INTERNATIONAL CIVIL AVIATION ORGANIZATION

AFI PLANNING AND IMPLEMENTATION REGIONAL GROUP

REPORT OF

THE FOURTH MEETING OF THE COMMUNICATIONS, NAVIGATION AND SURVEILLANCE SUB-GROUP

(CNS/SG/4)

(Dakar, Senegal, 25-29 July 2011)

Prepared by the ICAO Eastern and Southern African Office

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APPENDICES

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ACRONYMS

ABAS	Aircraft Based Augmentation System
ACC	Area Control Centre
ADS	Automatic Dependent Surveillance
ADS-B	Automatic Dependent Surveillance - Broadcast
ADS-C	Automatic Dependent Surveillance - Contract
AFS	Aeronautical Fixed Service
AFTN	Aeronautical Fixed Telecommunication Network
AIC	Aeronautical Information Circular
AIDC	ATS Inter-facility Data Communications
AIRAC	Aeronautical information regulation and control
AIS	Aeronautical Information Service
ACP	Aeronautical Communications Panel
AFI	Africa-Indian Ocean
AFISNET	AFI Satellite Telecommunication Network
AMC	ATS message handling system COM Centre
AMHS	ATS message handling system
AMS(R)S	Aeronautical Mobile-Satellite (R) Service
AMSS	Aeronautical Mobile-Satellite Service
ANSP	Air Navigation Service Provider
APIRG	AFI Planning and Implementation Regional Group
APV	Approach with Vertical Guidance
AR	Area of Routing
ASECNA	Agency for the Safety of Aerial Navigation in Africa and Madagascar
ATC	Air Traffic Control
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATNP	Aeronautical Telecommunication Network Panel
ATS	Air Traffic Services
ATU	African Telecommunication Union
BIS	Boundary Intermediate System
BBIS	Backbone Boundary Intermediate System
CAFSAT	Central Atlantic FIRs Satellite Telecommunication Network
CIDIN	Common ICAO Data Interchange Network
CNS	Communications, Navigation, and Surveillance
CPDLC	Controller pilot data link communications
CSP	Communication Service Provider
DME	Distance Measuring Equipment
EGNOS	European Geostationary Navigation Overlay System
ES	End System
EUROCONTROL	European Organization for the Safety of Air Navigation
FAA	Federal Aviation Administration
FIR	Flight Information Region
FM	Frequency Modulation
FMC	Flight Management Computer
FMS	Flight Management System
GBAS	Ground Based Augmentation System
GRAS	Ground Based Regional Augmentation System
GLONASS	Global Orbiting Navigation Satellite System (Russian Federation)
GLS	GNSS Landing System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System (United States)
HF	High Frequency
IATA	International Air Transport Association

ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
INS	Inertial Navigation System
IRS	Inertial Reference System
IS	Intermediate System
ISO	International Organization for Standardization
ITU	International Telecommunication Union
JAA	Joint Aviation Authorities
LAAS	Local Area Augmentation system
LEO	Low Earth Orbit
LPV	Localizer Precision with Vertical Guidance
MLS	Microwave Landing System
MODE S	Mode S - SSR Data Link
MSAW	Minimum safe altitude warning system
MTSAT	Multi-Functional Transport Satellite (Japan)
NAFISAT	North-East AFI Satellite Telecommunication Network
OSI	Open Systems Interconnection
PBN	Performance – Based Navigation
RAIM	Receiver Autonomous Integrity Monitoring
RCP	Required Communication Performance
RD	Routing Domain
RNAV	Area Navigation
RNP	Required Navigation Performance
RSP	Required Surveillance Performance
SADC	Southern African Development Community
SARPs	Standards and Recommended Practices
SBAS	Satellite Based Augmentation System
SATCOM	Satellite Communication
SITA	Société Internationale de Télécommunications Aéronautiques
SSR	Secondary Surveillance Radar
TCP/IP	Transport Control Protocol/Internet Protocol
TMA	Terminal Control Area
VDL	VHF Data Link
VHF	Very High Frequency
VNAV	Vertical Navigation
VOR	VHF Omni-directional Radio Range
VSAT	Very Small Aperture Terminal
WAAS	Wide Area Augmentation System
WGS-84	World Geodetic Reference System - 1984
WRC	World Radio communication Conference

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PART I - HISTORY OF THE MEETING

1. INTRODUCTION

1.1. Date and Venue of the Meeting

1.1.1 The Fourth Meeting of the APIRG Communications, Navigation and Surveillance Sub-group (CNS/SG/4) was held at the Conference Room of the Agence pour la Securite de la Navigation Aerienne en Afrique et a Madagascar (ASECNA), in Dakar, Senegal from 25 to 29 July 2011.

1.2. OFFICERS AND SECRETARIAT

1.2.1 Mr. Prosper Zo'o Minto'o, Regional Officer Communications, Navigation and Surveillance (RO/CNS) of the ICAO Eastern and Southern African Office, Nairobi, acted as Secretary of the Sub-group. He was assisted by Mr. Francois-Xavier Salambanga, Regional Officer Communications, Navigation and Surveillance (RO/CNS) of the ICAO Western and Central African Office, Dakar.

1.2.2 Mr. Richard Ruhesi from Uganda was unanimously re-elected Chairman of the meeting, and Mr. Boubacar Diallo from Guinea was elected Vice- Chairman.

1.2. OPENING AND CLOSING SESSIONS

1.2.3 On 25 July 2011, Mrs. Claire Andriamalaza, Head of ASECNA MET Division, welcomed the participants to the meeting on behalf of Mr. Amadou Guitteye, ASECNA Director-General. Mr. Akoa Benoit Okossi, Regional Officer Aeronautical Meteorology opened the meeting on behalf of Mr. Mam Sait Jallow, ICAO Regional Director for Western and Central Africa. In his address, he expressed profound gratitude to the Agence pour la Securite de la Navigation Aerienne en Afrique et a Madagascar (ASECNA), which kindly accepted to host the meeting, as a result of its commitment to international and regional cooperation within the ICAO framework. He indicated that the meeting had been convened at the same time as the 12th meeting of the APIRG ATM/AIM/SAR Sub-group (ATM/AIM/SAR/SG/12), in order to permit coordination between the two sub-groups in preparation for APIRG/18 meeting. He highlighted the efforts being made by AFI States as part of their responsibilities under Article 28 of the Convention on International Civil Aviation, and encouraged them to work toward the achievement of an integrated, interoperable and seamless aeronautical telecommunication infrastructure in order to meet the Global ATM operational concept requirements.

1.2.4 On 29 July 2011, Mr. Mam Sait Jallow, ICAO Regional Director for Western and Central Africa presided over the closing session, in the presence Mr. Amadou Guitteye, ASECNA Director-General.

1.3. ATTENDANCE

1.3.1 The meeting was attended by sixty one (61) delegates from twenty four (24) Contracting States and three (3) international Organizations.

1.3.2 The list of participants is at **Appendix A** to this report.

1.4. WORKING LANGUAGES

1.4.1 English and French were used as the working languages and documentation was issued in these languages.

1.5. AGENDA

1.5.1 The following Agenda was adopted:

Agenda Item 1: Election of Chairman and Vice-Chairman of the Sub-Group

Agenda Item 2: Terms of reference, work programme and composition of the Communications, Navigation and Surveillance Sub-group as defined by APIRG/17

Agenda Item 3: Follow up of APIRG/17 and CNS/SG/3 Conclusions and Decisions

Agenda Item 4: Aeronautical Fixed Service (AFS)

- 4.1. Review of the implementation and performance of the Aeronautical Fixed Telecommunication Network (AFTN) and the Air Traffic Services Direct Speech (ATS/DS) Network in the AFI Region, identification of deficiencies and remedial action for their elimination
- 4.2. Review of the report of the First meeting of AFI VSAT managers
- 4.3. Review of the report of the first meeting of the AFI AMHS Implementation Task Force
- 4.4. Planning and implementation guidelines
- 4.5. Other planning and implementation issues

Agenda Item 5: Aeronautical Mobile Service (AMS)

- 5.1. Review of the implementation and performance of the Aeronautical Mobile Service in the AFI Region, identification of deficiencies and remedial action for their elimination
- 5.2. Extension of VHF Radio coverage in the AFI Region – Other AMS related issues
- 5.3. Planning and implementation guidelines

Agenda Item 6: Aeronautical radio navigation service (ARNS)

- 6.1. Review of the implementation and performance of the Aeronautical radio navigation service in the AFI Region, identification of deficiencies and remedial action for their elimination
- 6.2. GNSS implementation
- 6.3. Planning and implementation guidelines

Agenda Item 7: Aeronautical Surveillance

- 7.1. Review of the status of implementation of the current aeronautical surveillance plan
- 7.2. Review of the report of the second meeting of the AFI Surveillance Implementation Task Force
- 7.3. Planning and implementation guidelines

Agenda Item 8: Aeronautical Radio Frequency Spectrum issues

Agenda Item 9: ICAO 37th Assembly (2010) and Twelfth Air Navigation Conference (AN/Conf/12, 2012) – CNS related issues

- 9.1. Follow up on Assembly 37th Session in the field of CNS
- 9.2. Development of a CNS Technology Roadmap

Agenda Item 10: Future work programme and composition of the CNS/SG

Agenda Item 11: Any other business

1.6 DRAFT CONCLUSIONS AND DECISIONS

1.6.1 The CNS Sub-group recorded its actions in the form of draft conclusions and draft decisions as follows:

1.6.2 Draft conclusions

1.6.2.1 Draft conclusions, when approved by the APIRG, deal with matters which in accordance with the APIRG Terms of Reference, merit the attention of States or which further action will be initiated by ICAO in accordance with established procedures.

1.6.3 Draft decisions

1.6.3.1 Draft decisions, when approved by the APIRG, deal with matters of concern only to APIRG and its contributory bodies.

LIST OF CONCLUSIONS AND DECISONS

DRAFT CONC./DEC. NO.	TITLE/TEXT
AGENDA ITEM 4 - AERONAUTICAL FIXED SERVICE (AFS)	
DRAFT CONCLUSION 4/01	**NEED FOR ICAO ASSISTANCE IN THE RESOLUTION OF AFS DEFICIENCIES** THAT THE ICAO REGIONAL OFFICES SHOULD EXPLORE ALL AVENUES TO ASSIST THE STATES CONCERNED IN RESTORING/IMPLEMENTING NON-OPERATIONAL AFS CIRCUITS BASED ON AFI AIR NAVIGATION PLAN REQUIREMENTS.
DRAFT DECISION 4/02	**CONTINGENCY PLANNING FOR AFI VSAT NETWORKS OPERATED SATELLITES** THAT THE SECRETARIAT SHOULD OBTAIN FROM THE INTELSAT COMPANY DISASTER RECOVERY PLANS FOR USE BY THE AFI AERONAUTICAL VSAT NETWORKS MANAGERS AS PART OF THEIR CONTINGENCY PLANS AIMED AT ENSURING CONTINUITY OF SERVICE IN CASE OF DISRUPTION OR FAILURE OF THE OPERATED SATELLITES.
DRAFT CONCLUSION 4/03	**ADOPTION OF BEST PRACTICES FOR AFI VSAT NETWORKS** THAT THE AFI STATES AND AIR NAVIGATION SERVICES PROVIDERS (ANSPS) OPERATING AERONAUTICAL VSAT NETWORKS SHOULD ADOPT THE BEST PRACTICES STATED AT **APPENDIX C** TO THIS REPORT, AS WELL AS ANY OTHER BEST PRACTICES TO BE DEVELOPED AS REQUIRED.
DRAFT CONCLUSION 4/04	**IMPLEMENTATION OF AFISNET AND CAFSAT NETWORKS' MANAGEMENT AND CONTROL SYSTEMS** THAT AFISNET AND CAFSAT PARTICIPATING STATES AND ORGANIZATIONS SHOULD ESTABLISH COMMON NETWORK MANAGEMENT AND CONTROL SYSTEMS WITH SHARED RESPONSIBILITIES, AND HARMONIZE THEIR MAINTENANCE POLICIES IN TO ENHANCE SYSTEMS' AVAILABILITY AND RELIABILITY.
DRAFT CONCLUSION 4/05	**MODERNIZATION OF AFISNET AND CAFSAT NETWORKS** THAT AFISNET AND CAFSAT PARTICIPATING STATES AND ORGANIZATIONS SHOULD PURSUE THEIR ACTIVITIES AIMED AT ACHIEVING MODERNIZED NETWORKS THAT CONTINUE TO MEET REGIONALLY/INTER-REGIONALLY AGREED PERFORMANCE REQUIREMENTS.

DRAFT CONC./DEC. NO.	TITLE/TEXT
DRAFT CONCLUSION 4/06	**MANAGEMENT OF INTERCONNECTIONS BETWEEN AERONAUTICAL VSAT NETWORKS** THAT THE CONCERNED STATES AND ORGANIZATIONS SHOULD ESTABLISH FORMAL ARRANGEMENTS TO IMPROVE THE MANAGEMENT OF VSAT NETWORKS INTERCONNECTIONS.
DRAFT CONCLUSION 4/07	**ARRANGEMENTS TO ENSURE SUSTAINABILITY OF NAFISAT AND SADC VSAT/2 NETWORKS** THAT, BASED ON EXPERIENCE GAINED AND AVAILABLE CAPABILITIES NAFISAT AND SADC VSAT/2 PARTICIPATING STATES SHOULD ESTABLISH ADMINISTRATIVE AND FUNDING ARRANGEMENTS IN A TIMELY MANNER TO ENSURE THAT AFS REQUIREMENTS CONTINUE TO BE MET.
DRAFT DECISION 4/08	**ESTABLISHMENT OF A TASK FORCE FOR THE REGIONAL PROJECT** THAT A TASK FORCE BE ESTABLISHED TO ADDRESS ISSUES RELATED TO THE DEVELOPMENT OF A REGIONAL PROJECT AIMED TO ENHANCE THE OVERALL PERFORMANCE OF AFI AERONAUTICAL VSAT NETWORKS, AND CONVERGE TOWARDS A CONSOLIDATED REGIONAL ATN INFRASTRUCTURE, WITH THE TERMS OF REFERENCE SHOWN AT **APPENDIX D** TO THIS REPORT. THE TASK FORCE SHOULD COMPLETE ITS ASSIGNED WORK BY DECEMBER 2011, AND REPORT TO APIRG/18 THROUGH THE CNS SUB-GROUP.
DRAFT CONCLUSION 4/09	**APPLICATION OF THE CONCEPT OF MULTINATIONAL FACILITY/SERVICE TO AN INTEGRATED AFI AERONAUTICAL TELECOMMUNICATION NETWORK (ATN) INFRASTRUCTURE.** THAT THE CONCEPT OF MULTINATIONAL FACILITY/SERVICE AS DEFINED IN THE REGIONAL AIR NAVIGATION PLAN (DOC 7474) IS APPLICABLE TO AN AFI INTEGRATED IP-BASED REGIONAL/INTERREGIONAL DIGITAL COMMUNICATION NETWORK, INCLUDING ITS EVOLUTION TOWARDS A CONSOLIDATED AFI AERONAUTICAL TELECOMMUNICATION NETWORK (ATN) INFRASTRUCTURE.
DRAFT CONCLUSION 4/10	**AFI AMHS IMPLEMENTATION STRATEGY** THAT THE AHMS STRATEGY SHOWN AT **APPENDIX E1** TO THIS REPORT BE ADOPTED FOR THE AFI REGION.
DRAFT DECISION 4/11	**DRAFT AFI ATN ARCHITECTURE PLAN** THAT THE SECRETARIAT: 1) SHOULD CIRCULATE TO AFI STATES AND ORGANIZATIONS THE DRAFT AFI ATN ARCHITECTURE PLAN SHOWN AT **APPENDIX F** TO THIS REPORT, FOR THEIR FINAL COMMENTS BY 30 SEPTEMBER 2011; AND 2) ACCORDINGLY FINALIZE THE DRAFT AFI ATN ARCHITECTURE FOR ADOPTION BY APIRG/18.
DRAFT CONCLUSION 4/12	**VSAT NETWORKS – PERFORMANCE MONITORING** THAT THE SECRETARIAT SHOULD FINALIZE THE PERFORMANCE DATA COLLECTION FORMS SHOWN AT **APPENDIX G** TO THIS REPORT; AND CIRCULATE THE FINALIZED FORMS FOR USE BY AFI STATES AND ENTITIES OPERATING/MANAGING VSAT NETWORKS IN ORDER TO HARMONIZE RELATED PERFORMANCE MEASUREMENT METHODOLOGY WITHIN AND BETWEEN ICAO REGIONS.

DRAFT CONC./DEC. NO.	TITLE/TEXT
DRAFT CONCLUSION 4/13	**NEED FOR FURTHER INVESTIGATIONS ON THE LACK OF FLIGHT PLANS** THAT, CONSIDERING THE HIGH PRIORITY TO BE ACCORDED TO THE ISSUE OF LACK OF FLIGHT PLANS, AFI AIR TRAFFIC SERVICE UNITS (ATSUS) REPORT AND CONDUCT INVESTIGATIONS ON MISSING FLIGHT PLANS DURING THE PERIOD FROM 15 TO 17 AUGUST 2011. THE RESULTS OF THEIR INVESTIGATIONS SHOULD BE COMPILED USING THE FORM ATTACHED TO THE REPORT, AND COMMUNICATED TO THE RELEVANT ICAO REGIONAL OFFICES.
DRAFT CONCLUSION 4/14	**INVESTIGATIONS ON THE LOSS OF AFTN MESSAGES IN THE AFI REGION** THAT IN ORDER TO FURTHER ANALYZE AND MITIGATE THE LOSS OF AFTN MESSAGES, INCLUDING FLIGHT PLAN MESSAGES IN THE REGION, AFI AFTN CENTRES CARRY OUT A THREE-DAY SURVEY ON AFTN PERFORMANCE FROM 15 TO 17 AUGUST 2011 (INCLUSIVE), USING THE FORMS AND MODEL MESSAGES TO BE CIRCULATED BY THE SECRETARIAT. IN SO DOING, THEY SHOULD: 1) USE THE AFTN ADDRESSES OF THEIR CORRESPONDENT ATSUS IN THE AFI REGION; 2) PROVIDE AVAILABILITY OF THE AFTN CIRCUIT(S) INVOLVED, BASED ON THE IMPLEMENTED ROUTING CONFIGURATION; AND 3) PROVIDE TRANSIT TIMES. NOTE: THE RESULTS OF THE AFTN SURVEY SHOULD BE SENT TO THE RELEVANT ICAO REGIONAL OFFICE BY 25 AUGUST 2011.
AGENDA ITEM 5 - AERONAUTICAL MOBILE SERVICE (AMS)	
DRAFT CONCLUSION 4/15	**ADOPTION OF THE GLOBAL OPERATIONAL DATA LINK DOCUMENT (GOLD)** THAT IN ORDER TO ENSURE REGIONAL AND GLOBAL HARMONIZATION OF DATA LINK OPERATIONS, THE GOLD BE ADOPTED FOR THE AFI REGION, IN REPLACEMENT OF THE FANS 1/A OPERATIONS MANUAL. NOTE: SOUTH AFRICA COORDINATES THE MAINTENANCE OF THE GOLD FOR THE AFI REGION.
AGENDA ITEM 6 - AERONAUTICAL RADIO NAVIGATION SERVICE (ARNS)	
DRAFT CONCLUSION 4/16	**UPDATED AFI GNSS STRATEGY** THAT THE AFI GNSS STRATEGY BE REVISED AS SHOWN AT **APPENDIX H** TO THIS REPORT.
AGENDA ITEM 7 - AERONAUTICAL SURVEILLANCE (AS)	
DRAFT DECISION 4/17	**ESTABLISHMENT OF AN AD HOC GROUP TO FINALIZE THE DRAFT AFI SURVEILLANCE STRATEGY** THAT AN AD HOC WORKING GROUP BE ESTABLISHED TO FINALIZE OPERATIONAL INPUTS TO THE DRAFT THE AFI SURVEILLANCE IMPLEMENTATION STRATEGY SHOWN AT **APPENDIX I** TO THIS REPORT; AND THE FINALIZED DRAFT STRATEGY BE SUBMITTED TO APIRG/18 FOR ADOPTION.
AGENDA ITEM 8 - AERONAUTICAL RADIO FREQUENCY SPECTRUM ISSUES	
DRAFT CONCLUSION 4/18	**IMPLEMENTATION OF AFI FMG ACTION PLAN** THAT AFI STATES AND ORGANIZATIONS IMPLEMENT THE ACTION PLAN PROPOSED BY THE AFI FREQUENCY MANAGEMENT GROUP AS SHOWN AT **APPENDIX J** TO THIS REPORT.

DRAFT CONC./DEC. NO.	TITLE/TEXT
AGENDA ITEM 9 - ICAO 37TH ASSEMBLY (2010) AND TWELFTH AIR NAVIGATION CONFERENCE (AN/CONF/12, 2012) – CNS RELATED ISSUES	
DRAFT CONCLUSION 4/19	**IMPORTANCE OF THE INFORMATION ON AIRCRAFT EQUIPAGE IN AIR NAVIGATION SYSTEM PLANNING AND IMPLEMENTATION** THAT, WHEN MAKING THEIR DECISIONS WITH RESPECT TO THE PLANNING AND IMPLEMENTATION OF AIR NAVIGATION SYSTEMS, AFI STATES SHOULD TAKE DUE ACCOUNT OF AVAILABLE AND RELIABLE DATA AND FORECAST ON AIRCRAFT LEVEL OF EQUIPAGE AND CAPABILITIES.
DRAFT CONCLUSION 4/20	**AFI STATES' REGISTERED AIRCRAFT EQUIPAGE AND CAPABILITIES** THAT, AFI STATES SHOULD SUPPORT SURVEYS CONDUCTED ON AIRCRAFT EQUIPAGE AND CAPABILITIES BY PROVIDING THE ICAO REGIONAL OFFICES WITH DETAILED INFORMATION CONCERNING THEIR REGISTERED AIRCRAFT.
AGENDA ITEM 10 - FUTURE WORK PROGRAMME AND COMPOSITION OF THE CNS/SG	
DRAFT DECISION 4/21	**FUTURE WORK PROGRAMME FOR THE CNS SUB-GROUP** THAT THE FUTURE WORK PROGRAMME AND COMPOSITION OF THE CNS SUB-GROUP BE AMENDED AS SHOWN AT **APPENDIX M** TO THIS REPORT.

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PART II – REPORT ON AGENDA ITEMS

REPORT ON AGENDA ITEM 1: ELECTION OF CHAIRMAN AND VICE-CHAIRMAN OF THE SUB-GROUP

2.1 Under this Agenda Item, the meeting re-elected Mr. Richard Rwahesi from Uganda as Chairperson of the CNS Sub-group. After noting the absence of Guinea, the meeting opted for the status quo with respect to the Sub-group Vice-Chairperson.

REPORT ON AGENDA ITEM 2: REVIEW OF THE TERMS OF REFERENCE, WORK PROGRAMME AND COMPOSITION OF THE COMMUNICATIONS, NAVIGATION AND SURVEILLANCE SUB-GROUP AS DEFINED BY APIRG/17

2.2 Under this Agenda Item, the Sub-group reviewed its terms of reference, work progamme and composition as established by APIRG /17. Amendments to the work programme were agreed. These are shown in the future work programme of the Sub-group considered under Agenda Item 10.

REPORT ON AGENDA ITEM 3: FOLLOW UP OF APIRG/17 AND CNS/SG/3 CONCLUSIONS AND DECISIONS

3.1 Under this Agenda Item, the meeting reviewed and noted the follow-up action taken on APIRG/17 and CNS/SG/3 Conclusions and Decisions as shown at **Appendix B** to this report.

REPORT ON AGENDA ITEM 4: AERONAUTICAL FIXED SERVICE (AFS)

4.1. Review of the implementation and performance of the Aeronautical Fixed Telecommunication Network (AFTN) and the Air Traffic Services Direct Speech (ATS/DS) Network in the AFI Region, identification of deficiencies and remedial action for their elimination

AFS implementation status and performance

4.1.1 The meeting noted that States had implemented the requirements for AFS communications as contained in the AFI Air Navigation Plan (ANP), FASID Tables CNS 1A (AFTN Rationalized Plan) and CNS 1D (ATS/DS Plan), using digital technology. However, some of the required AFTN circuits (such as Addis-Ababa/Asmara, Addis-Ababa/Djibouti) and ATS/DS circuits (such as Addis-Ababa/Asmara, Bujumbura/Kinshasa, Djibouti/Hargeisa, Kigali /Kinshasa) were yet to be implemented. The following drat conclusion was formulated:

DRAFT CONCLUSION 4/01	**NEED FOR ICAO ASSISTANCE IN THE RESOLUTION OF AFS DEFICIENCIES** THAT THE ICAO REGIONAL OFFICES SHOULD EXPLORE ALL AVENUES TO ASSIST THE STATES CONCERNED IN RESTORING/IMPLEMENTING NON-OPERATIONAL AFS CIRCUITS BASED ON AFI AIR NAVIGATION PLAN REQUIREMENTS.

AFTN circuit availability

4.1.2 The meeting noted that the implementation of aeronautical satellite telecommunications networks had significantly improved AFTN circuits' availability in the Region. However, availability rates remained below the *specified minimum of 97% stated in the AFI Air Navigation Plan (AFI/7*

Recommendation 9/3) in some cases, thus preventing normal distribution of messages related to flight planning and coordination between ATS units, aeronautical information services (AIS), operational meteorological information (OPMET) and search and rescue (SAR), with a negative impact on air transport operations safety and efficiency.

AFTN Transit Time Statistics

4.1.3 The meeting noted from reports made available to the Secretariat that the transit times prescribed in the AFI Regional Air Navigation Plan (ANP) were not met in many cases. In order to facilitate a thorough analysis of the root causes and identification of appropriate remedial action, States responsible for the operation of AFTN circuits were requested to monitor transit time statistics on the 23rd day of each third month (January, April, July and October) of each year, and exchange them with correspondents, other administrations and ICAO Regional Offices.

AFTN Circuit Loading

4.1.4 The meeting emphasized the importance of carrying out performance evaluation of AFTN circuits on the basis of statistics collected for a period of minimum three days at the interval of six months from 23 to 25 April and October. It therefore requested AFTN centres and stations experiencing difficulties in taking character count due to system limitations to record circuits loading in accordance with the criteria specified in ICAO Doc. 8259 - *Manual on the Planning and Engineering of AFTN*.

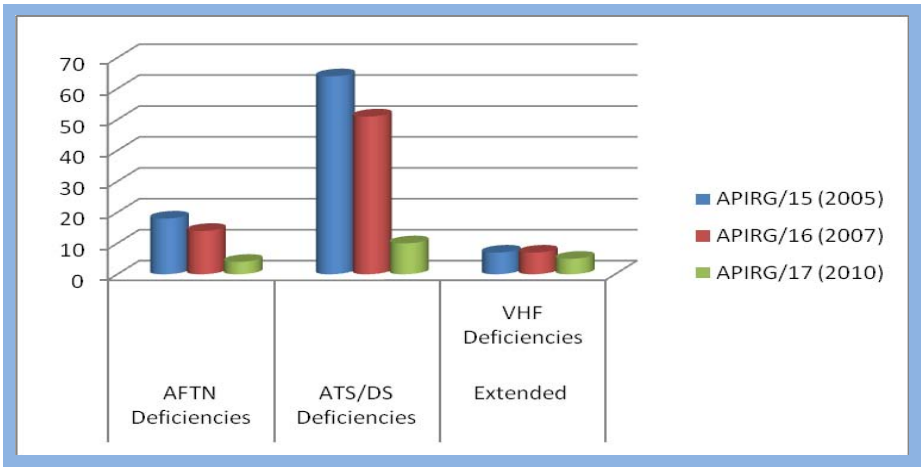
Transmission speed

4.1.5 The meeting noted that all AFTN main circuits were operating at 9.6 kb/second or 19.2 kb/second, while some links had the potential for meeting 64 kb/second requirement specified for ATN backbone circuits.

4.1.6 Appendix K to this report contains the AFS deficiencies reported in the AFI Region, in respect of international standards and recommended practices (SARPs) and requirements in the air navigation plan (ANP).

4.2 Review of the report of the First Joint Meeting of the AFI Aeronautical VSAT Networks Managers

4.2.1 The meeting reviewed the report of the First Joint Meeting of the AFI Aeronautical VSAT Networks Managers (AFI VSAT/1), which was held in Kwa-Zulu Natal, South Africa, from 13 to 15 June 2011, at the kind invitation of Air Traffic and Navigation Services Company Limited of South Africa (ATNS). It recognized the positive impact of VSAT technology in the resolution of air navigation deficiencies within the AFI Region as illustrated in the graphic below - *Communications deficiencies between APIRG/15 (2005) and APIRG/17 (2010):*



Challenges

4.2.2 It also noted a number of issues to be addressed to ensure that the existing aeronautical VSAT networks are technically and financially sustainable, and continue to operate satisfactorily meeting performance requirements and operational objectives. These included maintenance capabilities, modernization of network components, funding arrangements for the networks and related cost recovery mechanisms, and integration of VSAT networks in accordance as recommended by the Fifth meeting of All Planning and Implementation Regional Groups (ALLPIRG/5, 2006). ALLPIRG/5 particularly requested PIRGs to work towards integrated regional/interregional digital communication networks, with a centralized operational control and preferably based on the Internet Protocol (IP) (Conclusion 5/16 refers); and the Fourth Meeting of Directors-General of Civil Aviation (DGCA/4, 2010) accordingly called upon the African Commission for Civil Aviation (AFCAC), ICAO and other relevant institutions, including financial institutions, to support the implementation of such integrated programmes in the AFI Region, in order to enhance the regional air navigation infrastructure.

Comparative analysis

4.2.3 The various elements of existing VSAT networks (AFISNET, CAFSAT, NAFISAT and SADC VSAT 2) were thoroughly analyzed, including membership, system architecture, operations, working arrangements, interconnection with other networks, and development plans. Similarities and dissimilarities between the networks were identified and an initial set of applicable best practices associated with VSAT networks elements and features was discussed, based on ICAO standards and recommended practices and guidance material, as well as industry best practices. The following drat decision and conclusions were formulated:

DRAFT DECISION 4/02	**CONTINGENCY PLANNING FOR AFI VSAT NETWORKS OPERATED SATELLITES** THAT THE SECRETARIAT SHOULD OBTAIN FROM THE INTELSAT COMPANY DISASTER RECOVERY PLANS FOR USE BY THE AFI AERONAUTICAL VSAT NETWORKS MANAGERS AS PART OF THEIR CONTINGENCY PLANS AIMED AT ENSURING CONTINUITY OF SERVICE IN CASE OF DISRUPTION OR FAILURE OF THE OPERATED SATELLITES.

DRAFT CONCLUSION 4/03	**BEST PRACTICES FOR AFI VSAT NETWORKS** THAT THE AFI STATES AND AIR NAVIGATION SERVICES PROVIDERS (ANSPS) OPERATING AERONAUTICAL VSAT NETWORKS SHOULD ADOPT THE BEST PRACTICES STATED AT **APPENDIX C** TO THIS REPORT, AS WELL AS ANY OTHER BEST PRACTICES TO BE DEVELOPED AS REQUIRED.

DRAFT CONCLUSION 4/04	**IMPLEMENTATION OF AFISNET AND CAFSAT NETWORKS' MANAGEMENT AND CONTROL SYSTEMS** THAT AFISNET AND CAFSAT PARTICIPATING STATES AND ORGANIZATIONS SHOULD ESTABLISH COMMON NETWORK MANAGEMENT AND CONTROL SYSTEMS WITH SHARED RESPONSIBILITIES, AND HARMONIZE THEIR MAINTENANCE POLICIES IN TO ENHANCE SYSTEMS' AVAILABILITY AND RELIABILITY.

DRAFT CONCLUSION 4/05	**MODERNIZATION OF AFISNET AND CAFSAT NETWORKS** THAT AFISNET PARTICIPATING STATES AND ORGANIZATIONS SHOULD PURSUE THEIR ACTIVITIES AIMED AT ACHIEVING MODERNIZED NETWORKS THAT CONTINUE TO MEET REGIONALLY/INTER-REGIONALLY AGREED PERFORMANCE REQUIREMENTS.

DRAFT CONCLUSION 4/06	**MANAGEMENT OF INTERCONNECTIONS BETWEEN AERONAUTICAL VSAT NETWORKS** THAT THE CONCERNED STATES AND ORGANIZATIONS SHOULD ESTABLISH FORMAL ARRANGEMENTS TO IMPROVE THE MANAGEMENT OF VSAT NETWORKS INTERCONNECTIONS.

DRAFT CONCLUSION 4/07	**ARRANGEMENTS TO ENSURE SUSTAINABILITY OF NAFISAT AND SADC VSAT/2 NETWORKS** THAT, BASED ON EXPERIENCE GAINED AND AVAILABLE CAPABILITIES NAFISAT AND SADC VSAT/2 PARTICIPATING STATES SHOULD ESTABLISH ADMINISTRATIVE AND FUNDING ARRANGEMENTS IN A TIMELY MANNER TO ENSURE THAT AFS REQUIREMENTS CONTINUE TO BE MET.

Development of a regional project

4.2.4 The meeting acknowledged the need for a coordinated regional plan for the migration of the AFI AFS infrastructure towards an integrated regional/interregional digital communication network as a multinational facility/service *(AFI/7, Conclusion 10/6c)*, and established a dedicated task force with the terms of reference shown at **Appendix C** to this report. Proposals to be further considered by VSAT networks providers were received from the industry (INTELSAT and SITA).

4.2.5 Following discussions, the meeting formulated the following draft decision and draft conclusion:

DRAFT DECISION 4/08	**ESTABLISHMENT OF A TASK FORCE FOR THE REGIONAL PROJECT** THAT A TASK FORCE BE ESTABLISHED TO ADDRESS ISSUES RELATED TO THE DEVELOPMENT OF A REGIONAL PROJECT AIMED TO ENHANCE THE OVERALL PERFORMANCE OF AFI AERONAUTICAL VSAT NETWORKS, AND CONVERGE TOWARDS A CONSOLIDATED REGIONAL ATN INFRASTRUCTURE, WITH THE TERMS OF REFERENCE SHOWN AT **APPENDIX C** TO THIS REPORT. THE TASK FORCE SHOULD COMPLETE ITS ASSIGNED WORK BY DECEMBER 2011, AND REPORT TO APIRG/18 THROUGH THE CNS SUB-GROUP.

DRAFT CONCLUSION 4/09	**APPLICATION OF THE CONCEPT OF MULTINATIONAL FACILITY/SERVICE TO AN INTEGRATED AFI AERONAUTICAL TELECOMMUNICATION NETWORK (ATN) INFRASTRUCTURE.** THAT THE CONCEPT OF MULTINATIONAL FACILITY/SERVICE AS DEFINED IN THE REGIONAL AIR NAVIGATION PLAN (DOC 7474) BE APPLICABLE TO AN AFI INTEGRATED IP-BASED REGIONAL/INTERREGIONAL DIGITAL COMMUNICATION NETWORK, INCLUDING ITS EVOLUTION TOWARDS A CONSOLIDATED AFI AERONAUTICAL TELECOMMUNICATION NETWORK (ATN) INFRASTRUCTURE.

4.3 Review of the report of the first meeting of the AFI AMHS Implementation Task Force

4.3.1 The meeting reviewed and endorsed the report of First Meeting of the AFI ATS Message Handling System Implementation Task Force (AFI AMHS/I/TF/1), which was held at the ICAO Eastern and Southern Regional office, United Nations Complex, Nairobi, Kenya from, 19 to 20 May 2011, back to back with a Regional Workshop on ATS Message Handling System which took place from 17 to 18 May 2011. The workshop was based on ICAO SARPs and Guidance Material contained in *Annex 10 to the Chicago Convention, Doc 9880, Part 2 – Manual on detailed technical specifications for the AN using ISO/OSI Standards and Protocols*.

4.3.2 The meeting noted that a number of States had already implemented AMHS on a national basis, pending guidelines for international AMHS links. It accordingly recommended that AFI States conclude bilateral and/or multilateral agreements using the model developed by the Task Force, and

conduct trials to ensure interoperability between their AMHS systems. It also requested the Secretariat to conduct a regional survey on AMHS implementation. The entire report on AFI AMHS/I/TF/1 is accessible on the ICAO public website *(http://www.icao.int)*.

4.3.3 The meeting endorsed the draft AFI AMHS Implementation Strategy developed by the Task Force, as shown at **Appendix D** to this report, subject to further amendments to be made (as necessary) by the Secretary, based on the data to be provided by States through the recommended regional survey. The following draft conclusion was formulated:

DRAFT CONCLUSION 4/10	**AFI AMHS IMPLEMENTATION STRATEGY** THAT THE AHMS STRATEGY SHOWN AT **APPENDIX D** TO THIS REPORT BE ADOPTED FOR THE AFI REGION.

4.3.2 The meeting identified further work to be carried out by the Task Force, including the development of an AFI AMHS Manual based on the EUR AMHS Manual (Version 6.0), and of a regional AMHS implementation plan. Accordingly, the meeting agreed to amend the terms of reference, composition and programme of the AFI AMHS Implementation Task Force as shown in **Appendix E** to this report.

4.3.3 The meeting recalled State letter AN 4/49.1-09/34 of 14 April 2009, providing States with the procedures established for global coordination of AHMS information. States were therefore requested to designate representatives to register as users of the ATS Messaging Management Centre (AMC), and ensure that the designated users are duly trained on AMC web-based platform before they are actually allowed to enter data in *http://www.eurocontrol.int/amc*, and communicate to the ICAO Regional Offices the relevant details to the AMC users to facilitate their accreditation enabling them to access the AMC.

4.4 Planning and implementation guidelines for communications

4.4.1 The meeting reviewed the strategy for the implementation of the Global Plan Initiative (GPI-22) on Communication Infrastructure as described in the Global Air Navigation Plan (Doc 9750), and adopted this strategy for the AFI Region. **Appendix L** to this report provides a detailed description of the strategy.

4.5 Other communications planning and implementations issues

Aeronautical Telecommunication Network (ATN) Planning issues - Draft AFI ATN Routing Architecture Plan

4.5.1 The meeting recalled that, in 2005, APIRG/15 meeting reviewed a draft AFI ATN routing architecture, providing technical guidance on the planning and implementation of the transition to the ATN for ground-ground communications within the ICAO AFI Region, and requested the Secretariat to circulate it to States for comments and proposals for further consideration by the CNS Sub-group. It therefore agreed on the urgent need to expedite this task in order to facilitate gradual implementation of ATN within the AFI Region, in a coordinated manner. The following drat decision was formulated:

DRAFT DECISION 4/11

DRAFT AFI ATN ARCHITECTURE PLAN

THAT THE SECRETARIAT:

1) SHOULD CIRCULATE TO AFI STATES AND ORGANIZATIONS THE DRAFT AFI ATN ARCHITECTURE PLAN SHOWN AT **APPENDIX F** TO THIS REPORT, FOR THEIR FINAL COMMENTS BY 30 NOVEMBER 2011; AND

2) ACCORDINGLY FINALIZE THE DRAFT AFI ATN ARCHITECTURE FOR ADOPTION BY APIRG/18.

VSAT networks – Performance monitoring

4.5.2 The meeting recalled that, as part of its work on the harmonization of implementation activities relating to the use of VSAT networks, and pursuant to Conclusion 5/17 of the ALLPIRG/5 meeting, ICAO had developed minimum performance targets for VSAT networks in support of aeronautical ground-ground communications. These minimum performance targets which were endorsed by ICAO SP AFI RAN (2008) are summarized in Table below.

Minimum performance targets for VSAT network performance

Parameter	Value	Explanatory notes
Availability	>= 99.8%	The required overall availability of the communication service to the end user. It includes the consideration of all scheduled/non-scheduled maintenance and sun outages.
Bit error rate (BER)	<= 1 in 10^{-7}	BER is applicable to the physical layer of communications. Forward error correction (FEC) may be employed to achieve this figure.
One-way latency	< 400 ms	This implies that for voice communications, only a single satellite hop should be used.
		The major contributor to the latency is the propagation delay of approximately 240 ms (a single hop).
		Voice compression and encoding also introduce additional delays.
Call blocking probability	<= 2.5 x 10^{-3} (or 1 in 400 attempts)	This applies to a normal switched voice communications environment. In certain operational scenarios, it may be necessary to guarantee the availability of a voice circuit upon demand by employing priority/pre-emption techniques or dedicated satellite resources.
Call set-up time	<= 2 s	

4.5.3 The meeting endorsed the monitoring methodology developed by the Informal Coordination Meeting of Air Traffic Services over the South Atlantic (SAT) in order to assess the performance of Aeronautical Fixed Services (AFS) supported by VSAT networks. This methodology is based on the use of performance data collection forms shown at **Appendix G** to this report. The meeting requested the Secretariat to finalize and circulate these forms to the States and entities charged with planning and implementation of VSAT networks in order to harmonize related performance measurement methodology between ICAO regions. The following drat conclusion was formulated:

DRAFT CONCLUSION 4/12

VSAT NETWORKS – PERFORMANCE MONITORING

THAT THE SECRETARIAT SHOULD FINALIZE THE PERFORMANCE DATA COLLECTION FORMS SHOWN AT **APPENDIX G** TO THIS REPORT; AND CIRCULATE THE FINALIZED FORMS FOR USE BY AFI STATES AND ENTITIES OPERATING/MANAGING VSAT NETWORKS IN ORDER TO HARMONIZE RELATED PERFORMANCE MEASUREMENT METHODOLOGY WITHIN AND BETWEEN ICAO REGIONS.

Missing flight plans

4.5.4 The CNS Sub-group discussed the outstanding issue of missing flight plans in the AFI Region, in coordination with the ATM/AIM/SAR Sub-group. Mindful on the inherent safety risks, the two Sub-groups requested the Secretariat to coordinate a three-day regional survey from 15 to 17 August 2011, covering operational and technical aspects of flight plan processing. The following drat conclusions were formulated:

DRAFT CONCLUSION 4/13	**NEED FOR FURTHER INVESTIGATIONS ON THE LACK OF FLIGHT PLANS** THAT, CONSIDERING THE HIGH PRIORITY TO BE ACCORDED TO THE ISSUE OF LACK OF FLIGHT PLANS, AFI AIR TRAFFIC SERVICE UNITS (ATSUS) REPORT AND CONDUCT INVESTIGATIONS ON MISSING FLIGHT PLANS DURING THE PERIOD FROM 15 TO 17 AUGUST 2011. THE RESULTS OF THEIR INVESTIGATIONS SHOULD BE COMPILED USING THE FORM ATTACHED TO THE REPORT, AND COMMUNICATED TO THE RELEVANT ICAO REGIONAL OFFICES.

DRAFT CONCLUSION 4/14	**INVESTIGATIONS ON THE LOSS OF AFTN MESSAGES IN THE AFI REGION** THAT, IN ORDER TO FURTHER ANALYZE AND MITIGATE THE LOSS OF AFTN MESSAGES, INCLUDING FLIGHT PLAN MESSAGES IN THE REGION, AFI AFTN CENTRES CARRY OUT A THREE-DAY SURVEY ON AFTN PERFORMANCE FROM 15 TO 17 AUGUST 2011 (INCLUSIVE), USING THE FORMS AND MODEL MESSAGES TO BE CIRCULATED BY THE SECRETARIAT. IN SO DOING, THEY SHOULD: 1) USE THE AFTN ADDRESSES OF THEIR ATSUS CORRESPONDENTS IN THE AFI REGION; 2) PROVIDE AVAILABILITY OF THE AFTN CIRCUIT(S) INVOLVED, BASED ON THE IMPLEMENTED ROUTING CONFIGURATION; AND 3) PROVIDE TRANSIT TIMES. NOTE: THE RESULTS OF THE AFTN SURVEY SHOULD BE SENT TO THE RELEVANT ICAO REGIONAL OFFICE BY 25 AUGUST 2011.

REPORT ON AGENDA ITEM 5: AERONAUTICAL MOBILE SERVICE (AMS)

5.1 Review of the implementation and performance of the Aeronautical Mobile Service in the AFI Region, identification of deficiencies and remedial action for their elimination

5.1.1 The CNS Sub-group reviewed the implementation status and the performance of aeronautical mobile services in the AFI Region and noted the efforts made by States and Organizations to improve the aeronautical mobile service. **Appendix K** to this report contains the deficiencies affecting the aeronautical mobile service in the AFI Region.

5.2 Very High Frequency Communications (VHF) and other Aeronautical Mobile Service (AMS) issues

Very High Frequency Communications (VHF)

5.2.1 The meeting noted significant improvement in VHF radio extension coverage in most FIRs. However, possibilities of further extending VHF radio coverage were limited in many areas where implementation of remote stations is not practicable.

Other Aeronautical Mobile Service (AMS) issues

a) Controller-Pilot Data Link Communications (CPDLC)

5.2.2 The meeting noted that operational controller-pilot data link communications (CPDLC) were being implemented by States and Organization in their managed FIRs[1], in order to mitigate the geographical challenges limiting VHF radio coverage extension in some areas, as well as limitations inherent to HF radio communications. It recalled that the requirement for AFI ACCs was introduced in the Regional Air Navigation Plan (ICAO Doc 7474) by APIRG/13 in 2001, to support en-route operations, as well as APIRG Conclusion 17/25 reiterating this requirement.

b) Required Communication Performance (RCP)

5.2.3 The meeting discussed the concept of required communication performance (RCP) developed by ICAO in Doc. 9869, and its implementation in the AFI Region. RCP is a performance specification designed to serve as one possible safety net in airspace planning, to ensure that infrastructural, operational and technological components blend the aircraft systems and the ground systems to deliver a safe, reliable and repeatable service. The meeting reiterated APIRG Conclusion 17/26 requesting ICAO to support the implementation of the RCP concept through regional seminars and workshops.

c) Global Operational Data Link Document (GOLD)

5.2.4 The meeting was updated on developments concerning the Global Operational Data Link Document (GOLD), aimed to facilitate global harmonization of existing data link operations and resolve regional and/or State differences impacting seamless operations. It includes required communication performance (RCP) and surveillance specifications, based on RTCA DO-306/EUROCAE ED-122, and guidelines on post-implementation monitoring and corrective action to address a number of issues with satellite data communication services.

5.2.5 The meeting noted that the GOLD was finalized, and adopted by APANPIRG, NAT SPG and SAT groups[2]. It therefore recommended its adoption by APIRG to replace the current FANS 1/A Manual (FOM) endorsed by APIRG/16 (Conclusion 16/33 refers). The GOLD document can be downloaded using the following links:

1. *http://www.paris.icao.int/documents_open/subcategory.php?id=106,*
2. *http://www.ispacg-cra.com, and*
3. *http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/oceanic/data_link/.*

[1] In 2011, CPDLC procedures were operational/planned in Antananarivo, Brazzaville, Dakar Terrestrial, Dakar Oceanic, Johannesburg, Mauritius, Ndjamena, Niamey, Sal Oceanic, and Seychelles.

[2] The U.S. FAA recognizes the GOLD in its Advisory Circular (AC) 20-140A - Guidelines for Design Approval of Aircraft Data Link Communication Systems Supporting Air Traffic Services (ATS), and AC 120-70B - Operational Authorization Process for Use of Data Link Communication System.

5.2.6 The following draft conclusion was formulated:

DRAFT CONCLUSION 4/15	**ADOPTION OF THE GLOBAL OPERATIONAL DATA LINK DOCUMENT (GOLD)** THAT IN ORDER TO ENSURE REGIONAL AND GLOBAL HARMONIZATION OF DATA LINK OPERATIONS, THE GOLD BE ADOPTED FOR THE AFI REGION, IN REPLACEMENT OF THE FANS 1/A OPERATIONS MANUAL. NOTE: SOUTH AFRICA COORDINATES THE MAINTENANCE OF THE GOLD FOR THE AFI REGION.

5.3 Planning and implementation guidelines for communication data link applications

5.3.1 The meeting reviewed the strategy for the implementation of the Global Plan Initiative (GPI-17) on Communication Data Link Applications as described in the Global Air Navigation Plan (Doc 9750), and adopted this strategy for the AFI Region. **Appendix L** to this report provides a detailed description of the strategy.

REPORT ON AGENDA ITEM 6: IMPLEMENTATION AND PERFORMANCE OF AERONAUTICAL RADIO NAVIGATION SERVICE (ARNS)

6.1 Review of the implementation and performance of the aeronautical radio navigation service (ARNS)

6.1.1 The meeting reviewed the implementation and performance of the Radio Navigation systems. The meeting noted that there has not been any significant improvement in the service since the CNS/SG/3 meeting. **Appendix K** to this report contains the outstanding deficiencies affecting the aeronautical radio navigation service in the AFI Region.

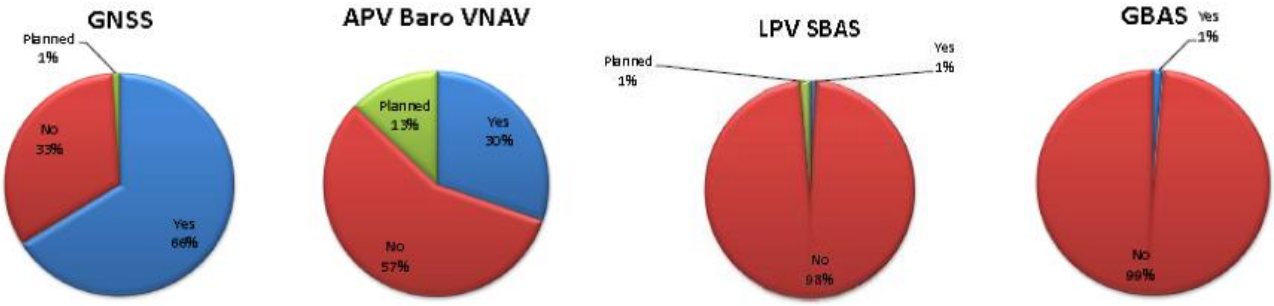
6.2 GNSS implementation

AFI SBAS Cost-Benefit Analysis

6.2.1 The meeting noted little progress in the implementation of APIRG Conclusion 17/29 on the need for an independent cost-benefit analysis for an AFI SBAS, and that coordination was being carried out between the Secretariat and AFCAC in order to have the study completed through consultancy before APIRG/18, based on the terms of reference developed by the Secretariat. It also noted that some States were contemplating the use SBAS for domestic operations involving poorly equipped airports that are not used by major airlines.

6.2.2 Furthermore, the meeting analyzed the results of a global survey on aircraft equipage conducted by IATA with the participation of 218 member airline fleets (covering more than 6000 aircraft) in 2010. These results are summarized as follows with respect to GNSS capabilities:

- APV Baro-VNAV: 30% aircraft equipped (13% planned to equip)
- Basic GNSS: 66% aircraft equipped (1% planned to equip)
- LPV/SBAS: 1% aircraft equipped (1% planned to equip)
- GBAS: 1% aircraft equipped (0% planned to equip)



6.2.3 IATA reiterated its member airlines opposition to support an SBAS cost recovery mechanism.

6.2.4 The meeting was of the view that the implementation of Assembly Resolution A37-11[3] (PBN implementation) should not be delayed because of SBAS related issues, since the current PBN requirements could be met using the current navigation infrastructure and aircraft equipage.

AFI GNSS Strategy Update

6.2.5 The meeting reviewed the GNSS aspects of the second meeting of AFI PBN/GNSS Task Force which was held in Dakar, Senegal from 13 to 15 June 2011. It also reviewed the status of implementation of GNSS in AFI Region in light of the experience gained in the other ICAO regions, and accordingly agreed to develop or update existing guidance material intended to assist States in implementing GNSS, including documentation related to AFI GNSS strategy/implementation plan, including PBN requirements (Assembly Resolution A37-11 refers), capacity building and safety assessment.

6.2.6 The meeting discussed and endorsed the Draft Updated AFI GNSS Strategy developed by the Second Meeting of the AFI PBN/GNSS Implementation Task Force. The updated strategy combines the use of all available GNSS technologies standardized by ICAO, including basic GNSS, aircraft-based augmentation system (ABAS), satellite-based augmentation system (SBAS), and ground-based augmentation system (GBAS).

6.2.7 However, concerning SBAS technology, the updated strategy defines the following elements to be taken into account by States considering its implementation:

1. Availability of conclusive cost-benefit analysis (APIRG Conclusion 17/29 refers)
2. Full compliance with ICAO technical requirements (Standards and Recommended Practices);
3. Agreement between stakeholders on pre-implementation cost benefit analyses on case by case basis;
4. Application of the user pays principle across all sectors (SBAS users). National authorities shall prevent cross-subsidization of non civil aviation users of SBAS.

DRAFT CONCLUSION 4/16	**UPDATED AFI GNSS STRATEGY** THAT THE AFI GNSS STRATEGY BE UPDATED AS SHOWN AT **APPENDIX I** TO THIS REPORT.

6.2.9 The meeting was informed of a number of hurdles noted that although many hurdles could be addressed by adding guidance material to the GNSS Manual, some other hurdles, however, required action by other ICAO bodies, States or equipment manufacturers.

[3] Replacing Assembly Resolution A36-23

6.3 Planning and implementation guidelines for Navigation systems

6.3.1 The meeting reviewed the strategy for the implementation of the Global Plan Initiative (GPI-21) on Navigation Systems as described in the Global Air Navigation Plan (Doc 9750), and adopted this strategy for the AFI Region. **Appendix L** to this report provides a detailed description of the strategy.

REPORT ON AGENDA ITEM 7: SURVEILLANCE

7.1 Review of the status of implementation of the current aeronautical surveillance plan

7.1.1 The meeting reviewed the status of implementation of aeronautical surveillance requirements for en – route operations against the AFI Air Navigation Plan requirements, in accordance with APIRG Decision 16/26 (Review of CNS system performance). The meeting noted that operational automatic dependent surveillance – contract (ADS-C) procedures were being implemented by States and Organization in their managed FIRs[4], in order to improve aeronautical surveillance. It recalled that the requirement for AFI ACCs was introduced in the Regional Air Navigation Plan (ICAO Doc 7474) by APIRG/13 in 2001, to support en-route operations, as well as APIRG Conclusion 17/31 reiterating this requirement.

7.1.2 The meeting was presented with ASECNA plans to implement ADS-C its six managed flight information regions covering 18 AFI States.

7.2 Review of the Report of the Second Meeting of the AFI Surveillance Implementation Task (AS/I/TF/2)

Draft AFI Surveillance Strategy

7.2.1 The meeting reviewed the Second AFI Surveillance Implementation Task Force Meeting which took place on 20-21 June 2011 in Dakar, Senegal. It endorsed the Draft AFI Surveillance Strategy as amended by the Task Force, as shown at **Appendix I1** to this report. However, the CNS Sub-group, in conjunction with the ATM/AIM/SAR Sub-group, established an Ad Hoc Working Group to determine the separation minima to be supported by selected surveillance technologies.

DRAFT DECISION 4/17	**DRAFT AFI SURVEILLANCE STRATEGY** THAT AN AD HOC WORKING GROUP BE ESTABLISHED TO FINALIZE OPERATIONAL INPUTS TO THE DRAFT THE AFI SURVEILLANCE IMPLEMENTATION STRATEGY SHOWN AT **APPENDIX I1** TO THIS REPORT; AND THE FINALIZED DRAFT STRATEGY BE SUBMITTED TO APIRG/18 FOR ADOPTION.

Exchange and monitoring of surveillance data

7.2.2 The meeting discussed the need for neighboring States/ACCs to exchange surveillance data to enhance aeronautical surveillance in the region, and for the AFI Region to implement a monitoring system to address reported problems. These issues were included in the Task Force future work programme.

[4] In 2011, ADS-C procedures were operational/planned in Accra, Algiers, Antananarivo, Brazzaville, Dakar Terrestrial, Dakar Oceanic, Johannesburg, Mauritius, Ndjamena, Niamey, Sal Oceanic, and Seychelles.

Categorization of terminal areas (TMAs) and aerodromes

7.2.3 The meeting noted that a limited number of States had participated in the survey conducted by the Secretariat as a follow up to APIRG Conclusion 17/33, by providing the data that were needed for the categorization of terminal areas (TMAs) and aerodromes. It therefore urged States having not yet done so to task designated contact persons with collecting and providing the required data.

Automatic dependent surveillance – Broadcast (ADS-B)

7.2.4 The meeting was briefed on the progressive evolution of ADS-B standards up to Version 2 (DO-260B) which incorporates changes aimed to address the various problems identified from operational experience and application development activities. It also noted that the future work of ICAO would include the development of low-power and low-cost ADS-B OUT/IN units, as well as multistatic radar which uses the emissions of other radio transmitters (e.g. broadcasting stations) to get a fix on the aircraft. Accordingly, the meeting requested AFI States planning to implement ADS-B to establish a proper regulatory framework based on applicable standards.

Future work programme and composition of the AFI Aeronautical Surveillance Implementation Task Force

7.2.5 The meeting reviewed and updated the future work programme and composition of the Task Force as shown at **Appendix I2** to this report.

7.3 Planning and implementation guidelines for Aeronautical Surveillance

7.3.1 The meeting reviewed the strategy for the implementation of the Global Plan Initiative (GPI-9) on Situational Awareness as described in the Global Air Navigation Plan (Doc 9750), and adopted this strategy for the AFI Region. **Appendix L** to this report provides a detailed description of the strategy.

REPORT ON AGENDA ITEM 8: AERONAUTICAL RADIO FREQUENCY SPECTRUM ISSUES

8.1 Review of the Report of the Second Meeting of the AFI Frequency Management Group (AFI/FMG/2)

8.1 The meeting reviewed the Report of the Second Meeting of the AFI Frequency Management Group which took place in Dakar, Senegal, from 18 to 19 April 2011, as presented by the Secretariat and the Rapporteur (ASECNA). After considering the terms of reference of the FMG as defined by APIRG/17, and the relevant activities of ICAO Aeronautical Communication Panel Working Group F, the FMG assessed progress made in the implementation of the conclusions and decisions from its first meeting (AFI/FMG/1)[5] and from APIRG/17 meeting. The Group also reviewed the ITU WRC-2012 on-going global and regional preparatory activities, including the work of ICAO ACP, ICAO workshop (December 2010), ITU Conference Preparatory Meeting (CPM/2) and ATU Preparatory Meeting (February 2011). The entire report of AFI/FMG/2 can be downloaded from the ICAO public website (*www.icao.int/esaf*, *www.icao.int/wacaf*).

8.2 The CNS Sub-group endorsed the terms of reference of the AFI/FMG Rapporteur, as well as an action plan for the AFI/FMG whose tasks include specific issues to be addressed by States and Administrations:

[5] The First Meeting of the AFI Frequency Management Group (AFI/FMG) was held in Dakar, Senegal, in September 2009.

- Monitor and report to APIRG the status of available capacity in the various aviation frequency bands;
- Review ICAO SARPs and Guidance Material;
- Coordinate activities in aeronautical frequency planning and protection of the aeronautical spectrum;
- Maintain AFI COM Lists by providing the relevant data;
- Support to ICAO position for the ITU WRC-2012 through national and regional initiatives.

8.3 The AFI FMG terms of reference, composition and future work programme are provided at **Appendix J1** to this report, together with the Group's action plan. The terms of reference of the Group's Rapporteur are shown at **Appendix J2**.

DRAFT CONCLUSION 4/18	**IMPLEMENTATION OF AFI FMG ACTION PLAN** THAT AFI STATES AND ORGANIZATIONS IMPLEMENT THE ACTION PLAN PROPOSED BY THE AFI FREQUENCY MANAGEMENT GROUP AS SHOWN AT **APPENDIX J1** TO THIS REPORT.

8.2 Review of ICAO position, including updates and preparations for the ITU-WRC -2012

8.2.1 The meeting was informed that the ICAO Council, at the 3rd meeting of its 193rd Session on 15 June 2011, had approved updates to the ICAO position on the International Telecommunication Union (ITU) World Radiocommunication Conference (2012) (WRC-12) issues of critical concern to aviation. It recalled the original ICAO position that was sent to ICAO Contracting States under cover of State letter E 3/5-09/61 dated 30 June 2009, and that this letter had mentioned that prior to WRC-12 new developments resulting from studies under way in ICAO and ITU might require the submission of additional material to the conference. The approved updates contain that additional material based on the latest results of ICAO and ITU studies.

8.2.2 The meeting's attention was drawn to the fact that the ICAO position in Appendix would be submitted to the ITU WRC-12 as an information paper. As such, active support from States was deemed to be the only means to ensure that the results of the WRC-12 reflect civil aviation's need for spectrum (ICAO Assembly Resolution A36-25 refers).

8.2.3 As an example, support received from States to ICAO position at ITU WRC-07 had lead to Recommendation 724 (WRC-07) - Use by civil aviation of frequency allocations on a primary basis to the fixed-satellite service, which calls administrations, in particular in developing countries and in countries with remote and rural areas to:

- Recognize the importance of VSAT operations to the modernization of civil aviation telecommunications systems;
- Encourage the implementation of VSAT systems that could support both aeronautical and other communication requirements; and
- Expedite, to the maximum extent possible and as necessary, the authorization process to enable aeronautical communications using VSAT technology;

8.2.4 The meeting encouraged States/organizations to participate in the ICAO Regional Frequency Spectrum Workshop in preparation for ITU WRC-12, and the 25th Meeting of the Aeronautical Communication Panel Working Group F (ACP-WG/F/25) to be held in Dakar from 6 to 14 October 2011.

REPORT ON AGENDA ITEM 9: ICAO 37TH ASSEMBLY AND TWELFTH AIR NAVIGATION CONFERENCE (2012): CNS RELATED ISSUES

Need for a CNS technology roadmap

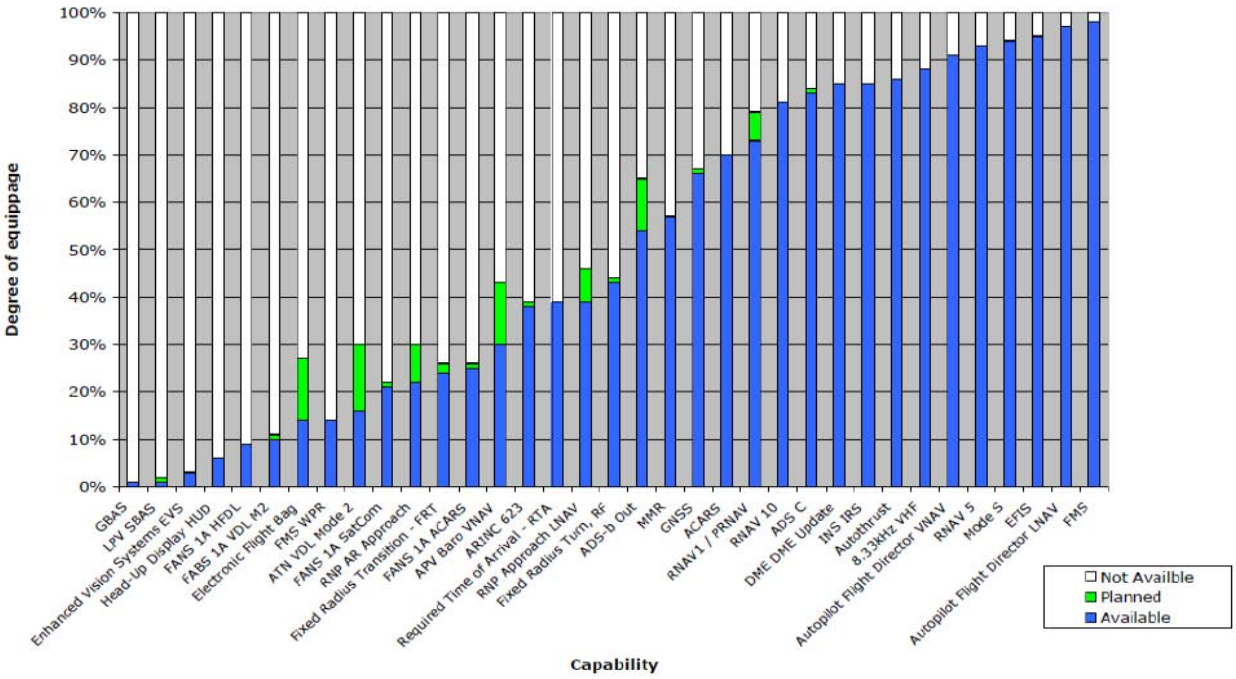
9.1 The meeting welcomed ICAO's initiative to develop a global roadmap applicable to international aviation as a whole that informs all States of the prospective capabilities of aircraft and also the implementation programmes of progressive ATS providers. It noted that at its 37th Session, the ICAO Assembly instructed the Council to organize a Twelfth Air Navigation Conference in 2012, to develop longer-term planning for ICAO based on an update of the Global Air Navigation Plan (GANP).

9.2 The Twelfth Air Navigation Conference (AN-Conf/12) would particularly develop communications, navigation, surveillance, avionics and aeronautical information roadmaps. The meeting therefore agreed that the work programme of the CNS Sub-group should include the development of regional roadmaps to be derived from the ICAO global roadmaps. These roadmaps would ensure compatibility between air navigation systems.

9.3 The meeting also requested States to promote collaborative decision- making and partnership within the aviation industry for developing and implementing integrated solutions for CNS infrastructure components, according to identified priorities; and called on AFCAC, ICAO and other relevant institutions to facilitate the funding arrangements necessary for integrated programmes aimed at enhancing the regional infrastructure, including human resource aspects, based on the CNS technology roadmaps.

Global survey on aircraft equipage

9.4 With respect to avionics, the meeting was presented with the results from a global survey conducted by IATA in 2010, covering 218 airline fleets and more than 6000 aircraft. These results are summarized as follows:



IATA Courtesy

9.5 The meeting emphasized the importance of having such comprehensive information on aircraft equipage for the purpose of air navigation system planning and implementation; and requested AFI States to provide the ICAO Regional Offices with detailed information concerning the level of equipage and capabilities of their registered aircraft.

DRAFT CONCLUSION 4/19	**IMPORTANCE OF AIRCRAFT EQUIPAGE IN AIR NAVIGATION SYSTEM PLANNING AND IMPLEMENTATION** THAT, WHEN MAKING THEIR DECISIONS WITH RESPECT TO THE PLANNING AND IMPLEMENTATION OF AIR NAVIGATION SYSTEMS, AFI STATES SHOULD TAKE DUE ACCOUNT OF AVAILABLE AND RELIABLE DATA AND FORECAST ON AIRCRAFT LEVEL OF EQUIPAGE AND CAPABILITIES.

DRAFT CONCLUSION 4/20	**AFI STATES' REGISTERED AIRCRAFT EQUIPAGE AND CAPABILITIES** THAT, AFI STATES SHOULD SUPPORT SURVEYS CONDUCTED ON AIRCRAFT EQUIPAGE AND CAPABILITIES BY PROVIDING THE ICAO REGIONAL OFFICES WITH DETAILED INFORMATION CONCERNING THEIR REGISTERED AIRCRAFT.

REPORT ON AGENDA ITEM 10: FUTURE WORK PROGRAMME AND COMPOSITION OF THE CNS SUB-GROUP

Review of the future Work Programme and Composition of the CNS Sub-group

10.1 Under this Agenda Item, the CNS Sub-group reviewed and updated its work programme and composition as shown in **Appendix M** to this report.

DRAFT DECISION 4/21	**FUTURE WORK PROGRAMME FOR THE CNS SUB-GROUP** THAT THE FUTURE WORK PROGRAMME AND COMPOSITION OF THE CNS SUB-GROUP BE AMENDED AS SHOWN AT **APPENDIX M** TO THIS REPORT.

REPORT ON AGENDA ITEM 11: ANY OTHER BUSINESS

Review of the conclusions and decisions of the Sixteenth Informal Meeting on the improvement of air traffic services over the South Atlantic (SAT/16) pertaining to CNS

11.1 The meeting was presented with the results of SAT/16 meeting of relevance to the APIRG CNS Sub-group. It particularly noted that SAT member States and Organizations had developed efficient cooperative initiatives aimed to ensure a coordinated implementation of CNS systems (AMHS, GNSS, SSR and ADS-C /CPDLC) through memoranda of understanding aimed to ensure their interoperability and interconnectivity, and recommended that AFI States participating in SAT activities should promote such initiatives in the AFI Region.

---END---

APPENDIX A

LIST OF PARTICIPANTS

No.	STATE/ ORGANIZATION	NAME	FONCTION	ADDRESS	TELEPHONE/FAX/E-Mail
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APPENDIX B

STATUS OF IMPLEMENTATION OF CONCLUSIONS AND DECISIONS OF APIRG/17

Conclusion/ Decision No. Strategic Objectives	Title of Conclusion/ Decision	Text of Conclusion/Decision	Deliverables/ Intended Outcome	Status of Implementation
Decision 17/12: **C**	Participation of Members at CNS/ SG Meetings	That, all States and Organizations which are members of the CNS sub-group should participate in sub-group meetings/teleconferences.	Increased participation in Sub-group activities ,	CNS/SG members notified. 60 participants attended CNS/SG/4 (July 2011)
Conclusion 17/13: **C**	AFTN Performance	That, D.R. Congo, Congo, Ghana and Nigeria should endeavour to improve the Accra/Kano and Brazzaville/Kinshasa circuits as soon as possible but not later than the end of December 2010.	Improved coordination between concerned FIRs.	States concerned have improved the circuits Accra/Kano and Brazzaville/Kinshasa.
Conclusion 17/14: **C**	AFTN Monthly Statistical Data	That, States which have not done so, follow up on and implement Recommendation 9/4 of AFI/7 (Performance of AFTN Circuits) and Decision 16/12 of APIRG/16 (Follow up of the performances of the aeronautical fixed service) by forwarding to the Regional Offices the AFTN Monthly Statistics (missing flight plans status, transit time statistics).	Statistical data submitted by all AFTN centres to support performance assessments.	States are providing the ICAO Regional Offices with their: • AFTN statistics of availability on a monthly basis, • Quarterly transit time statistics; and • Inputs to missing flight plans within the framework of regional surveys conducted
Conclusion 17/15: **C**	Development of an AFTN Database	That: a) States provide AFTN centers with statistics software for the automation of AFTN data collection; and b) ICAO develop a secured data base to facilitate web-based electronic compilation of AFTN statistical data collection and monitoring.	a) Timely submission of, and access to, statistical data facilitated. b) Improved monitoring of AFTN performance.	a) Implementation in progress. b) ICAO is in the process of developing a global Air Navigation database and web-based software tools to facilitate implementation monitoring.
Conclusion 17/16: **C**	Implementation of AMHS	That, when implementing AMHS as part of Aeronautical Telecommunication Network (ATN) system, AFI States and Organizations adopt a cooperative approach based on a regional coordination to ensure the continuity of AFS during the transition period between AFTN and full AMHS operations.	Coordinated implementation of AMHS in the Region.	The CNS Sub-group developed draft guidance material to assist States in implementing regional requirements for AMHS. Implementation timelines to be established by CNS/SG/5.

Conclusion/ Decision No. Strategic Objectives	Title of Conclusion/ Decision	Text of Conclusion/Decision	Deliverables/ Intended Outcome	Status of Implementation
Conclusion 17/17: **C**	Creation of an AMHS Implementation Task Force	That: a) A task force be formed with Terms of Reference as at Appendix 3.3A to this report in order to coordinate and plan for the implementation of AMHS in AFI; and b) ICAO continue to strongly support States in the implementation of AMHS by organizing more relevant workshops and seminars in AFI region.	a) Regional implementation strategy developed and adopted by APIRG. b) Aviation personnel familiarized with AMHS technology and procedures.	a) AMHS Implementation Task Force established in 2010. b) One ICAO Regional AMHS Workshop was held in 2011. States advised to register to Eurocontrol AMHS COM Centre (AMC), and AMC training guidelines developed, including computer- based training of registered personnel.
Conclusion 17/18: **C**	Implementation of ATS/DS Circuits	That, concerned States and Organizations take appropriate action and implement the outstanding AFI ANP ATS/DS Circuits. In doing so, the guidelines developed by ICAO for the implementation of VSAT should be taken into consideration and ensure: a) Harmonized networks avoiding the multiplication of sub-networks and technology; and b) Cost effective networks by sharing existing networks interconnection capability.	Full connectivity and improved coordination between ATS units.	a) Implementation achieved through AFISNET, CAFSAT, NAFISAT and SADC VSAT networks b) AFI States have implemented ATS/DS facilities in accordance with ANP requirements. (except States listed in APIRG Conclusion 17/19 below). To be discussed under APIRG/18 Agenda item 3.
Conclusion 17/19: **C**	Activation of AFS Circuits	That: a) DRC, Ethiopia, Eritrea, Rwanda and Burundi endeavour to activate the following circuits which have been implemented through NAFISAT/SADC/2 Networks in order to improve flights coordination: • Addis Ababa/Asmara, • Kinshasa/Kigali; and • Bujumbura/ Kinshasa. b) ICAO facilitates the necessary arrangements as required.	a) Activation of Addis Ababa/ Asmara, Kinshasa/Kigali and Bujumbura/ Kinshasa circuits. b) Improved	a) These links are yet to be implemented..To be discussed under APIRG/18 Agenda item 4. b) Follow up action was taken by the Secretariat and during NAFISAT and SADC VSAT coordination meetings in 2010 and 2011.

Conclusion/ Decision No. Strategic Objectives	Title of Conclusion/ Decision	Text of Conclusion/Decision	Deliverables/ Intended Outcome	Status of Implementation
			ATS coordination and flight safety.	
Decision 17/20: **C**	Need for an ATS-Voice Numbering Plan for AFI	That, in accordance with ICAO manual on ATS ground-ground voice switching and signaling (Doc 9804, Chapter 2 Section 2.3): a) A technical study for the development of a global ATS voice numbering plan for the AFI Region be conducted to ensure inter regional interconnection and interoperability of Voice Communication Switching Systems (VCSS) and; b) The work programme of the CNS/SG be amended accordingly.	Numbering plan developed for ATS voice communications.	a) The technical study is subjected to availability of funds. b) Implemented
Conclusion 17/21: **C**	AFISNET Network	That, AFISNET States/Organizations pursue their effort in implementing the various conclusions of the previous relevant meetings (Conclusion 16/07 of SNMC/16; Recommendation 6/18 of SP AFI RAN; Conclusion 17/02 of SNMC/17; Conclusions of the Joint Technical Team) to modernize the network by evaluating and re-engineering AFISNET.	Sustainable network meeting performance requirements.	A request for proposals was developed by AFISNET Management Committee meeting in accordance with SP AFI RAN/08 Recommendation 6/8.. To be discussed under APIRG/18 Agenda item 3.
Conclusion 17/ 22: **C**	Regular Meetings between VSAT Network Managers	That, in order to ensure interoperability between VSAT Networks AFI States should implement Recommendation 6/19 of SP AFI RAN 2008 calling for regular meetings to be held by VSAT Managers under the coordination of ICAO Regional Offices.	Integrated /consolidated SAT network.	Two Joint meetings of AFI VSAT networks managers meetings were held in 2011 and 2012. To be discussed under APIRG/18 Agenda item 3.
Conclusion 17/23: **C**	Back Up-Systems for AFS	That, States provide suitable backup systems for AFS (ATS/DS and AFTN) based on available conventional and emerging technologies (satellite, fiber optics etc.), and install and/or enhance their backup systems using: a) Satellite telephone voice and/or data facilities; b) Public switched telephone network ; c) Secured internet; and d) Voice over Internet Protocol (VoIP).	Continuity of services.	Recommended technologies are being implemented by States when and where available to support their ATS contingency plans.

Conclusion/ Decision No. Strategic Objectives	Title of Conclusion/ Decision	Text of Conclusion/Decision	Deliverables/ Intended Outcome	Status of Implementation
Conclusion 17/24: **C**	Submission of COM Lists	That, States that have not done so, submit their updated COM lists to the ICAO Regional Offices. The submitted lists should have the aeronautical coordinates provided in WGS-84 format.	AFI COM lists completed Efficient frequency assignment planning and management.	States frequency assignments are being notified to ICAO Regional Offices
Conclusion 17/25: **C**	Implementation of CPDLC	That, States implement CPDLC procedures for en-route operations in their managed oceanic and remote continental airspace.	a) Increased use of data link communications. b) Improved air-ground communications in FIRs	CPDLC procedures have been implemented within Areas of routing AR1, AR2 and AR6 (Accra, Algiers, Antananarivo, Brazzaville, Canarias, Dakar Terrestrial and Oceanic, Johannesburg, Mauritius, Ndjamena, Niamey, Sal, and Seychelles FIRs). . To be discussed under APIRG/18 Agenda item 3.
Conclusion 17/26: **C**	Implementation of RCP Concept	That : a) States take the advantage of RCP concept stated in ICAO Doc 9869 to improve the provision of aeronautical mobile service (AMS) meeting service level agreements; and b) ICAO support the implementation of the RCP concept through Regional Seminars and Workshops	a) Efficient ATS communications. b) Aviation personnel familiarized with RCP concept.	a) Implementation of required communication performance (RCP) has been postponed pending regional guidelines, Applicable RCP types are yet to be defined by APIRG CNS/SG and ATM/AIM/SAR/ SG b) Workshop material is under development.
Conclusion 17/27: **C**	Elimination of Aeronautical Radio navigation Service (ARNS) Deficiencies	That, States take urgent action to eliminate the current outstanding aeronautical radio navigation service (ARNS) deficiencies as identified in Appendix 4.1D to the report.	Increased compliance with Air navigation plan requirements.	Implementation in progress. To be discussed under APIRG/18 Agenda item 4 .
Conclusion 17/28: **C**	Need for a High Level Meeting on AFI GNSS Strategy	That, in order to assist AFI States in making an informed decision on the regional strategy for the introduction of GNSS applications, AFCAC organize as a matter of urgency a high level meeting in coordination with ICAO,	a) High level meeting held. b) Consistency in AFI GNSS Strategy.	An AFCAC/AU meeting was held in November 2010.

Conclusion/ Decision No. Strategic Objectives	Title of Conclusion/ Decision	Text of Conclusion/Decision	Deliverables/ Intended Outcome	Status of Implementation
		ASECNA, IATA, AFRAA and other relevant stakeholders.		
Conclusion 17/29: **C**	Need for an Independent Cost-Benefit Analysis	That, considering the lack of consensus between stakeholders on available cost-benefit analyses related to SBAS implementation in the AFI Region, a cost benefit analysis based on objective assumptions should be performed by independent experts, and submitted to the high level meeting to be organized by AFCAC on AFI GNSS strategy, for consideration.	Independent SBAS cost-benefit analysis completed.	Comprehensive Terms of reference developed for the study. Implementation subjected to availability of funds.
Decision 17/30: **C**	Coordination of Traffic Data for Aeronautical Studies	That, APIRG bodies should closely coordinate their work with the AFI Traffic Forecasting group (TFG) to ensure that accurate and reliable traffic data are made available for aeronautical studies conducted in the AFI Region, including CNS/ATM related Cost Benefit Analysis (CBA).	Common and reliable data source used for aeronautical studies in the Region.	Secretaries of APIRG bodies (sub-groups, task force) notified for consideration when conducting studies pertaining to their specific areas.
Conclusion 17/31: **C**	Implementation of ADS-C.	That, States implement ADS-C Procedures for en-route operations in their managed oceanic and remote continental airspace.	Improved situational awareness for en-route operations.	ADS-C procedures are operational in areas of routing AR1, AR2 and AR6 (Accra, Algiers, Antananarivo, Brazzaville, Canarias, Dakar Terrestrial and Oceanic, Johannesburg, Mauritius, Ndjamena, Niamey, Sal, and Seychelles FIRs).
Decision 17/32: **C**	Development of AFI Surveillance Strategy	That, in order to finalize the development of AFI Surveillance Strategy, the Terms of Reference, work programme and composition of the AFI Surveillance Task Force be amended as shown in Appendix 3.3D to this report.	AFI Surveillance Strategy finalized.	AFI Surveillance Strategy developed by the Aeronautical Surveillance Implementation Task Force, for consideration by the CNS Sub-group.
Conclusion 17/33: **C**	Data collection for Aerodrome and TMA categorization	That, no later than 31 December 2010, States which have not yet done so, compile and submit the relevant data concerning their managed aerodromes and Terminal Areas (TMAs) in order to facilitate the work of the CNS sub-group on their categorization. To this effect, States should ensure that close coordination is carried out between	Aeronautical surveillance requirements established based on categorization of AFI TMAs and aerodromes.	Survey conducted by ICAO Regional Offices with poor feedback from States.

Conclusion/ Decision No. Strategic Objectives	Title of Conclusion/ Decision	Text of Conclusion/Decision	Deliverables/ Intended Outcome	Status of Implementation
		civilian and military stakeholders.		
Conclusion 17/34: **C**	ICAO Position for the ITU WRC-2012	That, States and Air Navigation Service Providers (ANSPS): a) Continue their efforts on implementation of the relevant elements of ICAO Assembly Resolution A32-13 and in particular, participate in the preparatory work of the ITU and the ATU for WRC; and b) Continue to assign high priority to the tasks relating to the protection and availability of Radio frequency spectrum allocated to aeronautical services and in particular, actively participate in the relevant activities of the ITU-R and ATU.	Support to ICAO position for ITU WRC-12.	WRC-12 will be held in Geneva from 23 January to 17 March 2012, with the participation of CAA personnel in regional preparatory activities, and in AFI States delegations, conference committees, and coordination meetings with ICAO and ATU (African Group).
Conclusion 17/35: **C**	Deletion of Footnotes 5.330, 5.362B and 5.362C	That, States with footnotes at 5.330, 5.362B and 5.362C be urged to contact their spectrum regulators to delete theses footnotes	Footnotes deleted from ITU Radio Regulations.	AFI States concerned are listed in the ITU Radio Regulations. Included in ICAO position for WRC-12.
Conclusion 17/36: **C**	Registration of Operational Frequencies	That, States which have not formally registered their operational frequencies take the necessary steps to register their operational frequencies with their Telecommunication Regulatory Authorities.	All aeronautical frequencies duly registered.	States concerned are in the process of getting their operational frequencies registered in the ITU International Frequency Master Register.
Decision 17/37: **C**	Follow –Up of AFI/FMG Action Plan	That: a) The following States should follow up on ITU WRC-12 Agenda items and report to AFI/FMG: • South Africa: Agenda item 1.7; • Ghana: Agenda item 1.3; • Kenya: Agenda item 1.4; and b) The AFI/FMG rapporteur (ASECNA) coordinate and	Reports submitted to AFI/FMG and CNS/SG.	Ghana, Kenya and South Africa had delivered on these assignments. Action plan developed and presented to the 4th

Conclusion/ Decision No. Strategic Objectives	Title of Conclusion/ Decision	Text of Conclusion/Decision	Deliverables/ Intended Outcome	Status of Implementation
		follow up the AFI/FMG action plan and report to the CNS Sub-group.		meeting of APIRG CNS Sub-group (2011).
Conclusion 17/38: **C**	Non-Application of Charges for the Utilization of Aeronautical Frequency Spectrum	That, AFI States refrain from subjecting Air Navigation Service Providers to charges for the utilization of Aeronautical Frequency Spectrum, including aeronautical communications supported by VSAT Stations	AFI ANSPs exonerated from Radio Regulators' charges.	The Secretariat conducted a survey on States' policies and practices in 2011, with little feedback. Follow up action will be taken with States to get the required information.
Decision 17/39: **C**	Future Work Programme and Composition of The CNS Sub-Group	That, the work programme and composition of the CNS Sub-group be adopted as shown at Appendix 3.3F to this report.	CNS/SG work programme addressed and report submitted to APIRG/18.	Implemented.CNS/SG work programme and composition amended by CNS/SG/4 meeting.
Conclusion 17/40: **C**	CNS Performance Objectives	That, the CNS performance objectives and performance framework form developed by ICAO SP AFI RAN (2008) be amended as shown at Appendix 3.3G to this report.	Regional/national performance objectives updated..	Implemented. CNS regional performance objectives updated by CNS/SG/4 meeting.

APPENDIX C

VSAT NETWORKS BEST PRACTICES

		Best practices	Guidance material	Network compliance status			
				AFISNET	CAFSAT	NAFISAT	SADC
1.	**Year of completion**			1995	TBC	2008	2007
2.	**Period of Inception**			TBC	TBC	TBC	TBC
3.	**Membership**	N/A					
4.	**Satellite used**	Contingency planning required to ensure continuity of service in case of disruption or failure of operated satellite States shall provide the degree of facility reliability and availability consistent with their operational requirement.	ICAO, Annex 11 – Air Traffic Services, Section 2.30 ICAO, Annex 10, Volume I, Section 2.5 and Attachment F ICAO, Doc 9859 - Safety Management Manual.	No	No	No	No
5.	**Transponder (Up/Down)**	Contingency planning required to ensure continuity of service in case of disruption or failure of operated satellite States shall provide the degree of facility reliability and availability consistent with their operational requirement.	ICAO, Annex 11 – Air Traffic Services ICAO, Annex 10, Volume I, Section 2.5 and Attachment F ICAO, Doc 9859 - Safety Management Manual.	No	No	No	No
6.	**Frequency band**	In accordance with ITU Radio Regulations	ITU, Radio gulations	Yes	Yes	Yes	Yes
7.	**Topology**	Meshed network		Yes	Yes	Yes	Yes
8.	**Satellite access method**	Multiple Frequency – Time Division Multiple Access (MF-TDMA)	ICAO, Annex 10, Aeronautical Telecommunications, Volume III ICAO, Doc 9776, Manual on VHF Digital Link Mode 2	Yes	No	Yes	Yes

		Best practices	Guidance material	Network compliance status			
				AFISNET	CAFSAT	NAFISAT	SADC
			ICAO, Doc 9805, Manual on VHF Digital Link Mode 3				
9.	**Lease Bandwidth**	Available bandwidth should accommodate current and future services	ICAO, Annex 10, Aeronautical Telecommunications, Volume II ICAO, Annex 11, Air Traffic Services ICAO, Doc 4444 – PANS/ATM ICAO, Doc 9880- Detailed Technical Specifications on ATN ICAO, Doc 7474 (ANP/FASID)	Yes	Yes	Yes	Yes
10.	**Administrative arrangements**	States commitment should be formalized and documented, including delegation of operational, technical and financial authority (as applicable).	ICAO, Doc 7474 (ANP/FASID) – Guidelines for multinational facility/service	No	No	Yes	Yes
11.	**Technical arrangements (Maintenance Management)**	Network control centre (NCC) should be implemented for all networks.	ICAO, ALLPIRG/5, Conclusion 5/16	No	No	Yes	Yes
12.	**Network control centre (NCC)**	Network control centre (NCC) should be implemented for all networks. Dedicated Engineering Service Channels recommended	ICAO, ALLPIRG/5, Conclusion 5/16	No	No	Yes	Yes
13.	**Dedicated engineering service channel**	A dedicated service channel is recommended to facilitate coordination of maintenance between networks' stations	ICAO Annex 10, Volume I, Attachment F	Yes	Yes	No	No
14.	**Services supported**	Aeronautical fixed services (AFTN, ATS/DS) Aeronautical mobile service (AMS) – Extended VHF radio coverage	ICAO, Annex 10, Aeronautical Telecommunications, Volume II ICAO, Annex 11, Air Traffic Services ICAO, Doc 4444 –	Yes	Yes	Yes	Yes

		Best practices	Guidance material	Network compliance status			
				AFISNET	CAFSAT	NAFISAT	SADC
		Aeronautical Telecommunication Network (ATN) applications (AMHS, AIDC)	PANS/ATM ICAO, Doc 9880- Detailed Technical Specifications on ATN ICAO, Doc 7474 (ANP/FASID)				
15.	**New Services to be supported**	To be defined.		N/A	N/A	N/A	N/A
16.	**Funding mechanism for the networks**	Sustainable funding mechanism required for all networks.	ICAO, Doc 9082 – Policies on user charges	Yes	Yes	No	No
17.	**Connecti-vity (internal connectivity and interconnectio ns with other networks)**	Full connectivity required within and between all the networks ICAO to address all the identified non-technical issues.	ICAO, Doc 7474 – Air Navigation Plan (FASID) Connectivity Matrices for ATS/DS and AFTN AFI AFTN Routing Directory	No	No	No	No
18.	**Manage-ment of interconnectio ns**	Formal agreements recommended to address interconnection issues	ICAO Annex 10, Aeronautical Telecommunication s, Vol.II, Paras. 2.4.1 and 2.4.4	No	No	No	No
19.	**Base band transmis-sion protocols**	Use of standardised bit-oriented protocols Internet Protocol Suite (IPS) recommended X25 to be discontinued	ICAO, Annex 10, Aeronautical Telecommunication s, Volume III ICAO, Doc 9896 – Manual on ATN using IPS Standards and Protocols AFI/7 - Recommendation 9/6 APIRG Conclusion 13/10 APIRG Conclusion 16/13 APIRG Conclusion 16/14				
20.	**Transmis-sion speed**	AFTN main circuits: 1200 bauds ATN circuits: 9.6 Kbps ATN backbone circuits: 64 Kbps	APIRG Conclusion 12/13 APIRG ATN/TF/2 Report	Yes	Yes	Yes	Yes
21.	**AFTN circuit availability**	Circuit availability should be monitored and provided to ICAO Regional	ICAO, Doc 7474, ANP (AFI/7 Recommendations 9/3 and 9/4)	Yes	Yes	Yes	Yes

		Best practices	Guidance material	Network compliance status			
				AFISNET	CAFSAT	NAFISAT	SADC
		Office on monthly basis. Minimum requirement is: 97%					
22.	**Message transit times**	Message transit times should be monitored and provided quarterly to ensure that operational requirements are met.	ICAO, Annex 11, Air Traffic Services, Chapter 6 ICAO, Doc 8259, Manual on the Planning and Engineering of AFTN APIRG Conclusion 12/13	No	No	No	No
23.	**AFTN circuit loading**	Performance evaluation of AFTN circuits is required on the basis of statistics collected for a period of minimum three days at the interval of six months from 23 to 25 April and October. These include traffic volume, traffic statistics and circuit occupancy, which are needed to assess the suitability of the modulation rate of AFTN circuits.	ICAO, Doc 8259, Manual on the Planning and Engineering of AFTN	No	No	No	No

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APPENDIX D

TASK FORCE ON THE DEVELOPMENT OF REGIONAL PROJECT ON AN AFI INTEGRATED AERONAUTICAL TELECOMMUNICATION INFRASTRUCTURE TERMS OF REFERENCE

1. Vision

a) Continue to improve safety within the AFI region.
b) Enhance AFI Aeronautical Infrastructure safety.
c) Improve the contribution of infrastructure in AFI safety endeavours.
d) To enhance contribution of aeronautical communications infrastructure in the AFI region.
e) Enhancement of safety through elimination of deficiencies associated with AFI aeronautical infrastructure.

2. Objectives

a) Develop a sustainable and integrated/interoperable VSAT networks to provide aeronautical telecommunications services in AFI region;
b) Upgrade technical capabilities of the networks to comply with the ICAO SARPs and guidance material, user requirements and global best practices;
c) Ensure financial sustainability of the networks through equitable and fair allocation of costs to states and users;
d) Create harmonious and seamless administrative oversights for the networks;
e) Enlist states' commitment to this initiative;
f) Achieve the ATN concept for AFI; and
g) Apply appropriate costs-effective technologies.

3. Deliverables

The deliverables expected from the Task Force include:

3.1. Technical:

Deliverables   *a) Detailed gap analysis based on ICAO SARPs and guidance material, user requirements and global best practices;*   *b) Architectural requirements; Recommendations for a road-map, to be implemented by States; and*   **c)** *Maintenance.*
Deliverable   *Amendment proposal to the Air Navigation Plan as appropriate*.

Composition of the Technical Team:

- Egypt, ATNS (South Africa, **Team Leader**), Tanzania, ASECNA, Roberts FIR,

Botswana, Mozambique, Nigeria, IATA, Rwanda, France/Reunion, Swaziland, Uganda, SITA, CACAS

3.2. Financial:

Deliverables

a) Cost estimates;
b) Funding (project teams and integrated network model);
c) Cost recovery methods (cost sharing amongst states, billing); and
Maintenance.

Composition of the Financial Team:

- ATNS (South Africa), ASECNA (**Team Leader**), IATA, France, Kenya, Uganda

3.3. Administrative:

Deliverables

a) Oversight model;
b) States' commitment;
c) Legal issues; Governance; and
d) Maintenance.

Composition of the Administrative Team:

- ATNS (South Africa), ASECNA, Egypt, IATA, Kenya (**Team Leader**), Tanzania

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APPENDIX D2

AFI ATS MESSAGE HANDLING SYSTEM IMPLEMENTATION TASK FORCE (AFI AMHS/I/TF)

TERMS OF REFERENCE, WORK PROGRAMME AND COMPOSITION

1-TERMS OF REFERENCE

1) Conduct a comprehensive review of ICAO Standards and Recommended Practices (SARPs) pertaining to the Air Traffic Services Message Handling Service (ATSMHS) application as specified in Annex 10 – *Aeronautical Telecommunications* - Volume II and Volume III, and guidance material contained in ICAO *Manual on detailed specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI standards and protocols* (Doc.9880), *Global Air Navigation Plan* (Doc 9750) and other relevant provisions ;
2) Collect and analyze information on the status of AFI ANSPs ATS Message Handling Systems plans, including ongoing upgrades to existing systems;
3) On the basis of the above, develop a coordinated AFI transition strategy and plan with associated timelines to enable the streamlined coordinated implementation of AMHS.

Considerations

In addressing its terms of reference, the Task Force should consider, *inter alia*, the following aspects:

1) AFI AMHS systems should be:
    a. implemented in accordance with ICAO SARPs and technical specifications, and
    b. interoperable with systems implemented by other ICAO Regions;
2) Personnel training for operational migration from AFTN to AMHS;
3) AFS network backbone capabilities;
4) Systems that transition early will need to be capable of handling both AMHS and AFTN messages.
5) Establishment of an Information Management system to track implementation timelines; and
6) Impacts to users (compliance to new flight plan format, availability of qualified personnel, etc).

2-WORK PROGRAMME

Task No.	Global Plan Initiative	Subject	Target date
1	GPI-22	**Conduct of a Regional Survey on:** 1. AFS circuits specifications (circuit type, modulation rate, protocol, ITU code, VSAT network) 2. AMHS implementation status (implementations, plans, levels of service, protocols, implementation challenges, level of knowledge on AMHS and ATN, etc.) *Team Leader: Secretariat* *Team members: All Task Force Core members* *References:* • *APIRG/15 Report*	CNS/SG/5 2013

		• *ICAO Annex 10 (Vol. 2 and Vol.3)* • *ICAO Doc 9880*	
2	GPI-22	**Draft AFI AMHS Implementation Plan** 1. Draft AFI ATN Architecture 2. Draft AFI ATN Network Service Access Point Addressing Plan 3. Draft AFI AMHS Implementation Plan a. AFI FASID CNS1B Table b. AFI FASID CNS1C Table <u>*Team Leader: Rwanda*</u> *Team members: Angola, Ethiopia, Kenya, Mozambique, Rwanda, Sudan, Zimbabwe and ASECNA* *References:* • *Report of the Second Meeting of AFI ATN Planning Task Force* • *AFI Air Navigation Plan, FASID (CNS)* • *ICAO Annex 10 (Vol. 2 and Vol.3)*	CNS/SG/5 2013
3	GPI-22	**Draft AFI AMHS Manual** 1. Introduction 2. AFI AMHS Requirements 3. AFI ATS Messaging Service Profile 4. System implementation - Guidelines for system requirements 5. AMHS management 6. Tests and validation of systems 7. Operational procedures and recommendations 8. Miscellaneous 9. Appendices <u>*Team Leader: South Africa (ATNS)*</u> *Team members: Somalia (CACAS), South Africa, Tanzania, Uganda and ASECNA* *References:* • *ICAO EUR AMHS Manual (Doc 020)* • *ICAO Annex 10 (Vol. 2 and Vol.3)* • *ICAO Doc 9880*	CNS/SG/5 2013

3-COMPOSITION

Core members: *Algeria, Angola, Botswana, Egypt, Ethiopia, Ghana, Kenya, Malawi, Niger, Nigeria, Rwanda, Senegal, South Africa (ATNS), Sudan, Tanzania, Tunisia, Uganda, Zimbabwe, ASECNA, IFATSEA and Roberts FIR.*

Other members: *All AFI States and Air Navigation Service Providers (ANSPs) with implemented and planned AMHS systems.*

Note: *Members should nominate suitable experts involved in aeronautical telecommunications operations and systems engineering.*

-END-

APPENDIX E

STRATEGY FOR IMPLEMENTATION OF THE ATS MESSAGE HANDLING SYSTEM (AMHS) IN THE AFI REGION

TABLE OF CONTENT

1. INTRODUCTION

The ATS Message Handling System (AMHS), which has been defined in the ICAO Aeronautical Telecommunication Network (ATN) standards, is intended to be a replacement for the current legacy Aeronautical Fixed Telecommunications Network (AFTN).
In order to assist States /Organizations on the matters relating to the implementation of ATS Messages Handling System (AMHS) in the AFI region and to ensure a uniform, smooth and harmonious implementation and regional interoperability, the AMHS/I/TF was requested to develop a Draft AFI AMHS Implementation Strategy.

2. OBJECT OF THE DOCUMENT

This document presents the draft AFI strategy to guide States and/or Organizations in implementation of AMHS within the AFI Region as required by the terms of reference of the AFI AMHS/I/TF meeting, Nairobi, Kenya, 20-21 May 2011. The document contains:

- A background about the states of AMHS implementation in AFI and other Regions
- an AFI implementation strategy

3. BACKGROUND

The exchange of ATS messages, as part of the Aeronautical Fixed Service (AFS) defined in ICAO Annex 10 Volume II is an essential function to the safety of air navigation and to the regular, efficient and economical operation of ATS provision. The Aeronautical Fixed Telecommunications Network (AFTN/CIDIN) has so far provided an effective store-and-forward messaging service for the conveyance of text messages, using character-oriented procedures. However, with regard to the future requirements in the exchange of ATS messages and the technological evolution, AFTN/CIDIN technology is now becoming obsolete, and is not sufficiently flexible to support messaging functions found in modern messaging systems (such as transfer of binary information and data folders).

With a view to meet the critical requirements of the aviation community for enhancing its ground data communications by means of up to date technology, ICAO has specified that the Aeronautical Telecommunications Network (ATN) may replace the existing networks based on AFTN. The Aeronautical Telecommunication Network (ATN) will enable seamless communications between ground users (e.g. ANSPs, Airlines) and aircraft.

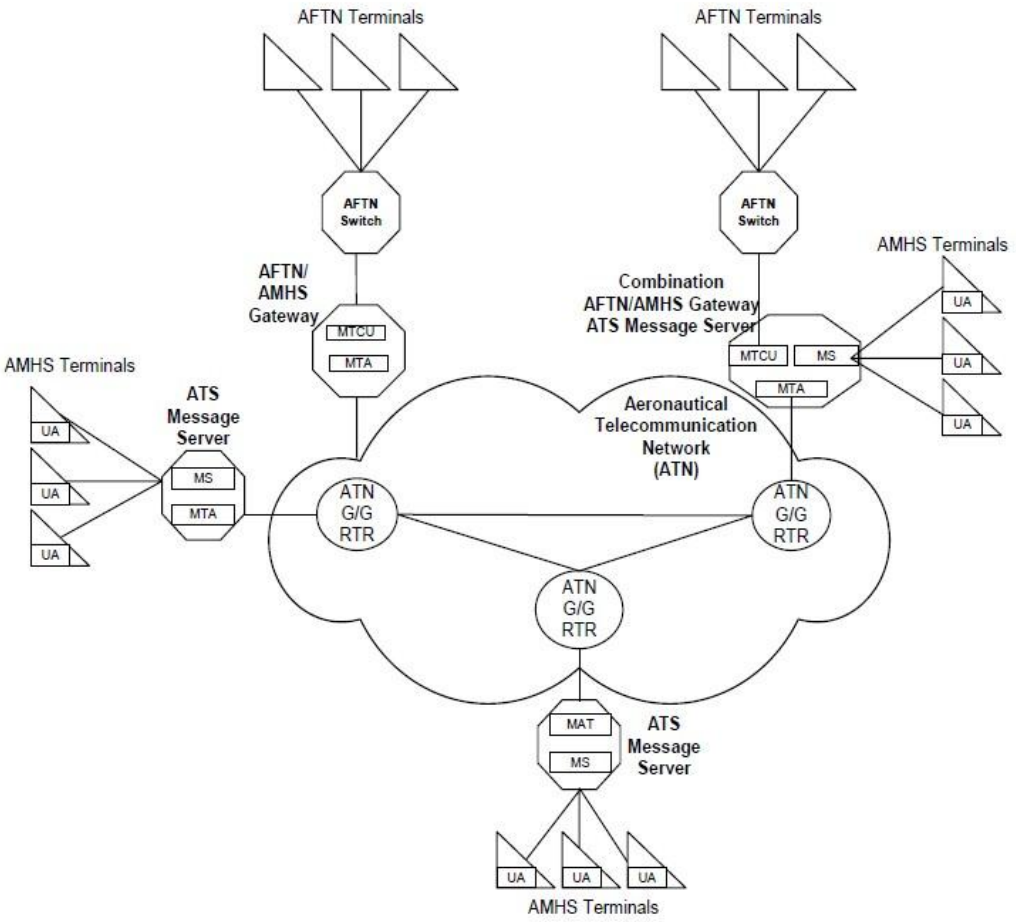
The most recent development with regard to messaging in the ATS environment is the ATS Message Handling System (AMHS). The AMHS is a natural evolution from AFTN/CIDIN and replaces the telegraphic style of working with a modern Message Handling System based on international Standards. The AMHS, being an ATN application utilizes the infrastructure of the ATN network, however this is not a prerequisite for the initial deployment of AMHS.

The AMHS is designed according to the International Telecommunication Union's (ITU) X.400 messaging standard which provides the core messaging framework similar to modern day email messages for the use of exchanging messages between Air Traffic Service users over the ATN. As an X.400-based system, the AMHS is specified in such a way that messages can be transferred from the sender to the recipient by passing reliably through intermediate AMHS systems. The AMHS system at the originating station, when it

first receives a newly submitted message, must determine the AMHS system that will receive the AMHS message. This may be:

- the destination AMHS,
- a relay AMHS, or
- the AFTN.

3.1 OVERVIEW OF AMHS



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In terms of functionality, the AMHS comprises the following components:

- the Message Transfer Agent (MTA) which performs the function of the message switch,
- the User Agent (UA) which performs the user access to the MTA and provides an appropriate user interface,
- the Message Store (MS) which provides the intermediary storage between MTA and UA and is usually co-located with the MTA, and
- the Access Unit (AU) which provides for intercommunication with other Messaging.

Three categories of AMHS end systems are defined for the support of the ATS Message Handling Service:

- the ATS message server (MTA)
- the ATS message user agent (UA)
- the AFTN/AMHS gateway.

3.2 TECHNICAL PROVISION

The provisions pertaining to AMHS, such as SARPs, technical manuals and /or specifications and general guidance material are now available and the Industry has so far developed systems to provide AMHS along these guidelines. The following ICAO documents constitute the main references:

- Annex 10, Volume II, Chapter 4
- Annex 10, Volume III, Part I, Chapter 3
- Doc 9880 Part IIB
- Manual for the ATN using IPS Standards and Protocols (Doc 9896)
- Doc 9705

3.3 REQUIREMENTS FOR THE NETWORK

The performance network to support the AMHS is very important to ensure a reliable AMHS service. From the ICAO SARPS, AMHS could be implemented using ISO or IPS protocols. There are already national AMHS implementations in place, based on the TCP/IP protocol suite. In addition, ANSPs have the necessary TCP/IP expertise on hand from various national applications. The broad market of TCP/IP products would facilitate rapid implementation with reasonable costs.

In the AFI Region, the States adopted to implement the AMHS under ATN/IPS as the ground-ground network in line with several ICAO Regions. Today, the majority of the links of current AFTN circuits are configured at 9600 kbps.

The implementation of the AMHS requires more bandwidth because of the overhead of the protocol. The network speed in areas of high traffic density is 64 kbps with at least 32 kbps in general. The AFI strategy will thus have to take into account the necessity of increasing the network capacity through the implementation of a successful ATN network.

This increased capacity will necessarily have an associated cost and may require the upgrade of the network infrastructures.

3.4 STATUS OF AMHS IMPLEMENTATION ACTIVITIES

At present, there are many initiatives and activities aiming at a rapid implementation and operation of the ATS Message Handling System (AMHS). At the level of ICAO, Regional working groups are tasked with the development of guidelines and the coordination of implementation. Regional AMHS workshops are conducted to facilitate coordination between States and exchange of information with manufacturers. In addition, trials and operational implementations are underway.

The 17th APIRG meeting, Ouagadougou, Burkina Faso, 2-6 August 2010 per conclusion 17/17 set up a Task Force to coordinate and plan for the implementation of AMHS in the AFI Region; and the SAT/16 meeting Recife, 02-06 May 2011 per conclusion 16/13 calls States to participate in the forthcoming regional Seminars and workshops organized by ICAO to support the implementation of AMHS regional Plans requirements.
Today, some AFI States have already installed AMHS systems, conducted trials and demonstrations for implementation of AMHS and have taken actions for the introduction of AMHS operationally on a national

basis. It is therefore necessary to develop a regional strategy, in order to conduct a standardized and harmonized implementation process within the AFI Region.

4. AFI AMHS IMPLEMENTATION TIMEFRAME

The implementation of the AMHS will follow several stages. Currently, only a very few states within the AFI region have AMHS infrastructures and the necessary network capacities. The AFI strategy should therefore take into account the experience gained from the equipped countries and progress studies conducted.

2011 –2013 Experimentation

During this period, pioneer and new States will continue to install AMHS systems. The experimentations and testing of interoperability will be expedited. This phase will allow the constraints related to the implementation and especially to the interconnections to be determined.

2011 - 2015 Validation of the architecture ATN – Upgrade of the network capacities

The harmonization and the increase of the network capabilities are necessary for the implementation of the AMHS. Several projects related to satellite VSAT networks of the AFI region are currently on going and in particular the audit of the AFISNET network which will involve some modifications to the network.

During the current phase, the ATN architecture will be validated and the increase of the capabilities of the various connections will be completed. These modifications can involve the modifications of the network infrastructure;

Due to the financial resources which it could require, the priority will be given to the main links establishing the ATN Backbone, which will allow to conduct effectively the experiments and to validate the ATN backbone.

During this period, the priority will be given to the systems of extremity AMHS in case of replacement of AFTN switches.

This deadline takes into account the necessary time for the validation of the ATN and AMHS architectures as well as the planning and the mobilization of the necessary financing.

From 2015 - Deployment in the main centers

In 2015, it can be considered that the ATN backbone and the network capabilities are quite completed.

The systems of extremity ATN / AMHS will then be deployed in the main centers with an AMHS/AFTN Gateway if required

From 2017 General Deployment

From 2017 onwards, all the End Systems of the network will have to be AMHS compatible. Various end-system such as the automated systems for the management of ATS data will be updated and the exchange l of ATS messages through the AMHS.

5. STRATEGY FOR IMPLEMENTATION OF THE AMHS IN THE AFI REGION

Considering the initiatives related to the AMHS implementation in the AFI region and the AMHS implementation activities progress in the other ICAO regions and in Industry, the AFI States/Organizations should take into consideration the following strategy to implement AMHS in the AFI region.

Considering:

1) The requirements for a reliable, secured and homogenous ground-to-ground Aeronautical Telecommunication Network to support the ATS Message Handling System (AMHS);

2) The availability of ICAO SARPs and technical manuals for the ATN/AMHS, the availability of equipment and readiness of vendors to support the AMHS ground-to-ground communications;

3) The availability of AMHS Transition and Implementation guidance materials required to assist States to ensure harmonization of procedures and protocols and thereby assure interoperability within the region;

4) The need for States using the currently AFTN systems for communication with other States and Regions to migrate gradually and harmoniously to the AMHS system by replacing the aging AFTN switches with ATS Message Transfer Agents (MTA);

5) The efforts of AFI States to take over and implement ATN/ AMHS; and

6) the need to support States to ensure a uniform, smooth and harmonious implementation;

THE GENERAL STRATEGY FOR THE IMPLEMENTATION OF AMHS INFRASTRUCTURE IN THE AFI REGION IS AS FOLLOWS:

a) Deploy a backbone network of ATN/IPS to provide a reliable infrastructure to initially support ground-to-ground applications (AMHS, AIDC…);

b) Use the TCP/IP communication protocol for the initial implementation of ATS Message Handling Systems, as a transition mechanism to enable AMHS operations to commence ahead of eventual full SARPs compliance;

c) The backbone States to implement in the short term a interoperable AMHS infrastructure and to conduct trials and studies on bilateral and multilateral basis in AFI region and on inter-regional basis to validate the operational implementation of AMHS and AMHS/AFTN Gateway;

d) The BBIS states with interface to other regions that adopt TCP/IP or, should establish connection based on bilateral agreement;

e) The none backbone States, to implement gradually AMHS when replacing their aging current AFTN systems and to connect to backbone States using the ATN/ IPS protocols and the appropriate security provision ;

IN ORDER TO ACHIEVE THE ABOVE STRATEGY THE FOLLOWING IS REQUIRED OF STATES AND ORGANIZATION IN THE AFI REGION:

a) States shall provide implementation in compliance with Annex 10 SARPS and ICAO Manuals, and with the Plans, Policies and AMHS Transition and Implementation guidance Materials adopted by APIRG;

b) Backbone States shall upgrade their network capability and later migrate to an IP sub-network capability for interconnection with other Backbone States and Non-backbone States.

c) States shall work co-operatively to assist each other on a multinational basis to implement the ATN and AMHS in an expeditious and coordinated manner and to ensure system inter-operability; and

d) States shall organize training of personnel to provide necessary capability to maintain and operate the ground-to-ground ATN/AMHS infrastructure and applications;

STRATEGY IMPLEMENTATION PLAN

	Short term 2011-2013	Mid-term 2014-2017	Long term2018-2023
APIRG technical provision	Elaboration of AFI technical provision	Implementation based on the AFI technical provision	
Telecommunications Infrastructure	Upgrade of ANSP VSAT networks and validation of the AMHS topology	Integration of AFI VSAT network and implementation of the AMHS topology	Full operational implementation of AMHS backbone and applications
Implementation of AMHS	Operation of (the existing AFTN system and progressive implementation of AMHS systems on national or regional basis	Implementation of AMHS systems at all Main AFTN centers and experimentation of inter-regional links	Completed transition of all the AFTN centers and full operational implementation
Operational deployment	AMHS trials on national basis and regional	Pursue of Trials on regional basis and operational implementation	Full AMHS operational implementation

Conclusion

The implementation of the ATN / AMHS requires the commitment of all the actors as was reaffirmed during the first meeting of the AMHS TASKFORCE. It will require the implementation of new systems of extremity ATN as well as the availability of an ATN network combining capabilities and adequate performances.

APPENDIX F

AFI

ATN ROUTING ARCHITECTURE PLAN

EXECUTIVE SUMMARY

This document provides technical guidance on the Planning and Implementing the transition to the Aeronautical Telecommunication Network (ATN) for ground communication within the ICAO AFI Region.

The routing architecture is based upon the need for a ground-ground infrastructure to eventually replace the existing AFTN infrastructure. For this reason, the routing architecture uses the existing AFTN infrastructure as a guideline for the positioning of ATN equipment.

The routing architecture is designed primarily for the ground-ground environment. It is intended that this architecture will be suitable as the routing architecture for the introduction of the air-ground communication requirements.

INTRODUCTION

This document presents an initial plan for the routing architecture within the AFI Region.

Terms used

Aeronautical Fixed Telecommunication Network (AFTN): a low-speed network providing the majority of ground-ground data communication services within the ICAO realm. This term is defined in ICAO Annex 10.

Boundary Intermediate Systems (BIS): a router that supports IDRP and routes PDUs to more than one routing domain. This term is defined in ICAO Doc. 9705.

Backbone Boundary Intermediate Systems (BBIS): a router that primarily routes PDUs between routing domains and does not support End Systems.

Note: This definition is similar to that found in ICAO Doc. 9705 and is meant to be consistent with that definition. This definition is made on the assumption that this version of the routing architecture is limited to the ground-ground infrastructure.

End Boundary Intermediate Systems (EBIS): a router that primarily routes PDUs between routing domains and connected End Systems.

End Systems (ES): an ATN system that supports one or more applications and that is a source and/or destination for PDUs.

Inter-Regional Boundary Intermediate Systems (IRBIS): a router that routes PDUs between systems (both End Systems and Boundary Intermediate Systems) within the Region with routers outside of the Region. These routers are the entry points into the Region and exit points from the Region for PDUs.

Network Service Access Point (NSAP) (address): a 20-octet value that uniquely identifies an interface between the Transport Layer and the Network Layer. In the ATN it provides the address of transport entity providing ATN Internet services.

Acronyms used

AFTN	-	Aeronautical Fixed Telecommunication Network
BIS	-	Boundary Intermediate Systems
BBIS	-	Backbone Boundary Intermediate Systems
CLNP	-	Connectionless Network Protocol
EBIS	-	End Boundary Intermediate Systems
ES	-	End System
IDRP	-	Inter-Domain Routing Protocol
IS	-	Intermediate System
PDU	-	Protocol Data Unit

ROUTING DOMAIN FUNDAMENTALS

The ATN consists of a set of End-Systems (ESs) and a set of Intermediate Systems (ISs). ESs are the source and destination of all data and are where the applications reside. ISs are better known as routers and relay PDUs from one system to another.

The ISs and ESs are organized into *Routing Domains*. Routing Domains are used to define sets of systems (that typically operate together) into clusters. These clusters have two major properties:

- they are controlled by a single administration/organization, and
- a significant amount of the traffic is internal to the cluster.

The single most important characteristic is that they are controlled by a single administration or organization. This characteristic is manifested in technical terms by mutual trust between all routers in a routing domain. Routing protocols are based on the fact that the information exchanged between *intra*-domain routers can be trusted. No special reliability or trust is required to accept information about advertised routes.

The second characteristic, most traffic is internal to a routing domain, is more an artifact of proper network engineering.

Routing domains are established through the NSAP addressing conventions established for the ATN in Doc. 9705, Sub-Volume 5. All systems with NSAP addresses defined with the same address prefix are by definition in the same routing domain.

Intra-Domain Routing

Intra-domain routing is the routing of PDUs from the source to destination where both are in the same domain. Intra-domain routing implies one or more ISs capable of routing PDUs across the domain. Examples of intra-domain routing would be CLNP-capable routers exchanging PDUs between two Local Area Networks.

Since the ATN is specified across State boundaries, there are no SARPs requirements for intra-domain routing. The choice and configuration of internal routers is a local matter.

Inter-Domain Routing

The central definition of routing in the ATN is concerned with inter-domain routing. This is a particularly difficult problem since by the very nature of inter-domain routing, the information received cannot be fully trusted.

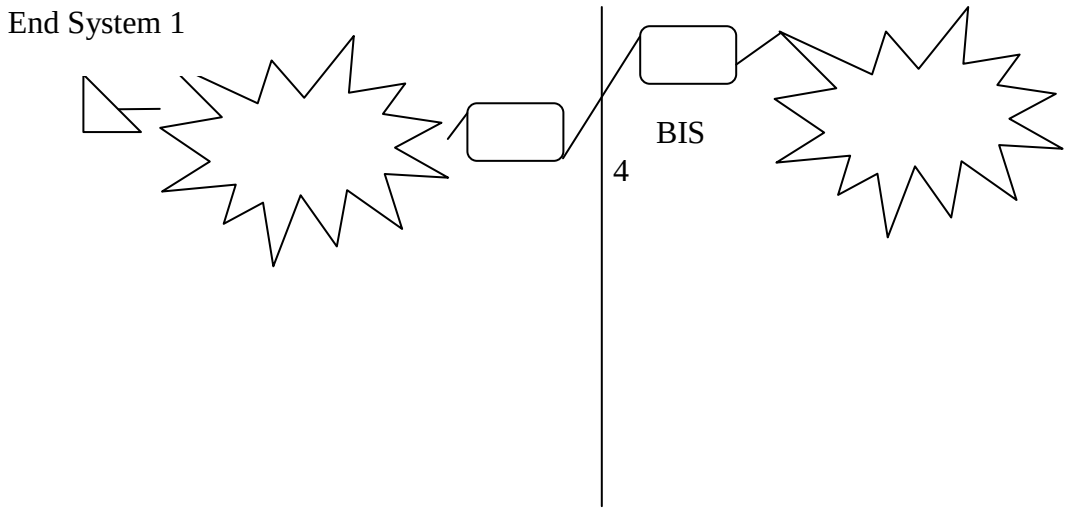
Inter-domain routing is based upon the mutual distrust of the received routing information. First, reliability mechanisms must be built-in to ensure the reliable transfer of the information. Second, the received information must be filtered to ensure that it meets the suitability constraints of the received system (in other words, can it be believed.)

After receiving the routing information, the inter-domain router must build routing tables based upon its internal policy about routing its data.

Types of Routing Domains

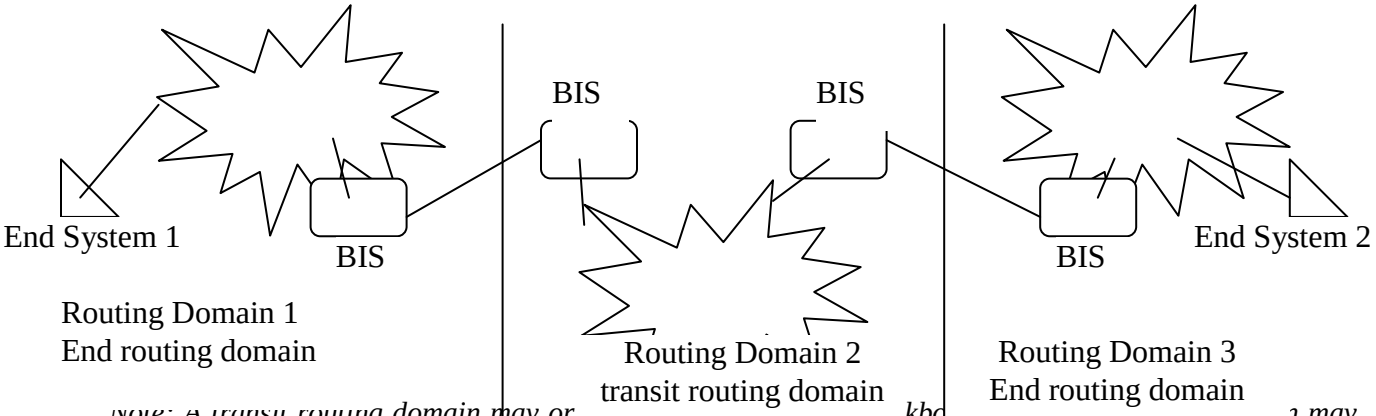
There are two basic types of routing domains: end routing domains, and transit routing domains.

An end routing domain routes PDUs to and from end-systems within its routing domain. Figure 1 shows an end routing domain.



gure 1 – End Routin

A transit s between two or mor ; an option also act as an end routing domain. An example of a transit domain is where a set of backbone routers is configured in their own routing domain with all of the end systems in end routing domains attached to the backbone.



Note: A transit routing domain may or kbo n may consist of BISs none of which are backbone routers.

Figure 2 – Transit Routing Domains

Routing Domain Construction

Based on the above, a routing domain consists of at least one inter-domain router.
Note: There must be at least one BIS. There is no requirement for any other equipment.
Routing domains are elements of the physical structure of the ATN.

ROUTER FUNDAMENTALS

All routers discussed within this document are ICAO Doc. 9880 compliant Boundary Intermediate Systems (BISs).

Note: Individual States may elect to use other routers that do not comply with the ATN IDRP requirements as found in ICAO Doc. 9880 within the limits of their own States. These router are internal State issues and outside the scope of this document.

Boundary Intermediate System Overview

Boundary Intermediate Systems comprise the interfaces between networks, and in particular, between different routing domains. The term "Boundary Intermediate System" can often be replaced with the more common term "router".
An important consideration in developing the routing architecture is the different roles that routers take within the ATN environment.

Router Types

There will be two primary types of BISs employed within the Region:

- Backbone BISs (BBISs), and
- End BISs (EBISs).

Backbone BISs

A BBIS is a router that primarily routes PDUs between routing domains. These routers are typically higher performance routers that aid in the efficient flow of data between domains. BBISs may have End-Systems connected to them, but often are limited to only router-to-router connections.
BBISs can be further subdivided into Inter-regional BBISs and Regional BBISs. Inter-regional Backbone BBISs are those backbone routers that connect to BBISs in other regions.
Regional BBISs are backbone routers that only connect to routers within the Region.
Note 1: A single high performance router may act as both a Regional BBIS and an Inter-regional BBIS based upon meeting the requirements for performance and reliability.
Note 2: For completeness of the routing architecture, it must be mentioned that the routers out-side of the Region to which Inter-regional Backbone BISs attach are, in fact, Inter-regional Backbone BISs in the other Region.
Note 3: The interconnection of backbone BISs typically require higher capacity communication lines based on the consolidation of traffic through those backbone routers. Even though the architecture takes into account existing AFTN infrastructure facilities, the need to upgrade the communication facilities as traffic through the backbone increases may be necessary.
Note 4: It is possible for some States to provide transit routing from their routing domains to the routing domains of other States using BISs that are not backbone routers.

End BISs

End BISs are connected to one or more BBISs and provide routing services to a single routing domain. Further, End BISs do not act as a transit router for passing PDUs between other routing domains.

AFI REGIONAL ROUTING ARCHITECTURE

The AFI Regional routing architecture is based upon several concepts:

1. from a routing domain point of view, the Region can be considered an "autonomous" area, that is, there is a difference between routers located within the Region and outside the Region.

2. routing domains and confederations of routing domains may be applied to areas within the Region.

3. States will make their own implementation and transition decisions.

The routing architecture can be divided into several distinct parts:

- the definition of the backbone routing structure for passing information between routing domains within the Region;
- the definition of the routing structure for passing information from this Region to other Regions;
- the definition of the routing structure between routing domains not on the backbone; and
- the definition of the routing structure for use in end-routing domains.

The first component is the definition of the backbone routing structure that supports the exchange of data within the Region. This part defines the interconnection of the major communication facilities in the Region and how they cooperate to link all of the systems in the Region.

The second part is needed to define how data will be routed between the systems within the Region with those systems outside the Region. More importantly, the structure describes how all global ATN systems are accessible from systems in the Region.

The third component is the definition of the structure that allows end routing domains to exchange data across the backbone to another end routing domain. This part defines how the end routing domains connect through the backbone.

The fourth component defines the routing structure that is used within an end routing domain. This part defines how the individual routing domains may be used to pass data.

Regional Backbone

The definition of a Regional Backbone is based upon the efficiencies that may be realized by concentrating the ATN traffic at major communication centres and using the economy of scale in passing this information between major communication centres.

The rationale for defining Regional backbone sites is based upon existing VSAT networks in the AFI Region and the flow of both AFTN traffic and possible future air-ground ATN traffic.

Within the Region there exist four VSAT networks (AFISNET, CAFSAT, NAFISAT and SADC) that can be used to simplify the definition of the backbone architecture.

However, it must be understood that the expected growth in communication traffic over the ATN could quickly exceed the capabilities of the existing communication infrastructure. Planning for the increased traffic loads will be needed as soon as ATN traffic begins to flow.

The architecture and communication requirements define a routing plan that incorporates alternate routing and communication paths so that no single router or communication failure can isolate major parts of the Region.

The initial AFI BBISs sites are defined in the following table by identifying those communication centres that are participating in more than one VSAT network as shown at **Attachment A**. Additional backbone sites will need to be identified in the future for increased reliability of the interconnections between the networks. This is done in subsequent paragraphs.

Item	ATN backbone router site	State

1	Antananarivo	Madagascar
2	Dakar	Senegal
3	Dar es Salaam	Tanzania
4	Johannesburg	South Africa
5	Kinshasa	Dem. Rep. of Congo
6	Luanda	Angola
7	Mauritius	Mauritius
8	N'djamena	Chad

Table 4.1 - Definition of initial AFI ATN Backbone router sites

At each ATN Backbone site, there should be at least one BBIS. States that are to be invited to committing to operate backbone routers are identified in the table above.

AFI Backbone router requirements

The definition of BBIS and the location of these routers may be affected by the requirements for backbone routers. A backbone router must meet several performance and reliability requirements:

- Availability
- Reliability
- Capacity; and
- Alternate routing.

Availability

A backbone router must provide a high-level of availability (24 hours a day, 7 days a week).

Reliability

A backbone router must be very reliable system that may require redundant hardware or more than one router per site.

Capacity

As a communication concentrator site, a backbone router must be capable of supporting significantly more traffic than other ATN routers.

Alternate routing

Based upon the need for continuity of service, backbone routers will require multiple communication links with a minimum of two and preferably three or more backbone routers to guarantee alternate routing paths in case of link or router failure.

Routing policies

States providing Regional BBISs must be capable of supporting routing policies that allow for Regional transit traffic and for dynamic re-routing of traffic based upon loading or link/router failures.

Inter-Regional Backbone

The second component of the AFI Regional Routing Architecture is the definition and potential location of Inter-Regional Backbone Routers. The manner in which this architecture was developed was to ensure that the use of the existing communication infrastructure is possible to the greatest degree. The use of the existing communication infrastructure should reduce the overall cost of transitioning to the ATN.

To re-state from the previous section, the Inter-Regional BBISs provide communication from routers within the AFI Region to routers in other regions. These Inter-Regional BBISs provide vital communications across regions and therefore need to have redundant communication paths and high availability. (Note: This can be accomplished through multiple routers at different locations.)

Within the current AFTN network environment, the following locations have been identified to initially serve centres outside the AFI Region:

Entry/Exit Centre	Region served
Addis Ababa	Middle East
Algiers	Europe
Casablanca	Europe
Cairo	Europe, Middle East
Dakar	South America
Johannesburg	Asia/Pacific, South America
Nairobi	Asia
Tunis	Europe

Table 4.2 - Centres with circuits to other Inter- Regional Backbones

For the transition to the ATN, connectivity to the other Regions should be a priority. This is especially important as other Regions begin the transition to the ATN and begin deploying ATN BISs.

Long Term Implementation

The transition to a fully implemented ATN requires that connectivity amongst the ICAO regions be robust. That is, there is the need to ensure alternate paths and reliable communication. Table 4.2 presents a minimal Inter-Regional Backbone that provides a minimum of 2 circuits to other ICAO regions that communicate directly with the AFI Region. For longer term implementation of the ATN, it would be advisable to have 3 circuits to each Region.

Initial Implementation

Note: Information is needed on the plans of States in implementing ATN.

The initial implementation of the ATN, outside of the AFI Region, will most likely be in North America, Europe and Asia/Pacific. Therefore, initial transition planning in AFI may focus on Europe and Asia/Pacific.

For connecting to Europe, there should be four (4) Inter-Regional BBISs. For example, the following locations would be candidates for such routers:

Algiers, Cairo, Casablanca and Tunis.

Note: The locations presented above are examples of possible router sites. The selection of actual locations will be based on implementation schedules and circuit availabilities.

For connecting to the Middle East, Inter-Regional BBISs may be located at the locations of the existing AFTN centres, Cairo and Addis Ababa. However, these routers would not be needed until such time as ATN traffic is destined for that Region and the location of the routers would be determined at that time.

For connecting to the ASIA/PAC, Inter-Regional BBISs may be located at the locations of the existing AFTN centres, Johannesburg and Nairobi. However, these routers would not be needed until such time as ATN traffic is destined for that Region and the location of the routers would be determined at that time.

For connecting to the SAM Region, Inter-Regional BBISs may be located at the locations of the existing AFTN centres, Dakar and Johannesburg. However, these routers would not be needed until such time as ATN traffic is destined for that Region and the location of the routers would be determined at that time. In the future, Luanda could be added for interface with the SAM Region.

Routing between Backbone Routers and Routing Domains

The third component of the AFI ATN routing architecture is the definition of the routing structure between end routing domains within the AFI Region through the regional ATN backbone. This is done by linking routing domains within the coverage area of each VSAT network to the ATN backbone sites on the same network. In this process additional backbones are identified.

Based upon the exiting VSAT network coverage areas, sub-regions are defined for routing efficiencies. These sub-regions are used to concentrate traffic. The goal of this architecture is to use the existing communication infrastructure and the facilities available at existing AFTN centres to the maximum degree possible.

Within the AFISNET area, six major routing domains can be identified:

- ASECNA member States, which could form a routing confederation
- Ghana
- Nigeria
- Roberts FIR
- Sal FIR; and
- Sao Tome and Principe.

Within the ASECNA ensemble, two additional backbones could be located at Brazzaville and Niamey to concentrate traffic as in the current AFTN.

In the Ghana domain, Accra is being linked to Sao Tome by VSAT for VHF extension. This facility could be used in the future to link the Sao Tome domain to the ATN. Thus Accra BIS will be a transit router for Sao Tome. For added reliability, Lagos BIS should transit through Accra, while Kano BIS is linked to N'djamena and Niamey.

In the SADC VSAT coverage area, each State constitutes a routing domain that will be linked to the Johannesburg BBIS.
In the NAFISAT coverage area, each State also constitutes a routing domain. The additional BBIS identified is at Khartoum. Each routing domain has at least two links to the ATN. The sub-regions are defined in Table 4.3. The table is organized with one site identified as a potential backbone router site identified above. This site is listed first and in bold text. The remainder of the sites in each sub-region follows.
Note: The identified backbone router sites are only examples. Actual backbone router sites will be determined by implementation schedules and States' willingness to implement backbone routers.

1. Location (State) of BBISs
Addis Ababa (Ethiopia) Sub-Regional Sites: Asmara, Djibouti, Mogadishu Other BBIS sites: Khartoum, Nairobi Other Regions: MID
Algiers (Algeria) Sub-Regional Sites: None Other BBIS sites: Casablanca, Dakar, Niamey, Tunis Other Regions: EUR
Antananarivo (Madagascar) Sub-Regional sites: Comoros, France (Reunion) Other BBIS sites: Johannesburg, Mauritius
Brazzaville (Congo) Sub-Regional Sites: Bangui, Douala, Libreville, Malabo, Other Sub-Region sites: Dakar, N'djamena, Niamey

1. Location (State) of BBISs
Other Regions: None
Cairo (Egypt) Sub-Regional Sites: Asmara, Tripoli Other BBIS sites: Khartoum, Tunis Other Regions: EUR, MID
Casablanca (Morocco) Sub-Regional Sites: Western Sahara Other BBIS sites: Algiers, Dakar Other Regions: EUR
Dakar (Senegal) Sub-Regional Sites: Abidjan, Bamako, Banjul, Bissau, Conakry, Nouakchott, Sal Other BBIS sites: Algiers, Brazzaville, Casablanca, Johannesburg, Niamey Other Regions: SAM
Dar es Salaam (Tanzania) Sub-Regional Sites: Seychelles Other BBIS sites: Kinshasa, Nairobi
Kinshasa (Democratic Republic of Congo) Sub-Regional sites: Entebbe Other BBIS sites: Dar es Salaam, N'djamena
Johannesburg (South Africa) Sub-Regional Sites: Beira, Bujumbura, Gaborone, Harare, Kigali, Lilongwe, Luanda, Lusaka, Maseru, Manzini, Windhoek Other BBIS sites: Antananarivo, Dar es Salaam, Dakar, Kinshasa, Mauritius Other Regions: ASIA/PAC, SAM
Khartoum (Sudan) Sub-Regional sites: Tripoli Other BBIS sites: Addis Ababa, Cairo, Nairobi, N'djamena
Mauritius (Mauritius) Sub-Regional sites: France (Réunion) Other BBIS sites: Antananarivo, Johannesburg, Nairobi
Niamey (Niger) Sub-Regional Sites: Abidjan, Accra, Kano, Ouagadougou Other BBI sites: Algiers, Brazzaville, Dakar, N'djamena
Nairobi (Kenya) Sub-Regional Sites: Entebbe, Mogadishu, Seychelles Other BBIS sites: Addis Ababa, Dar es Salaam, Khartoum, Mauritius Other Regions: ASIA/PAC
N'djamena (Chad) Sub-regional sites: Kano, Tripoli Other BBIS sites: Brazzaville, Niamey, Kinshasa
Tunis (Tunisia)

1. Location (State) of BBISs
Sub-regional sites: Tripoli Other BBIS sites: Algiers, Cairo Other Regions: EUR
2. Location (State) Transit BISs
Abidjan (Côte d'Ivoire) Transit for: Roberstfield
Accra (Ghana) Transit for : Cotonou, , Kano, Lagos, Lome, Sao Tome

Table 4.3 – Definition of AFI Geographic Sub-Regions

Routing within end domains

The fourth component of the AFI routing architecture is the definition of routing within end domains.

Routing Domains

Each State is expected to have one or more routing domains. Where a State chooses not to implement an ATN BIS, it may choose to incorporate its systems into a routing domain of another State.
The AFI ATN Backbone will consist of routers from the selected States. Each of these routers will be part of its State's routing domain.
Note: This means that the backbone will not be configured with its own routing domain.
Routing to the backbone and between backbone routers will be controlled through IDRP policies.
Each State will be responsible for the designation of routing policies for its End Systems and End BISs. Individual States will also be responsible for establishing routing policies for routing to its designated BBIS.
The use of routing confederations is for further study. It should be noted that the establishment of routing confederations within the AFI Region could simplify considerably the routing architecture since a routing confederation can be viewed externally as a single routing domain.

End BISs

It is assumed that naming and addressing (and routing domain definition) will be done on a Regional basis. Further, for areas within the Region that may utilize an End BIS serving more than one State, the naming structure will be based on the Regional NSAP format defined in Doc. 9880. Further, States may choose to either implement the Regional (or Sub-Regional) NSAP format or the State NSAP format based on whether it installs a BIS.

AFI Regional Routing Architecture

Summarizing the information presented above, the AFI Regional Backbone network will consist of at least one BBIS router in each of the sub-regions identified above. The actual location of the routers will be based upon implementation schedules and the choices of States.
The Inter-Regional BBISs may be configured to provide both Regional routing services and Extra-Regional routing services. However, these routers must be engineered with sufficient performance capabilities to provide such services.

The chart at **Attachment B** shows the configuration of the AFI routing architecture.

Transition Issues

This area needs further work. Information about plans of the States is required.

ATN Transition

Based upon the previous sections, the implementation of the ATN within the AFI Region may require considerable planning for the transition of the AFTN.

Initial Regional Implementation

The very beginning of ATN implementation will be bilateral testing between States. For this scenario, each State will need at a minimum:

- an ATN-compliant router,
- a means for managing the router,
- an ATN application, and
- a circuit connecting the States.

States involved in bilateral ATN trials should consider the use of the trial infrastructure in expanding the ATN throughout the Region.

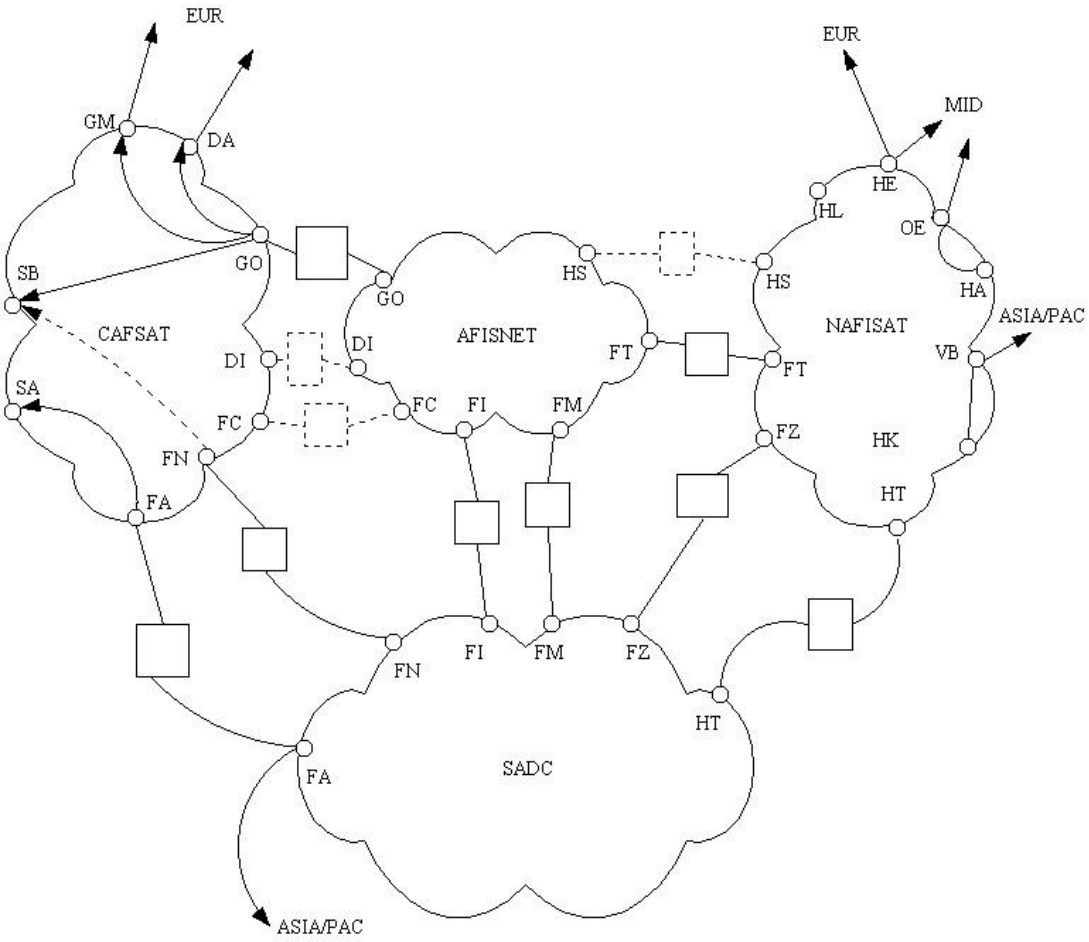
Regional ATN Implementation

At a certain time, sufficient bilateral trials will be underway to permit a region-wide ATN network based upon the plan presented above. As each State implements the ATN applications and network infrastructure, it will be added to the Regional infrastructure according to this plan.

-END-

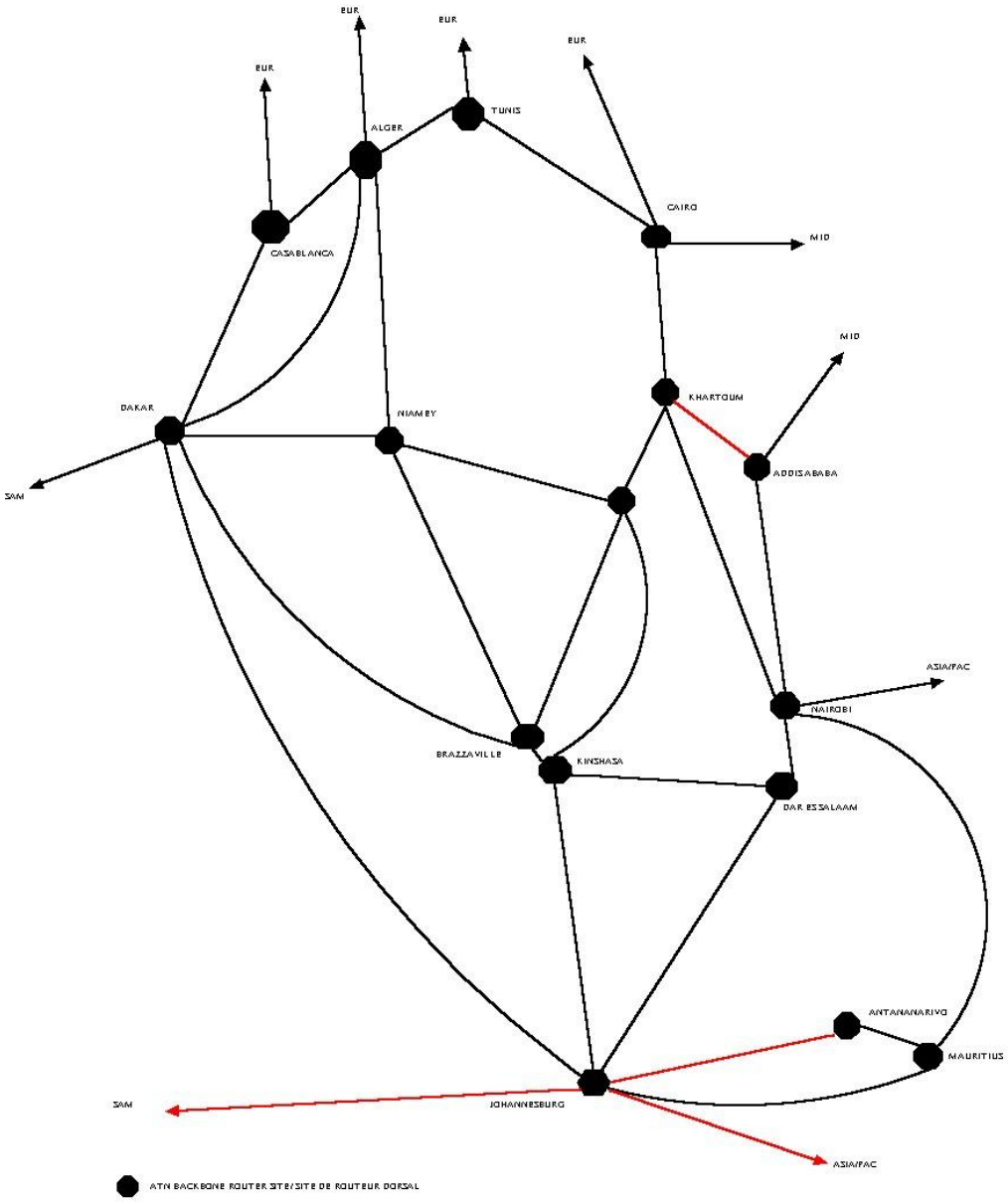
Attachment A

INDENTIFICATION OF BACKBONE ROUTER SITES



Attachment B

ATN BACKBONE



DRAFT AFI BACKBONE ROUTER INTERCONNECTION
PROJET D'INTERCONNECTION DE ROUTEURS DORSAUX DE LA REGION AFI

APPENDIX G

VSAT NETWORK PERFORMANCE DATA
COLLECTION FORMS

(Template)

Centre:

Date:

Parameters	Values	Remarks
Fixed Parameters		
Intelsat link Name	IS 901 @°E	
Transponder Number	36/36	
Satellite Earth Station Coordinates	LONG = ddd, mm O/E LAT = dd, mm N/S	Under WGS 84 Format
	AZ = ddd, mm O/E EL = dd, mm N/S	
Antenna Type and Size	….m	
Antenna Gain	Tx : …dBi Rx : …dBi	
SSPA type	X W	
Up Converter Frequency	MHz	
Down Converter Frequency	MHz	
Global Dynamic parameters		
EIRP		
G/T		
C/N0		
BER		
MTBF		
MTTR		
Parameter for Carrier Performance		
Carrier failure rate		
C/N0		
BER		

1: Performance of Aeronautical Fixed Service supported by CAFSAT

Performance of AFTN

Centre : Atlántico
Date /

Country	Terminal I	Terminal II	Support	COM Proto-col	Speed	Tran-sit Time	Routing	Monthly Availability 2011												½ Annual Ave-rage Availa-bility	
								01		02		03		04		05		06		1	
Brazil	Atlántico	Dakar	CAFSAT					TX	RX	TX	RX	TX	RX	TX	RX	TX	RX	TX	RX	TX	RX

2: Qualitative performance of ATS/DS

Centre :
Date /

Country	Terminal I	Terminal II	Support	Connexion Time	Nb of Attempts	One Way Latence Time	Call set up time	Voice Quali-ty (1 to 5)	Monthly Availability 2011						½ Annual Average Availability
Brazil	Atlán-tico	Dakar	CAFSAT						01	02	03	04	05	06	

3: Qualitative performance of Future CNS Services

Country	Terminal 1	Terminal II	Support	Provided Service	COM Protocol	Speed	Transit Time	Routing	Availability 2005-2010						Remarks
									05	06	07	08	09	10	
Brazil	**Atlántico**	**Dakar**	**CAFSAT**	AIDC											
Spain	**Las Palmas**	**Sal**	**CAFSAT**	AMHS											

APPENDIX H

Draft GNSS Implementation Strategy for the AFI Region

1. Introduction

1.1 The purpose of the AFI GNSS strategy is to define an evolution path for replacement of ground-based navigation aids, i.e. VOR/DME/ILS/NDB, ensuring that operational and other concerns such as positive cost-benefit are fully taken into account.

1.2 The AFI GNSS strategy assumes availability of a GNSS meeting of the specified parameters at every phase of deployment. It does not analyze GNSS systems configuration per se nor the advantages and disadvantages of various deployment strategies.

2. General Considerations

2.1 By necessity, satellite-based and ground-based navigation systems will co-exist for a period of time. Considering that the operation of a dual system is detrimental to a positive cost-benefit, users and providers will co-operate with the view of reducing the duration of the transition period as much as possible, having due regard for the following principles:

- The level of safety will not be downgraded during the transition;
- GNSS-based service must, before the end of the transition period, fully meet the required parameters of accuracy, availability, integrity and continuity for all phases of flight;
- During the transition, gradually evolving levels of functionality will be available;
- Operational advantage shall be taken in to consideration the available and capabilities at every step of deployment;
- Methods of application will take into account full consideration of safety considerations of any functional limitations;
- Users must be given sufficient advance notice to re-equip before ground-based systems are decommissioned.

3. Evolving functionality

3.1 Phase I (Short term), up to 2012:

- This phase will allow the use of GNSS as a primary-means of navigation for en-route, and for NPA; and as a supplemental-means navigation system for TMA. Existing ground infrastructure remains intact.

3.2 Phase II (Medium term) -2013 - 2016:

- **This phase will allow for:**

a) <u>En-route phase</u>: sufficient capability to meet en-route navigation requirements everywhere in the AFI Region. GNSS will continue to be used as principal en-route navigation. The same principle will be characterized by a clearly planned transition for the use of GNSS as the sole means for en-route navigation. Navigational aids will accordingly not be replaced, subject to consultation with the Users.

b) <u>Terminal areas</u>: sufficient capability to meet TMA navigation requirements everywhere in the AFI region. GNSS is approved as sole-means for TMAs, taking into account technical and legal developments, and institutional aspects.

c) Terminal area VOR/DME/NDB, and Locators not associated with ILS, will not be replaced during Phase II.

d) <u>Approach and landing phase:</u> sufficient capability for APV1 in the whole AFI Region. ILS will continue to be provided at aerodromes[1].

Note 1: Where the requirements for approach and landing can be met by APV 1, ILS CAT I should not be replaced.

During Phase II, the implementation of Long- term GNSS will be developed.

Phase III (Long term) 2017 onwards**:** It is assumed that more constellations of navigation satellites will be available to support GNSS as the sole-means of navigation from en-route to CAT I operations. CAT I by SBAS or GBAS will be available in those locations where analysis of historical MET data or traffic characteristics justifies the requirement. Other requirements will be met by ground-based augmentation system (GBAS). During Phase III, ILS CAT I will not be replaced, subject to consultation with users. Where CAT II/III ILS requirements have been confirmed, these facilities will remain unless technical evolution then demonstrates that the requirement can be supported by GBAS or SBAS.

4. The strategy will be reviewed periodically. In particular, it will be reviewed and updated at the beginning of each planning phase to ensure continuous relevance in support of the global ATM operational concept, taking into account technological evolution and developments in the field of GNSS.

5. **Summary of AFI GNSS Strategy**

AFI GNSS Strategy – Synopsis

	Short term	Medium term	Long term
Time scale	2008 – 2012	2013 – 2016	2017 and beyond
Certification	Primary for en-route Supplemental for TMA Non-precision approach (NPA)	Primary means from en route to APV	Primary means from en route to CAT-I
Oceanic and Remote Continental En route	Basic GNSS	Basic GNSS	Multi-constellation GNSS
Continental En route	Basic GNSS	Basic GNSS	Multi-constellation GNSS
Terminal	Basic GNSS	Basic GNSS	Multi-constellation GNSS
Approach and Landing	Basic GNSS with Barometric Altimetry	Basic GNSS with ABAS, SBAS*	Multi-constellation GNSS with ABAS, SBAS, GBAS
			CAT I (GLS) CAT II/III/ (GLS) as required

**Note: As from 18 November 2010, it is expected that ICAO Annex 10, Volume I will enable Category I approach operations supported by satellite-based augmentation system (SBAS). The upper vertical alert limit (VAL) for CAT I operations has drastically been increased from 15.0 m to 35.0 m. However, a vertical alert limit greater than 10 m for a specific system design may only be used if a system-specific safety analysis has been completed.*

GNSS INFRASTRUCTURE IN SUPPORT OF PBN REQUIREMENTS

Time scale		Short term	Medium term	Long term
		2008 – 2012	**2013 – 2016**	**2017 and beyond**
Certification		Primary for en-route Supplemental for TMA Non-precision approach (NPA)	Primary means from en route to APV	Primary means from en route to CAT-I
Oceanic and Remote Continental/ En route	GNSS Configuration	Basic GNSS	Basic GNSS	Multi-constellation GNSS
	PBN Nav Spec	RNAV-10, RNP-4	RNAV-10, RNP-4	RNAV-10, RNP-4
Continental En route	GNSS Configuration	Basic GNSS	Basic GNSS	Multi-constellation GNSS
	PBN Nav Spec	RNAV-5, RNAV-1	RNAV-5, RNAV-2, RNAV-1	RNAV-5, RNAV-2, RNAV-1
Terminal	GNSS Configuration	Basic GNSS	Basic GNSS	Multi-constellation GNSS
	PBN Nav Spec	RNAV-1 in a surveillance environment Basic RNP-1 in non-surveillance environment	Expand RNAV-1, or RNP-1 application Mandate RNAV-1, or RNP-1 in high density TMAs	RNAV-1 in a surveillance environment Basic RNP-1 in non-surveillance environment
Approach	GNSS Configuration	Basic GNSS	Basic GNSS with ABAS, SBAS*	Multi-constellation GNSS with ABAS, SBAS*
	PBN Nav Spec	RNP APCH: NPA RNP APCH: APV with Baro-VNAV or RNP AR APCH: APV with Baro-VNAV	RNP APCH: NPA RNP APCH: Expand APV (with Baro-VNAV and/or augmented GNSS) Expand RNP AR APCH: APV with Baro-VNAV	RNP APCH: NPA RNP APCH: APV (with Baro-VNAV and/or augmented GNSS) RNP AR APCH: APV with Baro-VNAV

**Note: Although SBAS operations not yet included in the PBN concept contained in ICAO Doc 9613, they have been introduced in the spirit of Assembly Resolution A36-23.*

6. **Conditions of Implementation of SBAS**

a) **Subjected to APIRG Conclusion 17/29:** ***Need of an independent Cost Benefit Analysis***

b) Full compliance with ICAO technical requirements;

c) Case to case Cost Benefit agreement before implementation;

d) The Civil Aviation stakeholders in particular governments should guarantee that there will be no cross-subsidization of non civil aviation users of SBAS. The users pays principle is to be applied across all sectors;

APPENDIX I1

AFI SURVEILLANCE STRATEGY

Draft - Revision 0.1

23 June 2011

REVISION INDEX SHEET

Version	Revision	Date	Reason for Change	Pages Affected
Draft	0	23/06/11	New Document	All

PROLOGUE

Air traffic is growing at a significant rate. There is also an increasing demand for more operating flexibility to improve aircraft efficiency and to reduce the impact of air travel on the environment. Improved tools are required to safely manage increasing levels and complexity of air traffic. Aeronautical surveillance is one such important tool in the air traffic management (ATM) process.

Surveillance plays an important role in air traffic. The ability to accurately determine, track and update the position of aircraft has a direct influence on the minimum distances by which aircraft must be separated (i.e. separation standards), and therefore on how efficiently a given airspace may be utilized.

In areas without electronic surveillance, where air traffic management is reliant on pilots reporting their position verbally, aircraft have to be separated by relatively large distances to account for the uncertainty in the reported position because of the delivery delay and the low rate at which the information is updated.

Conversely, in areas where electronic surveillance systems are used, and aircraft positions are updated frequently, the airspace can be used more efficiently by safely accommodating a higher density of aircraft through reduced separation minima. In this way the surveillance function provides an indication of any unexpected aircraft movements and is an important safety function.

Accurate surveillance can furthermore be used as the basis for automated alerting systems. The ability to accurately track aircraft enables air traffic controllers to be alerted when an aircraft is detected to deviate from its assigned altitude or route or when the future positions of two or more

aircraft are predicted to fall below minimum acceptable separation standards. Alerts may also be provided when the aircraft strays below the minimum safe altitude or enters a restricted area.

The existing fixed route structure provides increased certainty of aircraft movements making it easier for controllers to manage air traffic. With improved navigation performance on board aircraft, airspace users are demanding greater flexibility to determine the most efficient routes to satisfy their operating conditions. There is a push for restrictions associated with flying along fixed routes to be lifted. In such an environment, accurate surveillance is required to assist controllers in the detection and resolution of any potential conflicts associated with the flexible use of airspace which will result in a more dynamic environment.

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

TABLE OF CONTENTS

AFRICA-INDIAN OCEAN SURVEILLANCE STRATEGY

1

2 Introduction

Purpose

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

Implementation of surveillance systems should be based on a harmonized strategy for the AFI Region that would take into account the operational requirements and relevant cost-benefit analyses. It should also be based on action plans to ensure that AFI States, Regional 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:

- **Voice Reporting;**
- **Primary Radar (PSR);**
- **Secondary Surveillance Radar (SSR);**
- **Multilateration (MLAT);**
- **Automatic Dependent Surveillance-Contract (ADS-C); and**
- **Automatic Dependent Surveillance-Broadcast (ADS-B).**

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.

Applicability

This strategy was developed for use by the following stakeholders group within the Africa-Indian Ocean (AFI) Region:

- **The departments of the National Supervisory Authorities of AFI countries who are responsible for verifying ATM Surveillance Systems;**
- **The departments of the civil and military ANSP of AFI 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.**

Reference Documents

- **Doc 9924, Aeronautical Surveillance Manual;**

3 Aeronautical Surveillance – Air-Ground Surveillance Systems

The aeronautical surveillance system may be broadly divided into four parts:

- **a "remote surveillance subsystem" installed within the target under surveillance, which has two main functions: to collect the data from different onboard sensors/interfaces and to transmit them to other parts of the system or to other users;**

- **a sensor system that receives and collects surveillance information about targets under surveillance;**

- **a communication system which connects the sensor systems to an SDP system and allows transfer of the surveillance data. Ground communication may also support control and monitoring of the sensor; and**

- **an data processing system that combines the data received from the different sensors in one data stream, optionally integrates the surveillance data with other and provides/distributes the data to the users in a specified manner removing the possible different specificities of the different types of sensors.**

The sensor is a significant part of the aeronautical surveillance system. It provides surveillance information which is then presented to air traffic controllers. The available sensors/systems can currently be categorized as:

- **Non-Cooperative**
- **Independent Cooperative**
- **Dependent Cooperative**

The remainder of this section provides an high level overview of the sensors available for aeronautical surveillance applications.

Non-Cooperative Sensors / Systems

Primary Surveillance Radars (PSR)

Primary Surveillance Radars works by detecting reflections to transmitted pulses of radio frequency energy. The ground station typically consists of a transmitter, receiver and

rotating antenna. The system transmits the pulses and then detects and processes the received reflections. The slant range of the target is determined by measuring the time from transmission of the signal to reception of the reflected pulses. The bearing of the target is determined by noting the position of the rotating antenna when the reflected pulses are received. Reflections are obtained from targets of interest and fixed objects (e.g. buildings) which tend to create clutter. Special processing techniques are used to remove the clutter.

In the 1960s and 1970s, Primary Surveillance Radars was widely used for en-route surveillance. From the late 1970s many air navigation service providers decided to discontinue use of Primary Surveillance Radars for that application mainly because of its high cost and inability to provide identification, which became more important with increasing traffic densities. Also, mandatory requirements for aircraft to carry transponders in airspace with high traffic meant that surveillance could be provided using Secondary Surveillance Radars. In many countries the use of Primary Surveillance Radars is retained for defence or for weather-monitoring purposes rather than for the provision of civil ATC services.

Primary Surveillance Radars has not been standardized by ICAO, but remains a useful tool in busy terminal areas where it provides surveillance of aircraft not equipped with a transponder (intruder detection). The future use of traditional Primary Surveillance Radars is expected to decrease mainly due to widespread transponder carriage and the introduction of other surveillance technologies.

Primary Surveillance Radars is also used in airport surface surveillance applications to detect objects that stray onto the active areas of the airport and those aircraft with transponders that are configured to ignore SSR interrogations when on the ground.

Presently Primary Surveillance Radars are generally not the main means of providing surveillance because of its inability to provide target identification (this is mitigated to some extent by voice communication and specific procedures).

Independent Cooperative Sensor Systems

Secondary Surveillance Radars (SSR)

The Secondary Surveillance Radar system consists of two main elements, a ground-based interrogator/receiver and an aircraft transponder. The ground station typically consists of a rotating antenna. The aircraft's transponder responds to interrogations from the ground station enabling the aircraft's range and bearing from the ground station to be determined independantly. The bearing of the aircraft from the radar is determined by measuring the position of the rotating antenna when the reply is received. The range accuracy is generally constant within the coverage volume. However the bearing, being an angular measurement, is less accurate for aircraft that are further away from the radar.

The transponder is allowed a fixed delay within which to decode the interrogation and prepare the reply for transmission. This fixed delay is taken into account by the ground sensor when processing the reply.

Reference transponders, installed at known locations on the ground are used to confirm that the radar is operating correctly. The system is usually configured to generate an alert if the radar fails to receive a reply from the site monitor or reports its position outside a predefined area centred on its true position.

Secondary Surveillance Radars evolved from military applications that required an aircraft to be identified as friendly or hostile. The Mode A/C service was subsequently developed for civil aviation. Since then, Secondary Surveillance Radars has been significantly enhanced to include the Mode S service. Secondary Surveillance Radars share the frequencies 1 030 MHz for interrogations and 1 090 MHz for replies with other systems:

- **Mode A/C transponders provide an identity (Mode A) code and pressure altitude (Mode C) code in response to radar interrogations. The spacing of the interrogation pulses determines the mode and hence controls the transponder response. The Mode A identity code, in the form of a four-digit octal number, is assigned by ATC and entered into the transponder by the flight crew. The transponder receives altitude from an on-board pressure altitude encoder or air data computer.**

- **Mode S allows selective addressing of aircraft through the use of a 24-bit aircraft address that uniquely identifies each aircraft and has a two-way data link between the ground station and aircraft for the exchange of information. It was designed to be backward compatible with and supports all functions of Mode A/C. data link allows additional information such as airspeed, heading, ground speed, track angle, track angle rate vertical rate and roll angle to be obtained from the aircraft. Such aircraft derived data may be used to improve the tracking of the aircraft and to alleviate the need for radio calls for obtaining the information. Other information that may be obtained via the Mode S data link includes the aircraft ID, the altitude selected by the flight crew on the aircraft's mode control panel and an ACAS RA report.**

Multilateration (MLAT)

A multilateration system relies on signals from an aircraft's transponder being detected at a number of receiving stations. MLAT uses a technique known as TDOA to establish surfaces that represent constant differences in distance between the target and pairs of receiving stations. The aircraft position is determined by the intersection of these surfaces.

Multilateration can theoretically be performed using any signals transmitted periodically from an aircraft. However, systems used for civil purposes are based only on Secondary Surveillance Radars transponder signals. A multilateration system requires a minimum of four receiving stations to calculate an aircraft's position. If the aircraft's pressure altitude is known then the position may be resolved using three receiving stations. However, in

practice, operational multilateration systems have many more receiving stations to ensure adequate coverage and performance.

The accuracy of a multilateration system is non-linear within the coverage volume. It is dependent on the geometry of the target in relation to the receiving stations and the accuracy to which the relative time of receipt of the signal at each station can be determined. A multilateration system needs a common time reference to determine the relative TOA of the signal at the receiving stations. This is normally done in one of two ways:

- Centralized: all the received signals are sent to a central processing station where they are time-stamped by a common clock. In this case, the system must determine and make allowance for the message transit time between each receiving station and the central station. The system transmits messages between the central and receiver stations to monitor and adjust the transit time; or

- De-centralized: the clocks in all of the receivers are kept in synchronism by a common reference such as GNSS, or through the use of a transmitter at a known location. The distance between this transmitter and the receiving stations is known, and by monitoring the time of receipt of the signals from this transmitter at each receiving station, adjustments can be made to ensure the receiver clocks remain synchronized.

Multilateration systems may include transmitting stations capable of interrogating aircraft transponders. This may be necessary if there are no other interrogations in the coverage area of the system to generate SSR reply signals. It may also be necessary to obtain Mode A code, pressure altitude and possibly other (through Mode S replies) aircraft data. Some systems also use the interrogations and subsequent replies to measure the range of the aircraft from the transmitting station in a similar manner to radar. This range measurement supplements the multilateration TDOA information.

Multilateration systems can also process extended squitter signals in two ways:

- by using TDOA, as with all other transponder signals; and
- by decoding the message content to determine the aircraft's position (latitude and longitude), pressure altitude and velocity.

MLAT therefore provides a transition to an environment where the majority of aircraft will be equipped with ADS-B.

Multilateration may be used for airport surface, terminal area and en-route surveillance. Its use for surface surveillance applications relies on aircraft transponders being active while being on the ground. In many aircraft, the transponder's operation is controlled by the weight-on-wheels switch, also known as the squat switch. Mode S transponders continue to transmit squitters and may be selectively interrogated while they are on the ground. However, Mode A/C transponders are often inhibited from replying to

interrogations while the aircraft is on the ground to reduce the impact on nearby radar systems.

Dependent Cooperative Systems

Automatic Depandant Surveillance – Contract (ADS-C)

In ADS-C the aircraft uses on-board navigation systems to determine its position, velocity and other data. A ground ATM system establishes a "contract" with the aircraft to report this information at regular intervals or when defined events occur. This information is transmitted on point-to-point data links. This means the information cannot be accessed by other parties (i.e. other aircraft or other ATM systems). The aircraft operator and ATM provider each establish agreements with a data link service provider for delivery of the ADS-C messages. Information that may be transmitted in ADS-C reports includes:

- present position (latitude, longitude and altitude) plus time stamp and FOM;
- predicted route in terms of next and (next +1) waypoints;
- velocity (ground or air referenced); and
- meteorological data (wind speed, wind direction and temperature).

The airborne and ground systems negotiate the conditions under which the aircraft submits reports (i.e. periodic reports, event reports demand reports and emergency reports). Reports received by the ATM system are processed to track the aircraft on displays in a way similar to surveillance data obtained from SSR. The reporting rate for current oceanic operations is normally about 15 to 25 minutes. It is however possible for controllers to manually increase the reporting rate to support specific operations.

ADS-C is typically used in oceanic and remote areas where there is no radar. As a result, it is mainly fitted to long-range air transport aircraft and could support more efficient separation standards than in a case where ATC is reliant only on pilot reports. ADS-C is usually used in conjunction with CPDLC, which allows electronic data communication between ATC and flight crew as an alternative to voice communications.

Note: ADS-C is currently used entirely to provide procedural separation.

Automatic Depandant Surveillance – Broadcast (ADS-B)

ADS-B is the broadcast by an aircraft of its position (latitude and longitude), altitude, velocity, aircraft ID and other information obtained from on-board systems. Every ADS-B position message includes an indication of the quality of the data which allows users to determine whether the data is good enough to support the intended function.

The aircraft position, velocity and associated data quality indicators are usually obtained from an on-board GNSS. Current inertial sensors by themselves do not provide the required accuracy or integrity data, although future systems are likely to address this shortcoming. ADS-B position messages from an inertial system are therefore usually

transmitted with a declaration of unknown accuracy or integrity. Some new aircraft installations use an integrated GNSS and inertial navigation system to provide position, velocity and data quality indicators for the ADS-B transmission. These systems are expected to have better performance than a system based solely on GNSS, since inertial and GNSS sensors have complementary characteristics that mitigate the weaknesses of each system. Altitude is usually obtained from the pressure altitude encoder (also used as the data source for Mode C replies).

Since ADS-B messages are broadcast, they can be received and processed by any suitable receiver. As a result, ADS-B supports both ground-based and airborne surveillance applications. For aeronautical surveillance, ground stations are deployed to receive and process the ADS-B messages. In airborne applications, aircraft equipped with ADS-B receivers can process the messages from other aircraft to determine the location of surrounding traffic in support of applications such as the CDTI. Other, more advanced ASAs are under development and are expected to have a significant impact on the way in which air traffic is managed.

Three ADS-B data links (or signal transmission systems) have been developed and standardized:

Mode S[1] 1 090 MHz ES (1 090 ES) was developed as part of the Mode S system. The standard Mode S acquisition squitter is 56 bits long. The 1 090 MHz ES contains an additional 56-bit data block containing ADS-B information. Each ES message is 120 microseconds long (8 microseconds of preamble and 12 microseconds of data). The signals are transmitted at a frequency of 1 090 MHz, and have a data transmission rate of 1 Mbps. The ADS-B information is broadcast in separate messages, each of which contains a related set of information (e.g. airborne position and pressure altitude, surface position, velocity, aircraft ID and type, emergency information). Position and velocity are transmitted twice per second. Aircraft ID is transmitted every 5 seconds. The transmission of ES ADS-B is an integral part of many Mode S transponders, although it may also be implemented in a non-Mode S transponder device as well. There is international agreement that Mode S ES will be used for air transport aircraft worldwide to support interoperability, at least for initial implementation.

Universal access transceiver[2] (UAT) has been designed as a general purpose aviation data link to allow uplink of information in addition to the transmission of ADS-B data. Since each UAT transceiver is allocated a time slot, the receiver is able to perform a range check, based on the time of receipt of the message, to provide a rudimentary validation of the broadcast position. This feature also allows aircraft receiving messages to determine their range from the ground station.

VHF digital link Mode 4[3] (VDL Mode 4) was developed as a generic data link supporting CNS functions. The applicability was initially restricted to surveillance applications like ADS-C and ADS-B, but the regulatory restrictions were later removed so that VDL Mode

[1] The manual on Technical Provisions for Mode S Services and Extended Squitter (Doc 9871) contains details on Mode S ES
[2] The Manual on the Universal Access Transceiver (UAT) (Doc 9861) contains details of UAT.
[3] The Manual on VHF Digital Link (VDL) Mode 4 (Doc 9816) contains details of the VDL Mode 4.

4 is now available as a CNS data link. The system supports broadcast and point-to-point communications for air-ground and air-air applications.

4 ATS Services – Evolution of Aeronautical Surveillance

Aeronautical surveillance systems are designed to be used by ATS to improve capacity and to enhance safety. In support of applications, the ATS surveillance system should provide for a continuously updated presentation of surveillance information, including position indications.

En-route control service

En-route control services usually encompass large volumes of airspace (including oceanic areas) where aircraft are well established on their flight paths and are typically in cruise mode. Aircraft generally fly at high speeds in this phase.

A surveillance system for area control typically needs to provide surveillance over large volumes of airspace including remote areas where ground infrastructure may be limited or non-existent. The surveillance system should support controller safety net alerts such as cleared level monitoring, route adherence monitoring and restricted area monitoring. The provision of medium-term conflict detection tools is desirable. Position updates may not need to be as frequent as in other environments.

Surveillance systems suitable for area control include ADS-C, particularly in oceanic and remote areas, SSR, MLAT and ADS-B. The following table summarises the proposed evolution of air traffic surveillance solutions in the region:

EN ROUTE AIRSPACE OPERATIONS

	Short term (2008-2015)	**Mid- term (2016-2020)**	**Long term (2020 and beyond)**
	Surveillance technologies*	**Surveillance technologies***	**Surveillance technologies***
Type 1	SSR where implemented ADS-B MLAT	SSR where implemented ADS-B MLAT	Reduced number of SSRs ADS-B MLAT
Type 2	ADS-C SSR where implemented ADS-B MLAT	SSR where implemented ADS-B MLAT	Reduced number of SSRs ADS-B MLAT
Type 3	ADS-C Voice Reporting	ADS-C Voice Reporting	ADS-C Reduced Voice Reporting
Remote	ADS-C Voice Reporting	ADS-C Voice Reporting	ADS-C Reduced Voice Reporting
Oceanic	ADS-C Voice Reporting	ADS-C Voice Reporting	ADS-C Reduced Voice Reporting

*** Only when and where operationally justified and cost-effective.**

Note:

- Type 1: Complex traffic pattern and a high density traffic;
- Type 2: Complex traffic pattern and a medium density traffic; and
- Type 3: Low density traffic.

Approach control service

Approach control services are provided to controlled flights arriving or departing from one or more aerodromes. Vectoring may be performed at higher traffic density levels, and changes in altitude and heading are frequent. Arriving traffic may be placed in holding patterns when demand for services exceeds the aerodrome or airspace capacity.

In this environment, the role of ATM is to manage the flow of traffic to and from the aerodrome, to separate arriving traffic from departing traffic. Aircraft are typically separated by lesser minima than in the case of area control. Aircraft speeds are lower than in the en-route phase of flight.

Surveillance systems suitable for approach control include primary radar, SSR, multilateration (MLAT) and ADS-B. The following table summarises the proposed evolution of air traffic surveillance solutions in the region:

APPROACH AIRSPACE OPERATIONS

	Short term (2008-2015)	**Mid- term (2016-2020)**	**Long term (2020 and beyond)**
	Surveillance technologies*	**Surveillance technologies***	**Surveillance technologies***
Type 1	SSR where implemented PSR MLAT ADS-B	SSR where implemented PSR MLAT ADS-B	MLAT ADS-B
Type 2	SSR where implemented PSR MLAT ADS-B	SSR where implemented PSR where justified MLAT ADS-B	MLAT ADS-B
Type 3	Voice Reporting	Voice Reporting	Voice Reporting

*** Only when and where operationally justified and cost-effective.**

Note:

- Type 1: Complex traffic pattern and a high density traffic;
- Type 2: Complex traffic pattern and a medium density traffic; and
- Type 3: Low density traffic.

Aerodrome control service

Aerodrome control service is, inter alia, responsible for preventing collisions between aircraft in the vicinity of the aerodrome and between aircraft and vehicles in the manoeuvring area and between aircraft landing and taking off. Visual sighting of aircraft from the control tower is the primary means of determining position. During busy periods and in low visibility conditions, a surveillance system may be used to improve the safety and efficiency of aerodrome operations.

It also needs a high update rate in order to present a current picture in a rapidly changing environment.

A surveillance system supporting an aerodrome control service needs to have a high degree of accuracy to determine the location of targets on relatively narrow runways and taxiways, with the ability to detect both aircraft and vehicles, and to distinguish between closely spaced targets. The system also needs a high update rate in order to present a current picture in a rapidly changing environment. Aircraft and vehicles need to be clearly labelled on controller displays to avoid confusion. The surveillance system should support runway incursion monitoring and other alerting tools.

Surveillance systems suitable for aerodrome control include primary radar, secondary surveillance, multilateration and ADS-B. The following table summarises the proposed evolution of air traffic surveillance solutions in the region:

TERMINAL AIRSPACE OPERATIONS

	Short term (2008-2015)	**Mid- term (2016-2020)**	**Long term (2020 and beyond)**
	Surveillance technologies*	**Surveillance technologies***	**Surveillance technologies***
Type 1	SSR where implemented PSR MLAT ADS-B	SSR where implemented PSR MLAT ADS-B	MLAT ADS-B
Type 2	SSR where implemented PSR MLAT ADS-B	SSR where implemented PSR MLAT ADS-B	MLAT ADS-B
Type 3	Voice Reporting	Voice Reporting	Voice Reporting

*** Only when and where operationally justified and cost-effective.**
Note:

- Type 1: Complex traffic pattern and a high density traffic;
- Type 2: Complex traffic pattern and a medium density traffic; and
- Type 3: Low density traffic.

5 Data Exchange Format

Motivation on the use of ASTERIX to be included here

6 Data Sharing Agreement – Template

Proposed data sharing agreement to be included in thi section, with the necessary motivation.

7 Surveillance Performance Framework

7.1 En-Route Surveillance

SURVEILLANCE SYSTEMS PERFORMANCE FRAMEWORK				
Performance Benefits				
Safety	Timely availability of reliable infrastructure capabilities will improve ***safety*** and efficiency in aviation as well as improving airspace and aerodrome capacity. Timely availability of adequate radio spectrum will ensure the provision of viable air navigation services on a global basis and thus improve ***safety*** and efficiency in aviation.			
Environment	Optimal routing will reduce carbon ***emissions***.			
Efficiency	Timely availability of reliable communication capabilities will improve safety and ***efficiency*** in aviation as well as improving airspace and aerodrome capacity. Timely availability of adequate radio spectrum will ensure the provision of viable air navigation services on a global basis and thus improve safety and ***efficiency*** in aviation.			
Capacity	Timely availability of reliable infrastructure capabilities will improve safety and efficiency in aviation as well as improving airspace and aerodrome ***capacity***.			
Cost Effectiveness	Optimal routing will reduce ***operating cost***			
ATM Operational Concept Components	**Tasks / Project / Initiative**	**Timeframe Start-End**	**Responsibility**	**Status**
AOM, DCB, AO, TS, CM, AUO, ATMSDM				
AOM, DCB, AO, TS, CM, AUO, ATMSDM				
AOM, DCB, AO, TS, CM, AUO, ATMSDM				
AOM, DCB, AO, TS, CM, AUO, ATMSDM				
AOM, DCB, AO, TS, CM, AUO, ATMSDM				
Risk Management				
Risk Factors	Lack of Funding. Delay of Aircraft Equipage. System inter-operability & Harmonisation. Lack of SARPS. Insufficient Data.			
Risk Mitigation	Identification and application of different funding resources. Proactive consultation with ATM Community. Proactive consultation with Regulators. Access to ATM Community planning forums.			

Linkage to GPI's	
GPI-9: Situational Awareness	AO, TS, CM, AUO

7.2 Approach Surveillance

SURVEILLANCE SYSTEMS PERFORMANCE FRAMEWORK				
Performance Benefits				
Safety	Timely availability of reliable infrastructure capabilities will improve ***safety*** and efficiency in aviation as well as improving airspace and aerodrome capacity. Timely availability of adequate radio spectrum will ensure the provision of viable air navigation services on a global basis and thus improve ***safety*** and efficiency in aviation.			
Environment	Optimal routing will reduce carbon ***emissions***.			
Efficiency	Timely availability of reliable communication capabilities will improve safety and ***efficiency*** in aviation as well as improving airspace and aerodrome capacity. Timely availability of adequate radio spectrum will ensure the provision of viable air navigation services on a global basis and thus improve safety and ***efficiency*** in aviation.			
Capacity	Timely availability of reliable infrastructure capabilities will improve safety and efficiency in aviation as well as improving airspace and aerodrome ***capacity***.			
Cost Effectiveness	Optimal routing will reduce ***operating cost***			
ATM Operational Concept Components	**Tasks / Project / Initiative**	**Timeframe Start-End**	**Responsibility**	**Status**
AOM, DCB, AO, TS, CM, AUO, ATMSDM				
AOM, DCB, AO, TS, CM, AUO, ATMSDM				
AOM, DCB, AO, TS, CM, AUO, ATMSDM				
AOM, DCB, AO, TS, CM, AUO, ATMSDM				
AOM, DCB, AO, TS, CM, AUO, ATMSDM				
Risk Management				
Risk Factors	Lack of Funding. Delay of Aircraft Equipage. System inter-operability & Harmonisation. Lack of SARPS. Insufficient Data.			
Risk Mitigation	Identification and application of different funding resources. Proactive consultation with ATM Community. Proactive consultation with Regulators. Access to ATM Community planning forums.			
Linkage to GPI's				
GPI-9: Situational Awareness	AO, TS, CM, AUO			

7.3 Terminal Surveillance

SURVEILLANCE SYSTEMS PERFORMANCE FRAMEWORK	
Performance Benefits	
Safety	Timely availability of reliable infrastructure capabilities will improve ***safety*** and efficiency in aviation as well as improving airspace and aerodrome capacity. Timely availability of adequate radio spectrum will ensure the provision of viable air navigation services on a global basis and thus improve ***safety*** and efficiency in aviation.
Environment	Optimal routing will reduce carbon ***emissions***.
Efficiency	Timely availability of reliable communication capabilities will improve safety and ***efficiency*** in aviation as well as improving airspace and aerodrome capacity. Timely availability of adequate radio spectrum will ensure the provision of viable air navigation services on a global basis and thus improve safety and ***efficiency*** in aviation.
Capacity	Timely availability of reliable infrastructure capabilities will improve safety and efficiency in aviation as well as improving airspace and aerodrome ***capacity***.
Cost Effectiveness	Optimal routing will reduce ***operating cost***

ATM Operational Concept Components	Tasks / Project / Initiative	Timeframe Start-End	Responsibility	Status
AOM, DCB, AO, TS, CM, AUO, ATMSDM				
AOM, DCB, AO, TS, CM, AUO, ATMSDM				
AOM, DCB, AO, TS, CM, AUO, ATMSDM				
AOM, DCB, AO, TS, CM, AUO, ATMSDM				
AOM, DCB, AO, TS, CM, AUO, ATMSDM				

Risk Management	
Risk Factors	Lack of Funding. Delay of Aircraft Equipage. System inter-operability & Harmonisation. Lack of SARPS. Insufficient Data.
Risk Mitigation	Identification and application of different funding resources. Proactive consultation with ATM Community. Proactive consultation with Regulators. Access to ATM Community planning forums.

Linkage to GPI's	
GPI-9: Situational Awareness	AO, TS, CM, AUO

8 List of Acronyms and Abbreviations

3D	Three Dimensional
3G	Third Generation
3GPP	Third Generation Partnership Project
AAIM	Aircraft Autonomous Integrity Monitoring
ABAS	Aircraft –based Augmentation
ACARS	Aircraft Communications, Addressing and Reporting System
ACAS	Airborne Collision Avoidance System
ACC	Area Control Centre
ADF	Automatic Direction Finder
ADS	Automatic Dependent Surveillance
ADS – B	Automatic Dependant Surveillance – Broadcast
ADS – C	Automatic Dependant Surveillance – Contract
AERMAC	Aeronautical Message and Communication (Software Product)
AFI	Africa – Indian ocean area
AFN	ATC Facilities Notification (Fans 1/A Message)
AFS	Aeronautical Fixed Service
AFTN	Aeronautical Fixed Telecommunications Network
AGC	Automatic Gain Control
AIDC	Air Traffic Services Inter – Facility Data Communications
AIMU	Aeronautical Information Management Unit
AIP	Aeronautical Information Publication
AIREP	Air Report
AMC	Airspace Management Cells
AMCP	Aeronautical Mobile Communications Panel
AMHS	ATS message Handling System
AMS	Aeronautical Mobile Service
AMS® S	Aeronautical Mobile-Satellite (R) Service
AMSS	Aeronautical Mobile-Satellite Service
ANR's	Air Navigation Regulations
AO	Aircraft Operators
AOC	Aircraft Operating Company / Committee
AORRA	Atlantic Ocean Random Route Area
APIRG	AFI Planning and Implementation Regional Group
APN	Access Point Name
APP	Approach
APR	Automatic Position Reporting
APV	Approach with Vertical Guidance
AR	Area of Routing
ASM	Airspace Management
A-SMGCS	Advanced Surface Movement Guidance & Control System
ASP	Aeronautical Surveillance Panel
ATA	Actual Time of Arrival
ATD	Actual Time of Departure
ATFM	Air Traffic Flow Management
ATIS	Automatic Terminal Information Service
ATN	Aeronautical Telecommunications Network
ATOM	ADSAT Trials Operations Manual
ATS	Air Traffic Services or Aircraft Tracking System
ATS/DS	Air Traffic Service / Direct Speech
ATSMHS	Air Traffic Services Message Handling System
BA	Business Analyst
BER	Bit Error Rate / Beyond Economical Repair
BITE	Build-in Test Equipment
BOM	Bill of Material

BSA	Business Systems Administrator
CAMU	Central Airspace Management Unit
CAPEX	Capital Expenditure
CATS-ACCID &INCID	Civil Aviation Technical Standards / Accidents and Incidents
CATS-AIRS	Civil Aviation Technical Standards / Met Information And Aeronautical Info Services
CATS-ARM	Civil Aviation Technical Standards / Aircraft Registration Markings
CATS-ATO	Civil Aviation Technical Standards / Aviation Training Organisations
CATS-ATS	Civil Aviation Technical Standards / Air Traffic Services
CATS-DG	Civil Aviation Technical Standards / Dangerous Goods
CCA	Commissioner Civil Aviation
CDI	Course Deviation Indicator
CDP	Communications Data Processor
CDR's	Conditional Routes
CDRL	Contract Document Requirement List
CDU	Control and Display unit
CEU	Central Executive Unit
CFE	Customer Furnished Equipment
CFIT	Controlled Flight Into Terrain
CFMU	Central Flow Management Unit
CLD	Clearance Delivery
CM	Context Management
CNS	Communications, Navigation and Surveillance
COM	Communications
CPDLC	Controller Pilot Data Link Communication
CRC	Cycle Redundancy check
CRM	Customer Relationship Management
CRM	Collision Risk Modelling
CSD	Circuit Switched Data
CTA	Control Area
CTR	Control Zone
CUG	Closed User Group
DAIW	Danger Area Infringement Warning
DARPs	Dynamic user preference re-routes
D-ATIS	Digital Automatic Terminal Information System
DCPC	Direct Controller Pilot Communications (voice/data)
DCW	Digital Chart of The World
DDP	Delivered Duty Paid
DECT	Digital Enhanced Cordless Telecommunications
DEP	Departure
DF	Directional Finder
D-FIS	Digital Flight Information Service
DGNSS	Differential Global Navigation Satellite System
DHCP	Dynamic Host Configuration Protocol
DI	Direction Indicator
DL	Data Link
DLC	Departure Clearance
DME	Distance Measuring Equipment
DTED	Digital Terrain Elevation Data
DTM	Dual Transfer Mode
DTMF	Dual Tone Multi Frequency
DVD	Digital Versatile Disk
DVOR	Doppler VOR
DVR	Digital Video Recorder
EASA	European Aviation Safety Agency
EATCHIP	European Air Traffic Control Harmonisation and Integration Program
EATMS	European Air Traffic Management System
ECAC	European Civil Aviation
ECP	Engineering Change Proposal
EGNOS	European Geostationary Navigation Overlay System

ETA	Estimated Time of Arrival
EUR	European Region
EUROCAE	European Organisation for Civil Aviation Equipment
Eurocontrol	European Organisation for the Safety of Air Navigation
FAA	Federal Aviation Administration
FANS	Future Air Navigation Systems
FAT	Factory Acceptance Tests
FDP	Flight Data Processor
FDPS	Flight Data Processing System
FET	Further Education & Training
FIC	Flight Information Centre
FIR	Flight Information Region
FIS	Flight Information Service
FL	Flight Level
FMC	Flight Management Computer
FMECA	Failure Mode Effect and Critical Analyses
FMP	Flow Management Position
FMS	Flight Management System
FOB	Free on Board
FOR	Free on Rail
FPL	Flight Plan
FRACAS	Failure Mode Effect and Corrective Action System
FRT	Fixed Radius Transition
FTA	Fault Tree Analyses
FTE	Flight Technical Error
FUA	Flexible Use of Airspace
GAAP	General Aviation Accident Prevention
GBAS	Ground Based Augmentation System
GES	Ground Earth Station
GIC	GNSS Integrity Channel
GLONASS	Global Navigation Satellite System (Russian Federation)
GNSS	Global Navigational Satellite System
GPRS	General Packet Radio Service
GPS	Global Positioning System
GS	Ground Speed
GSM	Global System for Mobile Communications
GUI	Graphical User Interface
HDL	HF Data Link
HF	High Frequency
HFDL	High Frequency Data Link
HFP	Human Factors Practitioner
HFS	Human Factor Specialist
HME	Height Monitoring Equipment
HMI	Human Machine Interface
HMU	Height Monitoring Unit
HTTP	Hyper Text Transfer Protocol
IAS	Indicated Air Speed
ICG	Implementation Coordination Group
ICT	Information Communication Technology
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMAP	Internet Message Access Protocol
INS	Inertial Navigation System
IORRA	Indian Ocean Random Route Area
IP	Internet Protocol
IRS	Inertial Reference System
IRU	Inertial Reference Unit
ISD	Integrated Service Digital Network
ISS	Investigation and Standards Specialist

IT	Information Technology
JAA	Joint Aviation Authorities
JIT	Just In Time
KSIA	King Shaka International Airport
LAAS	Local Area Augmentation System
LAN	Local Area Network
LCC	Life Cycle Cost
LCD	Liquid Crystal Display
LIS	Logistic Information System
LNAV	Lateral Navigation
LRU	Line Replaceable Unit
LS	Logistic Support
LSA	Logistic Support Analyses
LSP	Logistic Support Plan
LSPP	Logistic Support Programme Plan
MACS	Minimum Acceptable Communication Service
MARS	Minimum Acceptable Radar Service
MASPS	Minimum Aviation System Performance Standards
MCDU	Multi Purpose Control and Display Unit (Acars and FMC)
MCO	Marketing communications Officer
MCOMS	Marketing and Communications Specialist
MDF	Main Distribution Frame/ Management Development Facilitator
MDP	Management Development Program
MEL	Minimum Equipment List
MER	Manager Employee Relations
MET	Meteorological
METAR	Aviation routine weather report
MLS	Microwave Landing System
MMR	Multimode Receiver
MMS	Maintenance Management System (Software product)
MNPS	Minimum Navigation Performance Specifications
MNT	Mach Number Technique
MODE S	Mode S SSR Data Link
MRT	Multi Radar Tracking
MSA	Minimum Sector Altitude
MSAW	Minimum Safe Altitude Warning System
MSSR	Monopulse Secondary Surveillance Radar
MTBF	Mean Time Before Failure
MTCA	Medium Term Conflict Alert
MTTR	Mean Time To Repair
NAVAID	Navigation Aids
NDB	Non Directional Beacon
NM	Nautical Mile
NOTAM	Notice To Airmen
NPA	Non-precision Approach
NQF	National Qualifications Framework
NSE	Navigation System error
NSTB	National Satellite Test Bed
OEM	Original Equipment Manufacturer
OLDI	On Line Data Interchange
OPS	Operations
ORTIA	OR Tambo International Airport
PANS-OPS	Procedure for ANS-Aircraft Operations
PBN	Performance Based Navigation
PBU	Period Of Beneficial Use
PBX	Private Branch eXchange
PCM	Pulse Code Modulation
PCUG	Private Closed User Group
PDA	Personal Digital Assistant

PDC	Pre Departure Clearance
PHS&T	Packaging, Handling, Storage and Transportation
POP	Post Office Protocol
POTS	Plain Old Telephone System
PPP	Point-to-Point Protocol
PSR	Primary Surveillance Radar
PSTN	Public Switched Telephone Network
PTN	Private Telecommunication Network
PVN	Private Voice Network
PWT	Personal Wireless Telecommunications
QNH	Pressure Setting for Altimeters (Usually In Hecta Pascals)
R/T	Radiotelephony
RA	Resolution Advisory (ACAS A\C Warning)
RAFC	Regional Area Forecasting Centre
RAIM	Receiver Autonomous Integrity Monitoring
RAM	Reliability, Availability and Maintainability
RAN	Regional Air Navigation
RCMMS	Remote Control Monitoring & Maintenance System
RCMS	Remote Control and Monitoring System
RCP	Required Communication Performance
RDP	Radar Data Processor
RF	Radius to Fix Area Navigation
RFC	Request for Change
RFP	Request for Proposal / Radar Front Processor
RFQ	Request for Quotation
RFT	Request for Tender
RNAV	Required Area Navigation
RNP	Required Navigation Performance
ROD	Record of Decision
ROI	Registration of Interest
ROT	Runway Occupation Time
ROX	Rate of Exchange
RPL	Repetitive Flight Plan/ Recognition of prior Learning
RPS	Recording And Playback System
RSP	Required Surveillance Performance
RTCA	Requirements and Technical Concepts for Aviation
RVR	Runway Visual Range
RVSM	Reduced Vertical Separation Minima
SAM	South American Region
SARP's	Standards and Recommended Practices
SAT	Site Acceptance Tests or South Atlantic
SATCOM	Satellite Communications
SBAS	Satellite – based Augmentation System
SBAS	Space Based Augmentation System
SDH	Synchronous Digital Hierarchy
SE	Systems Engineer
SID	Standard Instrument Departure
SIGMET	Information concerning en-route phenomena which may affect the safety of aircraft operations
SIGWX	Significant Weather
SLA	Service Level Agreement
SME	Small and Medium Size Enterprise
SMS-C	Short Message Service Center
SNMP	Simple Network Management Protocol
SRA	Special Rules Airspace / Surveillance Radar Approach
SRE	Surveillance Radar Element
SRU	Shop Replace able Unit / Surveillance Radar Unit
SSR	Secondary Surveillance Radar
SSS	System Support Suite

STAR	Standard Terminal Arrival Route
STCA	Short Term Conflict Alert
SWC	Soccer World Cup
TA	Traffic Advisory (TCAS A/C Warning, Tactical Manoeuvre Required)
TAAMS	Total Airport And Airspace Modelling Software
TAF	Terminal Area Forecast
TAR	Terminal Approach Radar
TAS	True Air Speed
TAT	Turn Around Time
TCAS	Traffic Collision Avoidance System
TCP	Transmission Control Protocol
TDM	Track Definition Message (Time Division Multiplex)
TET	Trainee Engineering Technician
TGO	Target generating Officer
TL	Technologist Logistics
TLS	Target Level of Safety
TMA	Terminal Control Area (Terminal Maneuvering Area)
TMS	Air Traffic Management Specialist
TOS	Traffic Orientation Scheme
TSA	Temporary Segregated Area
TSE	Total System Error
UHF	Ultra High Frequency
URS	User Requirement Statement / Specification
USB	Universal Serial Bus
VCCS	Voice Communication and Control Switch
VCR	Visual Control Room
VDF	VHF Directional Finder
VDL	VHF Data Link
VFR	Visual Flight Rules
VHF	Very High Frequency
VNAV	Vertical Navigation
VoIP	Voice Over Internet Protocol
VOR	VHF Omni directional Range
VOR	VHF Omni directional Radio Range
VPN	Virtual Private Network
VSAT	Very Small Aperture Terminal
WAAS	Wide Area Augmentation System
WAFS	World Area Forecast System
WAN	Wide Area Network
WANA	Wide Area Network A
WAP	Wireless Application Protocol
WBS	Work Breakdown Structure
WGS-84	World Geodetic Reference System 1984
WiFi	Wireless Fidelity
WLAN	Wireless Local Access Network
WWW	World Wide Web

APPENDIX I2

Terms of Reference, Composition and Work Programme of AFI Aeronautical Surveillance Implementation Task Force

Term of Reference

The AFI Aeronautical Surveillance terms of reference are to:

1. **Determine the operational performance requirements for aeronautical surveillance in the AFI Region, en-route, terminal areas (TMAs) and aerodromes operations.**

2. **Identify and quantify near term and long term benefits of relevant candidate surveillance systems.**

3. **Develop a draft AFI Surveillance plan including recommended target dates of implementation, taking into account:**

    - **Availability of SARPs,**
    - **Readiness of airspace users and air navigation service providers**
    - **Relevant RAN and APIRG recommendations, conclusions and decisions pertaining to aeronautical surveillance.**
    - **Work done by ICAO Surveillance Panel with the view to avoiding any duplication**

Note: *The Task Force should report to the next APIRG meeting with preliminary report to the ATM/AIM/SAR and CNS sub-groups*.

Composition:

- **Core members: ATNS (South Africa), ASECNA, IATA, Algeria, Ghana, Kenya, Nigeria, Rwanda, Tanzania and IFALPA.**

    - **States with large oceanic FIRs interface with other ICAO Regions and large continental coverage to be added to the composition as core members. (Democratic Republic of Congo, Mauritius and Seychelles)**

Working Groups:

Working Group for the development of the AFI En-route Surveillance strategy

- **Seychelles (Team Leader)**

- **South Africa**
- **Nigeria**
- **Ghana**
- **DRC**
- **IATA**
- **Mauritius**
- **Angola**

Working Group for the development of the AFI Terminal Area Surveillance strategy

- **ASECNA (Team Leader)**
- **Zambia**
- **South Africa**
- **IATA**
- **Tanzania**

Future Work Programme

No.	Activity	Target dates
1.	Review and amend the AFI Surveillance Strategy as necessary, based on available ICAO SARPs and relevant guidance material	CNS SG5 2013
2.	Collect relevant data to support categorization of AFI Terminal Areas (TMAs) and Aerodromes, in coordination with the ATM/AIM/SAR Sub-group.	CNS/SG/5 2013
3.	Develop Surveillance Distribution Data Format (ASTERIX)	CNS SG/5 2013
4.	Develop Guidelines for Surveillance Data Exchange Agreements based on other regions best practices	CNS SG/5 2013
5.	Develop Surveillance Data Distribution Format	CNS SG/5 2013
6.	Monitor the status of implementation of the AFI Surveillance Plan	CNS/SG/5 2013
7.	Develop amendment proposals to the AFI Air Navigation Plan (Doc 7474), FASID, CNS Tables 4A and 4B	CNS SG/5 2013
8.	Develop regional performance objectives and metrics	CNS/SG/5 2013

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APPENDIX J1

AFI Frequency Management Group (FMG) Action Plan

Action	By	deadline	Status of implementation
Development of the Terms of Reference for the Rapporteur of the AFI Frequency Management Group	Secretariat	30/06/2011	Completed
Allocation of necessary resources to ensure that the designated Officer is available to participate in all activities of relevance to his/her mandate	ASECNA	Continuous	Completed in 2011 and 2012 through hosting of AFI FMG/2 and WRC-12 preparatory workshop, as well as attendance at WRC-12.
Establishment of national regulatory provisions to protect the use of Fixed Satellite Service (FSS) for the provision of aeronautical telecommunications services	States/ICAO	31/12/2012	Follow up action to be taken on implementation of Recommendation 724 (WRC-07)
Development of a model of a national coordination framework to facilitate efficient dialogue between appropriate authorities and resolution of issues related to the provision, the optimum operation and protection of aeronautical telecommunications spectrum,	States/ICAO	31/12/2013	
Survey on AFI States policies and regulations pertaining to aeronautical telecommunications, and determination of areas of required assistance by AFI /FMG	ICAO	31/12/2011	Survey conducted. Data awaited from States
Coordination of trials on HF Propagation forecast with all States within the same frequencies allotment areas defined in AFI FASID Chart CNS 2.	States/ANSPs	31/12/2012	AMS Survey conducted in 2012, in coordination with IATA
Organization of regional workshops/seminars on the RCP concept (Doc 9869) as called for by APIRG Conclusion 17/26 to facilitate its implementation by AFI	ICAO	31/12/2013	
Review and update AFI database COM Lists	States/ICAO	31/12/2012	AFI COM Lists No.1, 2 and 3 are being updated in coordination with States
Finalization and maintenance of the Frequency	States/ICAO	31/12/2012	Software under

Action	By	deadline	Status of implementation
Assignment Planning Software			evaluation by ICAO Regional Offices
Coordination between States and stakeholders for the development of regional strategies,	States/ICAO	31/12/2013	
Specifications and criteria for software integrity validation	Rapporteur Cameroon, Ghana, Morocco, Rwanda and South Africa	31/12/2013	

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APPENDIX J2

Draft Terms of Reference for the Rapporteur of the AFI Frequency Management Group (AFI FMG)

A. Terms of Reference

The Rapporteur of the AFI Frequency Management Group (AFI/FMG) nominated among the members of the Group is tasked to coordinate the activities of the Group. He develops his activities in the frame of the Action Plan driven from the outcomes of the meetings of the Group in particular through:

1. The follow up of the implementation of AFI/FMG Conclusion and Decisions that need coordinated activities on frequency spectrum management within AFI region;
2. The promotion of AFI Civil Aviation position to the AFI institutions involved in frequency spectrum management (African Telecommunication Union (ATU); African Broadcasting Union-ABU, Regional Direction of International Telecommunication Union (ITU)…)
3. The Report to the ICAO Aeronautical Communication Panel bodies (AC Panel and AC Working Group F) on the current developing activities on frequency spectrum management in AFI Region;
4. The coordination with the similar Rapporteur on frequency management Group nominated in the neighboring ICAO regions
5. The provision to the report to APIRG/CNSG of the status of implementation of APIRGB Conclusions and Decisions pertaining to AFI/FMG activities.
6. Any other activities that could enhance the development of the optimum usage and ensure the protection of Aeronautical Frequency Spectrum.

B. General List of actions

In the short and near term the main activities of the Rapporteur of AFI Frequency management Group can be listed as follows:

1. Ensure the complete collection of COM List
2. Ensure the follow up of the usage of the frequency planning software with feedback from AFI FMG Members
3. Participate to the analysis of the results of the surveys by users (ANSPs forecast on HF, IATA survey on VHF Coverage, Interferences mitigation issues…);

C. Participation to meetings dealing with Aeronautical Frequency Spectrum

To develop efficiently his assigned tasks, the Rapporteur of AFI Frequency Management Group should be provided with the adequate resources aiming to ensuring his participation to the mayor events that could be of interest of the Group mandate.
In the other hand the Rapporteur should endeavor to ensure a relevant yearly planning of his activities allowing him to attend these meetings:;

The following meetings are activities with great relevance to AFI/FMG:

a) African Telecommunication Union Meeting for the preparation of WRCs;
b) ACP Working Group F meetings
c) CPM meetings
d) WRC meeting
e) Regional Seminar/Workshops on frequency spectrum management.

Appendix K

LIST OF DEFICIENCIES IN THE AIR NAVIGATION FIELDS

AFTN

StateName	*Requirements*	*Facilities or Services*	*Description of Deficiency*	*Date first reported*	*Comments on Deficiency*	*Description of Corrective action*	*Executing Body*	*Target date for implementation*	*Priority*
Eritrea									
	AFTN Plan, AFI Rec. 9/7	**Asmara AFTN centre**	**Circuit Asmara/Addis Ababa**	**2008**	**NAFISAT circuit is not operational**	**To be restored**	**Eritrea, Ethiopia**	**3112/2012**	**U**
Ethiopia									
	AFTN Plan, AFI Rec. 9/7	**Addis Ababa AFTN centre**	**Circuit Addis Ababa/Asmara**	**2008**	**NAFISAT circuit is not operational**	**To be restored**	**Ethiopia, Eritrea**	**31/12/2012**	**U**

Appendix K

LIST OF DEFICIENCIES IN THE AIR NAVIGATION FIELDS

ATS DIRECT SPEECH

State Name	Requirements	Facilities or Services	Description of Deficiency	Date first reported	Comments on Deficiency	Description of Corrective action	Executing Body	Target date for implementation	Priority
Algeria	ATS Direct Speech Circuits Plan, AFI/7 Rec. 9/9	Algiers ACC-FIC	Circuit Algiers/Tripoli	1998	Not implemented	Implement LTF circuit	Algeria, Libya	**31/12/2012**	U
Burundi	ATS Direct Speech Circuits Plan, AFI/7 Rec. 9/9	Bujumbura APP	Circuit/ Bujumbura/Kinshasa	1998	Not operational	VSAT implemented at Bujumbura and Kinshasa	Burundi, DR Congo	**31/12/2012**	A
Dem. Rep. of Congo	ATS Direct Speech Circuits Plan, AFI/7 Rec. 9/9	Bukavu TWR	Circuit Bukavu/Kigali	1996	Not implemented		DR Congo, Rwanda	**31/12/2012**	A
	ATS Direct Speech Circuits Plan, AFI/7 Rec. 9/9	Gbadolite TWR	Circuit Gbadolite/Bangui	2002	Not implemented	Could be implemented by interconnection between Bangu AFISNET and G'Badolite RVA domestic VSATs.	DR Congo, ASECNA	**31/12/2012**	A
	ATS Direct Speech Circuits Plan, AFI/7 Rec. 9/9	Goma APP	Circuit Goma/Bujumbura	1998	Not implemented		DR Congo, Burundi	**31/12/2012**	A
	ATS Direct Speech Circuits Plan, AFI/7 Rec. 9/9	Goma APP	Circuit Goma/Kigali	1998	Not implemented		DR Congo, Rwanda	**31/12/2012**	A
Eritrea	ATS Direct Speech Circuits Plan, AFI/7 Rec. 9/9	Asmara ACC	Circuit Asmara/ Addis Ababa	1998	The circuit has been disconnected	To be restored. NAFISAT	Eritrea, Ethiopia	**31/12/2012**	U
Ethiopia	ATS Direct Speech Circuits Plan, AFI/7 Rec. 9/9	Addis Ababa ACC/FIC	Circuit Addis Ababa/ Asmara	1998	The circuit has been disconnected	To be restored. NAFISAT	Ethiopia, Eritrea	**31/12/2012**	U
Rwanda	ATS Direct Speech Circuits Plan, AFI/7 Rec. 9/9	Kigali ACC	Kigali/Kinshasa		Unserviceable	To be restored SADC//2	Rwanda, DR Congo	**31/12/2012**	A
Somalia	ATS Direct Speech Circuits Plan, AFI/7 Rec. 9/9	Hargeisa APP	Circuit Hargeisa/Djibouti	1998	Not implemented	Implement LTF circuit	Somalia, Djibouti	**31/12/2012**	A

Appendix K

LIST OF DEFICIENCIES IN THE AIR NAVIGATION FIELDS

ARNS

State Name	Requirements	Facilities or Services	Description of Deficiency	Date first reported	Comments on Deficiency	Description of Corrective action	Executing Body	Target date for implementation	Priority
Angola	Navaids AFI/7, Rec. 10/4	Huambo	VOR/DME	1998	Not implemented	Implement facility	ENANA	31/12/2012	A
	Navaids AFI/7, Rec. 10/4	Kuito	VOR/DME	1998	Not implemented	Implement facility	ENANA	31/12/2012	A
	Navaids AFI/7, Rec. 10/4	Luena	VOR/DME	1998	Not implemented	Implement facility	ENANA	31/12/2012	U
	Navaids AFI/7, Rec. 10/4	Saurimo	VOR/DME	1998	Not implemented	Implement facility	ENANA	31/12/2012	U
Cameroon	Navaids AFI/7, Rec. 10/4	Maroua	VOR	1998	Not implemented	Implement facility	Cameroon	31/12/2012	A
Guinea	Navaids, AFI/7 Rec. 10/4	Kankan	VOR	1998	Not implemented	Implement facility	Guinea	31/12/2012	A
	Navaids AFI/7 Rec. 10/4	Labe	VOR	1998	Not implemented	Implement facility	Guinea	31/12/2012	A
	Navaids AFI/7 Rec. 10/4	Nzerekore	VOR	1998	Not implemented	Implement facility	Guinea	31/12/2012	A
Kenya	Navaids AFI/7 Rec. 10/4	Mandera	VOR/DME	1998	Not implemented	Implement facility	Kenya	31/12/2012	U
Lesotho	Navaids AFI/7 Rec. 10/4	Maseru	VOR/DME	2002	Not implemented	Implement facility	Lesotho	31/12/2012	U
Liberia	Navaids AFI/7 Rec. 10/4	Robertsfield	ILS 04	1998	Not implemented	Implement facility	Liberia	31/12/2012	U
Libya	Navaids AFI/7 Rec. 10/4	Sarir	VOR/DME	1998	Not implemented	Implement facility	Libya	31/12/2012	U
Madagascar	Navaids AFI/7 Rec. 10/4	Antsiranana	VOR	1998	Not implemented	Implement facility	Madagascar	31/12/2012	U
	Navaids AFI/7 Rec. 10/4	Maintirano	VOR	2002	Not implemented	Implement facility	Madagascar	31/12/2012	U
	Navaids AFI/7 Rec. 10/4	Morondava	VOR	1998	Not implemented	Implement facility	Madagascar	31/12/2012	U
	Navaids AFI/7 Rec. 10/4	Sainte Marie	VOR	1998	Not implemented	Implement facility	Madagascar	31/12/2012	A
Sao Tome & Principe	Navaids AFI/7 Rec. 10/4	Sao Tome	ILS 11	1998	Not implemented	Implement facility	Sao Tome & Principe	31/12/2012	A
Sierra Leone	Navaids AFI/7 Rec. 10/4	Freetown/ Lungi	ILS 30	1999	Unserviceable	To repair	Sierra Leone	31/12/2012	U

State Name	Requirements	Facilities or Services	Description of Deficiency	Date first reported	Comments on Deficiency	Description of Corrective action	Executing Body	Target date for implementation	Priority
	Navaids AFI/7 Rec. 10/4	Freetown/ Lungi	VOR/DME	1999	Unserviceable	To repair	Sierra Leone	31/12/2012	U
Somalia	Navaids AFI/7 Rec. 10/4	Hargeisa	VOR/DME	1998	Not implemented	Implement facility	Somalia	31/12/2012	U
	Navaids AFI/7 Rec. 10/4	Mogadishu	VOR/DME	1998	Not implemented	Implement facility	Somalia	31/12/2012	U
Sudan	Navaids AFI/7 Rec. 10/4	Geneina	VOR	1998	Not implemented	Implement facility	Sudan	31/12/2012	U
	Navaids AFI/7 Rec. 10/4	Karina	VOR/DME	1998	Not implemented	Implement facility	Sudan	31/12/2012	U
Tanzania	Navaids AFI/7 Rec. 10/4	Dodoma	VOR/DME	1998	Not implemented	Implement facility	Tanzania	31/12/2012	U
	Navaids AFI/7 Rec. 10/4	Mbeya	VOR/DME	1998	Not implemented	Implement facility	Tanzania	31/12/2012	U
Zambia	Navaids AFI/7 Rec. 10/4	Mongu	VOR	1998	Not implemented	Under installation	Zambia	31/12/2012	U
	Navaids AFI/7 Rec. 10/4	Solwezi	VOR	1998	Not implemented	Implement facility	Zambia	31/12/2012	U

Appendix K

LIST OF DEFICIENCIES IN THE AIR NAVIGATION FIELDS
AMS

State Name	Requirements	Facilities or Services	Description of Deficiency	Date first reported	Comments on Deficiency	Description of Corrective action
Angola	AMS AFI/7 Rec. 9/12	Luanda FIC	Inadequate VHF coverage of busy ATS routes	1998	Implement remote VHF stations	5 VHF stations to be installed
	AMS AFI/7 Rec. 9/12	Luanda FIC	HF poor quality and unavailable in oceanic area	2004	Improve facilities	Install adequate equipment
Dem. Rep. of Congo	AMS AFI/7 Rec. 9/12	Kinshasa FIR	Inadequate VHF coverage of busy ATS routes	1998	Improve facilities	Extension of VHF coverage in progress
Libya	AMS AFI/7 Rec. 9/12	Tripoli FIR	Inadequate VHF coverage of busy ATS routes	2004	Implement remote VHF stations	
Malawi	AMS AFI/7 Rec. 9/12	FIR Lilongwe	VHF coverage incomplete	2001	Install additional VHF relay stations at Muzuzu and Zomba	Extension of VHF coverage in progress. Equipment in place
Nigeria	AMS AFI/7 Rec 9/12	Kano FIR	Inadequate VHF Coverage	2009	Improve facilities	Extension of VHF coverage in progress
Somalia	AMS AFI/7 Rec. 9/12	Mogadishu ACC	Lack of VHF coverage of busy ATS ROUTES	1998	Implement remote VHF stations	Install VHF relays

Appendix L

Description of strategies for the implementation of the ICAO Global Plan initiatives pertaining to Communications, Navigation and Surveillance (CNS)

(Global Air Navigation Plan, Doc 9750)

1. COMMUNICATION INFRASTRUCTURE (GPI-22)

Description of strategy

1.1. ATM depends extensively and increasingly on the availability of real-time or near real-time, relevant, accurate, accredited and quality-assured information to make informed decisions. The timely availability of appropriate aeronautical mobile and fixed communication capabilities (voice and data) to accommodate ATM requirements and to provide the adequate capacity and quality of service requirements is essential. The aeronautical communication network infrastructure should accommodate the growing need for information collection and exchange within a transparent network in which all stakeholders can participate.

1.2. The gradual introduction of performance-based SARPs and system-level and functional requirements will allow the increased use of commercially available voice and data telecommunication technologies and services. In the framework of this strategy, States should, to the maximum extent possible, take advantage of appropriate technologies, services and products offered by the telecommunication industry.

1.3. Considering the fundamental role of communications in enabling aviation, the common objective is to seek the most efficient communication network service providing the desired services with the required performance and interoperability required for aviation safety levels at minimum cost.

2. DATA LINK APPLICATIONS (GPI-17)

Description of strategy

2.1. The implementation of less complex data link services (e.g. pre-departure clearance, oceanic clearance, D-ATIS, automatic position reporting) can bring immediate efficiency benefits to the provision of ATS. Transition to the use of data link communications for more complex safety-related uses that take advantage of a wide variety of CPDLC messages, including ATC clearances, is already being successfully implemented.

2.2. Use of CPDLC and implementation of other data link applications can bring significant advantages over voice communication for both pilots and controllers in terms of workload and safety. In particular, they can provide efficient linkages between ground and airborne systems, improved handling and transfer of data, reduced channel congestion, reduced communication errors, interoperable communication media and reduced workload. The reduction of workload per flight translates into capacity increases and enhanced safety.

2.3. Communication data link and data link surveillance technologies and applications should be selected and harmonized for seamless and interoperable global operations. ADS-C, ADS-B and CPDLC are in service in various regions of the world but lack global harmonization. Current regional initiatives, including utilizing unique message subsets and CPDLC procedures, hinder efficient development and acceptance for global aircraft operations. Existing and emerging technologies should be implemented in a harmonized global manner in the near term to support long-term goals. Harmonization will define global equipage requirements and therefore minimize user investment.

2.4. FANS-1/A and aeronautical telecommunication network (ATN) applications support similar functionality, but with different avionics requirements. Many internationally-operated aircraft are equipped with FANS-1/A avionics initially to take advantage of data link services offered in certain oceanic and remote regions. FANS-1/A equipage on international business aviation aircraft is underway and is expected to increase.

3. NAVIGATION SYSTEMS (GPI-21)

Description of strategy

3.1. Airspace users need a globally interoperable navigational infrastructure that delivers benefits in safety, efficiency and capacity. Aircraft navigation should be straightforward and conducted to the highest level of accuracy supported by the infrastructure.

3.2. To meet those needs, the progressive introduction of performance-based navigation must be supported by an appropriate navigation infrastructure consisting of an appropriate combination of global navigation satellite systems (GNSS), self-contained navigation systems (inertial navigation system) and conventional ground-based navigation aids.

3.3. GNSS provides standardized positioning information to the aircraft systems to support precise navigation globally. One global navigation system will help support a standardization of procedures and cockpit displays coupled with a minimum set of avionics, maintenance and training requirements. Thus, the ultimate goal is a transition to GNSS that would eliminate the requirement for ground-based aids, although the vulnerability of GNSS to interference may require the retention of some ground aids in specific areas.

3.4. GNSS-centered performance-based navigation enables a seamless, harmonized and cost-effective navigational service from departure to final approach that will provide benefits in safety, efficiency and capacity.

3.5. GNSS implementation will be carried out in an evolutionary manner, allowing gradual system improvements to be introduced. Near-term applications of GNSS are intended to enable the early introduction of satellite-based area navigation without any infrastructure investment, using the core satellite constellations and integrated multisensory airborne systems. The use of these systems already allows for increased reliability of non-precision approach operations at some airports.

3.6. Medium/longer-term applications will make use of existing and future satellite navigation systems with some type of augmentation or combination of augmentations required for operation in a particular phase of flight.

4. WORLD GEODETIC SYSTEM – 1984 (GPI-20)

Description of strategy

4.1. The geographical coordinates used across various States in the world to determine the position of runways, obstacles, aerodromes, navigation aids and ATS routes are based on a wide variety of local geodetic reference systems. With the introduction of RNAV, the problem of having geographical coordinates referenced to local geodetic datums is more evident and has clearly shown the need for a universal geodetic reference system. ICAO, to address this issue, adopted in 1994 the World Geodetic System — 1984 (WGS-84) as a common horizontal geodetic reference system for air navigation with an applicability date of 1 January 1998.

4.2. Fundamental to the implementation of GNSS is the use of a common geographical reference system. ICAO adopted the WGS-84 Geodetic Reference System as that datum, and many States have implemented or are implementing the system. Failure to implement, or a decision to use an alternative reference system, will create a seam in ATM service and will delay the full realization of GNSS benefits. Completion of the implementation of the WGS-84 Geodetic Reference System is a prerequisite for a number of ATM enhancements, including GNSS.

5. SITUTIONAL AWARENESS (GPI-9)

Description of strategy

5.1. The further implementation of enhanced surveillance techniques (ADS-C or ADS-B) will allow reductions in separation minima and an enhancement of safety, increase in capacity, and improved flight efficiency, all on a cost-effective basis. These benefits may be achieved by bringing surveillance to areas where there is no primary or secondary radar, when cost-benefit models warrant it. In airspaces where radar is used, enhanced surveillance can bring further reductions in aircraft separation minima and improve, in high traffic density areas, the quality of surveillance information both on the ground and in the air, thereby increasing safety levels. The implementation of sets of quality-assured electronic terrain and obstacle data necessary to support the ground proximity warning systems with forward-looking terrain avoidance function as well as a minimum safe altitude warning (MSAW) system will benefit safety substantially.

5.2. Implementation of surveillance systems for surface movement at aerodromes where weather conditions and capacity warrant will also enhance safety and efficiency while implementation of cockpit display of traffic information and associated procedures will enable pilot participation in the ATM system and improve safety through greater situational awareness.

5.3. In remote and oceanic airspace where ADS-C is used, FANS capabilities exist on many air transport aircraft and could be added to business aircraft. ADS-B can be used to enhance traffic surveillance in domestic airspace. In this respect, it should be noted that the 1090 extended squitter is available and should be accepted as the global choice for the ADS-B data link.

5.4. At terminal areas and at aerodromes surrounded by significant terrain and obstacles, the availability of quality-assured terrain and obstacle databases containing digital sets of data representing terrain surface in the form of continuous elevation values and digital sets of obstacle data of features, having vertical significance in relation to adjacent and surrounding features considered hazardous to air navigation, will improve situational awareness and contribute to the overall reduction of the number of controlled flight into terrain related accidents.

6. AERONAUTICAL RADIO SPECTRUM (GPI-23)

Description of strategy

6.5. States need to address all regulatory aspects on aeronautical matters on the agendas for International Telecommunication Network (ITU) World Radiocommunication Conferences (WRC). Particular attention is drawn to the need to maintain the current spectrum allocations to aeronautical services.

6.6. The radio spectrum is a scarce natural resource with finite capacity for which demand from all users (aeronautical and non-aeronautical) is constantly increasing. Thus the ICAO strategy on aeronautical radio spectrum aims at long-term protection of adequate aeronautical spectrum for all radio communication, surveillance and radio navigation systems. The process of international coordination taking place in the ITU obliges all spectrum users (i.e. aeronautical and non aeronautical) to continually defend and justify spectrum requirements. Civil aviation operations are expanding globally creating pressure on the already stressed and limited available aeronautical spectrum.

6.7. The framework of this initiative involves the support and dissemination by States of the ICAO quantified and qualified policy statements of requirements for aeronautical radio frequency spectrum agendas for ITU World Radiocommunication Conferences (WRC). This is necessary to maintain the current spectrum allocations to aeronautical services and ensure the continuing availability of adequate aeronautical radio spectrum and ultimately the viability of existing and new air navigation services globally.

-END-

APPENDIX M

TERMS OF REFERENCE, FUTURE WORK PROGRAMME AND COMPOSITION OF THE COMMUNICATIONS, NAVIGATION AND SURVEILLANCE SUB-GROUP (CNS/SG)

1. TERMS OF REFERENCE

a) Ensure the continuing and coherent development of the AFI Regional Air Navigation Plan in the fields of aeronautical communications, navigation and surveillance (CNS), including the development of CNS elements of the AFI CNS/ATM Implementation Plan in the light of new developments, in harmony with the ICAO Global Air Navigation Plan (Doc 9750) and the plans for adjacent regions;

b) Identify, review and monitor deficiencies that impede or affect the provision of efficient aeronautical telecommunications and recommend appropriate corrective action;

c) Prepare, as necessary, CNS/ATM cost/benefit analyses for the implementation options of C, N an S elements; and

d) Study, as necessary, institutional arrangements for the implementation of C, N and S systems in the AFI Region.

2. WORK PROGRAMME

Item	Global Plan Initiatives	Task description	Priority	Target date
		Communications		
1.	GPI-22	Follow up and monitor the implementation of VHF coverage in the AFI region in accordance with AFI/7 Rec. 5/12.	A	APIRG/19
2.	GPI-22	Update the AFI AFTN routing directory	A	APIRG/19
3.	GPI-22	In coordination with the ATM/AIM/SAR Sub-group, participate in the development of a communication infrastructure to support an AFI Central AIS Database (AFI CAD)	A	Continuing
4.	GPI-17	Monitor the development, and coordinate the implementation of guidance material for service level agreements between air navigations service providers and ATN service providers	A	APIRG/19
5.	GPI-17	Review and update, if needed, the ICAO Register of AMHS managing domains and addressing information pertaining to AFI.	A	Continuing
		Navigation		
6.	GPI-21	Analyze and review the Report of the AFI GNSS Implementation Task Force.	A	Continuing
7.	GPI-21	Follow up and monitor the implementation of Phase 1 of the AFI GNSS Strategy.	A	Continuing
		Surveillance		
8.	GPI -9	Analyze and review CNS aspects of the report of the Aeronautical Surveillance Implementation Task Force.	A	APIRG/19
		Communications, Navigation and Surveillance – General matters		
9.	GPI -9 GPI-17 GPI-21 GPI-22	Analyze, review and monitor the implementation and operation of aeronautical communications, navigation and surveillance (CNS) systems, identify CNS deficiencies and propose measures for their	A	Continuing

Item	Global Plan Initiatives	Task description	Priority	Target date
		elimination, as required		
10.	GPI -9 GPI-17 GPI-21 GPI-22	Give further consideration, as necessary, to the concept of multinational ICAO AFI air navigation facility/service addressed in the AFI/7 Report under Agenda Item 14 (AFI/7, Conclusion 10/6c).	C	Continuing
11.	GPI -9 GPI-17 GPI-21 GPI-22	In co-ordination with the ATS/AIS/SAR Sub-group, continue the evolutionary and harmonized development of the AFI CNS/ATM Systems Implementation Plan (AFI/7 Concl. 13/1).	A	Continuing
12.	GPI -9 GPI-17 GPI-21 GPI-22	In co-ordination with the ATS/AIS/SAR Sub-group, develop, as necessary, comprehensive business cases for competing CNS/ATM elements implementation options for the routing areas.	B	Continuing
13.	GPI -9 GPI-17 GPI-21 GPI-22	Co-ordinate plans developed by States, international organizations, airlines and industry for the implementation of the regional CNS/ATM systems implementation plan; and monitor CNS/ATM systems research and development, trials and demonstrations within the AFI Region and information from other regions.	B	Continuing
14.	GPI -9 GPI-17 GPI-21 GPI-22	Coordinate the implementation of ICAO Global Plan Initiatives pertaining to CNS and develop associated regional performance objectives.	A	Continuous
		Aeronautical Spectrum		
15.	GPI-23	Coordinate regional activities aimed at promoting ICAO position for ITU-WRC meetings, and improving aeronautical spectrum management and control in the Region.	A	Continuing

Priority:

A: High priority tasks on which work should be speeded up;
B: Medium priority tasks, on which work should be undertaken as soon as possible, but without detriment to priority A tasks; and
C: Lesser priority tasks, on which work should be undertaken as time and resources permit, but without detriment to priority A and B tasks.

3. COMPOSITION:

Algeria, Angola, Cameroon, Congo, Côte d'Ivoire, D.R. of Congo, Egypt, Eritrea, Ethiopia, Gambia, Ghana, Guinea, Kenya, Malawi, Mali, Mauritius, Morocco, Niger, Nigeria, Senegal, South Africa, Spain, Sudan, Tanzania, Tunisia, Zambia, ACAC, ASECNA, IATA, and IFALPA.

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