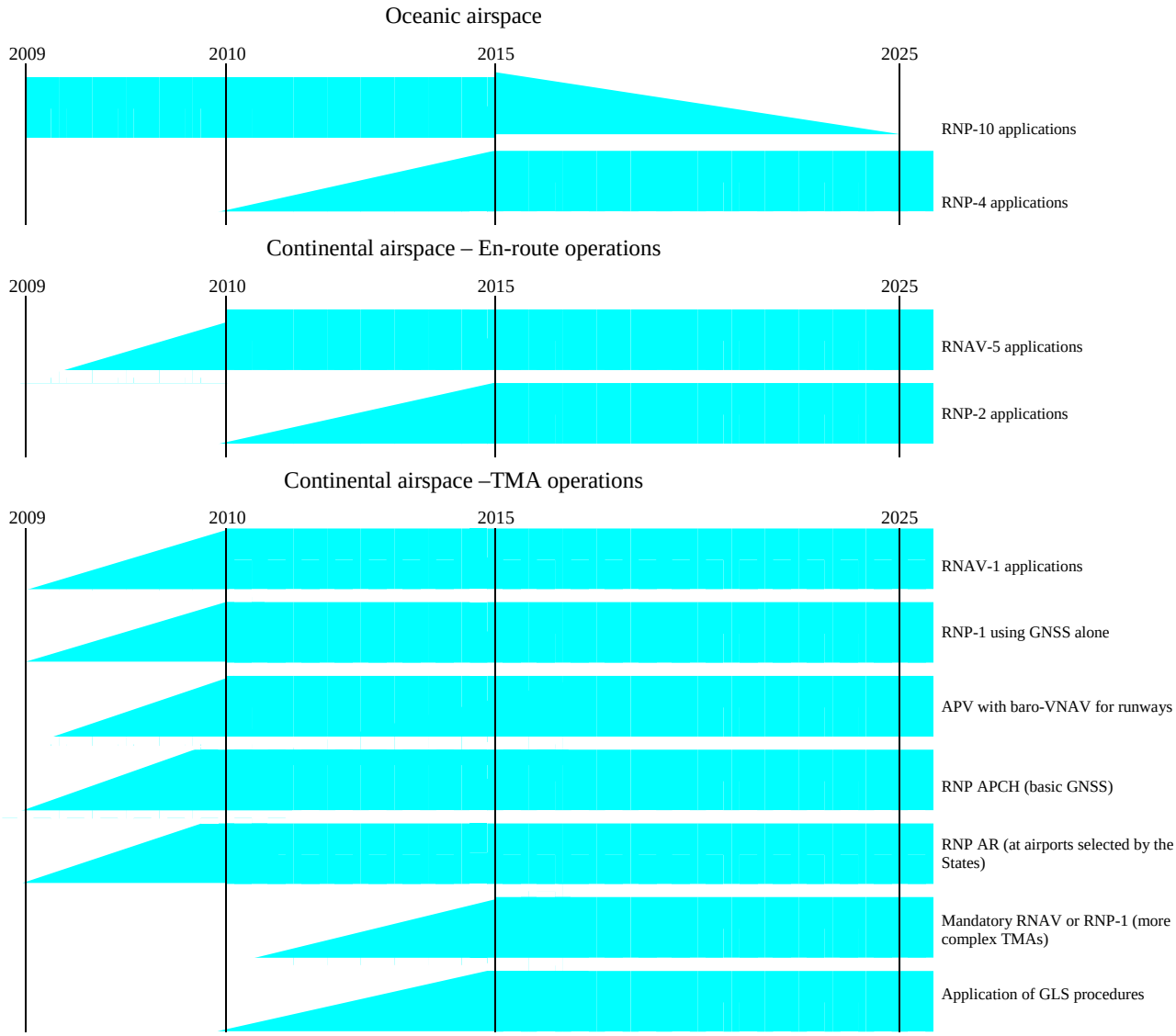
d) Use of RNP APCH (basic GNSS) approach procedures is expected in the short term in most international airports selected by the State, maintaining conventional approach procedures for conventional non-equipped aircraft.

e) Use of RNP AR approach procedures is expected in the short term at airports selected by the State, where operational benefits to be obtained are evident, based on the existence of significant obstacles.

f) In the medium term, it is expected that RNAV or RNP 1 applications will be extended to TMAs selected by the States, depending on ground infrastructure and aircraft navigation capabilities. At more complex TMAs, the use of RNAV or RNP 1 (exclusionary airspace) equipment will be mandatory. At less complex TMAs, both equipped and non-equipped aircraft will be allowed to operate.

g) In the medium term, it is expected that RNP APCH and RNP AR procedures will be extended to selected airports. Initial implementation of GLS procedures is also envisaged, thus ensuring a smooth TMA-to-approach transition, basically using GNSS for the two phases.

2.4 Timetable for operational requirements



3. EVOLUTION OF AIR NAVIGATION INFRASTRUCTURE

3.1 Short term (up to 2010)

a) Initial deactivation of NDBs.

b) Definition of the GNSS backup infrastructure.

c) Changes to DME infrastructure to meet ICAO RNAV (DME/DME) requirements at selected TMAs.

d) Initial implementation of ABAS for en-route, TMA, and NPA operations.

3.2 Medium term (2011-2015)

a) The implementation of GBAS CAT I stations at airports with sufficient operational demand will improve en-route and TMA operations (SIDs and STARs) on paths similar to those of the ILS.

b) At some airports, ILS systems will be maintained as GNSS/GBAS backup.

c) Initial deactivation of VOR for en-route operations.

3.3 Long term (2016-2025)

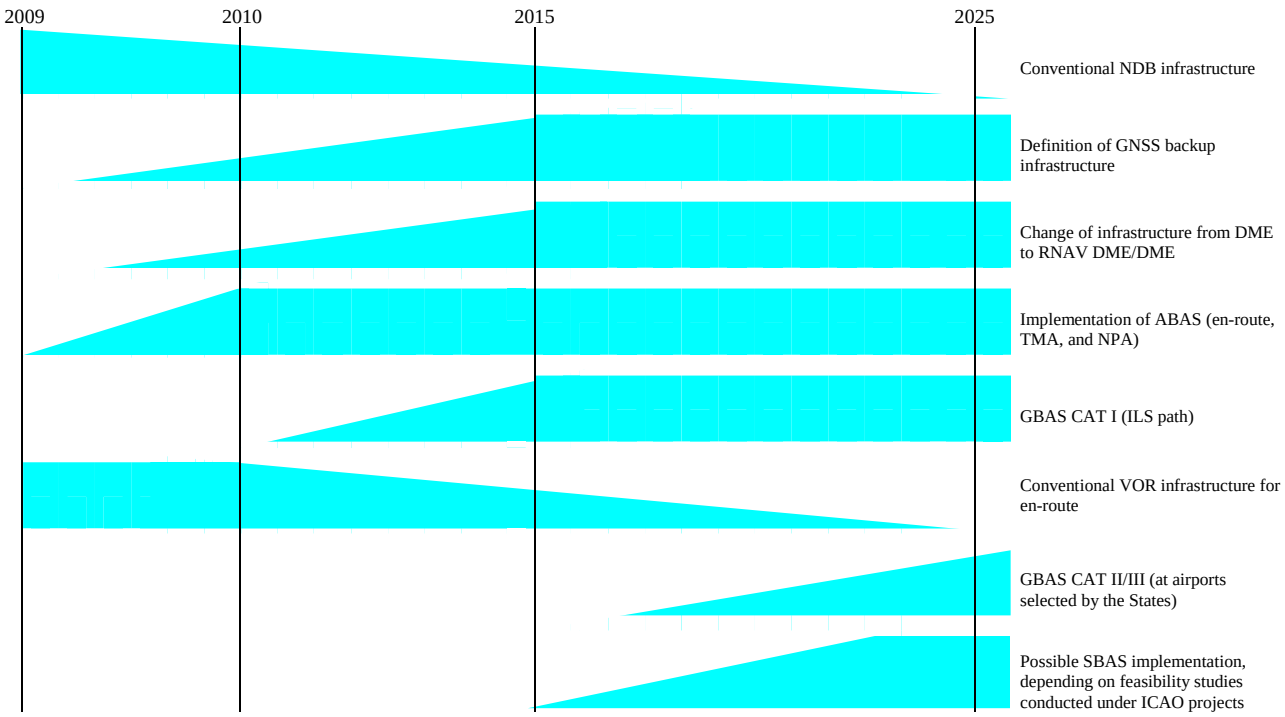
a) Continue deactivating conventional aids, maintaining the backup structure, if necessary.

b) Implementation of GBAS Cat II/III at selected airports.

c) Implementation of GBAS CAT I approach at other CAR/SAM airports with sufficient operational demand.

d) Possible implementation of SBAS, depending on feasibility studies already carried out and underway under ICAO projects, taking into account current mono-frequency systems and the evolution of ionosphere algorithms, as well as the future availability of a multi-frequency, multi-constellation satellite structure.

3.4 Timetable for air navigation infrastructure



4. TENTATIVE ACTION PLAN

4.1 Short term (up to 2010)

a) The implementation of an automatic tool for the development of procedures should be established in order to meet the new demand for procedures such as RNAV and RNP.

b) Analysis of DME/DME coverage and DME implementation to support operations, and introduction of improvements.

4.2 Medium term (2011-2015)

a) In order to determine which airports are suitable for the installation of GBAS CAT I stations, each State must make a cost-benefit analysis based on its own operational demand.

b) For each eligible airport, a GBAS ionosphere threat model will be required for certification and commissioning purposes.

c) Complete and conclude the SACCSA project to see the possibility of implementing an SBAS system in the CAR/SAM Regions.

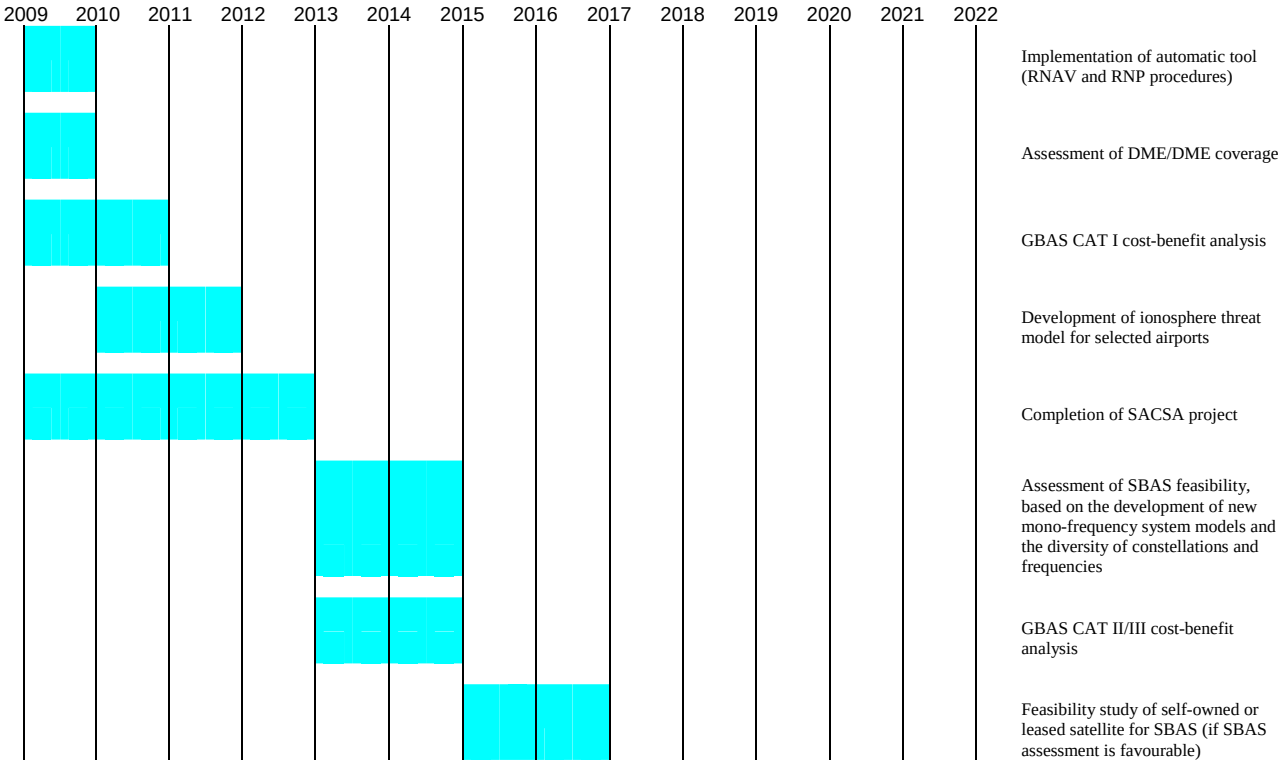
d) Assess the technical, operational, and financial feasibility of SBAS systems, based on the development of new mono-frequency system models, the future implementation of GPS operations, and the commissioning of the GALILEO constellation.

4.3 Long term (2016-2025)

a) In order to determine which airports are suitable for the installation of GBAS CAT II/III stations, each State must conduct a cost-benefit analysis, based on its own operational demand.

b) SBAS operations with a self-owned or leased GEO satellite, which could enable SBAS operations independently from WAAS and/or EGNOS.

4.4 Action Plan timetable



APPENDIX E

SURVEILLANCE STRATEGY FOR THE CAR/SAM REGIONS

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1. Introduction

1.1 General Considerations

Within the context of the GREPECAS/14, the Surveillance Regional Plan was updated and it was recognized that further analysis on that matter should take place by CNS Committee. The CNS Surveillance Task Force (CNS/SUR/TF) was then created and tasked, among other activities, to define a unified Air Surveillance Strategy for CAR/SAM Regions.

Subsequently, this initial document is the result of the task assigned to CNS Committee - CNS/SUR/TF, in which the preliminary elements for a Regional CAR/SAM Strategy in short, medium and long term for ADS-C and ADS-B use have been integrated into an Unified Regional Strategy for the Implementation of Surveillance Systems.

This surveillance strategy is derived from the "Global Air Navigation Plan for CNS/ATM Systems" (Doc. 9750) and the "CAR/SAM Regional Air Navigation Plan" (Doc. 8733), since technology is not an end in itself and should be based on clearly established operational requirements for ATM evolution.

The main objective of this strategy is to propose the surveillance systems that are suitable to be applied in short and medium terms within CAR/SAM Region and to define an evolutionary path that will promote safety, interoperability and cost effectiveness of the required infrastructure to meet the future ATM needs.

The surveillance strategy should be seen as a guidance document to all stakeholders, without any regulatory or mandatory requirements. Appropriate regulations should be published by Air Navigation Authorities when the use of new surveillance techniques is to be introduced in the States.

This strategy is a live document and should be reviewed and updated every two years.

1.2 Scope of the Surveillance Strategy

The surveillance strategy should be seen as a link between the Global Air Navigation Plan for CNS/ATM Systems (Doc. 9750) and the stakeholders' strategy for the air surveillance applications.

Implementation of surveillance systems should be based on a harmonized strategy for the CAR/SAM Regions that would take into account the operational requirements and relevant cost-benefit analyses. It should also be based on Action Plans to ensure that CAR/SAM States, Territories and International Organizations implement the necessary systems in accordance with consistent timescales.

The surveillance technologies considered in this strategy to meet present and future ATM expectations are listed bellow and briefly explained in Annex C:

- Primary Radar (SMR/ASDE);
- Secondary Surveillance Radar (SSR);
- Automatic Dependent Surveillance-Broadcast (ADS-B);
- Automatic Dependent Surveillance-Contract (ADS-C); and
- Multilateration.

In order to provide a global view of the surveillance strategy, the operational drivers, the required surveillance infrastructure and the regional studies and trials proposed in this document have been displayed in each chapter in a chronological presentation.

The timeframes illustrated in this document define the tentative dates when surveillance systems are estimated to become regionally operational. Nevertheless, some of the surveillance systems described in this strategy will be used to solve local issues prior to the timescales in this document, and thereby will migrate from pioneer areas into bigger regional areas.

In other words, new surveillance technologies implementation policy for CAR/SAM Region should be first based on a voluntary initiatives in pocket areas, using certified existing equipage which is to be followed by an implementation in wider areas supported by the Implementing Rule related to the upgraded equipage.

1.3 Structure of the Document

This document is structured as follows:

- Section 1 (this section) presents the general considerations, explains its scope and structure and describes its intended readers.
- Section 2 describes the Surveillance Operational Scenario Evolution, i.e. the envisaged operational drivers for short (2009-2010), medium (2010-2015) and long terms (2015-2025) in the Air Surveillance field, for En-Route and TMA Airspace, Aerodrome Operations and Aircraft Systems.
- Section 3 specifies the Surveillance Infrastructure Evolution required to cope with the foreseen operational environment and specifies a tentative action plan that needs to be accomplished in a timely manner, in order to promote the operational use of the new surveillance technologies.
- **Annex A** provides the meaning of the Acronyms used in this document.
- **Annex B** provides the definitions of the different terms used in this document.
- **Annex C** describes the principles of known surveillance techniques.

1.4 Intended Readers

This strategy was developed to the following stakeholders group within CAR/SAM Region:

- The departments of the National Supervisory Authorities of CAR/SAM countries who are responsible for verifying ATM Surveillance Systems;
- The departments of the civil and military ANSP of CAR/SAM states who are responsible for procuring/designing, accepting, and maintaining ATM Surveillance Systems;
- The Airport Operators, who are responsible for procuring/designing, accepting, and maintaining Surveillance Systems at airports level; and
- The Airspace Users, who are the final client of the ATM Surveillance Systems chain.

2. Surveillance Operational Scenario Evolution

2.1 En-Route and TMA Airspace

The surveillance operational scenario evolution for En-Route and TMA airspace is based on two fundamental principles for ground users in such airspace. These principles are dominant throughout the complete surveillance strategy and are:

- An independent surveillance system to track cooperative targets in TMA and en-route airspace; and
- Dependent cooperative surveillance.

2.1.1 Short term (until 2010)

Until 2010, independent surveillance systems will be predominant in CAR/SAM Regions. Until then, target position will only be determined by the ground sensors (eg. SSR, MSSR radars).

2.1.2 Medium term (2010-2015)

From 2010 onwards, the provision of ADDs to ground stations to support TMA and En Route operations is envisaged, following the increasing rate of Mode S equipped aircraft (new and overhauled) that will be able to transmit ADS-B messages (ADS-B out).

The first set of new applications that are envisaged to be supported in CAR/SAM Region are the ground Surveillance (ADS-B out) in a non-radar environment (ADS-B-NRA), in a radar environment (ADS-B-RAD) and Airborne Derived Data (ADS-B-ADD). ADS-B-out is expected to reach full operational capability status in 2015.

2.1.3 Long term (until 2015-2025)

Another set of possible new applications is related to Airborne Surveillance (ADS-B-in, possibly supplemented by TIS-B) including: Airborne situational awareness (ATSA-AIRB), visual separation on approach (ATSA-VSA) and In-trail Procedure in oceanic airspace (ATSA-ITP). ADS-B-in for air traffic situational awareness is expected to be launched after 2015.

It is expected that an integration of airport and airspace surveillance will become more widespread in long term. This requires an increased integration of surveillance information at the SDPD level, which will require updating to process and deliver the new information to surveillance users as the new systems become operational.

Until 2015, the ground service provider will remain responsible for the separation service and for maintaining separation. However, from 2015 onwards, there will be a number of ATM concepts which will begin to drive the evolution of the surveillance environment, these are:

- Enhanced planning with the tasks of the controllers operating in En-Route and TMA sectors becoming increasingly supported by more automation. The controller will make use of more ADD to provide a more accurate view of the situation and improvements in safety nets;
- Surveillance derived information will be made available to support Airborne Traffic Situational Awareness;
- Flight data processing systems will be upgraded to provide full 4D trajectory prediction aligned with the capabilities of 4D FMS;
- The limited delegation of separation tasks to aircrews in low and medium density airspace. This will require additional avionics infrastructure and additional tools for the controller and aircrew; and
- Introduction of preferred routing will require flight information to be displayed in real time to the controller.

2.2 Aerodrome Operations

2.2.1 Short term (until 2010)

For selected airports, detection of all mobiles within the aerodrome area is permanent throughout the whole strategy timeframe.

2.2.2 **Medium term (2010-2015)**

The use of ADDs to support aerodrome operations is envisaged; and the implementation of A-SMGCS level I (which may include ADS-B-APT application) and A-SMGCS level II will be enabled by systems such as Multilateration.

2.2.3 **Long term (until 2015-2025)**

Where airport operators foresee a benefit, a long term implementation of A-SMGCS level III (which may include the ATSA SURF application) and A-SMGCS IV may start. This may require an ADS-B-in infrastructure and an equipage of selected, appropriate airport vehicles with transponders.

2.3 **Aircraft Systems**

2.3.1 **Short term (until 2010)**

In short term, the use of SSR or SSR Mode S transponders for ground based surveillance radar or Multilateration systems will continue. This means that no additional equipment is foreseen on the aircraft until 2010.

2.3.2 **Medium term (2010-2015)**

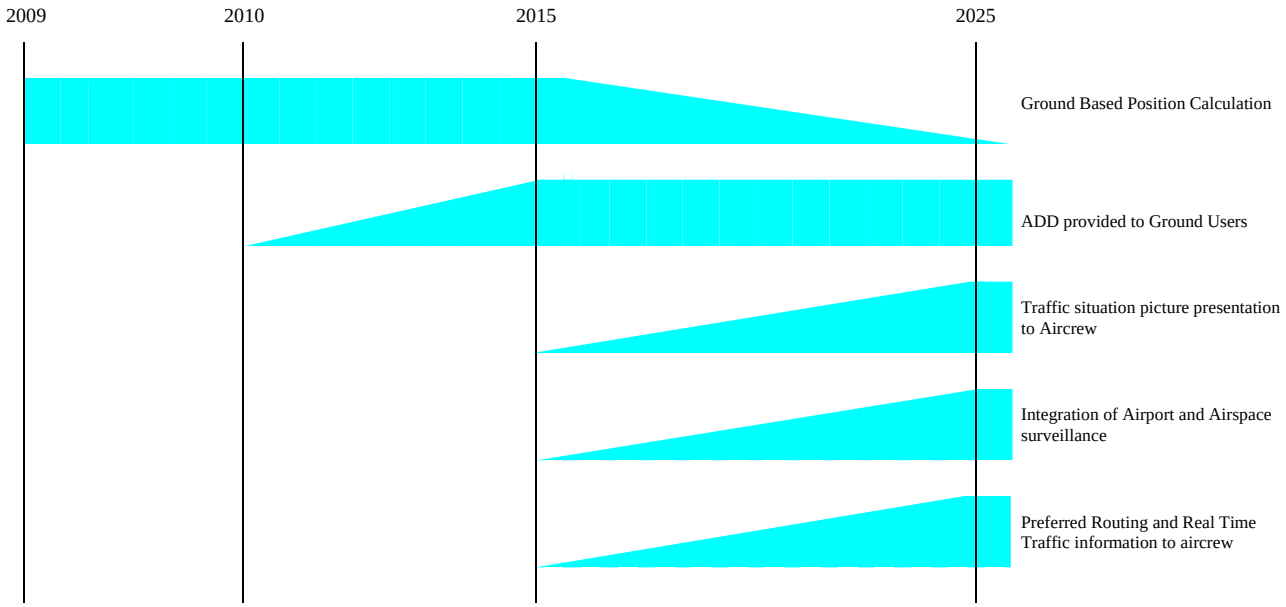
The implementation of new ground Surveillance Applications (ADS-B out), which will require integration between the aircraft navigation system and mode S transponders, in order to transmit intent information to other aircraft and ground users. This is enabled by ADS-B, using 1090 MHz Extended Squitter.

2.3.3 **Long term (until 2015-2025)**

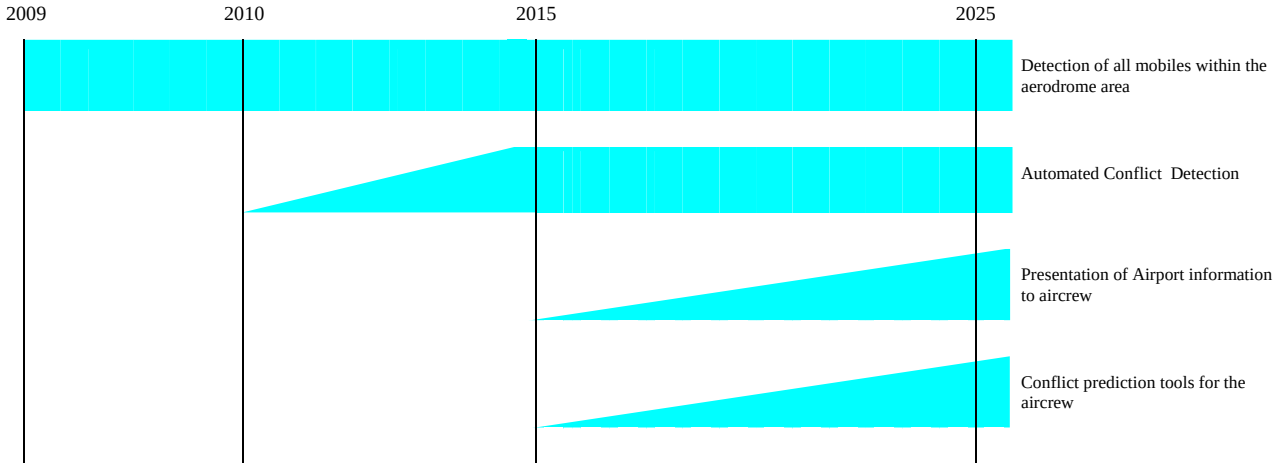
The implementation of ADS-B ASAS situational awareness applications will require an additional airborne SDPS and display system.

2.4 **Operational Drivers Timeframe**

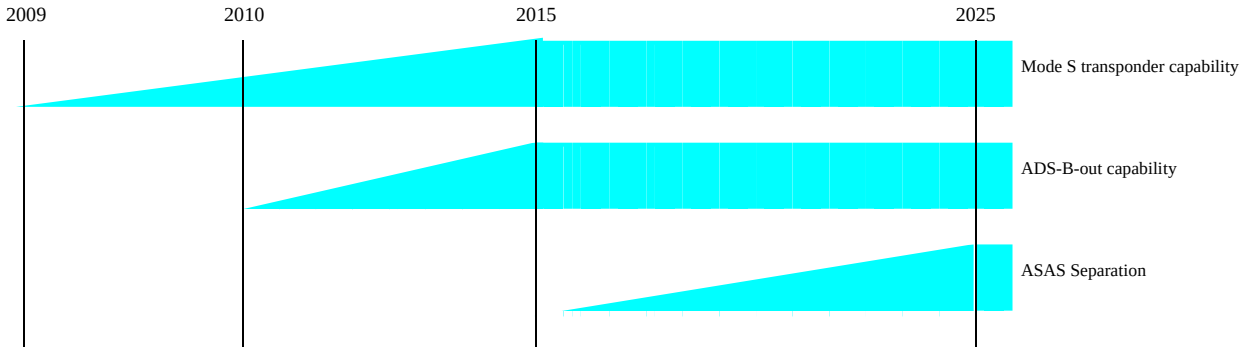
En Route and TMA Airspace



Aerodrome Operations



Aircraft Systems



3. Surveillance Infrastructure Evolution

3.1 En-Route and TMA Airspace

3.1.1 Short term (until 2010)

Co-operative surveillance, in the form of SSR radars, will still be the main means of surveillance and will be extensively used for air traffic surveillance by civil agencies for TMA and En-Route services within coverage of (ground based) interrogator station(s).

Implementation of monopulse SSR, in medium- and high-traffic en route and terminal areas will continue.

Use of ADS-B (ES Mode S receivers) will begin to provide surveillance for en-route and terminal areas not covered with radar, and to strengthen surveillance in areas covered with SSR Modes A/C and S.

3.1.2 Medium term (2010-2015)

SSR Mode S surveillance will be implemented in high density, State-selected TMAs in order to improve secondary radar performances. Since there will still exist legacy aircrafts that won’t be able to reply on mode S, a mixed mode interrogation will be required up to 2015.

Ground implementation for ADS-B (based on ES Mode S receivers) will increase to fill en route and terminal areas not covered with radar and to strengthen surveillance in areas covered with SSR Modes A/C and S.

Depending on the percentage of ADS-B equipped aircrafts, wide area multilateration (WAM) implementation should be considered as a possible transition path to ADS-B environment in a shorter timeframe.

ADS-C surveillance will be operationally used in all oceanic and remote airspace associated with FANS 1/A capacities.

Surveillance Data Processing and Distribution systems based on surveillance server technology will have to be progressively upgraded, in order to merge legacy radar data and information contained in the ADD and/or from Multilateration position calculations and promote data sharing between States using TCP/IP patterns.

3.1.3 **Long term (until 2015-2025)**

It is predicted that by 2020 the majority of the SSR and SSR Mode S systems currently installed are at the end of their operational life. Therefore, SSR Mode A/C radars that have completed their life cycle by that time won't be replaced anymore. ADS-B or multilateration systems will fully replace those decommissioned SSRs.

3.2 **Aerodrome Operations**

3.2.1 **Short term (until 2010)**

The main technology for calculating the position of mobiles (both aircraft and vehicles) will be Surface Movement (primary) Radar.

Implementation of multilateration will gradually increase, where aircraft respond to SSR Mode A/C or SSR Mode S queries.

3.2.2 **Medium term (2010-2015)**

A-SMGCS Level I/II will provide the benefits at the aerodrome and additional information may be required by the ground systems. The most effective means of achieving this would be via ADS-B, since aircraft will already be equipped and there will be a cost-effective upgrade path for the Multilateration ground stations, although there may be an impact on the avionics.

Although many Multilateration systems are configured with their own data fusion trackers as standard, a possible upgrade to existing SDPDs to support Aerodrome operations will be required.

3.2.3 **Long term (until 2015-2025)**

The introduction of A-SMGCS Levels III/IV at selected aerodromes will require aircrew to be presented, with an airport map and other mobiles for situational awareness and possible conflict prediction tools in the aircraft. Where airports foresee a benefit from these kinds of applications then a TIS-B service may be required to ensure a complete and consistent airport situation picture.

3.3 **Aircraft Systems**

3.3.1 **Short term (until 2010)**

In accordance with ICAO requirements, all aircraft flying within CAR/SAM controlled airspace are required to be equipped with a pressure altitude reporting device. It is not foreseen that there will be significant changes for aircraft systems prior to 2010 on that matter.

Until 2010 the implementation of ACAS II systems throughout commercial and general aviation will be almost completed, using Mode S transponder.

3.3.2 Medium term (2010-2015)

Begin the update of Mode S transponders, by integrating them to GNSS airborne systems, so that they will operate in ADS-B environments (ADS-B out).

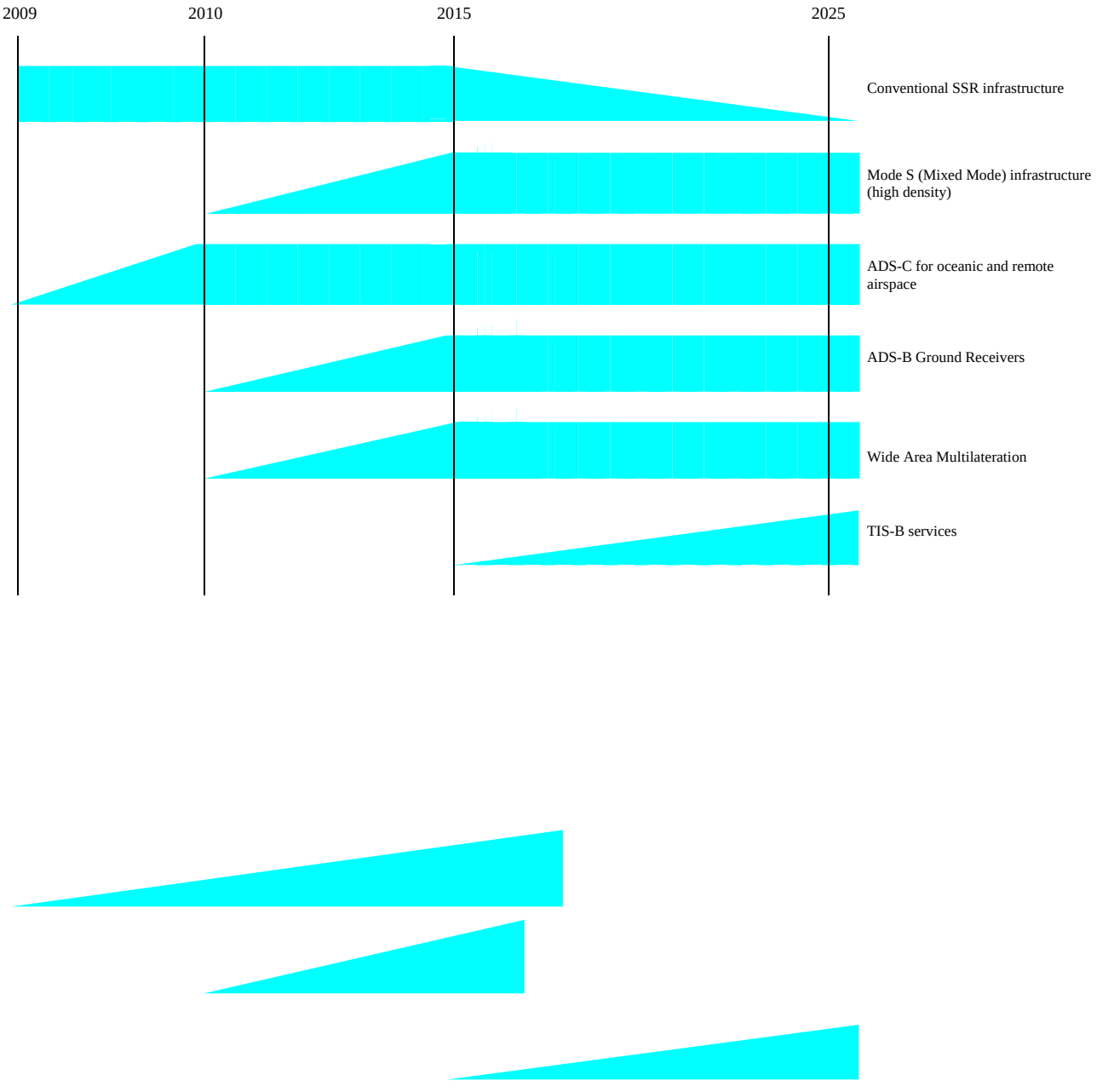
If aircraft are operating in airspace where the ADS-B Package I ground based surveillance applications are in use, then the avionics configuration will require changes to deliver the additional aircraft derived data required.

3.3.3 Long term (until 2015-2025)

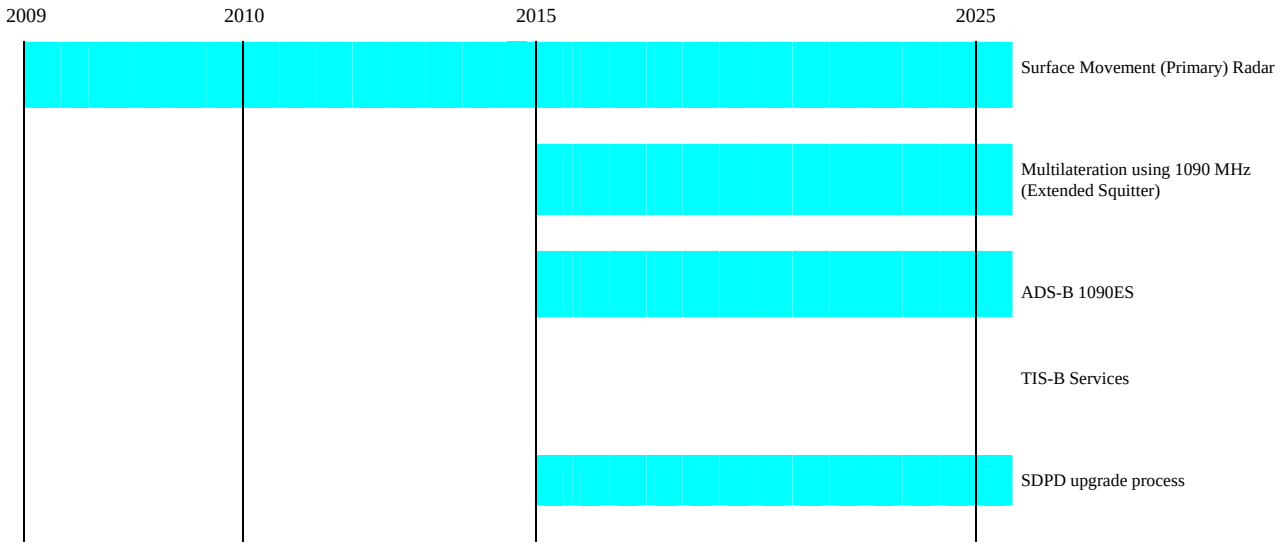
The move from ASAS spacing to ASAS separation and preferred routing may require a high integrity traffic situation picture, therefore the use of TIS-B may be required as well as the implementation of an airborne Surveillance Data Processing System (SDPS) to integrate ADS-B in and TIS-B for presentation of the air situation picture on a graphical display.

3.4 Surveillance Infrastructure Timeframe

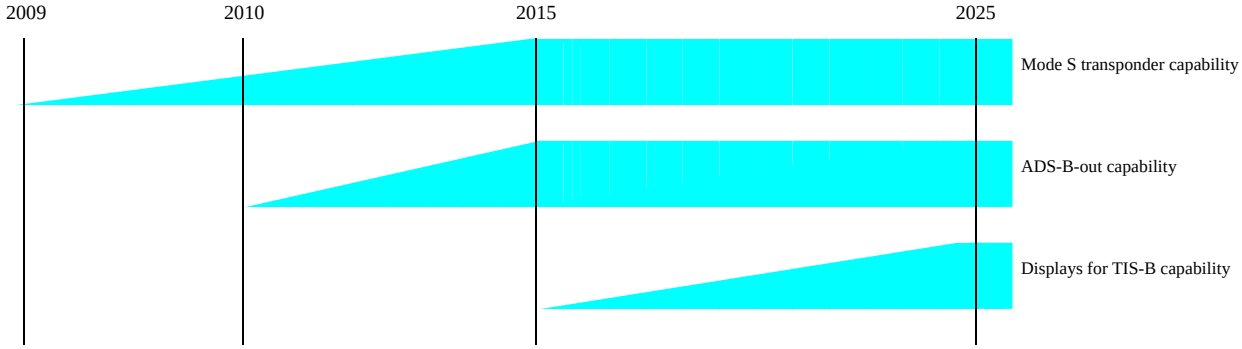
En Route and TMA Airspace



Aerodrome Operations



Aircraft Systems



3.5 Tentative Action Plan

3.5.1 Short term (until 2010)

Regional trials will have to be conducted in order to support the operational introduction of new techniques such as ADS-B and WAM. Such assessments would include Cost Benefit Analysis, safety assessments and detailing operational requirements.

In order to validate the timeframe forecasted by this surveillance strategy and assess the proportions of equipped aircrafts, each State/Territory/International Organization should evaluate the:

- useful life of their radars and the potentiality for their replacement with ADS-B;
- locations of potential ADS-C or ADS-B ground station sites;
- capabilities of existing and planned ATC automation systems to support ADS-C or ADS-B applications;
- maximum density traffic nowadays and expected for the year 2025;
- number of equipped aircrafts operating in the concern airspace;

- number, name and type of equipped aircraft of the airlines that have equipped aircrafts for mode S, ADS-C and ADS-B;
- rate of faulty Mode S airborne equipment and its behavior; and
- categorization of the accuracy/integrity data available in the aircrafts.

The ADS-B deployment should be associated at early stages in coordination with the States/Territory/International Organizations responsible for the control of adjacent areas, and the correspondent ICAO Regional Office. Therefore, a plan for data sharing should be established, based on bilateral agreements, aiming at a coordinated, harmonious and interoperable implementation of ADS-B.

As the increased dependence on ADS-B (1090 MHz Extended Squitter) is expected to grow, there is concern that the band will become saturated as more information is loaded onto the restricted band. Therefore it is required to study whether the use of 1090MHz continues to support the surveillance requirements.

3.5.2 **Medium term (2010-2015)**

In medium term, the capabilities of current Multi Sensor Trackers are to be assessed in light of the more stringent requirements need to support and process increasing amount of ADD.

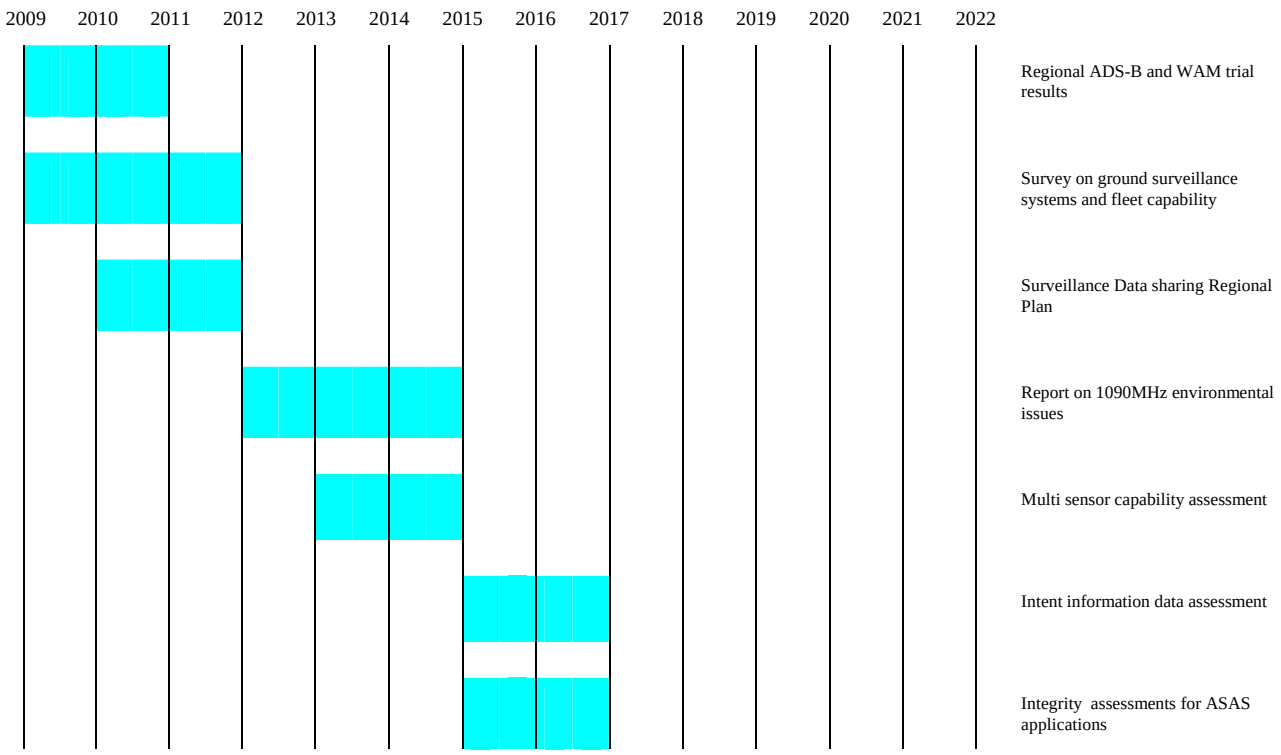
3.5.3 **Long term (until 2015-2025)**

In long term, it is required to identify the impact of the new procedures that are predicted to require ‘intent’ information from the aircraft. The precise definition of intent requires clarification to ensure avionics equipment and ground processing products can be developed in time to deliver the required information.

It is also required to identify whether the integrity requirements of the information presented to the aircrew while performing ADS-B Package I airborne surveillance applications may require the need for the uplink of traffic information to the aircraft to validate the integrity of the navigation data transmitted by ADS-B.

3.5.4 **Studies and Trials Timeframe**

Timeframe of the regional action plan



ANNEX A – ACRONYMS

ACAS	Aircraft Collision Avoidance System
ADD	Aircraft Derived Data
ADS	Automatic Dependent Surveillance
ADS-B	ADS-Broadcast
ADS-C	ADS-Contract
ANC	Air Navigation Commission
ANSP	Air Navigation Service Provider
APP	Approach (Centre or Control)
ASAS	Airborne Separation Assistance System
ASDE	Airport Surveillance Detection Equipment
A-SMGCS	Advanced Surface Movement and Guidance Control System
ATC	Air Traffic Control
ATM	Air Traffic Management
CDTI	Cockpit Display of Traffic Information
CNS	Communications Navigation and Surveillance
CPDLC	Controller Pilot Data link Communications
FDPS	Flight Data Processing System
FMS	Flight Management System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
ICAO	International Civil Aviation Organization
M-SSR	Mono-pulse Secondary Surveillance Radar
PSR	Primary Surveillance Radar
RSP	Required Surveillance Performance
SARPs	Standards and Recommended Practices
SDPD	Surveillance Data Processing and Distribution System
SMGCS	Surface Movement Guidance and Control System
SSR	Secondary Surveillance Radar
TCAS	Traffic Collision Avoidance System
TIS-B	Traffic Information Service – Broadcast

ANNEX B – DEFINITIONS

Surveillance is defined as the technique for the timely detection of targets and the determination of their position (and if required, the acquisition of supplementary information relating to targets) and the timely delivery of this information to users in support of the safe control and separation of targets within a defined area of interest.

Ground Based Surveillance is defined as 'ground based techniques for the timely detection of targets and the determination of their position (and if required, the acquisition of supplementary information relating to targets) and the timely delivery of this information to users in support of the safe control and separation of targets within a defined areas of interest'. The 'defined area of interest'' relates to the ability of the User to select which information is deemed necessary to ensure the safe implementation of the surveillance application within the physical airspace for which they are responsible.

Independent surveillance is a technique where the position of the aircraft is calculated by the ground and is not dependent on position data transmitted by the aircraft.

Dependent surveillance like ADS-B is based on the principle of the target informing the ground system and other targets of its own position. The target may also provide aircraft derived data. Dependent surveillance delivers Aircraft Derived Data (ADD). ADD may contain navigation position, identification and other data from the aircraft.

Cooperative surveillance is a technique that requires the mobile to equip with a dedicated surveillance systems which responds to transmissions from the ground system.

Non Cooperative surveillance is a technique where the position of the aircraft is calculated by the ground and is not dependent on position data transmitted by the aircraft or upon any deliberate interaction in the aircraft with active components e.g SSR transponders.

Basic surveillance delivers to the surveillance user:

- Aircraft position (latitude, longitude and altitude)
- Mode A

Elementary surveillance includes basic surveillance and also delivers to the surveillance user:

- Aircraft identity - Flight Identity or tail registration and 24 bit address,
- Flight Status,
- Aircraft pressure altitude in 100 ft or 25 ft units, if the aircraft is appropriately equipped.

Enhanced Surveillance delivers to the surveillance user a set of Aircraft Derived Data (ADD) to provide additional information to ground or air based ATM systems and safety nets. Enhanced surveillance may be delivered to ground system through Mode S SSR, ADS-B or Multilateration system (through active interrogations).

Aircraft Derived Data Different cooperative surveillance technologies extract different information from the aircraft. In its simplest form, the Mode A and Mode C information provided by the aircrafts SSR transponder can be classified as aircraft derived data or down linked aircraft parameters. When implemented using SSR Mode S, the following current or short term Aircraft Parameters are automatically extracted from the aircraft:

- Air Speed (Indicated Air Speed and Mach Number)
- Ground Speed
- Magnetic Heading Roll Angle
- Selected Altitude Track Angle Rate (or, if not available, True Air Speed)
- True Track Angle Vertical Rate

The enhanced surveillance parameters delivered by ADS-B include the position and longer term intent parameters e.g. 4D trajectory, trajectory change points etc.

Surveillance users are:

- Oceanic ATM Centers
- En-Route ATM Centers
- TMA/Approach ATM Units
- Airports/Tower ATM & Ground Traffic Management Units
- Military Centers
- Airline Aircraft Operations Centre
- Enhanced Tactical Flow Management System
- Data processing systems, such as Flight Data Processing Systems
- ATM Tools, such as Short Term Conflict Alert
- The target
- Adjacent Surveillance Functions
- Non ATM functions (e.g. Search and Rescue).

Surveillance Data Processing and Distribution systems accept information from surveillance sensors, process the information to develop the 'best' estimate of the position of a target and supply this information to users. In addition the SDPD may receive ADD and distribute this to surveillance users attached to the position information.

A-SMGCS is an airport system which provides surveillance to a ground controller. It has four implementation levels that provide different levels of functionality:

Level I A-SMGCS provides:

- Position; the presentation to a controller of the location of an aircraft or vehicle;
- Identification; the presentation to the controller the identity (flight identification or call sign) of the aircraft or vehicle.

Level II A-SMGCS provides a conflict prediction function to alert the controller of:

- Potential collisions (between aircraft/vehicle or aircraft/aircraft) on the runway surface or protected areas
- Potential entry of aircraft or vehicles into restricted areas.

Level III A-SMGCS includes functions that are being defined by the Airports and Environments Business Division to share traffic situation awareness amongst pilots and drivers and the introduction of the automated routing function. The guidance function may be enhanced by:

- Display of the airport map showing taxiways, runways, obstacles and the mobile position to aircrew and drivers;
- Providing dynamic map with updates of the runway status
- Triggering automatically the dynamic ground signs (stop bars, centerline lights, etc.) according to the route issued by the controller.

Level IV A-SMGCS corresponds to the improvement of the functions implemented at the level III. Of particular note to the surveillance strategy, the control function will be complemented by a conflict resolution function in the cockpit or vehicle.

ADS-B Package I is a set of Ground Based Surveillance, Airborne Traffic Situational Awareness and Airborne Spacing applications (reference 6). Note that since reference 6 was published, the application descriptions have been refined, although they remain largely in accordance with the referenced document. The text below summarizes the applications as of November 2005.

ADS-B Package I Ground Based Surveillance Applications are aimed at improving ATC surveillance on the ground for En-Route and TMA airspace and on the airport surface and at enhancing ATC tools through the provision of aircraft derived data enabled by ADS-B. These applications are:

- ADS-B-RAD ATC surveillance for TMA and En-Route airspace in areas that are already covered by radar systems
- ADS-B-NRA ATC surveillance in non-radar areas
- ADS-B-APT Airport surface surveillance
- ADS-B-ADD Aircraft derived data for ATC tools

ADS-B Package I Airborne Surveillance Applications are aimed at improving airborne (cockpit) surveillance in En-Route and TMA airspace as well as on the airport surface. These applications are:

- ATSA-SURF Enhanced traffic situational awareness on the airport surface
- ATSA-VSA Enhanced visual separation on approach
- ATSA-ITP In-trail procedure in oceanic airspace
- ATSA-AIRB Enhanced traffic situational awareness during flight operations

ADS-B Package I Airborne Spacing Applications are aimed at using airborne (cockpit) surveillance capabilities to carry out applications where the flight crew is able to maintain a time or distance from designated aircraft. These applications are:

- ASPA-S&M Enhanced sequencing and merging operations
- ASPA-C&P Enhanced crossing and passing operations

ASAS Applications are a set of operational procedures for controllers and flight crews that make use of the capabilities of Airborne Separation Assistance Systems to meet a clearly defined operational goal.

Airborne Spacing (ASPA) is an ASAS application category where the flight crew is able to maintain a time or distance from designated aircraft. The controller can use new spacing instructions to expedite and maintain an orderly and safe flow of traffic and is still responsible for providing separation in accordance with the applicable ATC separation minima. New procedures and responsibilities are expected with the introduction of Airborne Spacing applications.

Airborne Separation is an ASAS application category where the flight crew is able to provide separation from designated aircraft in accordance with the applicable airborne separation minima. In this application the controller can delegate separation relative to a designated aircraft to the flight crew through a new clearance however the controller is responsible for providing separation in accordance with the applicable ATC separation minima from other aircraft. New procedures and responsibilities are expected with the introduction of Airborne Separation applications.

Airborne Self Separation is an ASAS application where the flight crew is able to provide separation from all known aircraft in accordance with the applicable airborne separation minima. Airborne self separation is not considered within the timescales of this strategy.

ANNEX C – SURVEILLANCE TECHNIQUES

Primary Radar (PSR, SMR/ASDE)

Primary Radar operates by radiating high levels of electromagnetic energy and detecting the presence and characteristics of echoes returned from reflected objects.

Target detection is totally based on the reception of reflected energy, it does not depend on any energy radiated from the target itself, i.e. no carriage of airborne equipment is required.

Secondary Surveillance Radar (SSR)

Secondary Surveillance Radar (SSR) operates by transmitting coded interrogations in order to receive coded information from all SSR transponder equipped aircraft, providing a two way "data link" on separate interrogation (1030 MHz) and reply (1090 MHz) frequencies.

Replies contain positive identification, as requested by the interrogation, either one of 4096 codes (Mode A) or aircraft pressure altitude reports (Mode C). The co-operative concept ensures stable received signal strength and considerably lower transmitted power levels than Primary Radar. SSR enables Basic Surveillance.

SSR Mode S is a development of SSR using the same interrogation and reply frequencies as the SSR but the selective interrogations contain a unique 24 bit address that ensures all transmissions are only decoded by one aircraft's Mode S Transponder having that 24 bit address.

A Mode S station also transmits conventional SSR formats in order to detect SSR only aircraft (Mode A/C) in order to be downward compatible with SSR.

The SSR Mode S transponder is also a fundamental part of the ACAS airborne installation and the ADS-Broadcast when using the 1090 MHz Extended Squitter transmission. SSR Mode S enables elementary and enhanced surveillance.

Automatic Dependent Surveillance-Broadcast (ADS-B)

Automatic Dependent Surveillance - Broadcast (ADS-B) is a surveillance technique that allows the transmission of aircraft derived parameters, such as position and identification, via a broadcast mode data link for use by any air and/or ground users.

Each ADS-B emitter periodically broadcasts its position and other data provided by the onboard aircraft avionics systems. Any user, either airborne or ground based, within range of the emitter may choose to receive and process the information. Three technology options are available, these are ADS-B 1090ES [which has been selected as the initial link for CAR/SAM Region], VDL Mode 4 (Very High Frequency Data Link) and UAT (Universal Access Time). ADS-B enables elementary and enhanced surveillance.

Automatic Dependent Surveillance-Contract (ADS-C)

Automatic Dependent Surveillance - Contract (ADS-C) is a surveillance technique in which aircraft provide, via a data link, data such as position and identification, derived from the onboard aircraft avionics systems. A "contract" is established between the aircraft and the ground to transmit data at a particular event. An event could be time based, position based or as specified in the contract.

Currently ADS-C is usually implemented via SATCOM but any data link having the range capability would suffice. Whilst originally envisaged to be an ATN compliant data link, current implementations exploit a large part of the functionality through the FANS 1/equipment currently carried by many aircraft.

Traffic Information Service – Broadcast (TIS-B)

An air traffic situation picture derived by a ground based Surveillance Data Processing System may be broadcast from the ground to all aircraft within range and equipped with correct receivers. There are three roles of TIS-B, these are:

- TIS-B fundamental service: This 'gap filler service broadcasts information about aircraft that cannot be adequately obtained directly by ADS-B and is used to enhance the availability of surveillance information to users that are not normally able to receive ADS-B transmissions from other aircraft. This service will normally exclude from transmission those aircraft broadcasting ADS-B messages
- ADS-B validation service: This optional service compares aircraft ADS-B state vector data with surveillance data from ground-based sensors and broadcasts validation data
- ADS-B rebroadcast service: The automatic rebroadcast of ADS-B messages received over one data link, translated directly onto other data links for the purpose of extending ADS-B connectivity to users of incompatible data links.

Multilateration

Multilateration is a surveillance technique where aircraft replies from other SSR or SSR Mode S interrogations or spontaneous squitter message from Mode S transponder are passively received by 3 or more ground receiver stations. Using time of arrival techniques the position and altitude of the target can be determined. In some Multilateration systems, active Mode S selective interrogations are used to extract data from the aircraft.

The surveillance strategy distinguishes three levels of functionality, which are:

- Basic operation in which Multilateration uses time of arrival of signals to determine the position of aircraft.
- Elementary operation, which includes basic operation and the addition of active integrations to extract aircraft identification information from the flight systems
- Enhanced operations, which includes basic operations and the addition of active interrogations to extract any information (including aircraft identification) from the aircraft systems.

APPENDIX F

CAR/SAM REGIONAL GUIDANCE MATERIAL ON SEARCH AND RESCUE SERVICES QUALITY ASSURANCE PROGRAMMES

Version 2.0

May 2009

AMENDMENTS

The issue of amendments is announced regularly by ICAO through regular correspondence with States, and the ICAO NACC and SAM Offices' websites, which holders of this publication should consult. The space below is provided to keep a record of such amendments

RECORD OF AMENDMENTS AND CORRIGENDA

AMENDMENTS			
No.	Date applicable	Date Entered	Entered by

CORRIGENDA			
No.	Date applicable	Date Entered	Entered by

Contents

Chapter 1. DEFINITIONS

Accident. Any event related to the use of an aircraft which takes place in the period running from the moment a person comes on board for purposes of some flight, to the moment when all people have disembarked, during which:

a) any individual is mortally or seriously injured as a consequence of:
- being on board the aircraft, or
- in direct contact with any part of the aircraft, including parts which may have detached from the aircraft, or
- being directly exposed to the jet of a reactor,

except when the injuries are due to natural causes, have been self inflicted or caused by other individuals, or are injuries suffered by stowaways hiding in areas other than those destined for normal use by passengers and crew, or

b) the aircraft suffers structural damage or breakage which:
- adversely affect its structural strength, its performance or flight characteristics, and
- normally require major repair or replacement of the affected component,

except for engine failure or damage, when damages are limited to the engine, its cowling or its accessories; or for limited damage to the propellers, wing tips, antennas, tires, brakes or fairings, small dents or holes in the skin of the aircraft; or

c) the aircraft disappears or is totally inaccessible.

Note 1. – *Solely for statistical uniformity purposes, any injury causing death within the 30 days following the date in which the accident occurred is classified by ICAO as mortal injury.*
Note 2. – *An aircraft is taken as disappeared when the official search is terminated and no wreckage has been found.*
{Copied from ICAO Annex 13}

Human action. Human skills and limitations which affect the safety and efficiency of aeronautical operations.
{Copied from ICAO Annex 11}

***Unnecessary SAR Alert (UNSAR*).** Message which an RCC sends to the appropriate authorities subsequent to an unnecessary activation of the SAR system due to a false alarm.

Desktop audit. Follow-up evaluation performed off-site. It may be carried out through phone interviews of SAR unit personnel and/or through the revision of recordings/data and documentation.

Search. Operation usually coordinated by an RCC o an RSC, in which available staff and means are used to locate individuals in distress.

Update training. Repeated training implemented to maintain and update previously acquired knowledge and skills.

SAR proficiency training. Training carried out to maintain and update the knowledge and skills needed for a safe and efficient application of search and rescue procedures. Proficiency training includes update, supplementary, skill enhancement and corrective training.

Simulation training. Training conducted in a classroom/lab setting training which is aimed at helping the controller apply basic skills and knowledge.

Competence-building training. Training designed to enhance a controller's competence in a skill or in some operational position which the controller is qualified to hold.

Supplementary training. Training implemented whenever there are changes in procedures, regulations or new or revised equipment.

Area Control Centre (ACC). A unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction.

Flight Information Centre (FIC). A unit established to provide flight information service and alerting service.

Rescue co-ordination centre (RCC). A unit responsible for promoting efficient organisation of SAR service within a search and rescue region.

Joint rescue co-ordination centre (JRCC). A rescue co-ordination centre responsible for both aeronautical and maritime search and rescue operations.

Mission Control Centre (MCC). A part of the Cospas-Sarsat system which accepts alerting messages from local user terminals and other mission control centres and distributes them among the appropriate rescue co-ordination centres or other search and rescue points of contact.

General communications. Operational and public correspondence communications and message traffic unrelated to assistance, emergency, or safety, sent or received *via* radioelectric waves.

Search and rescue co-ordination communications. Communications required to co-ordinate the means that participate in a search and rescue operation.

Aircraft co-ordinator. A person who co-ordinates the participation of several aircraft in SAR operations.

Search and rescue mission co-ordinator. an official on temporary assignment to co-ordinate the response to an actual or apparent danger.

Search and rescue co-ordinator (CS). A person(s) or body(ies) belonging to an Administration charged with the general responsibility of setting up and providing SAR services and of making sure that the planning of such services is duly co-ordinated.

Accident site coordinator. A person appointed to co-ordinate search and rescue operations in a given area.

Delivery of a distress alert. A report of a dangerous situation sent to a unit which could provide or co-ordinate assistance.

Coastal earth station (CES). Maritime denomination of an INMARSAT ground station which links ship earth stations to ground communication networks.

Full evaluation of the SAR unit. Full evaluation of the SAR unit conducted on-site using the national checklist to assess the performance of the SAR unit in all areas.

SAR follow-up evaluation. Follow-up evaluation conducted on-site or through a desktop audit to make sure that the specific issues detected during the full evaluation of the SAR unit have been corrected.

Special evaluations. Evaluations to assess specific areas or problems as directed by the SAR authority. These evaluations may be scheduled or unscheduled.

SAR operational functions. Functions concerning the provision of a SAR service or the monitoring of such functions.

Means for search and rescue. Any mobile resource, including the units designated for search and rescue, which is used in search and rescue operations.

Search and rescue plan. General term used to describe the documents existing at all levels of national and international search and rescue structures, which detail the objectives, measures and procedures that support the provision of search and rescue services.

Three-step closure process. The three-step closure process is the method whereby the unsatisfactory points of an evaluation must be corrected and closed. The required response must be available after 60 and 180 calendar days and must describe the following three steps:

a) Corrective action. The initial action taken by the SAR unit to correct the discrepancy;

b) Follow-up action. Action taken during some period of time to confirm that the initial action did correct the discrepancy. It includes the date(s) when it was taken and the results obtained; and

c) Managerial control. Action taken by the SAR authority or unit for purposes of making sure that the problem will not happen again. Such action must identify those positions within the SAR unit that are responsible for periodically checking on the corrected discrepancy and deciding when such review will take place.

Search and rescue data supplier. A source with which an RCC gets in touch to obtain data to support search and rescue operations, including emergency information originating from communication equipment data bases, ship reporting systems and environmental data systems (e.g. meteorological data, marine currents or ELT 406 MHz data bases).

Alerting post. Any means designated to serve as an intermediate post between an individual reporting an incident and a rescue co-ordination centre or sub-centre.

SAR point of contact (SPOC). Rescue co-ordination centres or other established and recognised national contact points which can accept the responsibility for receiving Cospas-Sarsat alerting data for purposes of saving people in distress.

Person locator beacon (PLB). Personal assistance beacon which broadcasts alerts and issues signals for the homing radio.

Emergency position-indicating radio beacon (EPIRB). Device usually carried on board a ship which serves to broadcast a signal to alert search and rescue authorities and to allow rescue units to locate the site of the accident.

Distance-finding (DF). Radio homing on signals to determine a position.

Search and rescue region (SRR). An area of defined dimensions associated to an RCC within which search and rescue service is provided.

Chapter 2. BACKGROUND

2.1 The mission of SAR services is to find, assist and transport people in distress to a safe place where they will be properly taken care of. The key to organising and having successful SAR services lies in top management, whose mission is to perform managerial functions that will result in improved SAR operations, that is, having an organised, trained and available SAR system for the provision of effective assistance to people in distress.

2.2 The most common reasons why SAR top management fails in its mission are: deficient management of the SAR system under its responsibiltity, incorrect application of correct measures, attempting to do everything on its own using personal or sectoral criteria which are not always applicable, or lack of prior knowledge of the actual status of the SAR system being managed.

2.3 Initiatives aimed at enhancing the quality of SAR services will bring about substantially improved results and reduced costs, mainly by the elimination of the causes of unnecessary expenditures. These are important objectives of any administration, regardless of the amount of resources available. When top management assigns importance to quality, it tends to:

- carry out more activities, and make less mistakes;
- develop a good reputation; and
- raise the necessary resources for the growth and better performance of the system.

2.4 On the other hand, SAR organisations that neglect quality are subject to errors which may result in:

- a reduced number of lives saved;

- the adoption of wrong or late operational decisions that contribute to:

    1) confusion, accidents and equipment failures;
    2) incorrect or insufficient use of resources; and
    3) unnecessary spending of financial resources.

2.5 Due to increased air traffic activity and the use of large aircraft capable of carrying a large number of passengers, and its relationship with the responsibility of CAR/SAM States/Territories/International Organisations of safeguarding the safety of human lives, it was deemed important to develop a Search and Rescue (SAR) Services Quality Assurance programme with guidelines for the States on the implementation of such programme, so that it could be a useful quality management tool to ensure compliance with the objective of the National SAR Plan of each CAR/SAM State of saving lives by improving SAR preparedness.

2.6 The programme would also provide efficient SAR services within their respective SAR areas of responsibility, so that the needs arising in the event of accident of a large aircraft may be foreseen and met.

2.7 Prompt notification to a SAR unit of a danger threatening crews and passengers, as well as the planning of the operations required to assist them, are essential to ensure high safety standards in air and maritime activities, since they expedite the adoption of actions for their prompt resolution. It is also important for the results to be available to States, international organisations and ICAO, so as to have a better dissemination of lessons learned.

2.8 Quality assurance is a dynamic process used for continuous improvement of a SAR system. Although service quality will continue to be measured by some historical data method, such as the number of search and/or rescue missions conducted by air or maritime SAR units, delays in operations or communications established, or feedback from employees and customers, consideration should also be given to other factors that may not be so readily measured, such as the desire to work as a team, training, and action taken to support the SAR goal.

2.9 All these factors are also an important part of quality assurance. The success of the quality assurance effort depends on the recognition that all SAR providers in the CAR/SAM Regions, individually and collectively, must strive to provide the best possible service.

2.10 Thus, for its successful application, quality assurance in SAR services must include important functions such as: the selection, development and training of employees, communication, and the implementation of a participatory management.

2.11 Personnel **selection** is important because the new members of the SAR organisation must have skills consistent with the quality assurance philosophy (team work, responsibility, participation and commitment). It is desirable that individuals entering the organisation be highly capable of solving problems and that they have special skills (capable of working as a team, accountability, spirit of participation).

2.12 The area of **training** will also be essential in order to have personnel duly trained so that it can participate and introduce quality improvements. When hiring new personnel, an effort is made so that they may attain the foreseen objectives; the time and training devoted to the team and its development are an investment rather than a financial loss. There is a need to train both employees and managers, not only on quality improvement methods, but also on institutional processes and procedures, and to instill on them a quality culture.

2.13 Lack of training is an obstacle for participation programmes, which are a basic element of quality assurance. If the context is to support a participatory attitude, employees need to receive proper training. It should also be considered that, without the basic knowledge, the staff will not be able to carry out their job. The knowledge that employees require is basically that related to inter-personal and group relations and job skills.

2.14 On the other hand, the primary method that is used to motivate employees to adopt and participate in a quality assurance programme is a training programme where all the members of the organisation, at all levels, receive initial training on basic quality assurance concepts, in order to facilitate their understanding and encourage them to receive training and improve their communication skills, team work and participation at meetings.

2.15 Quality training and participation are closely linked. The improvement of SAR services is the responsibility of all its members. Therefore, training should be provided so that suggestions may come from every operational or managerial position. The idea is that they acquire a vision that is broad enough to allow them to improve the process as a whole and not just the one that corresponds to each individual post.

2.16 **Communication** should include the necessary methods to provide useful information for performing a good job and for better adaptation to the organisational culture. Personnel participation requires both training and information.

2.17 The communication of positive results obtained in the provision of services improve the morale and motivation of the personnel, while negative results should elicit efforts to overcome them. When relating participation to quality assurance, the importance of having good communication channels throughout the SAR organisation is highlighted.

2.18 In order to improve quality, the staff needs information on their performance, results obtained, and the contribution they make. Based on this information, people improve their knowledge and propose improvements which can represent, through the appropriate channels and **participation**, important innovations to the SAR organisation that has decided to take advantage of the motivation and commitment of all its members.

Chapter 3. SAR QUALITY ASSURANCE PROGRAMMES

3.1. INTRODUCTION

3.1.1 Quality assurance programmes should focus on the identification and correction of deficiencies ("disconformities" for the ISO standard) before they give rise to disorderly, imprecise and, therefore, inefficient search and rescue operations of a high and unnecessary economic cost. They should be planned and implemented in such a way that they contribute to the efforts made by administrations to improve the quality of search and rescue services as a whole. This chapter contains some quality assurance strategies that should be developed to ensure the results of quality assurance programmes.

3.2. SCOPE AND OBJECTIVE

3.2.1 The objectives established to support SAR goals are normally expressed in terms of a given response time, the percentage of people in distress or goods under threat of being destroyed that are saved. These objectives are logical and relatively easy to quantify. Other objectives may also be used, such as avoiding injuries and material damage, or alleviating anxiety, although they are more difficult to measure.

3.2.2 One of the purposes of the quality assurance programme is to provide specific guidelines for reporting, investigating and resolving different types of events which affect the quality of SAR services. The programme should be designed to work in conjunction with ICAO standards and recommended practices, as well as with State regulations.

3.2.3 However, the first objective of the programme should be to avoid errors that might lead to a reduction in the number of lives saved, the adoption of wrong or late operational measures, confusion when following the instructions issued during operations, equipment failures, or incorrect or inadequate use of the resources available to the SAR system.

3.2.4 The second objective of a SAR quality assurance programme should be to improve the quality of the services provided by SAR units.

3.3. STRUCTURE

3.3.1 The structure of the SAR quality assurance programme depends on the size and composition of the SAR system. An acceptable and productive structure of this programme generally requires that SAR management designate or select an expert with sufficient experience in the search and rescue (SAR) field as to become the quality assurance specialist of the SAR unit (SAR QA). The SAR QA specialist will assume quality assurance (QA) responsibilities for the unit and report directly to the head of the SAR unit.

3.3.2 For larger SAR units, the head of the SAR unit will establish a SAR quality assurance department with various specialists and a sub-chief with sufficient SAR experience, who would take on quality assurance tasks and responsibilities for the unit and report directly to the head of the SAR unit.

3.4. IMPLEMENTATION AND RESPONSIBILITIES

3.4.1 For purposes of developing SAR quality assurance programmes, the ICAO NACC and SAM Regional Offices will provide assistance and advice to SAR service providers of the CAR/SAM Regions.

3.4.2 All CAR/SAM States/SAR providers should implement a SAR quality assurance programme, with documentation on the subject. The programme should explain its purpose, objectives and responsibilities. The State or SAR service provider and each SAR unit should establish such programme.

3.4.3 CAR/SAM States/SAR service providers should keep their National SAR QA Plans updated, and assess their effectiveness.

3.4.4 The heads of SAR units should be aware of, and be involved in, the operations/programmes of their SAR units so as to ensure the highest level of quality and efficiency.

3.4.5 All employees are responsible for maintaining the highest level of quality in their performance.

3.5. CONTENTS OF THE PROGRAMME

3.5.1 The SAR QA programme should establish methods to identify and correct shortcomings and deficiencies, and to recognise progress made in the following areas:

a) SAR system management

- SAR update training
- Improvement of aeronautical and SAR phraseology
- English proficiency
- SAR communications
- Study of reviews/conclusions of SAR incidents or missions
- Incentives/recognition
- List of appropriate operational practices
- Assessment of (oral and written) communications/instructions that have taken place in the course of SAR missions
- Training through communication or co-ordination exercises, as well as comprehensive or field exercises
- Lessons learned from personal anecdotes
- Periodic quality assurance reports for SAR units containing trends, customer feedback, evaluations, etc.
- Resolution of identified problems
- Incorporation of actual SAR mission or operation scenarios into the new training programmes
- Internal, national and regional SAR assessment programmes.

b) Teamwork

The following list may be used to promote teamwork within search and rescue organisations:

- Training on teamwork with air traffic service personnel
- Teamwork incentive/recognition programmes
- Roles of the different positions
- Proposals for improving the respective operational manuals of each SAR unit
- Training course for SAR operational supervisors
- Team meetings/reports
- Clearly communicate the expectations of all employees
- Troubleshooting and analyses and measures for problem resolution
- Proposals for improving the respective SAR operational plans.

c) Communications

The following list of ideas may be used to improve communications among all the employees, in order to create a climate conducive to the exchange of information:

- Meetings of all the personnel (all levels) to address QA matters of common interest
- Electronic bulletin board system
- Access to information *via* internet/intranet
- National database containing domestic and local SAR QA data
- Information bulletins
- SAR QA seminars, conferences and workshops
- Reports from international SAR organisations such as: the International Maritime Organization (IMO); COSPAS-SARSAT; INMARSAT, etc., and other safety reports of the industry.

d) Customer service/feedback

The following is a list of ideas to request feedback from SAR personnel and customers (internal/external) concerning the quality of the service provided by the SAR unit and its impact on other organisations, customers and individuals:

- Training programmes for pilots
- Internal and external customer surveys
- Interaction with other aviation-related organisations
- Performance evaluation during the duty shift of the SAR operator/operational supervisor of the unit
- Meetings between SAR personnel and that of enterprises/organisations/bodies that contribute to SAR
- Familiarisation trips
- Contact with customer associations (for example, local flight schools, airlines, aviation organisations, etc.)
- Safety seminars for pilots and groups engaged in rescue
- Survival seminars/courses.

Chapter 4. VERIFYING THE COMPETENCIES OF SAR PERSONNEL

4.1 INTRODUCTION

4.1.1 In order to improve 14the technical competencies of search and rescue services on an ongoing basis, individual technical training requirements for technical performance purposes shall be identified and met.

4.1.2 The verification of personnel competencies is intended to provide operational personnel and supervisors feedback from SAR supervisors and quality assurance officials/specialists regarding their competencies. This feedback should also be used to develop plans to improve competencies, as applicable.

4.2 RESPONSIBILITIES

4.2.1 The head of the SAR unit is responsible for establishing and maintaining competence standards in the SAR unit. The SAR authority shall formulate guidelines specifying the required level of knowledge, both theoretical and practical.

4.2.2 All of the operational personnel of the SAR unit shall be required to periodically demonstrate that their performance meets the required competence standards. The SAR competencies of each SAR operator and supervisor shall be verified.

4.2.3 In large SAR units, SAR personnel specialised in on-the-job supervision and personnel training and evaluation (officials/specialists in quality assurance of search and rescue services) should be hired to perform this task within the unit.. SAR quality assurance officials/specialists shall prepare personnel competence verification shifts so that all operational staff is regularly investigated.

4.2.4 It is suggested that competence verifications be made at least twice a year. Advance notice of the conduction of competence verifications shall be given to search and rescue operational personnel and supervisors so that they may be mentally and functionally prepared. A sample checklist for personnel competence verifications is shown in the **Appendix** to this chapter.

4.2.5 In small SAR units, the head of the SAR unit or whoever he/she designates, shall fulfill these tasks. However, where arrangements are less formal due to the size of the SAR unit and the number of personnel, they must make sure that competence verifications are complete and thorough.

4.2.6 The official quality assurance operational supervisor shall continuously evaluate personnel performance using both direct and indirect methods. Indirect methods may include remote monitoring, review of recordings, written documentation, observations by other supervisors, SAR quality assurance officers, etc.

4.2.7 If, upon verifying the competence of a SAR operator, it is found that he/she would benefit from individual competence-building training, the following references may be used as guidance to determine the type of training required:

a) CAR/SAM Regional Guidance Material for Search and Rescue Services Quality Assurance Programmes, Chapter 7 – Training programmes;

b) ICAO Doc 9731, International aeronautical and maritime search and rescue services manual, Volume I, Chapter 3 – Training, qualification, certification and exercises.

4.2.8 Matters concerning SAR personnel performance cover technical performance areas which might benefit from technical update training. These matters are not necessarily deficiency areas. A SAR operator may, in general, have an acceptable technical performance and, nevertheless, benefit from training on some particular skill or task.

4.2.9 Once completed the verification of an operator's competencies, the official quality assurance operational supervisor that conducted the verification shall discuss the results with the operator.

4.2.10 Although competence verifications are not intended to be graded as pass/fail or satisfactory/not satisfactory, there may be occasions in which the performance of a SAR operator is found not to be satisfactory. In such cases, the certification shall be suspended and the operator shall receive appropriate update training, followed by a re-grading process. Under no circumstance shall a person who has been rated as "not satisfactory" be allowed to keep on working without supervision. If, after a reasonable period of time, a SAR operator is not capable of passing the competence verification, all details pertaining to the not satisfactory grading shall be collected and sent to the administrative authority.

4.2.11 Each SAR unit shall review, at least once a year, all personnel competence verifications conducted, so as to identify recurring and major competence needs. The results of this review shall be reflected in a report to the head of the SAR unit for purposes of developing effective future training plans.

4.3 DOCUMENTATION

4.3.1 Each competence verification of a SAR operator shall be discussed with said operator and be duly documented in the corresponding training record.

Appendix

Sample checklist for conducting personnel proficiency checks

PERSONNEL PROFICIENCY CHECK			**SAR Unit Name**
Name		Date	Position/Sector:
Weather ☐ VMC ☐ IMC ☐ Other	Workload ☐ Light ☐ Moderate ☐ Heavy	Complexity of SAR Case ☐ Not difficult ☐ Occasionally difficult ☐ Mostly difficult ☐ Very difficult	
Purpose: ☐ Proficiency check ☐ Follow-up ☐ Other			Review period: From: To:

Performance category	Performance indicator	More than Satisfactory	Satisfactory	Needs Improvement	Unsatisfactory
A. Separation	1. Separation is ensured.				
	2. Safety alerts are provided.				
B. Coordination	3. Performs handoffs/point-outs.				
	4. Required coordinations are performed.				
C. Control judgment	5. Good control judgment is applied.				
	6. Priority of duties is understood.				
	7. Positive control is provided.				
	8. Effective traffic flow is maintained.				
D. Methods and procedures	9. Aircraft identity is maintained.				
	10. Strip posting is complete/correct.				
	11. Clearance delivery is complete/correct and timely.				
	12. LOAs/directives are adhered to.				
	13. Additional services are provided.				
	14. Rapidly recovers from equipment failures and emergencies.				
	15. Scans entire control environment.				
	16. Effective working speed is maintained.				
E. Equipment	17. Equipment status information is maintained.				
	18. Equipment capabilities are utilized/understood.				
F. Communication	19. Functions effectively as a team.				
	20. Communication is clear and concise.				
	21. Uses prescribed phraseology.				
	22. Makes only necessary transmissions.				
	23. Uses appropriate communications method.				
	24. Relief briefings are complete and accurate.				
G. Other					

Comments:
Recommendation for Improvement:
Signature of person conducting check: Date:
Personnel Comments:
This report has been Discussed with me Personnel's signature _____ Date _____

Sample checklist for conducting SAR Mission Coordinator (SMC) proficiency checks

SAR MISSION COORDINATOR (SMC) PROFICIENCY CHECK			**Name of the SAR Unit**
Name		Date	
Meteorological conditions in the search area ☐ VMC ☐ IMC ☐ Other	Workload ☐ Light ☐ Moderate ☐ Heavy	Complexity of SAR Case ☐ Not difficult ☐ Occasionally difficult ☐ Mostly difficult ☐ Very difficult	
Purpose: ☐ Proficiency check ☐ Follow-up ☐ Other			Review period: From: To:

Performance Category	Performance Indicator	More than satisfactory	Reaches the level required	Has knowledge but needs improvement	Unsatisfactory
A. Reception of emergency alerts	1. Acknowledge receipt of emergency alerts, if necessary				
	2. Obtaining and assessment of all data on the emergency case				
	3. Determines the type of emergency equipment of the aircraft / disappeared vessel or in an emergency situation				
	4. Establishes personnel shift and/or through radio in appropriate frequencies to facilitate communications with SAR means				
	4. Verifies and keeps corresponding records of all procedures with a graph, if necessary				
B. Coordination of SAR services	5. Retransmits emergency alerts to RCC involved, if necessary				
	6. Delimits the area subject of search and decided the methods and means required				
	7. Designates the OSC (and ACO, if necessary), alert to SAR means and assigns the frequencies for communications in the search area				
	8. Organizes the delivery of instructions to SAR personnel affected to the search and further interrogation				
	9. Organizes the delivery of provisions for subsistence of survivors. If necessary				
	10. Informs the RCC Head of the search action plan				
	11. Coordinates the operation with adjacent RCC. When applicable				
C. Control criteria	12. Evaluates all the reports from any source and modifies the search action plan, if necessary.				
	13. Adopts previsions for the fuel provision of aircraft / vessels in long searches, organizes SAR personnel accommodation				
	14. Has positive control of the actions in course				
	15. Analyzes the order and result of events, in order to evaluate the need to recommend the RCC head to suspend the search				
D. Methods and procedures	16. Keeps in mind the RCC Operational Plan				

SAR MISSION COORDINATOR (SMC) PROFICIENCY CHECK		Name of the SAR Unit			
	17. Complies with letters of agreement / internal directives				
	18. Coordinates flight safety aspects for SAR aircraft with corresponding ATC units				
	19. Formulates the search action plan (and rescue plan, if applicable) assigns the search areas, sends the SAR means and designates the frequencies for communications in the accident scenario and watches for the compliance of instructions				
	20. Writes or takes necessary previsions to write reports on the running of operations				
	21. Expedites instructions in a timely, precisely and complete manner.				
	22. Permanently works with the OSC and makes sure to receive and assess all reports of the same and from the ACO (if case it has been designated)				
	23. Maintains an effective working rhythm				
	24. Releases SAR means in a timely manner when the assistance is no longer required.				
	25. Notifies and coordinates with accident investigative authorities and with security personnel the surveillance of the accident location.				
	26. If such were the case, notify the State of the aircraft / vessel registry in accordance with the established standards				
	27. Takes provisions for the writing of the final report on the results of the operation				
G. Others					

Comments:

Recommendations for the improvement:	
Signature of the person conducting check:	Date
SMC Comments:	
This report **has** **has not** been discussed with me	
SMC signature	Date

Chapter 5 – SEARCH AND RESCUE SERVICE EVALUATION PROGRAMME

5.1 INTRODUCTION

5.1.1 The standardisation of procedures and methods is essential for any service that has international commitments and which uses procedures affecting more than one unit. The degree of standardisation achieved is directly related to the proficiency with which individuals perform their tasks. This, in turn, determines the efficiency of the SAR service provided to users.

5.1.2 In search and rescue services, personal proficiency and the standardisation of procedures and methods are achieved and maintained through training, certification, verification of competencies, evaluations and audits and, more importantly, through the deliberate and conscientious participation of all SAR personnel.

5.1.3 This chapter deals with the need to carry out an ongoing evaluation of each SAR unit and of the SAR system in general. This task is normally performed by personnel which have been properly trained so as to understand all aspects of the organisation and which are charged with appraising personnel proficiency and with making a critical evaluation of SAR's general efficiency.

5.2 PURPOSE AND SCOPE OF THE EVALUATION

5.2.1 The SAR evaluation includes a review of each SAR unit, such as the search and rescue centre (RCC), the search and rescue sub-centre (RSC), or some other activity of the SAR, or an overall review of several units or of the whole domestic SAR system. The evaluation of the SAR units is necessary to guarantee that:

a) the service always be top quality; and

b) all units and staff apply criteria, standards, rules and procedures in the authorised manner.

Whatever the scope of the evaluation may be, it should be noted that some common objectives shall apply.

5.2.2 It must be kept in mind that evaluations must cover the management and implementation of SAR service procedures, while the "internal audit" is carried out to determine whether the quality management system complies with the provisions foreseen in the quality management requirements established by the organisation and whether it has been implemented and maintained in an efficient manner.

5.2.3 The audit programme must be planned taking into account the status and importance of the processes and areas to be audited; as well as the criteria, scope, frequency and methodology of audits. The selection of auditors and the conduction of audits must guarantee the objectivity and impartiality of the auditing process. Auditors may not audit their own performance.

5.2.4 SAR evaluation covers all or part of the following aspects:

a) Determining the standardisation, quality and suitability of services provided to users;
b) Making sure that operational procedures are consistent with the Letters of Agreement in force, and with domestic and international standards and legislation;
c) Determining and making recommendations regarding operational requirements;
d) Detecting any potentially unsafe operational procedure or practice, so as to permit the adoption of immediate corrective/preventive measures;
e) Detecting problem areas or deficiencies; determining their probable cause and recommending the immediate corrective/preventive measures as may deemed appropriate;
f) Examining the efficiency of communications and coordination among and within units; and
g) Examining the utilisation of staff, the work required in each position and unit payrolls, with a view to achieving the desired compatibility.

5.2.5 Once the SAR evaluation has been completed, the conclusions should be fully documented, making the relevant recommendations whenever changes are needed. The aspects requiring immediate correction should be reported and corrected as soon as possible, preferably before submitting the corresponding official report.

5.2.6 The management of the area being evaluated must make sure that action is taken without unjustified delay in order to correct the deficiencies detected and their causes. Follow-up activities must include verification of action taken, and reporting on the results of such verification.

5.3 PERFORMING THE EVALUATION

5.3.1 The designated staff should perform a periodic evaluation of the SAR, based on a minimum recommended frequency of at least once every two years. In those units where the evaluation team is part of the permanent staff, the evaluation should be an on-going process, particularly as regards personnel competence. Whenever necessary, it might be desirable to carry out interim evaluations of selected units, approximately midway between scheduled evaluations.

5.3.2 Before starting the SAR evaluation, it is common practice to notify the head or the person in charge of the unit involved. This person should obtain the assistance which might be required to properly conduct the evaluation, even getting in contact with other interested parties, such as agencies with which Letters of Agreement for the use of means and personnel during SAR operations have been signed. Perhaps it might also be necessary to organise consultations with the operators, other civil aviation groups or with military authorities. In this latter case, it might be necessary to give them advance notice of the nature of the aspects contemplated.

5.3.3 Once the SAR evaluation has been completed, a meeting should be called to report all important results and recommendations to the head or person in charge of the unit. The purpose of this meeting shall be to:

a) review the conclusions;
b) identify problem areas;
c) discuss other alternate solutions proposed;

d) appoint the person in charge of subsequent measures;
e) co-ordinate corrective/preventive measures; and
f) set provisional deadlines for completion of the measures deemed necessary.

5.3.4 Should there be the need to review some given aspect or function, special evaluations may need to be carried out at any point in time.

5.4 DOCUMENTATION

5.4.1 Once the evaluation of the SAR unit has been completed, the person in charge shall:

a) draft a report on each of the evaluated units which are part of the system;
b) prepare a written report on the in-flight test, as the case may be;
c) send the evaluation reports to the competent authorities.

5.4.2 The evaluation reports of the SAR units must be written as a narrative and include, at least, the data listed below with respect to each routine observation or evaluation:

a) a description of the deficiency or problem areas found;
b) recommendations for correcting the situation;
c) the agency, individual or persons in charge of implementing the subsequent measures, if applicable; and
d) the dates foreseen for the implementation of the necessary corrective measures.

5.4.3 The relevant sections of the evaluation report should be sent to units not belonging to the SAR, as the case may be, so that they may be duly advised and be able to adopt the required measures.

5.4.4 The SAR unit should notify the competent authority regarding the measures taken with respect to the problems found. This should preferably be done within the 30 days after receiving the report and then at regular intervals until all pending points have been resolved.

5.5 SEARCH AND RESCUE SERVICE EVALUATION PROCEDURES

5.5.1 This section offers standard procedures to evaluate compliance with ICAO SARPs as well as the specified guidelines and procedures at national and local SAR units within a State.

5.6 EVALUATION PROCESS

5.6.1 Full evaluation of the SAR unit

5.6.1.1 ***Preparation and notification***. A full evaluation of each of the SAR unit, using the checklist included in this Appendix to this chapter, must be carried out every two years. The SAR authority must notify the head of the SAR unit at least 30 days before carrying out a full evaluation. This notice may request data for the pre-evaluation review, and will request subjects of special interest for the evaluation.

5.6.1.2 ***Information meeting***. Should involve introducing the members of the team, and discussing the evaluation programme and activities with the head of the SAR unit and other staff related to the unit.

5.6.1.3 ***Conducting the evaluation***. The evaluation staff shall perform a full evaluation of the SAR unit through one or all of the following elements: -direct observations, operations room and/or monitoring the Operations Plan/SAR unit Operational Manual/data, attendance to staff meetings, observing training activities, reviewing administrative records, interviews/discussions and a review of previous SAR missions or exercise reports. If possible, items classified as not compliant should be discussed with the SAR unit staff to determine how much they know about the item. If a satisfactory answer is received, the item may be classified as satisfactory. If no satisfactory answer is received, the item must then be suitably classified. Interviews shall normally be held with the heads, supervisors, operation supervisors, and specialist staff of the SAR unit, SAR operators, etc. Additionally, representatives of agencies which contribute to the SAR service and who have letters of agreement signed with the SAR unit involved for the use of means, personnel and/or survival material, representatives of ATS units associated with the SAR unit, etc., may be interviewed.

5.6.1.4 ***Daily report meeting.*** The person acting as a leader will normally hold a daily meeting with the head of the SAR unit to report on the progress made with the evaluation.

5.6.1.5 ***Meeting to report on results***. The head of the SAR unit must be kept advised on the findings of the evaluating person/team once the evaluation is concluded. It is recommended that all available SAR unit personnel attend this results reporting meeting. At that time, or as soon as possible, a draft copy of the SAR evaluation report shall be delivered to the head of the SAR unit.

5.6.1.6 ***Review of the evaluation***. The leader of the evaluation team should deliver an evaluation review form to be filled in by the head of the SAR unit.

5.6.1.7 ***Re-identified items***. Items re-identified as “not satisfactory” in the evaluation of a SAR unit must be recorded under the same designation.

5.6.2 **SAR follow-up evaluations**

5.6.2.1 ***Preparation and notification***. Follow-up of SAR evaluations should normally be carried out unannounced or with a minimum notice of on-site evaluation, desktop audit or combination of both. These evaluations shall normally be carried out no less than six months after the date of the meeting reporting the results of the full evaluation of the SAR unit, or as may be determined by the SAR service authority. The head of the SAR unit may be requested to supply data for the pre-evaluation review. The on-site SAR follow-up evaluation must follow the same procedure as described in paragraphs 7.6.1.2 to 7.6.1.6.

5.6.2.2 ***Pending items***. Items previously classified as unsatisfactory should be considered as pending if the three-step closure procedure has not been carried out and/or the discrepancy can still be detected. Each item must be addressed in the evaluation report with an explanation as to why it had to be re-opened.

5.6.2.3 ***New items***. The new items identified during the SAR follow-up evaluation must be properly documented.

5.6.2.4 ***Closed items***. Items may be taken as closed when the discrepancy can no longer be detected, and:

a) the initial action adopted by the SAR unit to correct the discrepancy has been completed;

b) the action that has been taken for some period of time to make sure that the initial action has corrected the discrepancy has been completed; and

c) some action and/or programme has been implemented to make sure that the problem does not arise again.

5.6.3 **Special evaluations**

5.6.3.1 A special evaluation may be carried out whenever the SAR authority deems it necessary or upon request by the SAR unit.

5.6.4 **Evaluation reports**

5.6.4.1 ***Completion of the report***. The results of all evaluations must be documented so as to make sure that all the involved offices continue fully advised as regards the effectiveness of the search and rescue service system. All final reports must be completed and distributed within 30 days following the date of the meeting where the results were reported.

5.6.4.2 The SAR unit full evaluation reports should:

a) contain the results of the evaluations of regards the areas involved;
b) describe all the points which were reported; and
c) assign tracking control numbers to all the identified points.

Example of tracking control number of the SAR unit evaluation:

00-RC-XXXX-01D-FE
Legend

"00" refers to the year of the evaluation	"RC, RS" refer the type of SAR unit RC = RCC; RS = RSC, etc.
"XXXX" refers to the identification of the SAR unit	
"01" refers to the tracking number and "D" is the classification	"I" = unsatisfactory "S" = satisfactory
"FE" refers to the type of evaluation	"FE" = of the whole SAR unit "DA" = desktop audit "FU" = follow-up evaluation "SP" = special evaluation

5.6.4.3 ***Executive summaries***. Executive summaries of all SAR unit evaluations must be prepared.

5.6.5 **Response to SAR unit evaluations**

5.6.5.1 All items classified as unsatisfactory in SAR unit evaluations require a response which must comply with the three-step closure procedure: Corrective action, follow-up action and management control. Additionally, the following criterion applies:

a) **Action Plan**. Action plans for all items classified as unsatisfactory must be developed and made known to the corresponding SAR authority within 30 days following reception of the SAR unit final evaluation report;

b) **First response**. The head of the SAR unit must complete and send one first response to the SAR authority 60 days after the meeting where the results of the evaluation of the SAR unit were reported; and

c) **Second response**. The head of the SAR unit must complete and send the second response to the SAR authority 180 days after the meeting where the results of the evaluation of the SAR unit were reported and every 180 days henceforth, until all points have been closed.

APPENDIX
SAR UNIT ASSESSMENT CHECKLIST

SAR Unit: _____

SUBJECT	ASPECTS TO BE ASSESSED OR QUESTIONS TO REPLIER	SITUATION	COMMENTS	ICAO Ref.
A. ADMINISTRATION				
SAR Organization	1. Which official bodies have authority and responsibility to coordinate the aeronautical SAR services? 2. ¿Is the same body responsible to coordinate aeronautical and maritime SAR services? 3. Is there a national SAR committee, which coordinates SAR matters with other national official or private bodies and with SAR bodies of other States? 4. Does current organization meet SAR requirements?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Doc 9731- IAMSAR (Part I)
ICAO and States documents	1. Review availability and status of amendment (Annex 12, Doc. 9731 Parts I, II and III, SAR National Plan, Unit Plans of Operation, Manuals, guidelines, Circulars). 2. Are the documents updated?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		ICAO Regional Offices Manual

SUBJECT	ASPECTS TO BE ASSESSED OR QUESTIONS TO REPLIER	SITUATION	COMMENTS	ICAO Ref.
Status of differences to SARPS	1. Are there any differences with Annex 12? 2. ¿Has the state notified ICAO of these differences? 3. Have the differences been published in the AIP?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Annex 15 Manual de ICAO Regional Offices
Air Navigation Plan	1. Review the status of implementation of the CAR/SAM ANP in the SAR area.	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Annex 12 Chap. 2, para 2.5.1 and Note ANP CAR/SAM Doc. 9749
RAN CAR/SAM/3	1. Review the status of implementation of CAR/SAM/3 RAN Meeting Recommendations and Conclusions	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Report CAR/SAM/3 Doc- 9749
SAR personnel training	1. Does the RCC or RSC staff get training, qualification, titles or official certification? 2. Does SAR responsible body assess the status of training of personnel and does it take the necessary measures to correct the training needs detected?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Doc 9731- IAMSAR (Part I – Chap 3) Annex 12 Chap. 2, para. 2.1.1.3
B. OPERATIONS				

SUBJECT	ASPECTS TO BE ASSESSED OR QUESTIONS TO REPLIER	SITUATION	COMMENTS	ICAO Ref.
Capacity to attend responsibilities related to search and rescue	1. Are the units assigned to perform other tasks, which might detract from their ability to handle SAR responsibilities?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Doc 9731- IAMSAR (Part I Appendix H)
Operational Documentation	1. Does the unit have Plan of Operations duly updated, which provides guidance to comply with SAR situations foreseen in all the area under jurisdiction? 2. Is there an updated and accessible filing of permanent availability for SAR Unit personnel consultations with all SAR agreements with other adjacent RCC/RSC and/or with the SAR provider means?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Annex 12 Chap. 4, para. 4.2.1 until 4.2.4 inclusive Doc 9731- IAMSAR (Part II – Chap. 1, para. 1.5)
Operational Teamwork	1. Do you observe if SAR shift personnel work as a teamwork? 2. Is personnel foreseen to cover service shifts in the unit sufficient and is it ready to initiate and continue carrying out operational tasks on a 24-hours basis?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Doc 9731- IAMSAR (Part I – Chap. 2, para. 2.3.11) Annex 12 (Chap. 2, para 2.1.1 and para. 2.3.3
Operational Supervisor / SAR personnel	1. Is there an operational supervisor or a SAR staff in charge of the operational shift? 2. Is the supervisor / operator in charge trained to plan and coordinate SAR operations until the SMC takes over and/or perform other tasks that the SMC may assign during the development of a search or rescue?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Doc 9731- IAMSAR (Part I – Chap. 2, para. 2.3.11)

SUBJECT	ASPECTS TO BE ASSESSED OR QUESTIONS TO REPLIER	SITUATION	COMMENTS	ICAO Ref.
Communications available in the unit	1. Does the RCC have a two-way rapid and reliable communications with: (i) Associated ATS units; (ii) Associated RSC; (iii) The appropriate direction-finding and position-fixing stations; (iv) Where appropriate, coastal radio stations capable of alerting and communicating with surface vessels in the region; (v) Headquarters search and rescue (vi) All Maritime RCC located at the maritime SRR and RCC or joint RCC in adjacent SRR; (vii) The designated meteorological office or meteorological watch office; (viii) SAR Units (ix) Alerting post (x) The MCC servicing the SRR?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Annex 12 Chap. 2, para.2.4.1
	2. Does the RSC have two-way rapid and reliable communications with: (i) Adjacent RSC (ii) The meteorological office or meteorological watch office; (iii) Search and rescue units (iv) Alerting posts?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Annex 12 Chap. 2, para.2.4.2
	3. Does the national ground communication systems provide complete coverage of the jurisdictional area and with a rapid and reliable service?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Doc 9731- IAMSAR (Part I – Chap. 4, para. 4.5.7)
Communications Procedures	1. Is communications phraseology correctly applied? 2. Are communications procedures with SAR aircraft and ATS associated units correctly applied?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Annex 10 Annex 12 Chap. 2, para.2.3.3

SUBJECT	ASPECTS TO BE ASSESSED OR QUESTIONS TO REPLIER	SITUATION	COMMENTS	ICAO Ref.
Communications with SAR Units	1. Does the Unit Plan of Operations include procedures to establish communications with the civil search and rescue units provided by concurrent bodies?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Doc 9731- IAMSAR (Part I Appendix H, N° 37)
Coordination Procedures	1. Are coordination procedures adequately carried out with RCC/RSC, SAR units, and with the associated ATS unit?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Annex 12 Chap. 2, para.2.3.3
Operational Updating	1. How does the unit ensure that SAR personnel are updated in operational aspects? 2. Does SAR personnel from the main SAR contributory units receive training or participate in SAR exercises on a periodical basis? 3. Is there an official planning and assessment process regarding these exercises? 4. Does the unit have detailed information regarding the capacity (scope, number of persons that may be saved, alert time required to attend an alert, point of contact of the authority authorizing the support for the alert, etc) of all main search and rescue units within its jurisdictional area?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Annex 12 Chap. 4 Para. 4.4.1 Doc 9731- IAMSAR (Part I Appendix H)

SUBJECT	ASPECTS TO BE ASSESSED OR QUESTIONS TO REPLIER	SITUATION	COMMENTS	ICAO Ref.
Procedures related with medical evacuation	1. Are there any official procedures in the RCC/RSC, in order to make decisions on medical evacuation within its jurisdictional area? 2. Do SAR units have special equipment for medical evacuation? 3. Are there letters of agreement or other coordination tool in the RCC/RSC to receive medical care for all persons evacuated after a medical emergency?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Doc 9731- IAMSAR (Part I Appendix H)
Emergency Location Transmitter (ELT)	1. Does de RCC/RSC have instructions and means to have round the clock availability to the information contained in the ELT national registry operating in 406 MHz?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Report CAR/SAM/3 Doc- 9749 Doc 9731- IAMSAR (Part I, Chap. 4, Para.4.5.14 up to para. 4.5.22 inclusive
False alerts	1. Are there instructions to attend RCC/RSC false alerts? 2. Are there instructions to reduce RCC/RSC false alerts? 3. Is a registry kept and is the MCC serving the SRR informed?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Doc 9731- IAMSAR (Part I Appendix E)
C. OPERATIONAL SUPPORT				
Contingency Procedures	1. Are there any contingency procedures in case of a considerable failure of communications equipment?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		CAR/SAM REGIONAL GUIDANCE MANUAL FOR SEARCH AND RESCUE QUALITY ASSURANCE PROGRAMMES.
Documentation	1. Is there a complete registry (enough to the incident of all SAR events? 2. Is this registry consulted to analyse and improve the system? 3. Does the documentation available in the RCC/RSC satisfy the need for SAR personnel to take all necessary measures to comply with law requirements established?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Doc 9731- IAMSAR (Part I Appendix H)
D. QUALITY ASSURANCE				

SUBJECT	ASPECTS TO BE ASSESSED OR QUESTIONS TO REPLIER	SITUATION	COMMENTS	ICAO Ref.
SAR Quality Assurance Programme	1. Does the RCC/SRC have a quality assurance programme implemented? (a) Is there any guideline for such programme? (b) Has any SAR officer/SAR quality assurance specialist been designated?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		CAR/SAM REGIONAL GUIDANCE MANUAL FOR SEARCH AND RESCUE QUALITY ASSURANCE PROGRAMMES
Assessments	1. Are there any regional or national assessment programmes implemented? 2. If such were the case, which aspects do they assess? 3. How often are the assessments? 4. Do these assessments result in Action Plans and responsibility to apply the assessments?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Idem
E. TRAINING				
Certification and refreshment certification	1. Which is the training process and certification? 2. Who determines it?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Doc 9731- IAMSAR (Part I, Chap. 3)
Training tests	1. Is SAR staff required to demonstrate their performance? (a) Are there abilities tests carried out? (b) If so, how often? 2. Are there training courses? (a) Does the RCC/RSC have annual lists of requirements for training courses? (b) Who and how are training matters determined?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Doc 9731- IAMSAR (Part I, Chap. 3)

SUBJECT	ASPECTS TO BE ASSESSED OR QUESTIONS TO REPLIER	SITUATION	COMMENTS	ICAO Ref.
Reports to supervisors staff / SAR personnel	1. How are supervisors staff /SAR personnel informed on the changes in procedures? 2. When and who makes sure that all personnel have been informed?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Doc 9731- IAMSAR (Part I, Chap. 3)
Updating English refreshment courses	1. Is there any English course available to learn the English language? 2. How is any acceptable level of proficiency determined? 3. Are there any updating courses?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Doc 9731- IAMSAR (Part I, Chap. 3) Report CAR/SAM/3 Doc- 9749
F. EQUIPMENT AND FACILITIES				
Communications system	1. How reliable are communications (ground-ground, air-ground)? a) Aeronautical Fix Service (AFS) - AFTN - Speech Circuit b) Aeronautical Mobile Service (AMS) - VHF - HF 2. Are there procedures to compensate deficiencies? 3. How are SAR registries kept and maintained?	☐ Satisfactory ☐ Unsatisfactory ☐ Not applicable ☐ Not assessed		Doc 9731- IAMSAR (Part I, Chap. 4) (Part II, Chap. 2)

SUBJECT	ASPECTS TO BE ASSESSED OR QUESTIONS TO REPLIER	SITUATION	COMMENTS	ICAO Ref.
Location of the unit	1. Is the RCC/RSC located next to a FIC or an ACC so that the additional communications means may be reduced? 2. Do the dimensions of the locations assigned to the RCC/RSC satisfy the provision of SAR services? 3. What is the status of the RCC/RSC infrastructure? 4. Is there a new location required (indicate reasons, if affirmative) 5. Is there any general office equipment for tracks tracing, or charts showing the area of responsibility of the RCC/RSC and adjacent areas, file cabinets, etc? 6. Is there sufficient comfort contemplating the SAR personnel needs during operational shifts to cover 24-hours capacity (dining room, living room, wardrobe, toilettes, etc.?			Doc 9731- IAMSAR (Part I, Chap. 2, para. 2.3.8)

Assessment Team Name _____ Organisation _____

_____ _____

Original signed by
Date:

Chapter 6 – QUALITY SERVICE IMPROVEMENT PROGRAMME

6.1 INTRODUCTION

6.1.1 SAR authorities should seek initiatives to improve the overall quality of the search and rescue services they provide. This chapter contains several initiatives that should be taken into account by SAR authorities to improve the quality of SAR.

6.2 PERIODIC REVIEWS OF SAR UNIT RECORDS

6.2.1 The quality assurance official/specialist of the SAR unit should periodically review the SAR mission report records and the time records kept in the operational guard log book and, if available, any voice communications recordings, in order to guarantee that the overall quality of search and rescue services rendered is maintained.

6.3 ICAO TERMINOLOGY FAMILIARISATION PROGRAMME

6.3.1 Administrative and operational tasks are carried out in the RCCs. The administrative tasks involve keeping the RCC in a stage of permanent preparedness. Operational tasks involve the efficient performance of an SAR operation or exercise, and thus are of a temporary nature. Said tasks correspond to the SMC, whose duties may be performed by the head of the RCC or other trained personnel of the RCC. Said personnel may include members of other official or private agencies for purposes of facilitating co-ordination in those events in which use is made of elements belonging to such services but which have no training or a constant relation with aeronautical communications.

6.3.2 In the case of this staff coming from other agencies, SAR authorities and/or units should implement a programme to make them familiar with ICAO phraseology. The implementation of programmes to improve the phraseology of a SAR unit will contribute to avoiding misinterpretation of the messages exchanged between the staff mentioned in the previous paragraph and the professional personnel of the aeronautical SAR. The results of this programme could improve the quality of the services and contribute to avoiding incidents during SAR operations. This may be achieved through random voice recording reviews, voice recording monitoring evaluations, or through direct observation. It is important to follow up on this programme in order to give some type of recognition to SAR unit staff showing outstanding use of phraseology or a significant improvement in the use of ICAO standard phraseology.

6.4 SAR USER SERVICE/FEEDBACK

6.4.1 It is very important to establish good communications among SAR authorities/SAR units and SAR system users. All SAR system users, whether from commercial airlines, business aircraft or general aviation, can provide valuable feedback. Feedback from other aviation departments, for instance airdrome offices and ATS units, and from ATS internal staff is equally important. This feedback can be obtained through surveys and may be used as a method to determine the quality of the services rendered by the SAR unit.

6.4.2 ***SAR quality assurance surveys***

6.4.2.1 SAR units should conduct an internal and external SAR quality assurance survey every year to obtain feedback on the services they provide. A sample SAR quality assurance survey for SAR personnel is shown in the **Appendix** to this chapter.

6.4.2.2 The data collected from these surveys must be analysed and validated, and the results made available to all SAR staff. Based on the review of the collected data, those issues affecting the quality of services should be identified and assigned an order of priority, and an action plan should be developed and implemented to apply these matters. Surveys from previous years could be used as a basis to determine how the SAR unit is doing as regards the quality of the search and rescue services provided.

6.5 PILOT USERS/SAR STAFF FORA

6.5.1 SAR authorities should organize pilot/SAR staff fora at least once a year. These fora can generate good relations and enhance communications between SAR authorities, pilots and SAR staff. The main objective of these fora is to link the pilot in the cockpit with the SAR controller so as to have a better understanding of the responsibilities and functions of each party. It is recommended that these fora not be organised as meetings and that no concrete action be taken. These fora may also be used by SAR authorities/units to introduce and explain information regarding local and domestic SAR system and procedures.

6.6 PARTICIPATION IN PILOT SAFETY SEMINARS

6.6.1 SAR authorities should participate in pilot safety seminars in an effort to submit information on the SAR system related to SAR quality assurance.

6.7 VISITS TO SAR UNITS BY PILOTS

6.7.1 Pilots should be encouraged to visit SAR units (RCC, RSC) and to familiarise themselves with the SAR system. In rare occasions, SAR facilities may be unable to receive visits due to the work load or to other reasons. Consequently, pilots should contact the SAR unit before the planned visit and report the number of people in the group, the time and date of the proposed visit, as well as the main interest of the group. With this information on hand, the SAR facility can prepare a programme and have someone available to guide the group within the unit.

6.8 SAR SYSTEM FAMILIARISATION/TRAINING FOR PILOTS

6.8.1 It is recommended that SAR authorities consider developing a SAR system training programme for pilots. The programme would be intended to train pilots on how to make the best use of the SAR system, its functions, responsibilities, benefits and available services.

6.9 FAMILIARISATION TRAINING FLIGHTS FOR SAR STAFF

6.9.1 SAR authorities should establish a programme with the airlines to have the SAR staff participate in familiarisation flights. SAR supervisors and operators should be encouraged to participate in these flights. This programme would allow the staff of SAR units to have first-hand experience of cockpit activities.

6.9.2 They should also establish a programme for the staff of the SAR unit to participate in familiarisation flights in the area of jurisdiction. In the course of these flights, the radio communication difficulties that arise (generally due to transmitter/receiver equipment range or terrain configuration) in navigation, meteorology, etc., should be tested. These flights should preferably be conducted on aircraft intended to provide support in search and rescue operations.

6.9.3 Familiarisation flights should be considered as skill training for SAR supervisors and operators.

6.10 RECOGNISING QUALITY PERFORMANCE

6.10.1 Positive performance and quality recognition is as important as identifying deficiencies. SAR personnel, individually or as a team, should receive recognition for rendering a high standard of performance and quality of service. It is therefore recommended that SAR authorities/units develop a programme aimed at recognising quality performance.

6.11 MEASURING SAR PERFORMANCE

6.11.1 It is important that SAR providers find ways to continuously improve the safety and efficiency of SAR operations in order to optimise performance in general. This section describes various ways by which SAR performance cay be measured.

6.11.2 The following factors must be taken into account when measuring the performance and the quality of search and rescue services provided:

6.11.3 **Safety**. Safety being the top priority, the number of accidents and incidents handled by the SAR should not be the only thing to be measured. Measurements must include the level of risk which exists during SAR operations for the materials and crews engaged in the search and/or rescue.

6.11.4 **Delay**. It is vital that utmost efforts be made to make sure that emergency alerts, independently of the communications channel used, get to the RCC/RSC with the least delay possible. It is also vital that there be no delays in alerting SAR units of an imminent coming into action.

6.11.5 **Prediction.** Is the variable measure of performance? For example: The predictable measures must be compared with the real times it takes the SAR unit to apply (implement) the Operations Plan as opposed to the optimum times expected from it.

6.11.6 **Flexibility.** Flexibility refers to the ability of SAR personnel to adapt SAR operations to the changing conditions that may arise during the course of said operations. Greater flexibility makes it possible to explore operational opportunities as they arise. This includes guiding search and rescue units to more favorable routes or minimising delays or cancellations in some scheduled SAR operations as a result of unforeseen events affecting capacity such as, for example, bad weather. Flexibility measures will make it possible to review the extent to which the training received by the staff of the SAR unit allows them to make dynamic operational decisions as a result of meteorological changes or operational conditions either before or during SAR unit operations.

6.11.7 **Efficiency.** Efficiency may be measured in terms of a flight deviating from an optimum flight routing. For example: An efficient routing would reduce direct costs of operation by optimising the flight path and eliminating excess flight time, route distance, use of fuel in non optimal velocities and altitudes, time of arrival to the search and/or rescue area, time of search, etc. Efficiency measurements should compare the actual flight path with the ideal path.

6.11.8 **Availability.** Availability in search and rescue services is an indicator of the reliability and quality of the SAR services provided. Failures in key systems may reduce (or annul) the capacity of the system, causing delays, diversion or cancellation of flights scheduled for search and rescue; total or partial lack of fuel and/or lubricants for the timely replenishment of SAR units; health facilities not ready to receive and care for casualties as the case may be, etc.; which increases the costs of SAR service, becomes an added burden to the SAR supplier or, as in the last example, the difference between life and death of a survivor evacuated from the accident site.

6.11.9 **Access**. Access to an airport or to the area designated for search or rescue may increase the value of performance measurements; as in the case of path efficiency, the value of access can increase through the measures agreed upon in this regard with ATC units to obtain the release of the airspace that is inaccessible for SAR operations, airport reduction or limitations of the airspace itself. Access measurements must include the ability of the SAR unit to coordinate passage of SAR air units through restricted areas, the availability and quality of preferred routes, and the skills of the ATS provider, the ATS system and the airport to meet the demands for use.

6.11.10 **Cost of the service**. At the international level, habit and practice stipulate that the State rendering the aeronautical and maritime SAR services shall finance them, even when the assistance given is at the request of some other agency, for example, the RCC of another State. Hence, petitions for reimbursement to the State that requested or received the services are not usually submitted. Thus, the SAR system must have some financial support. Usually, this support increases when the party responsible for the SAR service can explain and demonstrate the importance of the SAR system through some efficient dissemination of the main activities it conducts. Therefore, measuring SAR performance based on its successes and failures acquires great importance for its growth based on what is required from it, while offering valuable information to assess efficiency and to determine the best way to improve.

SAR QUALITY ASSURANCE INTERNAL SAR UNIT SURVEY

(To be filled out by SAR personnel)

"Name of SAR unit" **QUALITY OF SEARCH AND RESCUE SERVICE EMPLOYEE SURVEY"**

"Name of SAR unit" is very interested in obtaining your feedback on the quality of services that you provide to users of the system and if all the tools you need are available to provide these services. Your comments are very important to us and we would like to thank you in advance for taking the time to complete this survey.

1. Please provide us with the following information (Optional):

Name:
Position:

2. How do you rate the overall quality of search and rescue services provided by your SAR unit?

- ❑ Excellent
- ❑ Good
- ❑ Average
- ❑ Fair
- ❑ Poor

3. How do you rate the quality of equipment that you work with?

- ❑ Excellent
- ❑ Good
- ❑ Average
- ❑ Fair
- ❑ Poor

4. How do you rate the type of training (includes proficiency training, refresher training, initial training, etc.) you received?

- ❑ Excellent
- ❑ Good
- ❑ Average
- ❑ Fair
- ❑ Poor

5. How do you rate the working environment?

- ❑ Excellent
- ❑ Good
- ❑ Average
- ❑ Fair
- ❑ Poor

6. How do you rate the attitude of SAR personnel as it pertains to professionalism and friendliness?

- ❑ Excellent
- ❑ Good
- ❑ Average
- ❑ Fair
- ❑ Poor

7. How do you rate the use of proper aeronautical phraseology in your SAR unit?

- ❑ Excellent
- ❑ Good
- ❑ Average
- ❑ Fair
- ❑ Poor

8. How do you rate the airspace and ATC procedures of your ATS unit?

- ❑ Excellent
- ❑ Good
- ❑ Average
- ❑ Fair
- ❑ Poor

9. How do you rate the availability and quality of local, national, and ICAO directives?

- ❑ Excellent
- ❑ Good
- ❑ Average
- ❑ Fair
- ❑ Poor

10. How do you rate the workload distribution (is the workload distributed evenly?)?

- ❑ Excellent
- ❑ Good
- ❑ Average
- ❑ Fair
- ❑ Poor

11. How do you rate the quality and timeliness of briefings (new procedures, changes to procedures, etc.)?

- ❑ Excellent
- ❑ Good
- ❑ Average
- ❑ Fair
- ❑ Poor

12. How do you rate the communications between SAR personnel (between personnel and personnel, supervisors and personnel, management and personnel, etc.)?

- ❑ Excellent
- ❑ Good
- ❑ Average
- ❑ Fair
- ❑ Poor

13. How do you rate your job satisfaction in your current position?

- ❑ Excellent
- ❑ Good
- ❑ Average
- ❑ Fair
- ❑ Poor

14. Please share with us any comments and/or suggestions pertaining to your SAR unit you believe that may need improvement.

Comments/Suggestions:

Chapter 7. COMPETENCE-BUILDING TRAINING PROGRAMMES

7.1 INTRODUCTION

7.1.1 There is a need for competence-building training in each SAR unit in order to maintain and update the knowledge and skills required to apply search and rescue procedures in a safe and efficient manner. This training includes update and supplementary training, improvement of skills, and corrective training.

7.1.2 Training can be achieved in different ways, using both internal and external methods (local competence-building). The most practical and efficient way of providing competence-building training is by developing a local competence-building training programme. This concept involves sending a limited number of employees to external training and, upon returning to the unit, they would train their colleagues in the areas in which they received training. This concept is known as "training the trainer" and would be useful to assist SAR authorities to complete their competence-building training programmes as required. This type of training may include training videos, discussion/summary of operational procedures, emergency procedures, co-ordination procedures, SAR incidents, contingency procedures, etc. Consideration should be given to preparing a room within the SAR unit to be used for competence-building training. This room must have the appropriate training equipment, that is, video cassette, TV set, white boards for markers, aviation charts, local, national and ICAO reference material, etc.

7.2 COMPETENCE-BUILDING TRAINING

7.2.1 Competence building should be a requirement for all operational personnel, as well as for support personnel that need to maintain their operational level of knowledge. This training is intended to maintain and update the knowledge and skills required for safe and efficient implementation of search and rescue procedures.

7.2.2 Competence-building needs will vary from one SAR unit to the other. Therefore, training should be adjusted to accommodate the requirements and needs of each unit.

7.2.3 Competence-building may include training on issues mandated by SAR authorities and local SAR units.

7.2.4 This type of training programme must be described in the directives for the SAR unit.

7.2.5 SAR authorities/units must make sure they apply an annual mandatory competence-building training programme and that competencies are acquired.

7.2.6 All training related to competence-building must be documented in the personal training record of each SAR official.

7.3 ***Update training***. Each SAR unit must establish an annual update training programme. SAR authorities, managers and supervisors must stress the fact that update training is intended to improve competencies and not to assess performance.

7.3.1 This programme should include, but not be limited to, training in the following topics:

a) ***Unusual situations***, such as adverse weather conditions, on-board equipment failure, pilot's lack of knowledge of the route, or other type of contingencies (for improved learning, training for emergencies must be based on actual incidents);
b) ***Barely used procedures***, for example: cases and planning of parachute jumping, communication with the public and the media, communication with relatives, scope of electronic scanning, interview techniques, rescue procedures, AMVER, receiving medical advice, etc.;
c) SAR agreements,
d) Data collection and evaluation;
e) Allocation of SAR resources;
f) Documentation of incidents;
g) Completion of instruction forms/questionnaires for SAR units;
h) Identification of elements of reference;
i) Risk assessment;
j) SAR communications;
k) End of SAR operations;
l) Emergency phases, SAR stages and components;
m) SAR resource capabilities;
n) SAR technology;
o) Search configurations;
p) Search planning;
q) Selection of SAR units;
r) Survival equipment;
s) Scope of visual scanning;
t) Water currents;
u) Aircraft performance and characteristics;
v) Co-ordination procedures;
w) Civil/militar coordination and joint use of airspace procedures;
x) Aeronautical phraseology;
y) Fire/life safety procedures at the SAR unit;
z) Other issues identified and reported by SAR authorities or local SAR units.

7.4 ***Supplementary training***. Operational personnel must complete the supplementary training prior to the implementation of new/revised procedures, regulations or equipment.

7.5 ***Skill-improvement training***. Training provided by the SAR operation supervisor when a need for improving the skills of a SAR operator is identified. When this happens:

a) the SAR operator must be notified in writing as to the skills in which he/she needs a higher level of training; and
b) the SAR operational supervisor, in co-operation with the operator, is responsible for developing the training to be provided to the SAR operator. The methods and contents will be tailored to the individual needs and will include laboratory scenarios, classroom training, computer lessons and on-the-job training. The SAR operational supervisor will determine the most effective method.

7.6 ***Remedial training***. Training aimed at correcting specific performance deficiencies, such as:

a) a SAR operator who makes mistakes due to a performance deficiency;
b) training provided following bad performance, which should be documented as remedial training.

7.6.1 The SAR controller shall be notified in writing about the topics to be covered and the reasons.

7.6.2 The SAR operator shall have reasonable opportunity to make comments about his/her performance during remedial training.

7.6.3 The methods and contents must be designed to meet the needs of the SAR controller and may include simulated scenarios with theoretical and/or practical laboratory exercises, classroom training and on-the-job training. The SAR operational supervisor must identify the most effective method.

Chapter 8. HUMAN FACTORS

8.1 The human factor is the essential element for achieving efficiency in any organization. Technology facilitates search and rescue tasks and, in many cases, is indispensable for the successful implementation of SAR operations. But the proper use of the tools which technology puts at SAR's disposal depends on the level of competence of the user is. It is the quality of human resources which makes the difference as regards performance. Thus, to optimise performance, one must try to establish an adequate professional and work environment.

8.2 Exclusively at the professional level, it should be stressed that an aspect which favours performance is motivation. From this point of view, motivation implies the provision of the means needed for professional development and for acquiring the capabilities required by the position. It also implies getting the person involved in achieving an aim which trascends mere individual interests. This can be done by creating a healthy spirit of teamwork and professional identity. The best of an individual emerges when committing to a project or an idea which will be of benefit to society. It is a matter of placing at the disposal of that individual all the means which, from a personal outlook, are required for the achievement of some general objectives.

8.3 From the above it is possible to conclude that a demanding training programme is a basic ingredient for motivation, strictly from its professional side. Furthermore, in activities with an implicit risk, training and professional improve the level of safety. This is an unquestionable reality and is applicable to search and rescue organisations since, due to the nature of their functions and the repercussions which SAR incidents may have, they are under the obligation of not only planning their activities in detail but also of improve all the knowledge acquired in their training as well as the response capabilities of the staff in charge of handling emergencies.

8.4 On the other hand, public opinion in developed societies demands the highest degree of protection and efficiency from emergency services, being quite sensitive to any errors deriving from lack of foresight, deficient planning or poor use of available resources.

8.5 RCCs exercise management and co-ordination functions which require a large diversity of skills as well as a resolute attitude. Their staff has to be highly specialised and, hence, requires theoretical and practical skills training and updating in SAR subjects, ratified through qualification procedures. The international nature of air and maritime activities and, consequently, of SAR activities, also demands certifications proving the levels of competence.

8.6 In a SAR system, administrative and support actions are combined with operational functions. Personnel organisation involves covering all the SAR organisation positions, deciding on personnel requirements and then hiring, selecting, evaluating, promoting, paying and training the necessary staff. Personnel organisation must be closely related to the organisation of functions and positions.

8.7 Staff **selection** should be quite strict, for the new members of the organisation should have skills consistent with the philosophy of Quality Management (teamwork, responsibility, esprit de corps and commitment). It is convenient for people coming into an organisation to show or have shown great capacity to resolve changing situations, as well as a series of particular skills and attitudes (ability to work as a team, responsibility, willingness to participate).

8.8 The **training** area is also fundamental to have a SAR staff which has been duly trained to participate and to introduce quality improvements into the system. If they do not have the necessary knowledge, they will be unable to make their contribution. The fact that personnel is hired means that an effort has been made to have those chosen achieve the desired objectives. The time and the training dedicated to the team and its development should be considered an investment and not an economic cost. The need for training applies both to SAR staff (supervisors and SAR operators) as well as to top and middle management of the service (SAR director, managers, heads of SAR units, etc.), not only in quality improvement methods but also in the processes and procedures of the organisation, and in an indoctrination aiming at a total quality culture.

8.9 Lack of training will make it difficult for participation programmes, which are a basic element in Quality Management, to prevail. Adequate training of employees constitutes the basis for a participatory attitude. Furthermore, without such basic knowledge, the SAR staff will not be able to do a good job. The knowledge they must have is that related to interpersonal and group relations, statistical/quality analysis and awareness of the objective of the SAR service, and the training which the position may demand.

8.10 All of the members of the organisation should receive initial training on Quality Management basics to facilitate their understanding of it and to encourage them to participate. It must be pointed out that the members of the organisation must be trained and increase their skills as regards communications, teamwork and participation at meetings.

8.11 The staff of the SAR system requires training if it is to be responsible for quality. Quality training and participation are closely linked. All members of a system are responsible for improving processes, hence; the training provided must be such that suggestions can be contributed from every position. What is involved is for every person to have a sufficiently broad view so as to improve the whole process, and not be limited to only the specific position of the individual, something which can be achieved through teamwork.

8.12 **Communications** should be taken as just another human resource department task. Methods should be devised to see to it that any information which might be useful for people gets to them so that they can do their jobs properly, and to adapt to the organisational culture. Employee participation requires not only training but information as well.

8.13 Communicating positive results to the staff improves their morale and their motivation, while hearing about the negative ones should encourage their efforts to correct them. Linking participation to quality emphasises the importance of establishing good communication channels throughout the SAR system. To improve quality, SAR staff needs information about its work, its results and its contributions. Thanks to such information, people improve their knowledge and can make suggestions which, through the appropriate participatory channels, may represent major innovations for any enterprise which may have decided to take advantage of the collective intelligence of its entire staff.

8.14 In human resource management under the Quality Management system, it is fundamental to encourage the **participation** of all members of the organisation. Participation, or “empowerment”, means encouraging, favouring and rewarding the SAR staff for behaving at all times in the way it deems convenient to achieve the goals of the SAR service. This means that, for the staff to participate, it has to receive the necessary instructions to make decisions affecting organisational management and results, receive information on the results, information enabling them to understand and contribute to those results and the rewards based on those results.

8.15 For real participation, the staff must receive adequate amounts of these four factors. Only thus will the staff be able to see a direct relationship between its efforts and the results of the organisation. For the participation to be effective, aspects such as the importance of the leadership style must be taken into account. The enterprises which use it consider their employees as professionals capable of fulfilling their tasks in a precise and effective way, and thus delegate on them a large measure of responsibility and allowing them to participate in the decision-making process.

Automation focused on the human element

8.16 A technology-oriented approach automates all possible functions and lets the human element handle the rest. This places the operator in the role of an automation custodian. A human-focused approach offers the operator an automated assistance that helps him/her save time and effort, since automation provides support to, but does not direct, the operator in the performance of his/her tasks. The three high-level automation objectives are: Usefulness, Operational Convenience and Acceptance by the Labour Force.

Status awareness

8.17 Status awareness is defined as perceiving the elements making up the environment within a volume of time and space, understanding their meaning, and projecting their condition in the near future. The elements of status awareness in the SAR service are extremely dynamic and are subject to changes ranging from subtle to significant, which can occur in short notice and which can affect, or do affect, the performance of an operator at a given moment. For example:

- Personal factors
- Meteorological conditions
- Airport infrastructure
- Time needed to get the SAR elements ready
- Availability of rescue personnel
- Work environment
- Geographical locations and preparedness for replenishment of SAR elements
- Aircraft performance
- Rescue operations equipment
- Adjacent units

Error management

8.18 Error management has two components: error reduction and error contention. Error reduction covers measures designed to limit the occurrence of errors. Error contention measures are designed to limit the adverse consequences of any errors which may still occur.

8.19 Error management includes the following:

- Measures to minimise the risk of individual and work team errors;
- Measures to reduce the vulnerability to error of certain tasks or task elements;
- Measures to discover, evaluate and then eliminate the factors which cause errors in the workplace;

- Measures to diagnose organisational aspects which create error-generating factors for the individual, the work team, the task and the workplace;
- Measures to improve troubleshooting;
- Measures to increase error tolerance by the workplace and the system;
- Measures to make sure that latent conditions are visible to those operating and managing the system;
- Measures to improve the intrinsic resistance of the organisation to human fallibility.

8.20 There is a relation among the concepts presented. Application of the concept of Automation centered on the human element will increase the Status Awareness of the SAR operator, which, in turn, becomes a component of the Error Management programme. SAR operators that keep a high degree of Status Awareness are more likely to detect errors and to control their consequences.

8.21 In an effort to further explain human factors related to the work of the SAR operator, the **Appendix** to this Chapter includes an extract of a document entitled "Human Factors for the Air Traffic Control Specialist: Handbook for the User's Brain", published by the United States Federal Aviation Administration in November 1995. Although the document was developed for air traffic controllers, it does include some of the results of research studies on human factors, as well as additional information useful for SAR operators, written in a succinct and easy-to-read format.

8.22 The topics included are: controller-pilot voice communications, memory, fatigue, and the effects of stress on data processing. These recommended techniques aim at helping to reduce the probability of error in voice communications, by remembering specific information, identifying signs of stress which could affect performance, and reducing fatigue.

The human factor and SAR training

8.23 On the other hand, the IAMSAR manual emphasises RCC personnel training and improving professionalism. It stipulates that the head of the SAR service is responsible for the formulation of training programmes for SAR personnel, so that it may reach and maintain a high level of competence. Stressing the above, it states that the directors of the service must make sure that said personnel is as mature and as competent as required to perform the tasks which may be assigned to it.

Appendix

QUALIFICATION OF SAR PERSONNEL

INFORMATION AND CONCLUSIONS ABOUT RCC PRACTICES BASED ON SEVERAL STUDIES CONDUCTED IN THE UNITED STATES

1. **Background**

1.1. To ensure that SAR services endure and improve, the U.S. Coast Guard has conducted studies in recent years that have indicated typical traits of high-performing rescue coordination centers (RCCs) and rescue sub-centers (RSCs). This paper discusses some of these traits.

1.2. The U.S. is addressing shortfalls, especially with regard to perishable skills, excessive workload, recurrent training, and technical and communications capabilities. In this paper we offer conclusions that may be of interest to other SAR authorities as well. Our investigation has been supported in part by other countries as is indicated below.

1.3. RCCs operated by the U.S. Coast Guard are unlike typical international RCCs in some ways. Our RCCs are actually multi-mission command centers that handle a full range of law enforcement and marine safety functions, and are staffed mainly by military officer and enlisted personnel on three-year tours. Communications watches are handled outside the RCCs.

1.4. The following studies examined RCC staff selection and retention, SAR training, staff qualification and recertification, tasks assigned, and workload expectations:

1.4.1. S/V MORNING DEW Case Study: involved the sinking of a sailing vessel off the north jetty of Charleston Harbor, South Carolina in December 1997 that claimed the lives of four persons.

1.4.2. 1999 Command Center Improvement Study: included a resident assessment of work processes and problems at one RCC and one RSC to assess the impact of growing non-SAR workload, since our RCCs are actually multi-mission command centers.

1.4.3. 2001 SAR Mission Coordinator (SMC) Front End Analysis (FEA): intended to help understand the actions and outcomes of accomplished SMCs.

1.4.4. 2002 Research and Development Report on Human Performance for Command Centers: examined command center performance from a human factors and performance perspective.

1.4.5. 2002 Report on Fatigue and Endurance: highlighted workforce and workload concerns associated with the Egypt Air 990 disaster.

1.4.6. 2003 RCC Benchmarking Study: examined the best practices of selected foreign joint or maritime RCCs. Australia (JRCC-civilian), Canada (JRCC-military and

civilian), Hong Kong (MRCC-civilian), the Netherlands (JRCC-civilian), Sweden (JRCC-civilian), and the UK (MRCC-mainly civilian) assisted with this study.

1.5. These studies helped the U.S. to identify areas in which we would like to improve, including:

a) Knowledge and skills for all aspects of SMC duties
b) Refresher training
c) Proficiency in all aspects of search planning software
d) Understanding of search theory
e) Available training time
f) Multi-tasking requirements
g) Staffing levels
h) Standards and policies
i) Technical and communications capabilities
j) Administrative workload
k) Command briefings
l) Length of watches
m) Sleep and sleep/wake cycles

1.6. One study noted that multi-tasking could lead to chronic fatigue and mistakes. Multi-tasking can seriously disrupt integrative and decision-making processes needed to manage a SAR case. Multi-tasking is actually a sequence of serial events rather than work being done in parallel. When attention is diverted from one task to another, performance in both tasks degrades. Attention can be diverted by activities such as administrative tasks, answering non-SAR phone calls, monitoring RCC entrances, fatigue and noise. Attention can be better sustained by limiting the number of cases handled by a single person, adding a supervisor during high caseloads to maintain the big picture, and assigning an extra person to handle non-SAR tasks. A prevalent view is that good staff can multi-task; however, humans can only attend to one task at a time.

1.7. The following list indicates some types of remedial actions that the U.S. has taken or has planned consequential to the studies indicated above:

a) Include some civilian RCC staffing
b) Establish an RCC Standardization Team
c) Standardize common qualification, planning and decision-making processes
d) Standardize SAR checklists
e) Improve the RCC personnel selection process
f) Identify and centralize specialized system skills that require frequent practice
g) Increase the grade levels of enlisted and officer military staff
h) Increase the RCC staffing per watch position
i) Reduce watches from 24 hours to 12 hours
j) Make reference materials available online
k) Revise SAR School class schedule so new staff can attend prior to reporting to the RCC
l) Increase SAR School instructor staff
m) Revise SAR School curriculum to account for additional decision-making skills
n) Develop standard job aids for SAR mission coordinators (SMCs)

o) Develop web-based search planning training to enable 24/7 practice and refresher training
p) Limit the number of active SAR cases worked by a single person to two
q) Provide assistance with active cases at night between 0200-0600 hours
r) Make staff available to augment the watch during times of high operational tempo

1.8. The studies have also led to creation of an integrated distress response communications system called "Rescue 21" to modernize the entire coastal communications infrastructure, and the SAR School curriculum is being revised to account for this new technology.

1.9. A Standardization Team has been established (as an extension of our National SAR School) that visits every RCC and RSC every 18 months to ensure that standard policies and procedures are being followed and to test the search planning knowledge and skills of the RCC staff.

2. **Analysis**

2.1. The following paragraphs based on the studies indicated above (especially the Benchmarking Study) discuss some RCC practices that contribute to optimal proficiency, professionalism and accomplishment of the SAR mission.

2.2. *Optimal RCC staffing seems to be 7 + 1 per watch position.* At a minimum, 6 + 1 is warranted if 8 or 12-hour watches are stood. This issue is independent of the number of watch positions needed; both must be adequate. The term "+1" indicates a supervisor available to assist the watch during surge operations. Based on workload assessments conducted by the U.S. Coast Guard Research and Development Center, an RCC with only two watch positions should have 7 + 1 (or at least 6 + 1) staffing for both positions, except that an RCC with a low caseload might be able to share a supervisor between two watch positions with comparable duties. If staffing is lower than this, say 5 + 1, then the RCC staff should definitely not have any non-SAR or extra administrative duties assigned. Four of the six countries participating in the Benchmarking Study have 7 + 1 staffing standards. Staffing should be such that ample time off watch can be provided for leave, training, sickness, etc.

2.3. *RCCs should be staffed so that no person stands more than a 12-hour watch.* Longer watches lead to fatigue and degraded ability to perform SAR duties. All of the RCCs in the Benchmarking Study stand either 8 or 12-hour watches with 2 or 3 staff on duty at all times.

2.4. *Typical initial RCC formal training should be two months or more, and initial on-the-job training should be 7 months or more.* These durations were the averages for the six RCCs involved in the Benchmarking Study. Many countries provide all or part of their formal SAR training either by sending RCC staff to training institutions in other countries, or by using graduates of such schools to train other staff. The needed formal training may vary with relevant experience levels of new staff, and on-the-job training may be longer if RCC staff also performs primary duties in addition to SAR. One to three weeks of formal training is typically devoted to communications, with three weeks provided for RCCs that perform their own communications watches. Note that hiring of master mariners or air traffic controllers as RCC staff is a common practice of the RCCs of the six countries previously mentioned, and the average RCC experience level is ten years.

2.5. *SAR training should include several days of simulations and exercises.* Ideal facilities for these will include full-scale mock-ups of an actual RCC facility and computers for each person in the classroom. Students usually consider simulations and exercises to be the most effective and meaningful portions of a course. Computers at desks should be used to enable students to practice skills, as they would have to on watch, as soon as they are taught. RCC mock-ups should include real equipment as much as possible.

2.6. *Provisions should be made for recurrent training and re-certification of RCC staff.* Time must be provided to practice SAR proficiency skills. Adequate staffing enables some personnel to receive refresher training outside of their normal watch. Web-based training modules can be used at any time as an extension of SAR training institutions. Such training should keep the staff proficient in determining drift and in use of environmental data, and can include interactivity, immediate feedback, frequently asked questions, practice exercises, and threaded discussions. Annual SAR proficiency tests that include written exams and use of search planning software help with maintenance of important search planning proficiency, which is a technical and fleeting skill. Solving lengthy SAR simulation problems on watch may contribute to fatigue that could affect performance later on watch for an actual SAR case. An RCC Halifax risk-based work review concluded that generally 25% of an SMC's time is required for skill maintenance and updating.

2.7. *Make SAR the only mission of an RCC or RSC.* RCC and RSC staff should not be overburdened with non-SAR and administrative tasks that reduce their vigilance to the SAR mission. At a minimum, an appropriate number of the RCC staff should be SAR experts, not multi-mission managers. For the obvious reason, RCC personnel need to be true SAR professionals, not just fairly good at handling a variety of missions.

2.8. *Steps should be taken to help maintain vigilance and proficiency on communications watches.* Vigilance is the ability to detect, say, a potential distress call out of radio background chatter or out of a large volume of non-distress traffic. Studies have shown that vigilance begins to degrade after only 20 minutes on a radio watch and declines with fatigue, performance of additional unrelated tasks, decrease in the signal-to-noise ratio, low light conditions, and as more channels or antennae sites are monitored.

2.9. Distress call watches should normally be limited to two hours. A person coordinating a SAR case should not also be responsible for maintaining a communications watch, or for answering non-SAR related phone calls during high tempo operations.

2.10. Background noise of 70 dB is disruptive to conversation and levels above 80dB seriously degrade concentration; use of headsets instead of loudspeakers and a sound-absorbing environment can help reduce noise.

2.11. Attempting to work during a normal sleep period degrades performance. Distress calls are more likely to be missed during the period from 0200-0600 when people are most challenged to stay alert; more rest outside this time or more assistance during this time may help.

2.12. Special diligence should be exercised when new equipment is introduced to ensure that use of the equipment is thoroughly understood.