

Kenya Civil Aviation Authority

Air Navigation Services

**ICAO Seminar/Workshop on
Air Traffic Services System
Capacity 8-10 June 2016
Nairobi**

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Objective

Share with audience information on how KCAA-ANS addresses the issues related to:

- ATS operational supervision and management;
- Airspace and sector capacity assessments and planning;
- Traffic planning including Air Traffic Flow Management (ATFM); and
- Assessments of operational requirements for ATM supporting technologies.

Outline

- **Introduction**
- **Establishment of authority for ATS**
- **Determination of the need for ATS**
- **Establishment and designation of ATS units**
- **Capacity management and assessment**
- **Division of responsibilities between ATS units**
- **Airspace sectorization and equipment**
- **Pending solutions**
- **References**

Introduction

Kenya Civil Aviation Authority (KCAA) was established on 24th October 2002 by the Civil Aviation (Amendment) Act, 2002 with the primary functions towards; Regulation and oversight of Aviation Safety & Security; Economic regulation of Air Services and development of Civil Aviation; **Provision of Air Navigation Services**, and Training of Aviation personnel KCAA; as guided by the provisions of the convention on international civil aviation, related ICAO Standards and Recommended Practices (SARPs), the Kenya Civil Aviation Act, 2013 and the civil aviation regulations.

Introduction Con't

➤ KCAA has dual functions

1- Regulator

2- Service Provider

➤ As Service Provider

Responsible for the management and operation of Air traffic services and Search and Rescue within the Nairobi Flight Information Region (FIR).

➤ Services offered; En-route, Approach and Aerodrome control , Search and Rescue and **Air Traffic Flow Management (ATFM)**

Establishment of authority for ATS

According to ICAO Annex 11, Contracting States shall **determine**, in accordance with the provisions of the Annex and for the territories over which they have **jurisdiction**, those portions of the airspace and aerodromes where air traffic services will be provided. They shall thereafter arrange for such services to be established and provided in accordance with the provisions of this Annex,

Establishment of authority for ATS Con't

except that, by **mutual agreement**, a State may **delegate** to another State the responsibility for establishing and providing air traffic services in flight information regions, control areas or control zones extending over the territories of the former

NAIROBI FIR CHART

[ENR 6-3 \(AO\) APRIL 2016.pdf](#)

Establishment of authority for ATS Con't

IN Nairobi FIR ATS is provided at;

ACC (North and South) – En-route surveillance

FIC – Flight Information Service (Procedural)

JKIA – Aerodrome and Approach Surveillance

MIA – Aerodrome and Approach Surveillance

EIA – Aerodrome and Approach Control

Wilson – Aerodrome Control

Kisumu – Aerodrome Control

Malindi – Aerodrome Control

Wajir – Aerodrome and Approach Control

Lokichoggio – Aerodrome Control



Determination of the need for ATS

Annex 11 requires that provision of air traffic services be determined by consideration of :

- The types of air traffic involved;
- The density of air traffic;
- The meteorological conditions;
- Such other factors as may be relevant.

The types of air traffic involved;

Nairobi FIR has a mixture of different types of air traffic with aircraft of varying speeds (large and small jets, turbo props, piston, helicopters, UAS, microlights) **H/M/L**

Determination of the need for ATS Con't

The density of air traffic;

High at major crossing points (LOV, WAV, EVARU, MAV, NV, MOV) and Nairobi TMA, Wilson and Wajir.

The meteorological conditions;

Generally good except in Nairobi during specific times of the year (fog) and TS at Kisumu

Such other factors as may be relevant.

- Wilson where traffic has grown due to training schools and increase in number of flights to the national parks and Somalia
- Challenge for oceanic TFC, nil desert and few mountains

Establishment and designation of ATS units

Nairobi FIR has the following units;

- i) ACC (North and South)
- ii) FIC
- iii) Approach Control
- iv) Aerodrome Control

Annex 11 recommends that **delineation** of airspace, where air traffic services is to be provided, should be related to the nature of the route structure and the need for efficient service rather than to national boundaries.

This has been taken into consideration by KCAA

Establishment and designation of ATS units Con't

Previous structure

[ENR 6-3.pdf](#)

Current structure

[ENR 6-3 \(AO\) APRIL 2016.pdf](#)

Capacity management and assessment

According to Annex 11, the capacity of an ATS system depends on **many factors**, including the **ATS route structure**, the **navigation accuracy** of the aircraft using the airspace, **weather-related factors**, and **controller workload**. Every effort should be made to provide sufficient capacity to cater for both **normal and peak** traffic levels; however, in implementing any measures to increase capacity, the responsible ATS authority shall ensure, that **safety levels are not jeopardized**.

Capacity management and assessment Con't

[RADAR AIRSPACE.pdf](#)

Capacity management and assessment Con't

The number of aircraft provided with an ATC service **shall not exceed** that which can be safely handled by the ATC unit concerned under the prevailing circumstances. In order to define the maximum number of flights which can be safely accommodated, the appropriate ATS authority should **assess and declare** the ATC capacity for control areas, for control sectors within a control area and for aerodromes.

ATC capacity should be expressed as the maximum number of aircraft which can be **accepted over a given period** of time within the airspace or at the aerodrome concerned.

Capacity management and assessment Con't

As per ICAO Doc 4444; when assessing the amount of peak hourly traffic load, i.e traffic load to be handled in that clock hour during which the highest number of movements occurs the peak hourly traffic load should be derived from **traffic data collected** during an average day of the peak week of the year; maximum instantaneous traffic load, which is the traffic load at the busiest instant within the peak hour as determined traffic in a sector

Capacity management and assessment Con't

At present there is no generally accepted method for the assessment of controller capacity. However, work on this subject has been conducted by a number of States. The method developed in the United Kingdom, which is similar to the United States' method, is based on an over-all assessment of workload (on an arbitrary scale) made by an observer who is himself/herself an experienced air traffic controller

Capacity management and assessment Con't

normally having controlled traffic in the sector under review. The assessments are then related statistically to the traffic flow, from instant to instant

Nairobi FIR

Based on

- Statistics of incidents that occur
- Delays that occur due to traffic workload
- Area of surveillance/ATCO
- Feedback from ATCOS

Capacity management and assessment Con't

Nairobi FIR

- ACC is sectorized and service is by surveillance radar
- Approach in Nairobi and Mombasa under radar surveillance with reduced lateral limits
 - Nairobi – 50 Nm radius from 100Nm
 - Mombasa – 40 Nm from 80Nm
 - Eldoret – 50 Nm (Includes Kisumu to FIB)
 - Wajir – 50 Nm (from none)
- Dedicated FIC position that handles all VFR operations

Capacity management and assessment Con't

JKIA, EIA, Kisumu, Wajir, Lokichoggio serviced with only one runway without rapid exit taxiways thus limiting number of operations.

- e.g JKIA can only handle 25 movements per hour due to the limitations on ground infrastructure
- Mombasa, Wilson, Malindi have two crossing runways thus increasing capacity but not to maximum due the crossing factor
- Expectation, 2nd parallel runway with rapid exit taxiways at JKIA to increase capacity hence 2 ATCO positions and a ground position in Twr and sectorization of Nairobi Approach Control

Capacity management and assessment Con't

In assessing capacity values, factors to be taken into account should include,

- a) The level and type of ATS provided;
- b) The structural complexity of the control area, the control sector or the aerodrome concerned;
- c) Controller workload, including control and coordination tasks to be performed;
- d) The types of communications, navigation and surveillance systems in use, their degree of technical reliability and availability as well as the availability of backup systems and/or procedures;

Capacity management and assessment Con't

- e) Availability of ATC systems providing controller support and alert functions; and
- f) Any other factor or element deemed relevant to controller workload.

ACC (North and South) – En-route surveillance

- Handles all IFR traffic in the airspace under its jurisdiction
- Manages RCC activities on a part time basis

FIC – Flight Information Service (Procedural)

- Handles all VFR traffic within the FIR
- Participates in monitoring traffic for SAR purposes

Capacity management and assessment Con't

JKIA – Aerodrome and Approach Surveillance

- Manages traffic within JKIA and Nairobi TMA
- Vertical limits (Gnd – FL 195) Lateral limits (50Nm)
- SMR at JKIA Twr
- PSR and SSR mode S/ **ADS-C** used in the TMA
- VHF communication/ **CPDLC**

MIA – Aerodrome and Approach Surveillance

- Manages traffic within MIA and Mombasa TMA
- Vertical limits (Gnd – FL 145) Lateral limits (40Nm)
- PSR and SSR mode S/**ADS-C** used in the TMA
- VHF communication/**CPDLC**
- RSC type II

Capacity management and assessment Con't

EIA – Aerodrome and Approach Control

- Manages traffic within EIA and Eldoret TMA
- Vertical limits (Gnd – FL 145) Lateral limits (50Nm)
- Procedural control used in the TMA
- VHF communication
- RSC type II

Wilson – Aerodrome Control

- Manages traffic within Wilson AD traffic zone
- Vertical limits (Gnd – 6500ft) Lateral limits (15Nm)
Area II of Nairobi control zone
- PSR and SSR mode S/**ADS-C** under Nairobi TMA
- VHF communication

Capacity management and assessment Con't

Kisumu – Aerodrome Control

- Manages traffic within Kisumu AD traffic zone
- Vertical limits (Gnd – 9000ft) Lateral limits (15Nm) Kisumu control zone
- VHF communication
- RSC type II

Malindi – Aerodrome Control

- Manages traffic within Malindi AD traffic zone
- Vertical limits (Gnd – 5000ft) Lateral limits (15Nm) Malindi control zone
- VHF communication
- RSC type II

Capacity management and assessment Con't

Wajir – Aerodrome and Approach Control

- Manages traffic within Wajir AD traffic zone
- Vertical limits (Gnd – 5000ft) Lateral limits (15Nm)
Wajir control zone
- VHF communication
- TMA Vertical limits (1500ft – FL145) lateral limits (50Nm)
- RSC type II

Lokichoggio – Aerodrome Control

- Manages traffic within Loki AD
- VHF communication
- RSC type II

Division of responsibilities between ATS units

According to Annex 11, the appropriate ATS authority shall designate the area of responsibility for each air traffic control (ATC) unit and, when applicable, for individual control sectors within an ATC unit. Where there is more than one ATC working position within a unit or sector, the duties and responsibilities of the individual working positions shall be defined.

Division of responsibilities between ATS units

Entire FIR

- ACC North mandated with activities in the Northern sector
- ACC South – Southern sector

Nairobi

- Nairobi Approach – Nairobi CTR and TMA
- JKIA Twr – Traffic on maneuvering area and AD circuit at JKIA
- Wilson Twr – Traffic on maneuvering area and AD circuit at Wilson and Area II of Nairobi control zone

Division of responsibilities between ATS units

Mombasa

- Mombasa Approach – Mombasa CTR and TMA
- MIA Twr – Traffic on maneuvering area and AD circuit at MIA
- Malindi Twr – Traffic on maneuvering area and AD circuit at Malindi Airport and Malindi control zone

Division of responsibilities between ATS units

Eldoret

- Eldoret Approach – Eldoret CTR and TMA
- Eldoret Twr – Traffic on maneuvering area and AD circuit at Eldoret
- Kisumu Twr – Traffic on maneuvering area and AD circuit at Kisumu Airport and Kisumu control zone

Division of responsibilities between ATS units

Wajir

- Wajir Twr – Traffic on maneuvering area and AD circuit at Wajir and control zone Wajir
- **Wajir Approach** – Wajir CTR and **TMA**

Lokichoggio

- Lokichoggio Twr – Traffic on maneuvering area and AD circuit at Loki

Airspace sectorization and equipment

According to ICAO Doc 9426, once it has been decided that ATS is to be provided, the airspace, wherein such services are rendered, should be designated by the following terms:

- Flight information region (FIR);
- Control area (CTA);
- Control zone (CTR).

In addition, aerodromes where air traffic control (ATC) is provided, should be designated as controlled aerodromes.

Airspace sectorization and equipment con't

- FIRS normally encompass the entire airspace over the territory of a State. Adjacent FIRS should be **connecting** and, if possible, be delineated so that operational considerations regarding the route structure encompassed by them take precedence over their alignment along national borders
- The decision to establish **more than one FIR** to cover the airspace over a State is, for obvious reasons, not only primarily dependent on the

Airspace sectorization and equipment con't
size of the State concerned but also dependent
on the **air route structure** extending over the
State, its **topography** and **cost effectiveness**
considerations and the need to keep facility
management problems of the ATS units
providing services in them to manageable
proportions

- Delineation of FIR boundaries over the high seas is subject to **regional air navigation agreement** and

Airspace sectorization and equipment con't

Should be based on the **existing and expected air route structure** as well as on the **ability** of selected provider States to furnish the required services without undue efforts

- CTAs should be established so that they cover that airspace which will **encompass the flight paths of instrument flight rules (IFR) flights** within an FIR to which it is believed necessary to provide ATC.

Airspace sectorization and equipment con't

- When deciding whether or not ATC should be provided, the following should, among other factors, be taken into account:
 - a) The desire of operators of flights concerned to obtain that service;
 - b) The types and density of air traffic at any moment or during specific periods and the resulting risk of possible collisions between flights;

Airspace sectorization and equipment con't

- c) The prevailing meteorological conditions;
- d) Other relevant factors of a local nature, i.e. the general topography; hospitability of the area overflown, etc.

Airspace sectorization and equipment con't

According to ICAO Doc 4444, The air traffic control (ATC) system must be **adaptable to temporary as well as more permanent changes** in air traffic volume and composition. Usually an increase in air **traffic** results in an **increase** in the controller's **workload** and if overload situations are anticipated to reoccur and for prolonged periods, a re-distribution of responsibilities may be necessary. The airspace may therefore be divided into sectors within

Airspace sectorization and equipment con't

which air traffic services (ATS) are provided by one or more ATS operating positions. Normally a sector is part of a Control Area and/or a Flight Information Region (FIR)/Upper Information Region (UIR). It could also be a Terminal Control Area around major aerodromes within which specific approach functions are performed.

Airspace sectorization and equipment con't

When reviewing the need for the division of the airspace into sectors the following factors should be considered:

- a) The configuration of the ATS route network;
- b) The amount and mix of air traffic;
- c) The geographical distribution of traffic;
- d) The capacity of the ATS personnel.

Airspace sectorization and equipment con't

When assessing the ATS route network configuration, the following factors should be taken into account:

- a) Number of ATS routes served;
- b) Number of intersections of ATS routes;
- c) The proportions of aircraft in level flight and in climb or descent;
- d) Significant aircraft performance characteristics

Airspace sectorization and equipment con't

- ICAO Doc 4444 outlines that limitations in the air-ground communication and radar coverage in specified portions of the airspace may have an impact on the sector configuration.
- The main difficulty in making an assessment is **determining an acceptable normal workload**. However, from experience gained during overload conditions this assessment can be estimated if the capacity of one

Airspace sectorization and equipment con't

sector is known. The capacity of the remaining sectors can then be determined.

The following factors should be taken into account when designing APP sectorization:

- a) ATS route structure, entry and exit points, intersections, holding points;
- b) Aerodromes and runway configurations to be served by the sectors;
- c) Flight profiles;

Airspace sectorization and equipment con't

- d) Navigation tolerances on ATS routes concerned and for holding areas;
- e) Airspace required for ATC initiated flight paths, i.e. vectoring areas;
- f) Routing and flight levels for transiting air traffic;
- g) Control methods applied to air traffic within the sector;

Airspace sectorization and equipment con't

- h) Factors influencing the division of responsibilities and co-ordination between APP and other units; and
- i) Physical considerations (operational positions, communication and/or radar coverage, etc.). are frequent and opposite-direction air traffic has to be controlled, or where the route network covered by the sector extends over a large geographical area.

Airspace sectorization and equipment con't

Nairobi FIR

ACC – 2 sectors (North and South)

Due to choke points at LOV and WAV 3rd sector in plan

JKIA Twr – 1 position handling ground and air traffic

Due to volume of traffic and expansion and ground position plans ongoing

Airspace sectorization and equipment con't

Split of arriving and departing traffic handling will be done once 2nd Rwy is in place.

Approach will be split into 2 sectors (Arr/Dep) in the meantime point merge (PBN) will be used to ease traffic flow

Wilson already has in place a split of air and ground operations

Eldoret has combined AD and App and plans ongoing to physically split the 2 units

Airspace sectorization and equipment con't

[RADAR AIRSPACE.pdf](#)

[NAIROBI CTR ZONE AIRSPACE DIVISION.pdf](#)

[AIRAC sup 2.16 DATA LINK.pdf](#)

Airspace sectorization and equipment con't

Equipment in use in Nairobi FIR

Communication – VHF, HF and CPDLC

Navigation – VOR/DME, NDB, PBN
(GNSS/SIDS/STARS), ILS

Surveillance – 2- PSR, 6- SSR Mode S, ADS-C

Pending solutions

- Activation of Wajir TMA
- Use of CPDLC – Ongoing
- Use of ADS-C
- Implementation of ADS-B and MLAT
- Under discussion - ATFM

References

- ICAO Annex 1 - Personnel Licensing
- ICAO Annex 10 - Aeronautical
Telecommunication (Vol I – IV)
- ICAO Annex 11 - Air Traffic Services
- ICAO Doc 4444 - PANS/ATM
- ICAO Doc 9426 - ATS airspace planning
manual
- Kenya Civil Aviation Act 2013
- KCARS - Air Navigation Regulations
- KCAA - ANS MANSOPS Part 1 (ATM)

“Unless commitment is made, there are only promises and hopes; but no plans.”

-Peter F. Drucker

**LET US BE COMMITTED FOR BETTER
AIRSPACE MANAGEMENT = SAFETY**



Thank You! - Asante