ICAO DAKAR UNITING AVIATION

Report on the External Audit of AFISNET

Accra, Ghana/15-19 February 2016

Report to SNMC 23th

Prepared by the Secretariat, and Presented by

François-Xavier SALAMBANGA
RO/CNS/WACAF

OVERVIEW

I. Background
II. Composition of AFISNET
III. Operational service supported by AFISNET
IV. Futur Operational service to be supported by AFISNET
V. Administrative service supported by AFISNET
VI. SNMC Mechanims and Meetings
VII. Recommendation 6/18 Sp AFI/RAN 8
VIII. Joint Technical Evaluation and re-engineering Exercise
IX. Technical Specifications and funding mechanisms
X. Objectives of the Audit
XI. Audit principles
XII. Audit procedures
XIII. Audit Outcome

Background

AEROSATEL (renamed AFISNET): Satellite based Telecommunications network conceived between 1986 and 1987 by ICAO

- **Funded by European Union in 1992 and implemented by ALCATEL.**
- **Objectives**:
  - **Improvement of communication for the reinforcement of air navigation safety in the Western and Central African region by the implementation of AFI Planned AFTN & ATS/DS Circuits;**
  - **Backbone to support the implementation of CNS/ATM components (ATN, Extended VH coverage, GNSS, and Surveillance data exchange) around the Benin Gulf ;**
- **At the beginning eight (8) earth stations for Nigeria, one (1) for Ghana and six (6) for ASECNA countries (Cameroon, Central Africa, Congo, Gabon, Niger and Chad)**

Composition of AFISNET

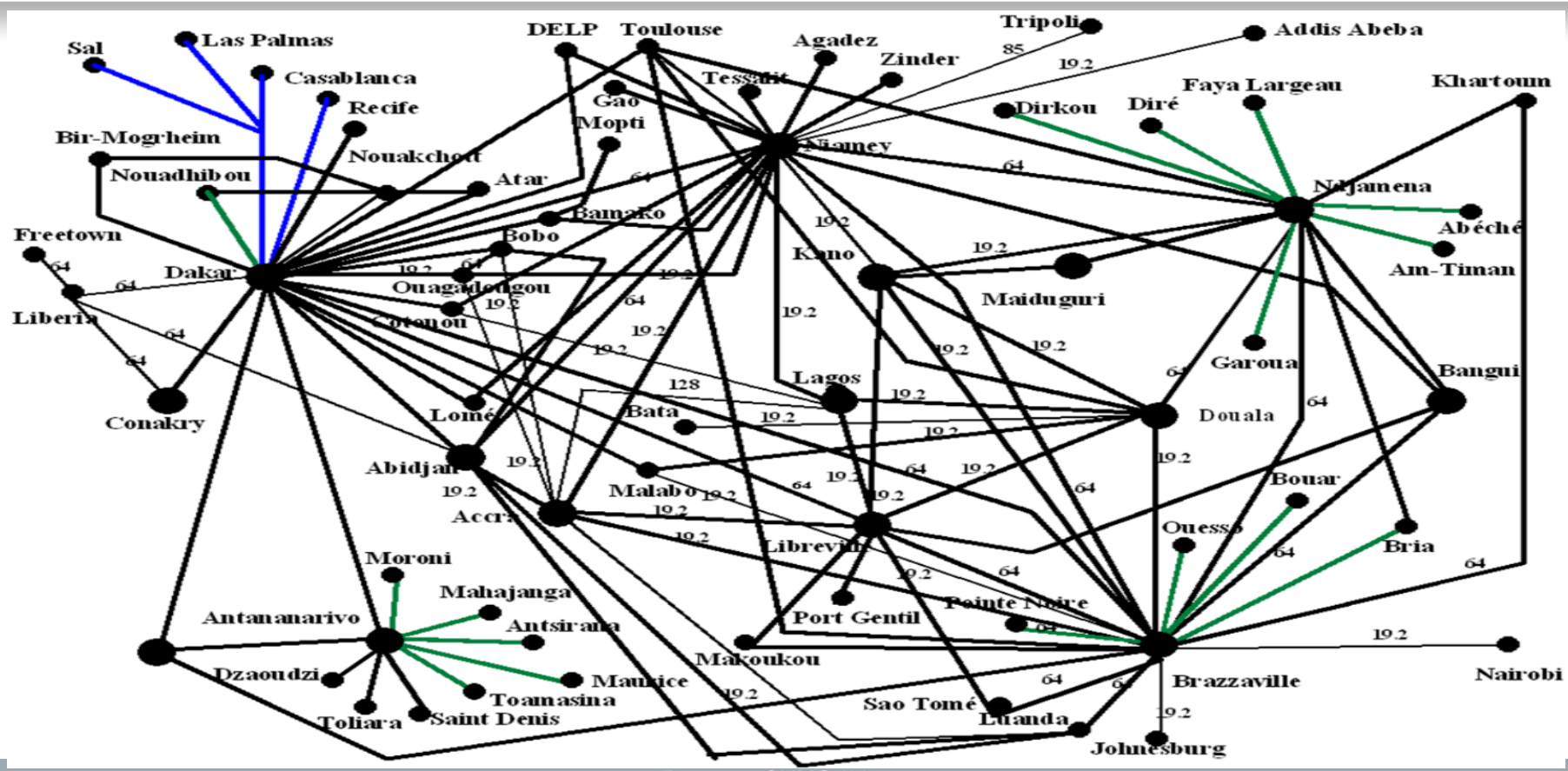
- **Network widened with the implementation of new stations in western, Central, Southern and Northern Africa, Indian Ocean (Madagascar, Mauritius, La Reunion), Europe (Las Palmas, Toulouse) and South America & Caribbean (French Guyana, Brazil and Trinidad & Tobago).**

- **Currently composed with more than seventy (70) earth stations of various standards: B (11m), F2 (7.30m), F1 (3.7-4.5m) operating mainly in FDMA / SCPC mode in meshed/star topology.**

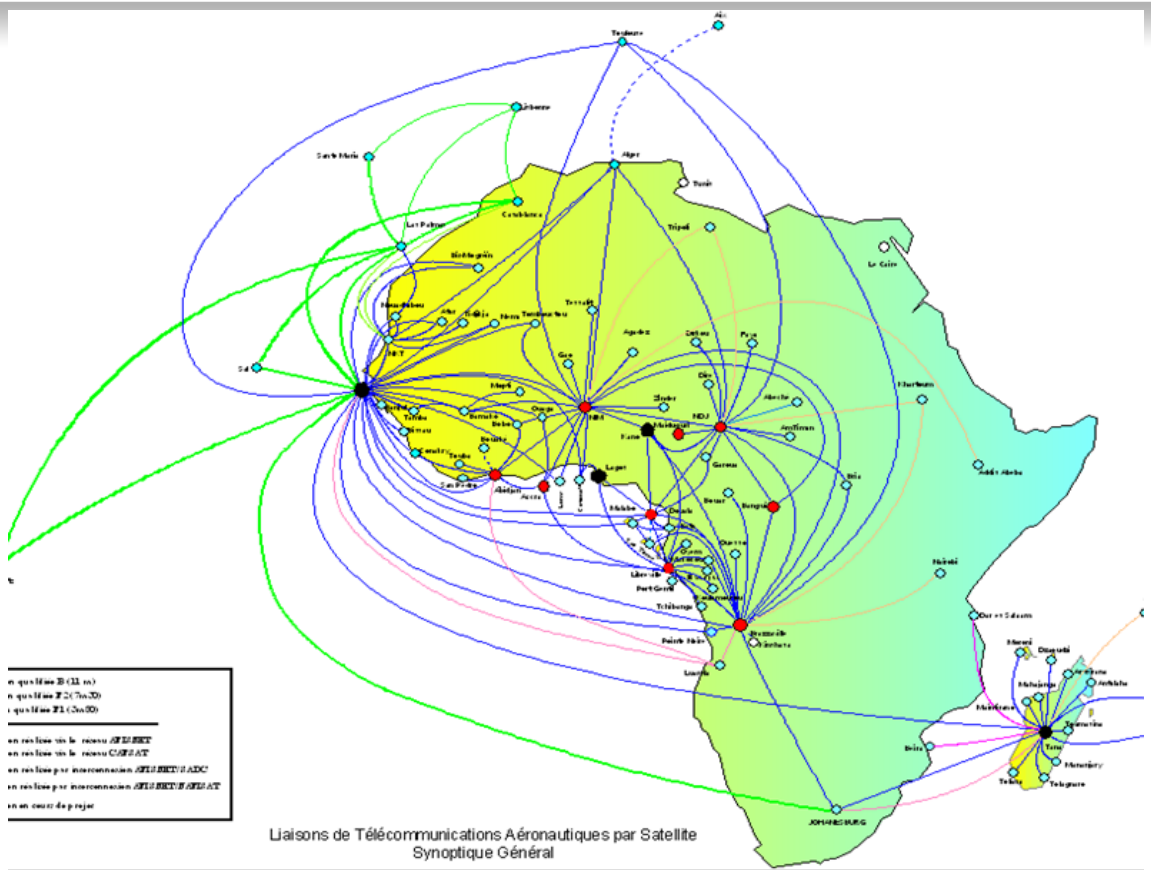
- **In 2004, successfully migration of AFISNET from Intelsat old satellite IS-903@325.5°East to satellite IS-10-02@359° East**

- **Operating on transponders 20 EH/ 20 EH & 23 EH/ 23 EH and fully interconnected to NAFISAT , SADC-2, and CAFSAT Networks.**

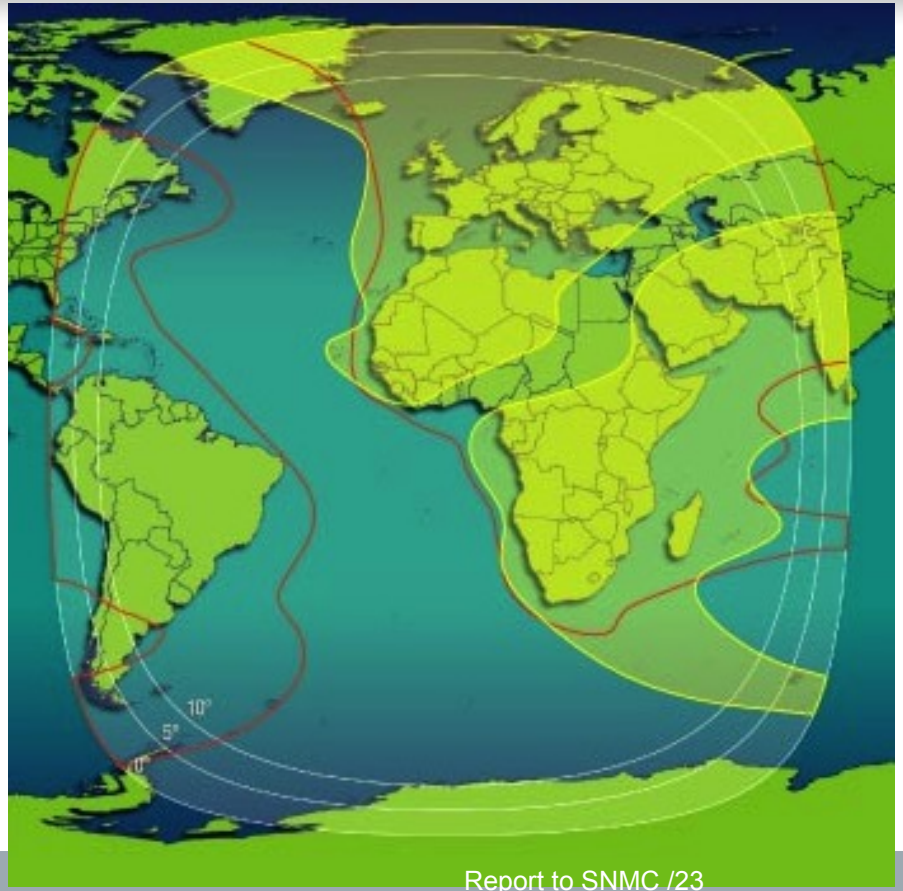
Composition of AFISNET (cnt'd)



Composition of AFISNET (end)



Satellite IS 10-02 @ 359°E Coverage



OPERATIONAL SERVICES SUPPORTED BY AFISNET

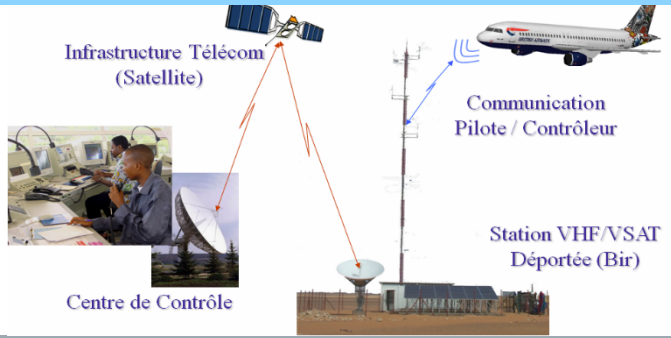
Aeronautical Fixed Service (AFS):

- ATS/DS: Direct communications between Air traffic controllers;
- AFTN/AMHS: Aeronautical Fixed Telecommunications Network /ATS Message Handling System;
- GTS: Global Telecommunications System (WMO);
- **AIS/AIM: Aeronautical Information Service/ Aeronautical Information Manaagement;**

OPERATIONAL SERVICES SUPPORTED BY AFISNET

Aeronautical Mobile Service (AMS)

- Ground-ground links for remote Air-ground VHF duplex voice communication by VSAT (extended VHF range);
- Ground-ground links to carry the SITA ACCARS data to ensure duplex Air-ground ADS-C/CPDLC



FUTUR OPERATIONAL SERVICES TO BE SUPPORTED BY AFISNET

- **Interconnexion of ATM Systems**
- **AIDC: ATS Interfacilities *Data* communication**
- **VoIP: Voice over IP**
- **VDL: VHF Data Link**
- **Augmented GNSS data (e.g EGNOS)**
- **Surveillance data exchange (SSR, ADS-C & ADS-B, MLAT)**
- **SWIM: System Wide Information Management**

ADMINISTRATIVE SERVICES SUPPORTED BY AFISNET

- Maintenance Coordination Telephone Service;
- Aeronautical Administrative Communications;
- Intranet/Internet ;
- Software Applications for Maintenance and miscellaneous

SNMC Framework

SNMC: **S**atellite **N**etwork **M**anagement **C**ommittee Objectives:

- **Decide on network concept and topology in accordance with ATM requirements and ICAO SARPs and guidance materials.**
- **Ensure continued operation of AFISNET, meeting CNS/ATM plan requirements of AFI /MID /EUR Regions.**
- **Decide on type and levels of service to be provided and monitor Network performance**
- **Review and take appropriate actions to clear service dysfunctions within the Required Service Performance Level (RSPL) defined.**

SNMC Framework

- Harmonize the implementation of facilities and services
- Ensure Intra & interregional connectivity, taking due account of:
  - cost/benefit analysis:
  - business case development
- Monitor and harmonize Network maintenance operation through a cooperation methodology between network centers with regard to:
  - Maintenance personnel team training and exchange,
  - Spare parts exchange, fault location/repairs, and turnaround time
- Develop and modernize AFISNET after a Joint Technical Evaluation and Re-engineering team assessment.

Recommendation 6/18 Sp AFI/RAN 8

Calls upon to implement SNMC /16 conclusion 16/07

A) AFISNET member to implement a Joint Technical Evaluation of the network by establishing a Team of qualified experts tasked to:

- Conduct a comprehensive assessment of the network potential for current and future requirements and applications;
- Identify technical and operational deficiencies of the current network and propose short-term solutions for their mitigation;

Recommendation 6/18 Sp AFI/RAN 8 (cnt'd)

- Develop user requirements and basic specifications for the re-engineering of the network, to be submitted to formal approval by members;

- Participate in the request for proposals (RFP) process and;

B) Develop a request for proposals (RFP) for re-engineering/ upgrading AFISNET:

- including technical, operational, financial and institutional aspects through the ICAO technical cooperation mechanism

- based on a comprehensive assessment of current and future requirements and applications to be supported by the network

Joint Technical Evaluation (JTE) Exercise

- **Joint Technical Team for AFISNET Evaluation and Re-engineering established by SNMC 17 (conc. 17/02);**
- **ICAO WACAF followed up and coordinated a Team Leader and SNMC meetings**
- **SNMC 18, Ouagadougou July 2010**
  - ✓ Endorsed JTE recommendations;
  - ✓ Tasked the JTE Team to develop Technical Specifications for an External Evaluation;

Joint Technical Evaluation (JTE) Exercise (cnt'd)

SNMC 19, Accra November 2011
SNMC 20, Abuja, October 2012
SNMC 21, Conakry, December 2013
SNMC 22, Lomé, December 2014

- **Formally adopted the draft Technical specifications Document for a request for proposals;**
- **Agreed on the applicability of ICAO procurement Reference to the project;**
- **Requested ICAO to:**
  - **conclude the contract for the External Evaluation exercise with ADPi and;**
  - **Coordinate and report to SNMC Board**

AUDIT PRINCIPLES

- **Transparency and disclosure for results examination and informed decision making;**
- **All-inclusiveness vis-à-vis ICAO related SARPS**
- **Systematic, consistent and objective;**
- **Fairness: audited center to have opportunity to monitor, comment on, and respond to the Audit processes;**
- **Collaboration: Voluntary information provision**
- **Evidences documented Facts finding;**

AUDIT PROCEDURES

- **Kick of Meeting in Lagos, June 2015**
- **Joint Survey of Abidjan, Abuja, Accra; Brazzaville, Dakar, Douala, Kano, Lagos, Libreville, Monrovia, N'Djamena, Niamey and Tambacounda;**
- **Presence of neigbhoring JTE members in site surveys (ex: for the survey of Niamey, GCAA and NAMA to attend);**
- **Review meeting in Accra, September 2015;**
- **Review meeting in Dakar, October 2015**
- **End to end responsibility of the consulting company (ADPi) for the conduct of the audit.**

Technical aspect

AUDIT OUTCOME

Strengths	Weaknesses
Satellite Access FDMA for operational services (AFTN, MET,ATS/DS and Remote VHF coverage); the network has been operating quite well until now and supports the different services	Some equipment of the network is aging making it difficult to find spare parts.

Technical aspect

AUDIT OUTCOME

Strenghts	Weaknesses
A decentralized maintenance philosophy has been established by SNMC Members: Corrective maintenance is conducted by the local staff with the headquarter assistance as required. Preventive Maintenance is conducted following a yearly schedule	Maintenance costs have drastically increased over time

Technical aspect

AUDIT OUTCOME

Strengths	Weaknesses
Each member of the network (ASECNA, GCAA, NAMA, Roberts) has been updating the network equipment under its jurisdiction as required	Bandwidth optimization is quite inefficient

AUDIT OUTCOME

Strengths	Weaknesses
Network maintained operating since to SNMC Coordination actions	The network has become quite heterogeneous among the various entities, i.e. different manufacturers and/or equipment

AUDIT OUTCOME

Strenghts	Weaknesses
The Network Supports Basic AFS & AMS services	The network cannot support some existing and future services due to the inadequacy of its technology (e.g. : No global management NMS, IP technology yet to be implemented)

AUDIT OUTCOME

Strengths	Weaknesses
The network is still running and provides services (ATS/DS, AFTN, MET) after over 20 years in operation.	Spare parts of some critical components such as antenna tracking systems are no longer available. This makes maintenance difficult.

AUDIT OUTCOME

Strengths	Weaknesses
It has produced indigenous Satellite communications expertise in the various member state organizations.	Because of too many different hardware that replace some obsolete components, network performance monitoring is difficult or near impossible in some cases.

AUDIT OUTCOME

Strengths	Weaknesses
The network provides a platform to implement other national services by member states.	Maintenance procedure are no longer uniform between member organizations because many different components now exist. Network management is difficult.

AUDIT OUTCOME

Strengths	Weaknesses
It creates regional and sub-regional technical collaboration and information sharing among member organizations	Spare part sharing/Loaning among member organizations is no longer common because each organization replaced many components with different hardware.

AUDIT OUTCOME

Strengths	Weaknesses
The network is operationally scalable as some non-CNS services are presently carried on the network by some member states.	Operational cost is increasing because personnel at the earth station must be trained on each new technology acquired to replace obsolete component in the network

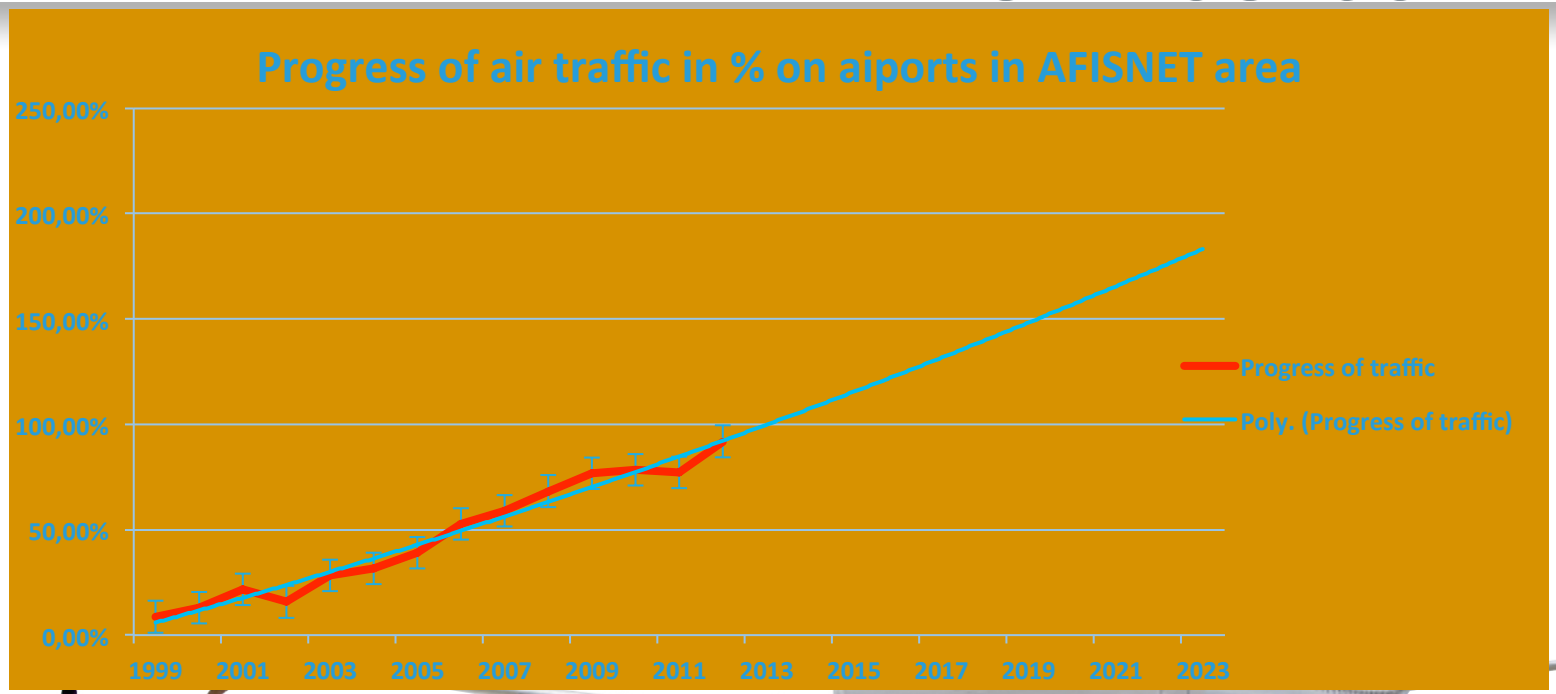
AUDIT OUTCOME

Strengths	Weaknesses
Awareness of SNMC Members on ICAO Standards and Regional best practices	Difficulty to maintain circuit and services availability generally at the ICAO standard of 99.97% (somewhere around 94% due to obsolete hardware and protocols)

AUDIT OUTCOME

Stations		Unit price K€	Total price K€	Equipment
Type B Station 11m Dakar, Antananarivo, Kano, Lagos	4	600	2 400	11m antenna dish with motorization + wvguide
		300	1 200	Dateno Amplification system, shelter + UPS
		200	800	Beacon receiver, APS, MCU, ACU, Redundant Up/Dn converter, PowerMeter
		200	800	Modems/multiplexor
		1 300	**5 200**	**Station estimation**
Type F2 Station 7,3m Abuja, Accra, Bangui, Douala, Libreville, ...	9	500	4 500	7,3m antenna dish with motorization +wvguide
		300	2 700	Dateno Amplification system, shelter + UPS
		200	1 800	Beacon receiver, APS, MCU, ACU, Redundant Up/Dn converter, PowerMeter
		180	1 620	Modem/mux
		1 180	**10 620**	**Station estimation**
Type F1 Station 4,6m Bamako, Malabo, Monrovia, Nouakchott, Ouaga...	7	200	1 400	4,6m antenna dish + wv guide
		120	840	Redundant outdoor Amplification system
		70	490	Beacon receiver, Power meter
		150	1 050	Modems/multiplexor
		540	**3 780**	**Station estimation**
Remote stations	100	**80**	**8 000**	**modem/mux/Rf (except antenna/energy part**
Bandwidth	3,2Mbit/s			Bandwidth for existing CNS services only. New services (AIDC, AMHS, ...) are not fully considered.
Maintenance percentage of CAPEX			15%	
Cost estimate of existing AFISNET network	**CAPEX**		**27 600**	Only CNS/ATM network without internet services
	OPEX		**2 940**	Without Bandwidth Cost

AUDIT OUTCOME



AUDIT OUTCOME

Evolution of services

- AFI selected ASBU Modules
- Clear transition plan with regard to the evolution of services supported by AFISNET,
- Insurance that the introduction of the emerging services (ATM systems interoperability, AMHS; AIDC; EGNOS; SWIM; Surveillance data exchange …) meets and maintain an acceptable level of safety by the ATM System.

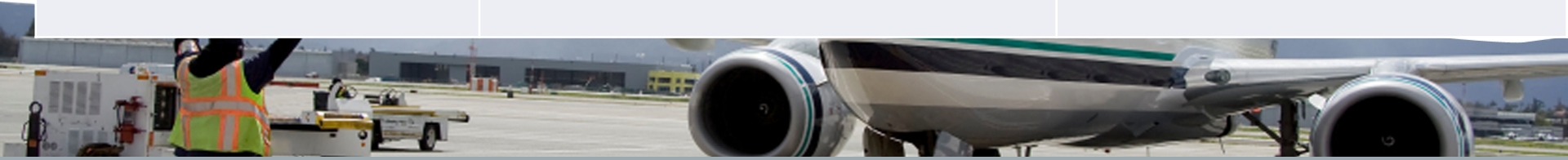
AUDIT OUTCOME

Migration of the services within the ICAO ASBU selected Modules for the AFI region to be considered with regard to :

- **ASBU technology Roadmap defined in the GANP and;**
- **The derived AFI implementation strategies in order to ensure;**
- **The provision of a seamless ATM service within and beyond the coverage of AFISNET**
- **APIRG Project Approach.**

Improvement & reengineering

Audit Finding	Improvement	Implementation
Heteregenuous and obsolete Hardware	Replace/Repair as applicable	Short Term
	Re-engineering with new technology	Medium & Long Term
Failure Resiliency: Lack of modularity of CX FRAD	Implement new FRAD NET PERFORMER	Medium Term



Improvement & reengineering

Audit Finding	Improvement	Implementation
Limited scalability of the System	To be factored in the future re-engineering	Medium term
Limited Bandwith optimization	To be factored in the future re-engineering	Medium term
No Monitoring of devices and links	To be factored in the future re-engineering as a requirement but taking into account the specific environment of each member	Medium Term

Improvement & reengineering

Audit Finding	Improvement	Implementation
Maintenance	Implementation/enhancement of predictive maintenance	Medium Term
Training	Development and implementation of a common Training Programme including language training (French & English)	Short Term

Improvement & reengineering

Audit Finding	Improvement	Implementation
Lack of Surveillance Data sharing	Trial to be conducted on surveillance data sharing among members	Short Term
Dissemination of MET Information	Provision of sufficient bandwith	Short Term
	New needs to be factored in the future re-engineering	Medium Term

Improvement & reengineering

Audit Finding	Improvement	Implementation
AFTN/AMHS implementation	Provision of sufficent bandwith	Short Term
	AMHS to be implemented in accordance with the AFI implementation Strategy and plan	Medium Term
Limited deployment of AIDC	Implementation over AMHS	Medium Term
Unability to support EGNOS	EGNOS support to be taken into account in the future re-engineering in accordance with EGNOS WAN Requirements	Medium Term

STEPS FORWARD

- Follow up and implememementation of the Decisions of SNMC Board by SNMC ;
- SNMC Secretariat will continue coordinating the implementation
- Need of Support by Partners.

“We know where to go”

SNMC CORE MEMBERS

ICAO

THANK YOU