



REPUBLIC OF KENYA



KENYA CIVIL AVIATION AUTHORITY

**AIRSPACE MASTER PLAN
2015-2030**

**DELIVERABLE 5 (D5)
EXECUTIVE SUMMARY**

DOCUMENT REVIEW

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1 INTRODUCTION

1.1 Purpose of the document

In 2005, the Kenya Civil Aviation Authority (KCAA) published the Kenya Airspace Master Plan for the period 2005-2015 to assist Kenya's effort into implementing the new CNS/ATM technologies at that time, and into defining the related investment strategies.

To pursue this effort in consistency with the ICAO Aviation System Block Upgrade (ASBU) methodology, as defined in ICAO Doc. 9750 (4th Edition), KCAA launched a study for the preparation of a new Master Plan for the period 2015-2030 in order to plan the necessary evolutions and associated investments to be made by KCAA in Kenya Air Navigation Services (ANS) over the following 15 years.

This document is the Executive Summary of the Final Report. It presents the main findings of the study and the main recommendations for the implementation of the Master Plan. It consolidates the results of three deliverables, "D1 – Organizational Review of KCAA and Analysis of Current Airspace Infrastructure in Kenya" [Ref 1.], "D3 Part 1 – Preliminary Environmental Impact and Benefits Assessment" [Ref 3.], "D3 Part 2 – Review of Institutional, Legal and Regulatory Issues" [Ref 4.], and "D4 – Developmental Impact Assessment and Project Implementation Plan" [Ref 5.].

The deliverable "D2 – Economic and Financial Analysis" is confidential.

The deliverable "D5 – Final Report" encompasses the present Executive Summary and the four other deliverables D1, D2, D3 and D4.

1.2 Reference documents

- [Ref 1.] KCAA Airspace Master Plan 2015-2030; Deliverable 1 "Organizational Review of KCAA and Analysis of Current Airspace Infrastructure in Kenya"
- [Ref 2.] KCAA Airspace Master Plan 2015-2030; Deliverable 2 "Economic and Financial Analysis"
- [Ref 3.] KCAA Airspace Master Plan 2015-2030; Deliverable D3 (Environment part) "Preliminary Environmental Impact and Benefits Assessment"
- [Ref 4.] KCAA Airspace Master Plan 2015-2030; Deliverable D3 (Legal part) "Review of Institutional, Legal And Regulatory Issues"
- [Ref 5.] KCAA Airspace Master Plan 2015-2030; Deliverable D4 "Developmental Impact Assessment and Project Implementation Plan"

Additional reference documents are listed within the above deliverables.

1.3 Acronyms

The following acronyms are used in this document.

Acronym	Definition
A-CDM	Airport Collaborative Decision Making
A-SMGCS	Advanced Surface Movement Guidance & Control System
ACC	Area Control Centre

ADS-B	Automatic Dependent Surveillance – Broadcast
ADS-C	Automatic Dependent Surveillance – Contract
AFI	African Indian Ocean region
AFIS	Aerodrome Flight Information Services
AFISO	Aerodrome Flight Information Service Officer
AFTN	Aeronautical Fixed Telecommunication Network
AIDC	ATS Interfacility Data Communication
AIM	Aeronautical Information Management
AIP	Aeronautical Information Publication
AIS	Aeronautical Information Services
AIXM	Aeronautical Information Exchange Model
AMAN	Arrival Management
AMHS	ATS Message Handling System
ANS	Air Navigation Services
ANSP	Air Navigation Service Provider
APCH	RNP Approach
APIRG	AFI Planning and Implementation Regional Group
APP	Approach
ASBU	Aviation System Block Upgrade
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATFM	Air Traffic Flow Management
ATIS	Automatic Terminal Information Service
ATN	Aeronautical Telecommunication Network
ATS	Air traffic Services
ATSEP	Air Traffic Safety Electronics Personnel
ATM	Air Traffic Management
ARO	Aerodrome Reporting Office
AWOS	Automated Weather Observing System
CCO	Continuous Climb Operations
CDO	Continuous Descent Operations
CDR	Conditional Route
CNS	Communication, Navigation and Surveillance
COM	Communication

CPDLC	Controller Pilot Data Link Communication
D-ATIS	Digital Automatic Terminal Information Service
DMAN	Departure Management
DME	Distance Measuring Equipment
EASA	East African School of Aviation
EFS	Electronic Flight Strips
EMS	Environmental Management System
ENR	En-route
FIS	Flight Information Service
FL	Flight Level
FUA	Flexible Use of Airspace
GANP	Global Air Navigation Plan
GBAS	Ground Based Augmentation System
HF	High Frequency
HMI	Human Machine Interface
HQ	Headquarters
HR	Human Resources
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IFSET	ICAO Fuel Savings Estimation Tool
ILS	Instrument Landing System
JKIA	Jomo-Kenyatta International Airport
KAA	Kenya Airport Authority
KAAO	Kenyan Association of Aircraft Operators
KCAA	Kenya Civil Aviation Authority
KMD	Kenya Meteorological Department
KQ	Kenya Airways
KRA	Kenya Revenue Authority
MET	Meteorology
MLAT	Multilateration
MOU	Memorandum of Understanding
MSSR	Monopulse Secondary Surveillance Radar
NAVAID	Navigation Aid
NEMA	National Environment Management Authority

NM	Nautical Mile
NOTAM	Notice To Air Men
OJT	On-the-job Training
OJTI	On-the-job Training Instructor
OLDI	On-Line Data Interchange
OPSUP	Operational Supervisor
PIA	Performance Improvement Area
PBN	Performance Based Navigation
PSR	Primary Surveillance Radar
R&D	Research & Development
RCC	Rescue Coordination Centre
RMCS	Remote Monitoring and Control System
RNP	Required Navigation Performance
RWY	Runway
SAR	Search And Rescue
SBAS	Satellite-Based Augmentation System
SEA	Strategic Environmental Assessment
SID	Standard Instrument Departure
SM	Safety Manager
SMR	Surface Movement Radar
SMS	Safety Management System
SSR	Secondary Surveillance Radar
STAR	Standard Terminal Arrival Route
SWIM	System Wide Information Management
TMA	Terminal Manoeuvring Area
TWR	Tower
UPS	Uninterruptible Power Supply
UTP	Unit Training Plan
VCS	Voice Communication System
VHF	Very High Frequency
VOR	VHF Omnidirectional Range
VSAT	Very Small Aperture Terminal
WAM	Wide Area Multilateration

2 METHODOLOGY

2.1 Principles

The Kenya Airspace Master Plan was prepared by respecting some key principles:

- **To ensure consistency at global and regional levels**

ICAO published major documents at global and regional levels to assist States to ensure continuity and harmonization in their modernization programs.

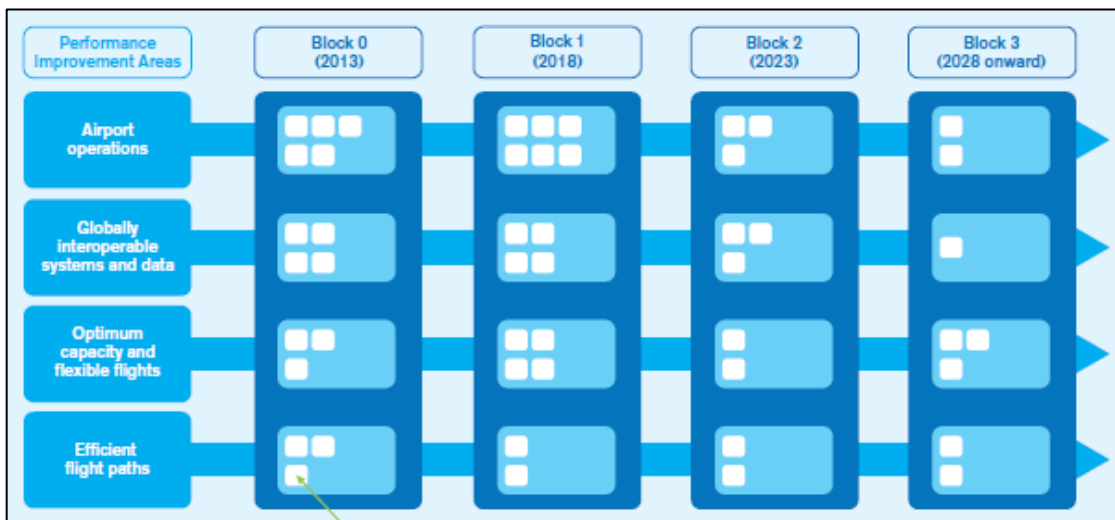
At Global level:

In 2010, ICAO launched the Aviation System Block Upgrade (ASBU) initiative as the framework to apply the concepts defined in the ICAO GANP (Doc 9750).

The ASBUs comprise a suite of Modules organized into building Blocks which can be introduced and implemented in a State or Region, depending on their need and level of readiness.

Four building Blocks (0, 1, 2 and 3) have been defined based on timelines for the various capabilities they contain. The initial operating capabilities are 2013, 2018, 2023 and 2028 respectively.

The core of this concept is linked to four specific and interrelated Performance Improvement Areas: “Airport Operations”; “Globally-interoperable systems and data”; “Optimum capacity and flexible flights”, and “Efficient Flight Paths”.



The ICAO GANP (Doc 9750) also includes eleven technology roadmaps in the following domains:

- Communication
- Navigation
- Surveillance
- Information Management
- Avionics

At Regional level

The “AFI Planning and Implementation Regional Group” (APIRG) published the ICAO “AFI Air Navigation System Implementation Action Plan for the African-Indian Ocean (AFI) Region”, which defines the priority of the region through the selection and prioritization of the ASBU Block 0 modules. ANNEX B provides an overview of the ASBU Block 0 modules and their priority.

- **To consider Airspace Users’ expectations**

The Airspace Users, as end users of the KCAA air navigation services, shall be consulted and their expectations have to be considered as major drivers in the identification of improvements.

- **To consider other major stakeholders**

KCAA has strong interactions with other stakeholders to deliver efficient ANS, which includes the Airports Operator (KAA) and the MET Department (KMD). Particularly, it is important to ensure consistency with their plans.

- **To take account of the current situation in Kenya**

The current situation in Kenya is the starting point and it constitutes the basis on which the Master Plan has to be developed. For that purpose, it is essential to identify and understand:

- Strengths of the current operations and systems;
- Weaknesses of the current operations and systems;
- On-going projects.

- **To anticipate any legal or regulatory issue**

It is arguable that some of the forthcoming evolutions will come with regulatory issues, e.g. implementation of mandates for required aircraft equipment. These regulatory issues take time to be set and shall be anticipated.

Additionally, any legal issue that could prevent the timely implementation of the proposed evolutions should be identified as early as possible.

- **To be implementable**

The future Master Plan has to be realistic, feasible and implementable taking into account all the constraints identified during the process.

2.2 Approach

The general approach adopted to produce the Airspace Master Plan was based on the following steps:

1) Analysis of the current situation

The understanding and the analysis of the current situation is the first key step of the process.

In that perspective, two site visits were organized in July 2015 at Nairobi JKIA, Wilson airport, Mombasa, Eldoret, Kisumu, Malindi and the East African School of Aviation (EASA).

The objectives of these visits were to:

- Interview the stakeholders, namely Kenya Airport Authority (KAA), the Kenya Meteorological Department (KMD), Kenya Airways (KQ), Fly540 and the Kenya Association of Air Operators (KAAO).
- Identify the strengths and weaknesses of the current situation.
- Identify the Airspace Users' expectations.
- Collect information about on-going projects, and regional and national plans.

In this context, it has to be stressed that the audit reports from KCAA/Regulator were made available to the project team to better assess the current situation.

2) Benchmarking mission

A benchmarking mission was organized in Europe with KCAA representatives. The objective was to sensitize them to some of the forthcoming evolutions, and to assess how applicable these evolutions are in the Kenyan context.

DSNA (Paris-CDG), Eurocontrol (Brussels), ENAC and ESSP (Toulouse) were among the visited organizations.

3) Recommendations on future evolutions

Based on the outcomes of the first two steps, a set of recommendations were formulated in each domain (e.g. ATM, CNS, Training, etc.).

These recommendations are made to address the current weaknesses while taking into account the current strengths, the on-going KCAA projects (e.g. AIS system renewal), the national plans (e.g. KAA's plans for a 2nd runway at JKIA) and the regional initiatives (e.g. the East African Upper Airspace and Northern Corridor Initiative).

These recommendations fall within the framework of the regional priorities (AFI ANS Implementation Action Plan), except those that are specific to the Kenya requirements.

These recommendations together with the outcomes of the first two steps are documented in the deliverable D1 [Ref 1.].

4) Legal analysis

This step focused on the identification of potential legal and regulatory issues through an analysis of the proposed recommendations.

The outcomes of this step are consolidated in the deliverable D3 [Ref 4.].

5) Implementation plan

An approach and a timeline were then developed for the implementation of the recommended evolutions in terms of ANS organization, operations, technical means, human resources and legal /institutional aspects.

The results of this step are documented in the deliverable D4 [Ref 5.].

6) Stakeholders consultation

A Stakeholders forum was then organized to present the evolutions considered in the proposed Airspace Master Plan. ANNEX A contains the list of consulted stakeholders.

The deliverables D1 and D4 were updated following this Stakeholders forum.

7) Financial analysis

A financial analysis of the proposed evolutions was performed. The results are documented in the deliverable D2 [Ref 2.].

3 MAIN ANS EVOLUTIONS

This section lists the main findings and recommendations in each ANS domain.

These recommendations are classified over three periods of 5 years:

- Short term (1-5 years from now),
- Medium term (6-10 years from now),
- Long term (11-15 years from now).

3.1 ANS – General

3.1.1 Findings

The main findings concerning ANS in general are:

- The Safety Management System (SMS) is not fully implemented as there is no dedicated personnel assigned to this mission, no complete training plan on SMS and inconsistencies in the incident investigations.
- The R&D activity identified in the previous Kenya Airspace Master Plan has not been implemented due to a lack of guidance.
- The previous KCAA Airspace Master Plan covered a 10 year period but it has not been formally reviewed during this period.

3.1.2 Recommendations

In the short term

KCAA should focus on the implementation of the SMS unit, which requires to:

- Appoint an SMS Manager and create the SMS unit,
- Staff the SMS unit with permanent and ad-hoc staff at ANS-HQ but also at the stations,
- Provide an external technical assistance to this SMS unit for the practical implementation of SMS,
- Develop the functions and procedures of the SMS unit (as recommended in D1 section 4.1.4).

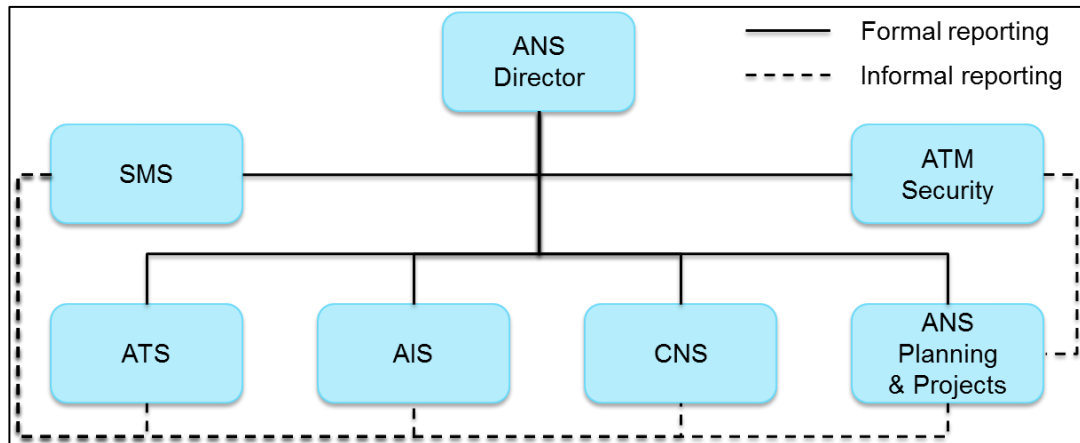
Additionally, it is proposed to set-up a dedicated “ANS Planning and Projects” unit, which would encompass the so called “R&D activity” previously envisaged. In that perspective, KCAA should:

- Appoint an "ANS Planning & Projects" Manager,
- Staff the unit at ANS-HQ and provide it with external training,
- Develop the functions and procedures of this unit (as recommended in D1 section 8.2).

In the medium term

Although ATM security has not been a major concern so far, it is now part of ICAO regulations. This activity should be initiated within the “ANS Planning and Projects” unit (in the short term) but a dedicated “ATM Security Management” unit should be created in the medium term (as recommended in D1 section 8.4).

The development of these units will impact the ANS Directorate organization which should be modified as depicted on the figure hereafter.



Note: The SMS unit and the ATM Security unit could form a single unit.

In the short, medium and long terms

The present KCAA Airspace Master Plan should be subject to a structured review on a regular basis to take account of the latest changes at national, regional and global levels. It is recommended to have a structured review every 3 years as the ICAO GANP (Doc 9750) is planned to be updated every 3 years.

3.2 ATM – En-route Operations (ENR)

3.2.1 Findings

The main findings are:

- The military areas, currently defined as danger, restricted, prohibited areas 24/7 in the Kenya AIP (e.g. HKR10 area), which prevent the airspace users to have direct routes.
- The need to use ADS-C and CPDLC to palliate the deficiencies in VHF and HF in the oceanic areas under KCAA's responsibility and to enable the use of RNP4 specifications and lower, as requested by airspace users.
- The two distant choke points in the ACC North sector.

3.2.2 Recommendations

In the short term

The main evolutions to be undertaken by KCAA should be:

- The extension of the FUA to include the HKR10 area to meet the airspace user's requests to have more direct routes.

Particularly, it should be possible to plan a route through this area at D-1, depending on the military activity. For that purpose, a message will be sent to the airlines at D-1 to indicate which parts are active and non-active (in 3 dimensions).

- The routes network improvement using PBN by creating CDRs (using PBN) through the HKR10 area and by providing double routes between Nairobi and Wajir.
- The ADS-C and CPDLC operational use, particularly over the oceanic area.
- The Free Route concept implementation in the oceanic area, depending on ADS-C and CPDLC operational transition.
- The implementation of a local ATFM to have a better view of capacity offer and demand in the short term.

This evolution will be important for the management of JKIA APP capacity management issues. Particularly, the capacity of all sectors will need to be defined.

- The operational use of AIDC between Nairobi and Mombasa.

In the medium term

KCAA should:

- Pursue the routes network improvement using PBN benefiting from the last aircraft navigation system performance and the FUA.
- Implement the use of AIDC with neighboring countries.
- Extend the Free Route concept implementation to the continental airspace, above a defined level.

During this period, it is also recommended to:

- Implement the new ACC proposed by KCAA.
- Implement a new En-route sectorisation, leading to the creation of a 3rd En-route sector.

In the long term

The following evolutions should be considered:

- Extend the use of AIDC/OLDI to additional neighboring countries.
- Implement ATFM at a regional level (on the assumption that it could not be done earlier).

- Pursue the implementation of the Free Route concept, at regional level and by progressively decreasing the FL above which it is used.

3.3 ATM – Approach & Tower Operations (APP/TWR)

3.3.1 Findings

The main findings are:

- The Nairobi APP congestion.
- The incorrect vehicles management on the maneuvering area with the use of separate frequencies for vehicles and aircraft.
- Some issues related to the coordination between the control tower authority (KCAA) and the apron cab authority (KAA).

3.3.2 Recommendations

In the short term

ILS Cat II operations at JKIA for runway 06 should be enabled as soon as the on-going actions from KAA are finalized.

For APP operations improvement, KCAA should undertake:

- Implementation of arrival and departure sequencing management (AMAN and DMAN) in Nairobi, covering both JKIA and Wilson operations in order to improve the operations at Wilson airport.
- Implementation of the TMA in Wajir (which has already been designed).
- Continuation of the PBN implementation procedures at additional airports across the country. Particularly, there exists a strong requirement from the airspace users to implement PBN procedures at Wilson airport.

The following evolutions should then be implemented in Nairobi:

- The Point Merge concept, which implies the definition of new arrival routes. Point Merge is referenced as a technique to support Continuous Descent Operation (CDO) (ICAO Doc. 9931), reducing pilot and controller workload.
- A new Nairobi APP sectorisation, which will lead to split the APP sector into two APP sectors.

For TWR operations improvement, KCAA should undertake:

- The JKIA tower cab reorganisation, with the creation of additional positions (ground control, clearance delivery) and the review of the arrangements of each TWR position, improving the integration of existing equipment (e.g. A-SMGCS display) and any new equipment (e.g. AMAN & DMAN displays).
- The improvement of the apron management.

This should rely on the establishment of a MoU between KCAA and KAA for the management of Apron areas at the main airports, the formal training of KAA Apron Managers and the consideration of the extension of KCAA systems to partly equip the KAA Apron cab with common systems such as VHF operating panels and EFS displays.

- The improvement of the vehicle management on the manoeuvring area.

This should rely on the establishment of a driving permit for vehicle drivers who need to enter the movement area, on the training of the vehicle drivers accordingly and on the development of a procedure on the use of SMC and other TWR frequencies by the vehicle drivers, limiting the use of the SMC frequency to specific situations.

- The operational transition to the Wilson new tower. The new tower should include one additional ground coordination position.
- The provision of air traffic control at Lamu airport and flight information and alerting services at several other smaller airports.
- Nairobi A-CDM development among the JKIA stakeholders, the aim being to ensure better coordination between the airport stakeholders in order to improve traffic flows and to make appropriate decisions at the right time in nominal and adverse conditions through accurate and reliable information sharing. It is important to note that DMAN deployment is fully dependent on the A-CDM implementation.
- JKIA 2nd runway ANS adaptations.

These adaptations will include the creation of additional tower positions for the management of the second runway and the extension of the CNS/ATM infrastructure to consider this second runway (e.g. ILS).

In the medium term

There should be the continuation of the PBN implementation and the provision of ANS at smaller airports.

3.4 Aeronautical Information Services (AIS)

3.4.1 Findings

In Kenya the AIS includes the following main functions:

- Aeronautical data and aeronautical information management,
- Aeronautical Information Publication (AIP),
- NOTAM management,
- Provision of pre-flight and post-flight information,
- Aeronautical Charts Management (as per ICAO Annex 4),
- Flight plan Management for ATS Reporting Offices (ARO),
- Instrument Flight Procedure Design.

These functions are currently implemented by two main software components: one is supporting the Procedure Design activities and the other one is supporting the core AIS functions.

The procurement for a new AIS/AIM system is currently ongoing.

3.4.2 Recommendations

In the short term

The priority should be given to the replacement of the AIS system as it is currently under implementation by KCAA. Particularly, this renewal will include:

- Migration from the AIXM 4.5 database into an AIXM 5.1 database.
- Upgrade of some functionalities of the AIS system.
- Upgrade of the HMIs to the AIS system users, providing the airspace users with on-line services to file flight plans.

Later on; once the implementation of the new AIS system is well on the track, KCAA should perform:

- Integration of “AMHS/AFTN management and operations” within the scope of responsibilities of AIS by moving this function to the NOTAM Office. This change will allow KCAA to address the current COM Centre staff shortage by reducing its activities.
- Relocation of AIS offices. Coordination with KAA should be done to have adequate offices (e.g. Kisumu, Wilson).

In the medium term and long terms

The challenges for KCAA should be:

- Implementation of SWIM at national level, taking account of the regional context.
- Extension of the AIM System to integrate new functionalities enabled by the SWIM environment.

3.5 Search and Rescue (SAR)

3.5.1 Findings

The main findings are:

- All SAR activities are currently manual and require a lot of time to provide an answer.
- Lack of a dedicated frequency for communication with the search aircraft, away from the operational frequencies.

3.5.2 Recommendations

In the short term

An upgrade of the Rescue Coordination Centre (RCC) should be made through the procurement and installation of an integrated aeronautical SAR software.

In this context, to prepare the installation and operational use of this SAR software in the RCC, KCAA should maintain a register of available resources to perform the search and rescue.

A dedicated frequency for communications with the search aircraft, away from the operational frequencies, should be provided.

3.6 Communications

3.6.1 Findings

The main findings are:

- Significant issues with the communication links (i.e. lack of redundancy and throughput).
- No AIDC or OLDI with adjacent centers.
- The need to implement ADS-C and CPDLC (as requested by the Airspace users).

3.6.2 Recommendations

In the short term

The following main evolutions are recommended:

- Provision of additional communication equipment to support the proposed short term ATM evolutions.

Particularly, this evolution concerns the additional TWR positions at JKIA, at Wilson airport and at the smaller airports.

It also concerns the provision of a dedicated frequency for SAR operations, the improvement of the VHF coverage to fill a gap in the VHF coverage and the procurement of necessary communication equipment for the new ACC (VCS, voice recorder and reproducer...).
- Improvement of the communication links.

This evolution will provide redundancy and increased throughput at national and international level, enabling the transition from AFTN to AMHS, the use of AIDC between Nairobi and Mombasa and the integration of JKIA MSSR in the A-SMGCS (surveillance).
- Replacement of the VCS in Malindi and Kisumu as they reached their end of life.
- Replacement of the HF equipment to be used for back-up purposes once ADS-C and CPDLC are operational.

- Procurement of communication equipment to fix some other weaknesses identified in communications.

It concerns the replacement of the Intercom system at Eldoret airport and the provision of an ATIS system at Wilson.

In the medium term

The recommended evolutions are:

- Replacement of part of the communication equipment and infrastructure at the end of its theoretical life. It concerns part of the VHF equipment, VCS, voice recorders/reproducers, VSAT and radio links.
- Procurement of a mobile tower to cater for events at a location where there is no ANS or in the case of disaster.
- Improve the communication infrastructure to support the implementation of SWIM in the medium term.

In the long term

The evolutions concern:

- Replacement of the remaining part of the communication equipment at the end of its life. It concerns part of the VHF equipment, VCS, voice recorders /reproducers, radio links and the AMHS.
- Implementation of the ATN Baseline 2. In this context, arrangements with the Communication Service Provider should be considered for installation and operation of ATN routers and ground VDL radios.

3.7 Navigation (equipment)

3.7.1 Findings

The main findings are:

- Lack of remote control and spare parts for some conventional facilities.
- An insufficient implementation of satellite-based operations.

3.7.2 Recommendations

In the short term

The required evolutions concern:

- Installation of VOR/DME remote control at some airports to fix the problems related to the lack of remote control of existing VOR/DME (e.g. Mombasa).
- Installation of an ILS for the 2nd runway at JKIA.

In the medium and long terms

Moving towards satellite based navigation is consistent with regional orientations and expected to progressively lead to the rationalization of conventional NAVAIDs.

In Kenya, the conventional NAVAIDs (VOR, DME and ILS) will need replacement in 2024/2025 and then in 2028/2029.

At that date, decision will have to be made to replace or not these VOR/DME after consultation of the airspace users to define a navigation roadmap beforehand.

For the ILS in Nairobi, decision will have to be made to replace or not these ILS, taking account of GBAS, knowing that GBAS CAT II requirements are still under validation.

The eventual availability of SBAS in the long term should be considered in the navigation roadmap that will need to be drawn in the medium term.

3.8 Surveillance

3.8.1 Findings

The main findings are:

- Lack of spare parts for the maintenance of the SMR, PSRs and MSSRs. It is noted that a maintenance agreement has since been concluded.
- Insufficient surveillance system available at JKIA for A-SMGCS operational use (no interface to the MSSR and no Airport MLAT system).
- On-going implementation of ADS-B and MLAT systems. However, some issues were pointed out in the deliverable D1, section 5.3.3.3, which should be addressed by KCAA.

3.8.2 Recommendations

In the short term

The recommended evolutions are:

- ADS-B operational transition and the commissioning of the ADS-B system currently under implementation by KCAA.
- Extension of some MLAT systems currently under implementation at some airports to WAM systems (Kisumu and possibly Malindi) in order to improve the surveillance coverage of the approach area to these airports.
- Installation of an airport MLAT system at JKIA for integration into the A-SMGCS system to improve the airport surface surveillance, particularly the automatic identification of targets in A-SMGCS.

In the medium term

The recommended evolutions are:

- Replacement of the SMR at JKIA at the end of its theoretical life.

- Preparation of the transition from MSSR to ADS-B.

The option of not replacing the MSSRs at the end of their theoretical life in 2025 should be envisaged, requesting preparation of the transition to a full ADS-B environment in En-route. Such a transition comes with the definition of a mandate for on-board equipage. In that case, the regulatory material should be prepared and published in the 2020/2022 timeframe in order to be applicable in 2026. In this context, the MLAT system previously installed at JKIA could be extended to a WAM system to provide redundancy in the approach to Nairobi.

In the long term

The transition to a full ADS-B environment in En-route will be effective.

The PSR in Nairobi and Mombasa will need to be replaced at the end of their life. This replacement will need to be made after the transition to ADS-B is made as the combined MSSR/PSR will be replaced by a PSR.

3.9 ATC Systems

3.9.1 Findings

The main findings are:

- Paper strips are still used as the transition to electronic strips has not been made.
- A-SMGCS is still not operational due to a lack of surveillance data and to a controller working position arrangement, which does not allow the effective use of the A-SMGCS surveillance display.
- Lack of AWOS display in Mombasa APP to directly provide weather data to APP controllers.

3.9.2 Recommendations

In the short term

KCAA should implement the necessary procurements or upgrades of ATC systems to support the recommended ATM evolutions and CNS improvements. It includes the following evolutions of ATC systems:

- 1) Procurement and installation of AMAN and DMAN tools at JKIA.
- 2) Procurement and installation of dedicated Tower EFS systems at JKIA, Wilson airport and Mombasa to facilitate the transition from a paper strips environment to an electronic strips environment.
- 3) Procurement and installation of an AWOS display in Mombasa APP to directly provide weather information to APP controllers.
- 4) A series of EUROCAT system upgrades to interface with the new ATC systems (AMAN/DMAN, Tower EFS), to integrate new surveillance data (ADS-B, WAM)

and to provide one additional display in JKIA Tower for the second runway operations.

- 5) Operational transition of the A-SMGCS after integration of Nairobi MSSR data and the JKIA Tower cab reorganization to allow the effective use of A-SMGCS surveillance.
- 6) A-SMGCS system upgrade to process the airport MLAT data to improve the airport surveillance function.

In the medium term

The EUROCAT system should be upgraded in the 2021/2022 timeframe and a replacement will need to be considered at the end of its theoretical life in 2025.

As part of these upgrade and replacement, the following evolutions will have to be considered:

- SWIM implementation (e.g. impact on FDPS and the need to take account of flight objects).
- Free Route concept implementation in En-route continental airspace.
- Installation of additional EUROCAT positions in the existing ACC to support the creation of a third ACC sector.
- Definition and implementation of a Disaster Recovery concept with the new ACC. This should be considered together with the procurement of one new ATC system for the new ACC.
- ATN Baseline 2 implementation.

In the context of a regional ATM integration, which encourages the development of a harmonized implementation and modernization of ANS facilities (cf. East African Upper Airspace and Northern Corridor Initiative), KCAA and its neighboring ANSPs should investigate the opportunity of having joint procurements, particularly for the procurement of the future ATC system.

There could be different degrees of involvement, from the development of common operational and technical requirements in support to the procurement process by each ANSP to the actual joint procurement of CNS/ATM systems, similarly to what exist in Europe with COOPANS.

An operational transition of the A-SMGCS alerts function should be made following the effective operational use of the A-SMGCS surveillance function.

The A-SMGCS should be replaced at the end of its theoretical life in 2025.

3.10 Auxiliary equipment

3.10.1 Findings

The main findings are discrepancies with the air-conditioning and electrical power supply.

3.10.2 Recommendations

In the short term

It is recommended that KCAA refurbish the following equipment:

- Electrical Power Supply
 - To incorporate appropriately sized Voltage Regulators & UPS units to supply sensitive facilities in all Stations.
 - To ensure electrical supply to houses other than equipment shelter and security lighting along the perimeter fences.
- Air Conditioning
 - To refurbish installations to ensure effective cooling in equipment rooms, including shelters.
 - To supply electrical power to the air conditioners from a regulated power source (voltage stabilizer).
- Remote Monitoring, Control and Display System:
 - To implement an RMCS to monitor, control and display remotely status of equipment shelters, power supplies and air conditioners in the Stations.
 - To monitor, control and display remotely status of navigational aids in the Stations whenever it is not available.
- Centralized Clock System
 - To provide a centralized clock system in the Stations whenever it is not available.

3.11 Training

3.11.1 Findings

Training covers the training organization, the training facilities (Training Units in the stations and the East African School of Aviation) and the training staff, addressing the following categories of ANS personnel: ATC Officers (ATCO), AIS Officers and the Technical and engineering personnel (ATSEP).

The main findings are, whatever the categories of ANS personnel:

- Lack of OJT instructors.
- Discrepancies between the international best practices and the operational and continuation training organization in the various unit training.

- Lack of training programs.

3.11.2 Recommendations

In the short term

The evolutions should be:

- Development of training plans and programmes for the different categories of personnel and the different stations, i.e. ATCO but also AFIS Officers for the smaller airports, all AIS officers assigned at the various AIS offices and ATSEP, so as to be in line with the international recommendations and best practices.
- Development of AIS proficiency check tools as required by the ICAO to aid in the regular assessment of AIS officers.

In parallel, it is recommended to provide continuation training to ensure the skills maintenance and development training for the qualification of both instructors and supervisors. This should include:

- For ATCO, the provision of OJTI and OPSUP training to ATCOs who are instructors and/or operational supervisors.
- For AIS personnel, the provision of specialized training to AIS staff in the Aeronautical Chart activity and the provision of specialized and refresher training to PANS-OPS Officers.
- For ATSEP, the provision of training on instructional techniques and the provision of refresher and advanced technical training.

Concerning EASA, it is recommended:

- To equip EASA with a multimedia room and with a NAVAIDS simulator.
- To standardize training strategy and methodology by getting close to other training academies.
- To develop MOUs with neighbouring countries to ensure that the facilities and resources deployed at EASA will be fully utilized over time. Similarly, with the same objective, to develop MOUs with other KCAA Directorates. In June 2016, KCAA reported that the development of MOUs within KCAA is an on-going action.

In the medium term and long terms

It is recommended to pursue the training for the three main categories of personnel (ATCO/AFISO, ATSEP and AIS).

In the long term

A 3D Tower simulator should be installed at JKIA for the training of ATCOs.

3.12 Human Resources (HR)

3.12.1 Findings

The main findings are:

- Staff shortage in most stations for the three main categories of personnel (ATCO, ATSEP and AIS).
- Additional staff will be required to man the new positions in support of the recommended ATM improvements.

3.12.2 Recommendations

In the short term

KCAA should first consider the recruitment and training of ATCOs, AIS staff and technical staff to palliate the deficits of human resources identified in the current organization. This recruitment and training should continue to enable the manning of the new positions related to the identified ATM improvements.

The number of ATCO should be increased to meet the current needs but also to handle the following short and medium terms evolutions:

- Additional Tower positions at JKIA for the existing runway (Ground control, Clearance delivery) and for the 2nd RWY.
- Additional Tower position at Wilson (Ground coordination).
- JKIA Approach re-sectorisation.
- En-route re-sectorisation.
- OJT instructors.
- Provision of ATC services at Lamu airport.

During this period, AFIS Officers recruitment and training will also start to enable the progressive deployment of AFIS at some other smaller airports.

The number of AIS officers has to be increased to meet the current needs for:

- Additional active designer.
- Additional officer for the "Aeronautical Maps & Charts".
- Additional officers at airports, including OJT instructors.

The aeronautical communication officers should be re-deployed to other functions (SMS data collection and possibly AFIS at some smaller airports) once the ADS-C and CPDLC are completely operational and the HF is no longer required as a main means of communication.

Some EASA instructors should also be recruited to meet the identified lack of staff (e.g. CNS instructors).

In the medium term

The recruitment and training of AFISOs and technical staff will continue to support the deployment of AFIS positions and the lack of technical staff.

In the long term

An ATCO recruitment and training will occur to handle the implementation of the centralised ATFM foreseen at regional level.

4 ENVIRONMENTAL ANALYSIS

4.1 Potential environmental impacts of the proposed evolutions

An analysis of the potential environmental impacts of the proposed ANS evolutions in the KCAA Airspace Master Plan was performed. This analysis relied on:

- The identification of the ASBU modules having environmental benefits and being applicable to KCAA in the frame of the Master Plan; and
- The application of associated benefits mechanisms to the Kenyan context.

A qualitative analysis of the environmental benefits was done and when possible a quantitative analysis was conducted. Quantification of the benefits was done using the ICAO IFSET tool.

The main modules applicable to KCAA that will bring environmental benefits are:

- B0-APTA Optimization of Approach procedures including Vertical Guidance
- B0-RSEQ Improved Traffic Flow through Sequencing (AMAN/DMAN)
- B0-FRTO Improved Operations through Enhanced En-route Trajectories
- B0-CDO Improved Flexibility and Efficiency in Descent Profiles using CDOs – Continuous Descent Operations
- B0-CCO Improved Flexibility and Efficiency Departure Profiles using CCOs – Continuous Climb Operations

The benefits mechanisms come as follows:

On the air side,

- Reduction in the flight length, and/or better flight lateral and vertical profiles, with possible continuous descent, and/or less diversions, which will allow aircraft to reduce fuel burn and CO₂ emission.
- Aircraft path higher and/or avoiding noise sensitive areas which will allow to reduce the noise impact.

On the ground side,

- Reduction in the taxi out time and holding time which will allow for reduced fuel burn/consumption and CO₂ emission and reduced noise at the airport.

Two of the most beneficial ASBU modules in the Kenya context are B0-CDO and B0-CCO.

Continuous Descent Operations (CDO) feature optimized profiles that allow aircraft to come in from high altitudes to the airport at minimum thrust settings, decreasing noise in local communities and using up to 30% less fuel than standard 'stepped' approaches. The implementation of additional recommended evolutions such as AMAN (B0-RSEQ) and Merge Point will contribute to the full realization of these environmental benefits.

4.2 Compliance to Environmental Regulations

Legally, the Kenyan Environmental Management and Coordination Act No. 8 of 1999 and the Environmental (Impact Assessment and Audit) Regulation 2003 would demand that a Strategic Environmental Assessment (SEA) is done for the Master Plan and that the SEA outcomes be part of the Master Plan documentation to be compliant to the Kenyan laws.

After consultations with the National Environment Management Authority (NEMA) on the need for a SEA, NEMA advised that KCAA prepares a brief on the Master Plan and presents to NEMA for advice whether a SEA will be required.

To assist in the delivery and monitoring of achievements of the recently adopted Action Plan, KCAA should consider developing an Environmental Management System (EMS) capable of being certified under ISO 14001:2004, the internationally recognized standard to deliver and continually improve environment management.

The EMS has the superior advantage in that it presents formalized mechanisms through which the Basket of Measures can be realized.

An EMS follows a 'plan-do-check-act-review' cycle, incorporating written policies, procedures, and records associated with the significant environmental effects of an organization. A fully functional EMS is typically embedded within an organization's existing business processes such as its strategy and planning cycles, operational activities, marketing and communications, procurement and training functions.

5 INSTITUTIONAL, LEGAL AND REGULATORY ISSUES

The implementation of the recommendations could raise potential challenges and issues with respect to the legal and regulatory context in Kenya. This analysis was performed and the outcomes are documented in the deliverable D3 [Ref 4.]. These outcomes are summarized hereafter.

5.1 Separation between the Operator and the Regulator

5.1.1 Findings

In Kenya, the air navigation services provider and the regulator are within KCAA.

This is a major issue since ICAO recommends separating the services providers from the regulator in order to ensure the independence of the regulatory system.

5.1.2 Recommendations

It is recommended that KCAA ensures at least a functional separation between the regulator and the ANSP:

- By placing the related activities into different specialized entities in KCAA.
 - Each one of the entities is in charge of a very precise scope of activities, receives a well identified manpower and budget and the necessary competencies for performing its tasks.
 - The Director and the staff of the ANSP are not placed under the authority of the regulator.
- Within KCAA budget, each Directorate must have a proper and identified budget. For each Directorate, the yearly budget should be elaborated by its Director, the coordination being assured by the DG, and then submitted to the Board for adoption.
- Besides the Director General, the Director and/or the heads of Units of the entity performing regulatory tasks related to ANS also report to the Board on their activities related to these tasks so that the Board verifies, as far as possible, the effective functional separation.
- A mechanism preventing shortcomings emanating from conflicts of interest should be established.

5.2 The definition of crimes and offences

5.2.1 Findings

The Civil Aviation Act, 2013 provides very few offences related to unlawful acts against civil aviation and none against air navigation services and facilities.

5.2.2 Recommendations

It is recommended that more are introduced, preferably in the Civil Aviation Act:

- The definition of crimes and (main) offences allowing to suppress the different unlawful acts against civil aviation,
- Possibly, their corresponding penalties,
- The procedures for ascertaining the offences.

These recommendations should be put in the context of the recommended ATM Security development (cyber-security). Thus, the Civil Aviation Act and eventually the civil aviation regulations on crimes and offences should complement the measures that will be implemented by KCAA/ANSP for ATM Security.

5.3 Safety Management

5.3.1 Findings

Some deficiencies were identified in the implementation of the SMS by the ANSP (see 3.1.2).

5.3.2 Recommendations

It is recommended that:

- The basic principles for a voluntary and a mandatory reporting system are established in the civil aviation act.

The law must ensure a legal protection for the reporter and more generally a protection of the information source.

These basic principles are implemented in the civil aviation regulations (i.e. regulations related to the SMS of an ANSP).

- Regulatory provisions should provide that “All activities undertaken in an ATS SMS shall be fully documented”.

5.4 How KCAA (ANSP) could collaborate or provide air navigation services to/with neighboring countries

5.4.1 Findings

KCAA (ANSP) wishes to play a role at the regional level in the provision of ANS.

Provision of services for/with other States could include: air traffic control, CNS, aeronautical information.

5.4.2 Recommendations

From a legal and institutional point of view, different options may be considered for cooperation with neighboring countries.

5.4.2.1 Kenya provides air navigation services on behalf of another State

In that case, the delegation is done through an agreement between States (Annex 11).

The agreement should include:

- The conditions under which the delegation is agreed,
- The residual responsibility of the delegating States,
- Mentions regarding the liability of the ANSP. The agreement needs to address issues of jurisdiction and conflict of laws in order to ensure the protection of victims of accidents caused by ANSP errors,
- The rules on the allocation of liability and related recourse actions. Two models for liability of the ANSP can be envisaged:
 - Claims are to be addressed to the delegating State, the courts of which hear such claims in its courts and apply the national law of that State.
 - The other model renders the ANSP in question primarily liable for damage caused.

5.4.2.2 A multinational air navigation facility/service

The purpose of a multinational facility/service is to serve international air navigation in airspace extending beyond the airspace serviced by a single State.

The participating States must conclude an agreement defining their responsibilities and the terms under which the multinational facility/service is to be provided.

The agreement should cover basic provisions such as:

- Objective of the agreement,
- Obligations of States party to the agreement,
- Definition and description of the facility/service,
- Legal responsibility,
- Liability aspects,
- Managerial aspects: governing bodies and decision-making arrangements, organization and staffing, etc...
- Financial aspects: cost determination, cost sharing, budgeting,
- Taxation and other government levies,
- Procedures for settlement of disputes.

5.4.2.3 Kenya wishes to establish a cooperation with adjacent countries

This cooperation could take the form of a surveillance data sharing with adjacent countries to improve coordination across borders (cf. deliverable D1 [Ref 1.]).

In that case, administrative and technical agreements between KCAA (ANSP) and other ANSPs are appropriate.

Nevertheless, due to the sensitive nature of the data shared/provided (for many States, surveillance is closely linked to sovereignty), such arrangements may be subject to State approval unless there is a regional or sub-regional legal framework allowing this data sharing.

The agreement on surveillance data sharing must address various issues, whose content depends on the number of participating members and on the complexity of the data sharing system, e.g. Governance structure, Legal instrument, Charging, Liability, Conditions of use and Compliance.

5.5 Apron Management Service

5.5.1 Findings

At JKIA, apron management is performed by KAA. But there is apparently no clear definition of the areas of responsibility and related tasks between KCAA and KAA.

5.5.2 Recommendations

It is recommended that:

- A Letter of Agreement between KAA and KCAA is established to comply with ICAO requirements and to prevent from liability issues (determine who is responsible for each task and, eventually, liable for damages resulting from these tasks).
- The civil aviation regulations should be amended as follows:
 - The obligation for all drivers who must circulate on the apron and, eventually, the manoeuvring area to hold a “Movement area driving certificate”.
 - When there is an apron management service, the obligation for the ATS unit and the airport operator to conclude specific agreements which define, in detail, the respective areas of responsibility.
 - The staff operating an apron management service should hold a certificate issued by the KCAA.

5.6 Air Navigation Service Charges

5.6.1 Findings

There are no regulatory provisions on ANS charges. The existing regulations do not constitute an appropriate regulatory framework since they are restricted to the definition of the criteria on which the implementation of charges is based (such as distance flown or maximum take-off mass for the en route charges).

5.6.2 Recommendations

It is recommended to establish a regulatory framework for ANS charges ensuring a transparent system with a fair and equal treatment of all users.

This regulatory framework should provide for basic rules related to:

- The establishment of the cost basis,
- The allocation of costs of air navigation services among aeronautical users,
- A consultation mechanism,
- Charges collection.

Similar provisions should be established for airports charges.

5.7 Search and Rescue

5.7.1 Findings

In Kenya, KCAA ANS is responsible of the Search & Rescue (SAR).

5.7.2 Recommendations

As regards draft SAR regulations:

- KCAA shall use the existing Kenya Aeronautical and Maritime SAR plan as a basis to fulfil its own tasks and this should be specified in the regulation;
- Regulation 19 could specify that “the plan shall be updated according to the findings resulting from these exercises and to draw lessons of practical experience”;
- Eventually, develop the principles for the financing of SAR;
- Develop rules for implementation of the performance objective established by the AFI regional plan.

5.8 Meteorological services for Air Navigation

5.8.1 Findings

The provision of aeronautical meteorology is not part of KCAA. Kenya has chosen the financing of all or part of the service provision by tax payers through the general State budget.

5.8.2 Recommendations

Kenya should consider the financing of aeronautical meteorological services through user charges:

- In accordance with ICAO’s policy on charges for ANS, financing of all or part of the service provision could be made through user charges;
- This financing should be integrated into the civil aviation (ANS) regulations providing the basic rules for ANS charges (see section 5.6);
- In order to ensure transparency:
 - The MET department is requested to justify in a transparent manner the use of the funds allocated from air charges;

- Its costs are carefully watched by KCAA as “economic regulation” is one of its functions.

5.9 Implementation of ADS-B System

5.9.1 Findings

KCAA aims at moving from MSSR to ADS-B as sole means of ground surveillance (in some parts of the airspace).

5.9.2 Recommendations

KCAA should:

- Establish a mandate for ADS-B in its airspace (equipment, targeted aircraft)
- Develop concepts of operations (responsibilities, operational procedures, phraseology...) and update the Kenya AIP and information documentation accordingly.
- Issue systems certification
- Deliver regulatory approvals

For example, for operational approval, a domestic air operator must comply with the following requirements:

- To have an aircraft that is equipped and approved;
- All operational considerations must be addressed;
- The air operator must establish procedures in its Company Operations Manual for the guidance of its personnel and any other procedures related to ADS-B, which are necessary for safe operations. These procedures must include training;
- The operator must provide training to each flight crew member involved with ADS-B operations. The training should also provide the flight crew with information regarding dependencies of other systems such as GPS and Flight Management System and the consequences of their malfunction or failures on the ADS-B system. Method of compliance with incident reporting and Minimum Equipment List must also be addressed in this training.

5.10 Airport Collaborative Decision Making (A-CDM)

5.10.1 Findings

The implementation of an A-CDM has been identified as a means to improve APP and TWR operations in JKIA (see 3.3.2).

The efficiency of the CDM process implies the involvement of all stakeholders at the concerned airport: airlines, air navigation service provider, airport operator, ground handlers, MET office and others (fire, police, customs, fuel, etc.).

5.10.2 Recommendations

It is recommended that an MoU setting the framework of the Airport CDM Project should be signed by all the airport partners as soon as they have decided to implement Airport CDM. This would ensure reliable and consistent operations, clearly formalise the roles and responsibilities of all partners and covers some legal issues.

However, there is one blocking issue with respect to the implementation of an A-CDM, which is the lack of functional separation between the regulator and the ANSP.

Indeed, KCAA is also the Regulator and it cannot be part of an A-CDM MoU because it has to be above the other stakeholders (as the regulator is in charge of licensing and supervising the services providers).

5.11 Training, License and Certificate

5.11.1 Findings

Discrepancies between the current training situation and the international recommendations and best practices regarding the training have been identified (see 3.11).

5.11.2 Recommendations

ATCO

- To improve the understanding and the implementation of the training system, regulations should be amended to make clear the distinction between the training phases with their respective requirements.
- A national training plan (i.e. a UTP template) should be developed by the Regulator in liaison with EASA and the user Departments to standardize the training process and organization throughout the Kenyan training units.
- In order to reduce legal exposure, KCAA should effectively exercise its responsibilities in terms of certification and oversight.

AIS/AIM

As regards the civil aviation (ANS) regulations, some requirements should be added:

- Documented job descriptions for each function with the related skills and knowledge;
- Development of a training programme for each type of training (ab initio, on the job training, specialized, recurrent, refresher) to be approved by KCAA/Regulator.

As the need for competency assessment of AIS/AIM personnel is a requirement in Annex 15, a policy to govern the initial and periodic competency assessment of AIS/AIM personnel is required as a priority.

ATSEP

- The civil aviation (ANS) regulations should provide that “appropriate records shall be maintained so that the qualifications of personnel can be confirmed”.
- The certification system provided for in the civil aviation (ANS) regulations (47 and 48) should be clarified.

5.12 Invoicing and Collection of Charges

5.12.1 Findings

KRA is in charge of collecting aviation revenue on behalf of the KCAA.

The airspace users with credit facilities are invoiced monthly and pay at the end of each month. KCAA reported that this is the majority of the airspace users. For the other airspace, those without credit facilities and those who fly within the airspace occasionally, they have to pay as they file flights plans. For these airspace users, KCAA (AIS) reported that there is no automation of invoicing, i.e. AIS prepares the “invoicing”, goes to KRA with the pilot to pay and comes back to approve the flight plan. Other pilots have to wait.

5.12.2 Recommendations

It is recommended to:

- Implement a system interface with KRA.
- Assess the compliance of the collection of charges by KRA with ICAO’s policy on charges, which must apply the following principles:
 - As the “revenues” are collected, they should be transferred directly to a specified treasury or other government account;
 - The revenue collected by KRA must not be used for purposes other than the provision of ANS;
 - The corresponding funds and amounts must be paid on the account of the KCAA in a timely manner.

ANNEX A. LIST OF CONSULTED STAKEHOLDERS

The following organizations attended the Stakeholder Forum organized on the 24th of February 2016 to present the ANS evolutions considered in the KCAA Airspace Master Plan:

- Air Kenya
- East African Civil Aviation Academy (EACAA)
- Fly540
- International Air Transport Association (IATA)
- International Civil Aviation Organization (ICAO)
- Kenya Air Force (KAF)
- Kenya Airways
- Kenya Association of Air Operators (KAAO)
- Kenya Civil Aviation Authority (KCAA), including the following Directorates:
 - Aviation Safety Standards and Regulations
 - Air Navigation Services (ANS)
 - East African School of Aviation (EASA)
 - Corporation Secretary
- Kenya Defense Forces (KDF)
- Kenya Maritime Authority (KMA)
- Kenya Meteorological Department (KMD)
- Kenya School of Flying
- Mission Aviation Fellowship (MAF)
- Rudufu Ltd
- Safe Air Company (SAC K Ltd)
- Uganda Civil Aviation Authority

ANNEX B. AFI ASBU BLOCK 0 MODULES PRIORITY

The table hereafter provides an overview of the ASBU Block 0 modules, along with their priority in the African Indian Ocean Region (AFI).






PIA	Module Description	Module Id	Priority
PIA 1 Airport Operations	Improve Traffic flow through Runway Sequencing (AMAN/DMAN)	B0-RSEQ	2
	Optimization of Approach Procedures including vertical guidance	B0-APTA	1
	Increased Runway Throughput through optimized Wake Turbulence Separation	B0-WAKE	2
	Safety and Efficiency of Surface Operations (A-SMGCS Level 1-2)	B0-SURF	2
	Improved Airport Operations through Airport-CDM	B0-ACDM	1
PIA 2 Globally- interoperable systems and data	Increased Interoperability, Efficiency and Capacity through Ground-Ground Integration	B0-FICE	1
	Service Improvement through Digital Aeronautical Information Management	B0-DAIM	1
	Meteorological information supporting enhanced operational efficiency and safety	B0-AMET	1
PIA 3 Optimum capacity and flexible flights	Improved Operations through Enhanced En-Route Trajectories	B0-FRTO	1
	Improved Flow Performance through Planning based on a Network-Wide view	B0-NOPS	2
	Initial capability for ground surveillance	B0-ASUR	2
	Air Traffic Situational Awareness	B0-ASEP	2
	Improved access to Optimum Flight Levels through Climb/Descent Procedures using ADS-B	B0-OPFL	2
	ACAS Improvements	B0-ACAS	1
	Increased Effectiveness of Ground-Based Safety Nets	B0-SNET	2
PIA 4 Efficient Flight Paths	Improved Flexibility and Efficiency in Descent Profiles (CDO)	B0-CDO	1
	Improved Safety and Efficiency through the initial application of Data Link En-Route	B0-TBO	2
	Improved Flexibility and Efficiency Departure Profiles - Continuous Climb Operations (CCO)	B0-CCO	1

ANNEX C. SUMMARY TABLE

The table hereafter provides an overview of the proposed ANS evolutions for the period 2015-2030. It highlights the link with the ICAO ASBU modules (mainly in the Blocks 0 and 1).

Legend for the evolutions concerning ATM En-route, APP/TWR, AIS and national evolutions:

- ATM En-route evolution: blue square
- APP and TWR evolution: green square
- En-route and APP/TWR evolution: purple square
- AIS evolution: orange square
- National evolution: red square

Id	Evolutions	Short term 2016-2020	Medium term 2021-2025	Long term 2026-2030	Notes and remarks
Operational evolutions (ASBU, Regional performance objectives, National evolutions...)					
Air Navigation Services – General					
1.	“Safety Management System” Unit implementation				
2.	“ANS Planning & Projects” Unit implementation				
3.	“ATM Security Management” Unit implementation				
ATM En-route operations, APP & TWR operations, and AIS operations					
PIA 1 Airport Operations					
4.	B0-RSEQ				
5.	B0-APTA				


















6.	B0-SURF B1-SURF	JKIA A-SMGCS Level 1 then Level 2		Based on Surveillance evolution 36, 37
7.	B0-ACDM	JKIA A-CDM		Based on Regulatory evolution 44
	PIA2 Globally-interoperable systems and data			
8.	B0-FICE	AIDC use nationally	AIDC use regionally	
9.	B0-DATM B1-DATM	AIS/AIM system renewal	AIM system extension	
10.	B1-SWIM		SWIM	
11.	B0-AMET	MOI APP AWOS display		

	PIA3 Optimum capacity and flexible flights					
12.	B0-FRTO B1-FRTO	FUA extension	Oceanic	Free Routing Continental	Continental Regional	Based on Communication evolution 24
		Routes network improvement using PBN				
13.	B0-NOPS	ATFM Local	New ACC sectorisation		ATFM Regional	
		New Nairobi APP sectorisation				
14.	B0-ASUR	ADS-B Ops use			Full ADS-B En-route	Based on Surveillance evolutions 36, 37
		JKIA MLAT and WAM (MLAT extension)				

15.	B0-SNET	ATC Systems Safety Nets (ENR & TWR) Ops use			
PIA4 Efficient Flight Paths					
16.	B0-CDO B0-CCO	JKIA Point Merge PBN SID, STAR, APCH procedures			
17.	B0-TBO B1-TBO	ADS-C & CPDLC ops use		ADS-C & CPDLC using ATN Baseline 2	Based Communication evolution 24

	National evolutions				
18.	National evolutions	<div data-bbox="712 448 880 507" style="border: 1px solid blue; padding: 2px; margin-bottom: 5px;">New ACC</div> <div data-bbox="712 523 1028 943" style="border: 1px solid green; padding: 5px; margin-bottom: 5px;"> JKIA TWR cab reorganisation JKIA 2nd RWY adaptations JKIA Cat II Wilson TWR Wajir TMA Apron mngt Vehicle mngt ANS at small airports </div> <div data-bbox="712 967 1028 1098" style="border: 1px solid orange; padding: 2px; margin-bottom: 5px;"> AMHS/AFTN mngt & operation AIS offices relocation </div> <div data-bbox="712 1121 880 1209" style="border: 1px solid red; padding: 2px;">RCC upgrade</div>			

Users requirements					
19.	To provide direct routes through military areas, which are currently defined as danger, restricted and prohibited areas 24/7 (e.g. HKR10 area). (D1, 4.2.2.1)	FUA extension			See evolution 12
20.	To use of ADS-C and CPDLC in oceanic and remote continental area to enable the use of RNP4 specifications and lower so as to reduce separations (D1 4.2.2.2)	PBN routes network improvement and data link communication infrastructure			See evolutions 12 and 17
21.	To maintain the conventional routes network based on VOR/DME for low performance aircraft while they still need these routes (D1, 4.2.2.2)	Conventional Navigation Aids strategy in view of a long term NAVAIDs rationalization			See evolution 35
22.	To reduce the impact of the operations at JKIA on the Wilson airport in order to provide more departure slots at Wilson airport (D1, 4.3.2.2)	New PBN procedures at Wilson airport Consideration of Wilson airport operations in AMAN/DMAN deployment at JKIA			See evolutions 4 and 5
23.	To introduce Satellite-based operations to increase efficiencies, Continuous Climb Operations (CCO) and Continuous Descent Operations (CDO) (D1, 5.2.2)	PBN routes network improvement PBN SID, STAR, APCH implementation Point Merge implementation			See evolutions 12 and 16

Infrastructure evolutions (CNS and ATC systems)				
Communication				
24.	Communication equipment (VHF, VCS, REC/REP) extension			
25.	Communication equipment (VHF, VCS, REC/REP) replacement			
26.	HF equipment replacement			
27.	SWIM infrastructure			
28.	AMHS replacement			
29.	COM infrastructure replacement			
30.	COM links improvement			
31.	Mobile tower			
32.	ATN Baseline 2 implementation			
Navigation				
33.	VOR/DME remote control			
34.	ILS for JKIA 2 nd runway			
35.	NAVAIDS rationalization			
Surveillance				
36.	ADS-B			 Based on ADS-B mandate (see evolution 45)

37.	MLAT/WAM	JKIA Airport MLAT MLAT extended to WAM	JKIA WAM		
38.	PSR, SMR replacements				
	ATC Processing Systems				
39.	AMAN/DMAN				
40.	ATC system upgrades				
41.	ATC system for new ACC				
42.	Existing ATC system replacement				
43.	A-SMGCS	Level 1 MLAT integration Level 2			
Regulatory aspects including mandates					
44.	Regulatory evolutions	Separation between the regulator and the operator Civil Aviation Act updates Environmental Mgt System			See section 5
45.	Mandates (preparation & publication)		ADS-B mandate		

*** End of document ***