

SPATIAL DISTRIBUTION AND CHARACTERIZATION OF POTENTIAL AERODROME OBSTACLES ON FLIGHT SAFETY OPERATIONS IN MALLAM AMINU KANO INTERNATIONAL AIRPORT, KANO-NIGERIA

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Abstract

The safety of travelling by air is an absolute pre-requisite for air transport, as it is recognized as a very safe and fastest mode of transportation worldwide. The safety of an aircraft around the vicinity of an aerodrome during approach, take-off and taxiing around the maneuvering area is very critical and of tremendous significant in flight operations. Therefore, this study focuses on the spatial distribution and characterization of the potential Aerodrome obstacles on flight safety operations, in Mallam Aminu Kano International Airport. Electronic Theodolites was used to get the bearing of the identified obstacles (i.e. obstacles on the runway and take-off climb). Administrative map was used to identify the location of the study area and features such as roads and L.G.A. boundary. Quick Bird imagery was used to extract the fixed physical features (both manmade and natural) within the vicinity of the Kano Aerodrome and its environs in ArcGIS 10.1, using the editor tool. The location of the aerodrome obstacles was compared with the International Civil Aviation Organization (ICAO) standards and recommended practices (SARPS) by characterizing the obstacles into authorized and unauthorized obstacles. The result identified eight (8) types of obstacles which include antennas, trees, buildings, instrument landing systems (ILS), communication mast, hill, pole and concrete pillar that penetrates into different obstacle limitation surfaces within the study area. The result further revealed that 60.0% of the obstacles in (Mallam Aminu Kano International Airport) aerodrome were communication masts, 26.7% are made up of the instrument landing system (ILS).14.8% of the obstacle constitute of trees, 3.0% of the obstructions were buildings, while antenna, concrete pillar, hill and pole contributes 1.5%, 1.5%, 0.7% and 0.7% respectively. It was also observed that there were 41 authorized obstacles, and these obstacles were found on the runway and transitional surface. On the other hand, 106 were unauthorized obstacles, most of them were found on the inner horizontal surface. Consequently, based on the findings of this study, it is recommended that Nigeria being a member state of ICAO, should as a matter of urgency be ICAO e –TOD compliant (Electronic, Terrain and Obstacles data). As this will go a long way in checking the menace of Aircraft / Obstacles collision to the barest minimum, so as to ensure regularity, efficiency and above all safety in Aviation Industry.

Keywords: Aerodrome, Flight Safety, E-TOD, Obstacles.

Introduction

Transportation is the movement of people, animals and goods from one location to another (Blanchard, 1996). Modes of transport worldwide include air, rail, road, water, cable, pipeline and

space. Transportation as embedment can be divided into infrastructure, vehicles and operations. Transport is important because it enables trade between persons which is essential for the development of civilizations. Transport infrastructures consists of the fixed installations such as roads, railways, airways, waterways, canals, pipelines and terminals, such as airports, railway stations, bus stations, warehouses, trucking terminals, refueling depots and seaports (Blanchard, 1996).

Aviation industry (Air transport system) is a critical component of our national economy providing for the movement of people and goods throughout the world, which is also critical for economic growth. It is a fast growing sector of the economy, providing a number of social and economic benefits (Whitelegg, 2000). According to International Civil Aviation Organization ICAO (2001) Aerodrome is a defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft. While, Aircraft is any machine that can derive support in atmosphere from the reactions of air other than reactions of air against the earth's surface.

Sebastian, Sanjiv, Lyle and Mike (2008), observed that the threat on some of the aircrafts flying at low altitude such as aerial vehicles (UAVs) to operate at high altitude, have to be under a close human supervision at low altitude, this is because even a low-speed collision within the environment can be fatal.

Green, Sevcik and Oh, (2005) argued that, unmanned aerial vehicles (UAVs) performing reconnaissance survey for the police, news or the military must fly at low altitude. Sebastian *et al.* (2008) pointed out that; flying close to and among obstacles is difficult because of the challenges in sensing and observing small obstacles, because controlling a complex system to avoid obstacles in three dimensions is usually difficult. Some aspects of collision avoidance are easier for air vehicles than ground vehicles. Any object close to the intended path of an air vehicle must be avoided as opposed to ground vehicles where deviations from the nominal ground plane indicate obstacles and are often not visible until they are close. The use of helicopters, rather than fixed wing aircraft also helps in case of any eventuality, because it is possible to come to a hover in front of an obstacle. The availability of appropriate sensors, logistical issues of mounting a vehicle with sufficient sensing, computing and communication gear. This could be seen January, 2015 in France which led to the closure of two out of the four runways at the Charles de Gaulle international Airport. The two runways were shut down due to the fact that the police helicopters were operating at a very low level in an attempt to track the suspects of the Charlie Hebdo incidence in France (Jim, 2015).

The safety of an aircraft around the vicinity of an aerodrome during approach, take-off and taxing around the manoeuvring area is very critical and of tremendous significant in flight operations. A high-rise building, a series of wind turbines, electricity poles, communication mast, hills, mountains are fixed obstacles that affects the safety of aerodrome traffic and poses dangers to flight operations (Peter and Vander, 2008).

South African Civil Aviation Regulation (SA-CAR), 2015 stated that any communications structure, buildings, whether temporary or permanent which has the potential to endanger the navigable airspace, or has the potential to interfere with the operation of navigation, surveillance systems, instrument landing systems and meteorological systems are referred to as Obstacle. Obstacles in the vicinity of an airport, whether they are natural or constructed, may seriously limit the scope of aviation operations into and out of the airport. It is essential that off-airport land use planning take full account of obstacles implications. An airport's obstacles limitation surface (OLS) is determined in accordance with ICAO (1987).

The most important role of aerodrome obstacles limitation surfaces (OLS) is to set and supervise the maximum height that an obstacle around an airport is allowed. This is usually referred to as Inner Horizontal Surfaces (IHS) or Conical Surface. The inner Horizontal Surfaces (IHS) is a circular surface, which has a height of 45m with a radius ranging from 2 to 4km, depending on the runway reference length. The conical surface slopes outward from the IHS with a slope angle of 5% up to a runway reference length. Where, one of these surfaces is protruding, an aeronautical study should be carried out to ensure that the obstacles do not affect the safety and regularity of operations to/from the airport (Teuge, 2009).

Civil Aviation Act (2006) defined the airspace around the aerodromes to be maintained free from obstacles so as to permit the intended aeroplane operations at the aerodromes from becoming unusable by the growth of obstacles around the aerodromes. In Nigeria, Nigerian Civil Aviation Authority (NCAA) is empowered to prohibit and regulate installation of any structure which by virtue of its height or position is considered to be an obstacle to safe operations.

Previous studies of this nature have been hampered due to paucity nature of data. However, with the introduction of Remote Sensing and GIS techniques, data is now available for effective research. Remote sensing is recent technology/techniques that have the capability of acquiring information about object/phenomena without having physical contact with them. Therefore, a study of this kind where location and identification of features and, or obstacles, remote sensing technique is second to none.

Literature review and conceptual framework

In most developing countries particularly Nigeria, several plane crashes were recorded resulting from collision with obstacles within the vicinity of an aerodrome. For example in June 1996, a plane crash occurred at Jos airport resulting from collision of an aircraft with a communication mast which lead to loss of lives and properties (Ado, 2009). Also, Sky Executive Aviation Services crash on the approach to Calabar Airport on 21st May, 2002 (Federal Ministry of Aviation, 2015). Another serious incident involving a Baggage tractor (DOUGLAS) Towing tug on the ramp collides with the aircraft while taxiing at Murtala Muhammed International Airport, Ikeja-Lagos, in January, 2008 (Accident Investigation Bureau, 2015).

Thomson (2007) carried out a research on cost effective Grassland Management strategy to reduce the number of Bird strikes at the Brisbane Airport, Australia. The Data used for the study are mainly, Maps of Brisbane Airport showing each habitat type which is divided into 250mx250m to allow reference points to be located at least 250m apart in close habitat and 500m apart in open habitat. The result of the study showed that, the habitat compared within Brisbane airport boundaries, grasslands surrounding runways, taxiways and aprons possesses the greatest richness and abundance of bird species that pose the potential hazard to aircraft operations. Also, Ibis and Australian Kestrel were identified as the bird species that poses risk to aircraft at Brisbane airport.

Peter and Vander (2009) also carried out a research on the spatial variation on flight safety between the existing pylons and two optional routes for the new transmission line around Schiphol in Geval Van, Germany. The result of the research opined that the two routes plays same role in the movement of aircraft in and around and the chance of collision with birds are deem to be insignificance.

Dukiya, and Gahlot, M. (2012) conducted a research on bird aircraft strike threat assessment using Avian Radar Information at New Jersey airport, USA. The study made use of Accipiter Avian Radar Technologies, Inc., 25 kW, X-band marine radar operating at 9.4 GHz with a wavelength of 3cm. The result of the study revealed that, the changing pattern of both bird activity and threat density

in four target areas (A,B,C and D) in 24hr period were similar. However, daily variation may be influenced by factors other than bird activity at day time and at night, like weather and wave action.

Anastasios (2002) worked on Bird strikes risk assessment using GIS, at Athens International Airport, South Africa. The research made use of the study includes: the observation of the Airside Monitoring and Inspection team (AMI) that performs routine and non-routine inspections on air fields concerning the status of the runways and taxiways. The findings of the study found a temporal variation of the bird strikes for example, during the first Month of the year the majority of the birds contributed to bird strike risk were water fowl, with a significant contribution from starlings and a minor one of gulls. In spring and the beginning of summer, gulls bird species participated in the bird strike risk. From mid-Summer to mid-Autumn, it was raptors bird species that posed the highest risk. During the two last months of the year the contribution of starlings to the bird strike risk was the most significant.

Dukiya and Gahlot (2012) carried out a research on the evaluation of the effect of bird strikes on flight safety operations at Mallam Aminu Kano International Airport, Kano. The study made use of aviation safety ranking value (ASRV) to evaluate and rank the risk of bird strikes species. Their result concluded that a significant number of varieties of bird species were observed in the vicinity of Kano airport and the propensity of these birds to collide with aircraft is real and this is a menace to the aviation industry.

Ahmed (2011) conducted a study on the assessment of the effect of birds strike on flight safety operations in Mallam Aminu Kano international airport Kano, Nigeria. The result of the study came to conclusion that twelve of the bird species were involved in forty four (44) strikes at the airport during the period 2001-2010. The study also revealed that most of the strikes occurred during the rainy seasons from May- October. Distribution of the bird strikes by phase indicates that 32% occurred on approach, 25% on landing roll, 20% on take-off, 4.5% on descend, 4.5% during climb, while 14% of these strikes the phase is unknown.

However, it is of interest to note that, to the best of the researchers knowledge despite the potential risk poses by the Aerodrome obstacles none of the previous studies have focused on the spatial analysis of the threats of potential fixed aerodrome obstacles on flight safety operation in the study area. This became necessary because of the increase in the rate of urbanization that Kano is experiencing in recent years, led to construction of more buildings and other human activities taking place within the vicinity of the airport. This is the gap in knowledge that the present research intends to fill.

Conceptual Issues

Aerodrome Mapping Information

Aerodrome is defined as area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft. The term aerodrome is used in this sub-section include: aerodromes, heliports, vertiports, and sea-plane aerodromes. As future applications are developed, more stringent data numerical requirements may be required. Aerodrome mapping data originators and integrators are urged to use this information when providing those data to system designers and users (CAA, 2008).

Based on the availability of one standardized aerodrome mapping database (AMDB), a wide variety of applications can be envisioned. It is important to note that multiple user classes can

benefit from using these databases, including: pilots, controllers, aerodrome managers, and aerodrome emergency/security personnel. The following is the application of standardized aerodrome mapping database (AMDB):

- a) Runway operations
- b) Emergency and security service management
- c) Surveillance and runway incursion detection and alerting
- d) Aerodrome surface guidance and navigation
- e) Aerodrome facility and asset management
- f) Route and hold-short display and deviation detection and alerting
- g) Chart information
- h) Display of digital ATIS information
- i) Aerodrome and airline resource management
- j) Training (flight simulation)

Aerodrome Data

a) Characterization of Aerodrome Mapping

Unlike terrain databases, which are typically represented as grid points with associated elevation data, aerodrome databases are typically constructed from a photogrammetric image that is converted to vectors and assigned themes and attributes using GIS techniques. This is because many important data elements are features and not just elevations. These features are more easily characterized by points, lines, and polygons. Examples include runway edges, hold points, and stand locations. In other words, in AMDBs, not only should the aerodrome surface be properly represented (as is done in terrain databases), but also all existing natural or man-made objects (features) should be properly characterized (CAA, 2008). The use of vector-based data has several advantages:

- Small data storage requirement
- Easy use of a relational database structure
- Easier updating
- No need of feature recognition software
- Easy attachment of attributes

Consequently, it is recommended that vector-based data (points, lines, and polygons) be used for the characterization of aerodrome features in AMDBs. An alternate approach is to use raster data or imagery. Using this approach, features are portrayed via contiguous pixels of equal or similar density number. This less precise method may be acceptable for some applications.

Aerodrome surface data, unlike terrain data, represents regular geometric objects that can be grouped or classified. Examples of classifications are: runways, taxiways, service roads, localizer antennas, glide slope antennas, buildings, radar sites, radio navigation facility sites, etc. All of these can be described with their own set of attributes, most of which are related to horizontal positioning. These attributes combine to provide a set of aerodrome data requirements that are distinguished from those of terrain data. This distinction must be recognized and preserved, since

more attributes will be required to appropriately create the aerodrome images for use by different users including flight crews.

The array of attributes used to describe aerodrome features is not complete. It is imperative, to reduce the cost of systems that use the aerodrome data, to use standard representation classes and attributes. It is the intent of this document to define these requirements.

b) Aerodrome obstacle data

Aerodrome obstacles penetrate a defined obstacle identification surface. In determining obstacle data requirements, certain accuracy parameters are applied to construct buffers around obstacles and estimate whether they penetrate the defined surface. Depending on the area specified, unrealistically large, converging or overlapping buffers may be generated, resulting in high false alarm conditions. Internationally recognized survey standards should be used.

c) Aerodrome area terrain data

Consideration of terrain on and around the aerodrome is essential to terminal area airspace operations such as approach, departure, and contingency procedure planning. Hazards related to terminal area terrain awareness and avoidance have been cited as a major contributing factor in controlled flight into terrain (CFIT) accidents. Terrain is also important to aerodrome surface operations. It defines the surface topography of the ground in and around the surface movement areas. Since terrain data shares a physical boundary with many surface geometric objects on the aerodrome (runways, taxiways, buildings, etc.), it is important that the terrain data be correlated with these other data types.

Data Acquisition

Any method is acceptable for capturing aerodrome mapping data subject to the information requirements specified in this document. Examples include: aerial photogrammetry, satellite photogrammetry, field surveying, and digitization of existing analog charts. A description of the process used to acquire aerodrome mapping data must be provided. This information must be consistent with this document.

Data Merging

In order to maintain data quality where multiple data sets are merged to create a complete AMDB, each individual data set must be geo-referenced to the WGS-84 ellipsoid (horizontal) and orthometric height (vertical). To avoid potential mismatch problems resulting from different features or themes being captured by different methods and/or originated from different sources, it is recommended that digital graphical editing procedures be used to align and/or match the shifted features using as reference the feature(s) that was geo-referenced with the highest accuracy.

Data Conversion

Data sets may need to be converted to WGS-84 latitude/longitude (horizontal) and orthometric height (vertical); however, the original data, prior to the conversion, must meet the quality standards described in this document. Algorithms used to convert data to WGS-84 (horizontal) and orthometric height (vertical) must not degrade the data quality below levels described in this document.

Data Source Identification and Traceability

The data originator must identify the source of any aerodrome mapping data provided to the user. The source data originator must produce adequate information such that the traceability of an AMDB can be maintained in accordance with the established quality procedures and processes. This can be accomplished with the provision of an appropriate metadata record for each contextual data sub set as described in this Chapter. Traditionally, a survey report generated by an accredited surveyor will contain sufficient information. If this type of survey report is generated, the data originators must release this report on request.

Obstacle Limitation Requirements

>The requirements for obstacle limitation surfaces are specified on the basis of the intended use of a runway, i.e. type of approach and take-off or landing, and are intended to be applied when such use is made of the runway.

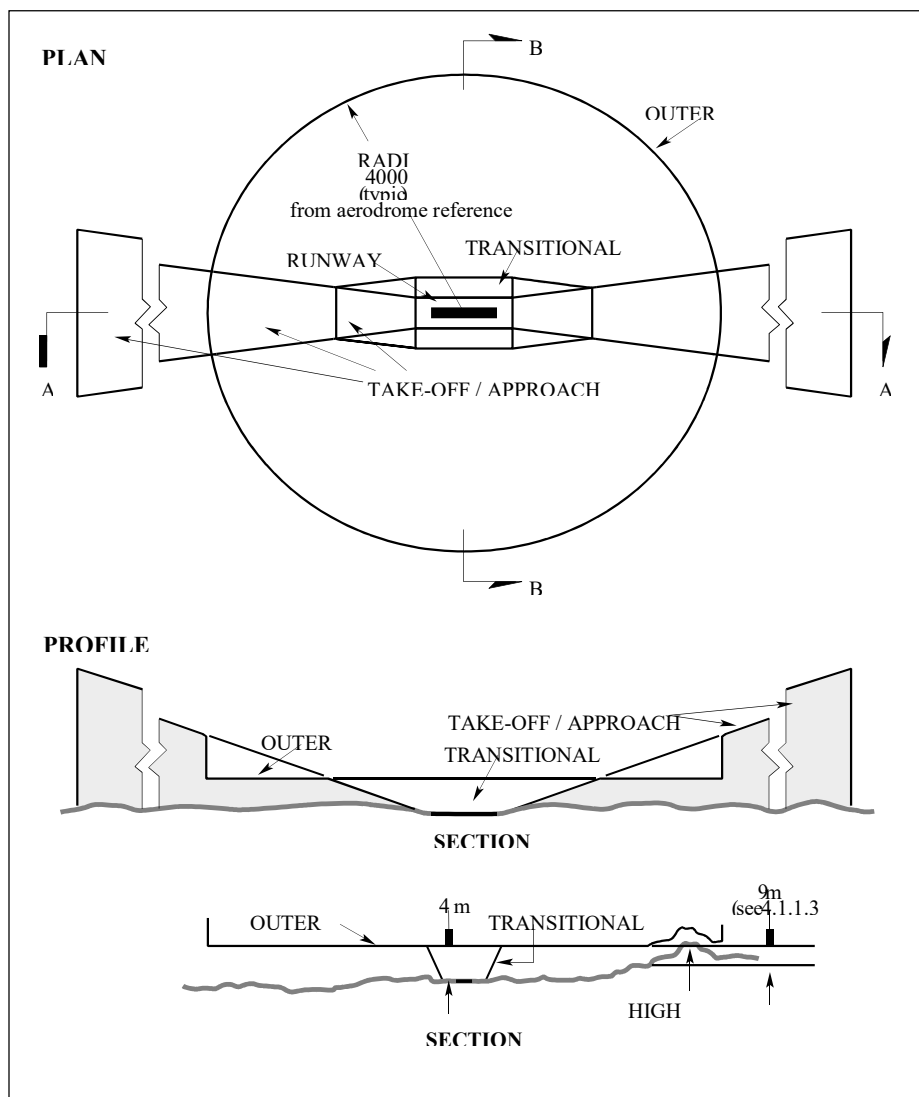


Figure 1: Obstacle Limitation Surfaces

The Study Area

Size and Location

The area under investigation is located between Latitude $11^{\circ} 52' 30''$ N and $12^{\circ} 07' 30''$ N of the equator and between Longitude $8^{\circ} 27' 00''$ E and $8^{\circ} 42' 30''$ E of the Greenwich meridian (KSG, 2019). It covers a landmass of about 20,131km² bordering Katsina State to the northwest, Jigawa State to the northeast, Bauchi State to the southeast and Kaduna State to the southwest. The Metropolitan area of the state covers 499km². Kano state is characterized by low rainfall (850-870mm) and high rainfall of about 4200mm in a wet year, thus it has a distinct wet and dry season. The temperature is slightly above 30°C (Sarah and Charles, 1988).

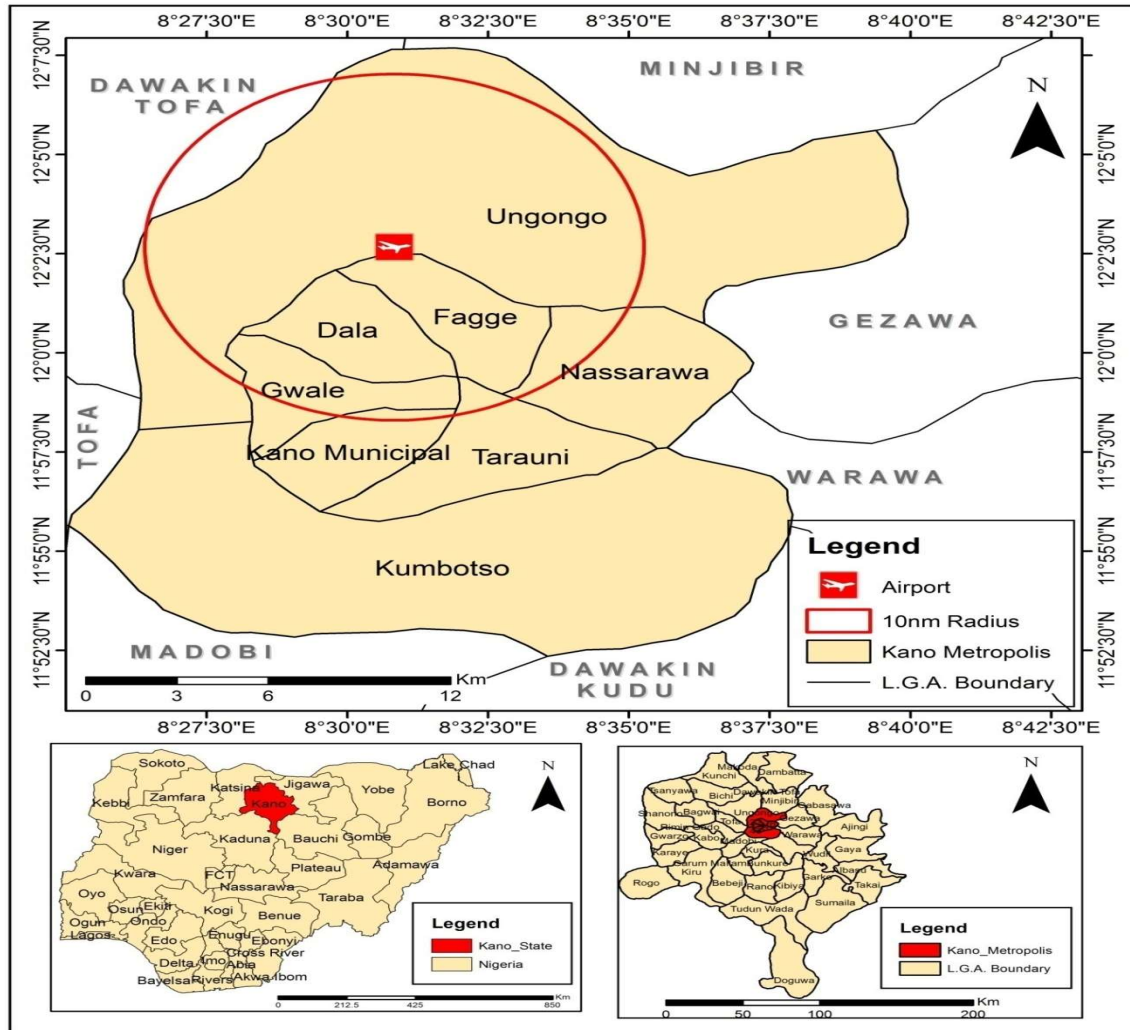


Figure 2: Kano Metropolis showing Location of Mallam Aminu Kano Int'l Airport

Source: Adapted from the administrative map of Kano State (2019)

Socio-Economic Activities of the Airport and It's Services

Prior to this date, Kano also recorded the first ever aviation activity in Nigeria when a Royal Air Force aircraft operated by the British colonialist landed at a polo ground in the city in 1925. This

historic reconnaissance flight during the WWI later developed into regular military flights. The infrastructural development of the airport actually started in 1930, thus making the city of Kano into a veritable hub rivaled only by Khartoum in the African continent. Owing to the historical status of Kano Airport, the Nigerian airspace which comprises both the continental and oceanic territorial airspace is named the Kano Flight Information Region (FIR). Kano hosts KLM the longest-serving foreign airline in Nigeria which started operations since 1947. In January 1957, the airport was opened for 24 hours operations with Comet 15, DC-6 and Argon flights becoming the first to use the main runway. Currently the bulk of international flights cater for the large Lebanese community in Kano and Muslim pilgrimages to Mecca.

Materials and research methods

The materials required for the study include the following:

- Differential Global Positioning System (DGPS)
- Electronic Theodolite.
- QuickBird Imagery.
- Administrative Map of the study area
- Obstacles Limitation Surface based on ICAO standards.

Methods

Differential Global Positioning System (DGPS) was used to get the coordinates xyz of the Aerodrome obstacles. Electronic Theodolites was used to get the direction of bearing of the identified obstacles. Administrative map was used to identify the location of the study area. Quick Bird imagery was used to extract the fixed physical features (both manmade and natural) within the vicinity of the Kano Aerodrome and its environs in ArcGIS 10.1 using the editor tool. This served as the base map for the study. While the obstacle limitation surfaces (OLS) are set of standards used to check the level of conformity in terms of obstacles penetration with ICAO Standards. Secondary data was also obtained from published and unpublished thesis; information from journals, text books, internet materials, research thesis was also used.

Data Processing

The imagery was used to extract the fixed physical features (both manmade and natural) within the vicinity of the Kano Aerodrome and its environs in ArcGIS 10.1 using the editor tool. This served as the base map for the study.

A baseline of known length was established with the feature normal to the midpoint of the baseline. Two differential GPS points were formed at the ends of the baseline. Two theodolite readings were taken to the top of the feature from each end of the baseline plus distance.

Method of Data Analysis

- **Identification and mapping of potential aerodrome obstacles on flight safety operations**

The coordinates extracted from the differential GPS were converted to degree decimal and entered into the Microsoft Excel and saved as comma separated value (.csv) file format and then imported into the ArcGIS environment where the points were overlaid on the base map.

➤ **Examination of Pattern of the Potential Aerodrome Obstacle on Flight Operations**

This was achieved using average nearest neighbour analysis to determine if the distribution pattern of the obstacles within the approach, take off and taxiing is random, clustered or dispersed. The average nearest neighbour in ArcGIS calculates the z-score and the nearest neighbour index. The pattern was determined based on these two parameters. The nearest neighbour index is given by:

= Observed Mean Distance

Expected Mean Distance

➤ **Determine the level of conformity (locations) of the potential aerodrome obstacles as relates to ICAO Standards and Recommended Practices (SARPS)**

Having identified and mapped out the aerodrome obstacles with the pattern distribution and their threats to flight operations, the level of conformity was achieved by making comparison with International Civil Aviation Organisation (ICAO) standards and recommended practices (SARPs) on obstacles limitation surfaces with the identified aerodrome obstacles in Mallam Aminu Kano International Airport.

Result and Discussion

➤ **Identification And Mapping Of Aerodrome Obstacles On Flight Safety Operations**

In an attempt to identify and map aerodrome obstacles at Mallam Aminu Kano International Airport, Kano State, Nigeria, a Differential Global Position System (DGPS) survey was carried out at the Airport and its immediate environment (i.e. 10nm from the aerodrome reference point) using the World Geodetic System 1984 (WGS-84) reference system in accordance with existing ICAO Standards and Recommended Practices and accepted industry best practices. The identification and mapping of the obstacles was carried out for different obstacle limitation surfaces (OLS). The objectives of the OLS is to define the airspace around the aerodrome to be maintained free of obstacles so as to permit the intended airplane operations at the aerodromes to be conducted safely and to prevent the aerodrome from becoming unusable by the growth of obstacles around the aerodrome. The distribution of obstacles for the different OLS is presented in the following sub-sections:

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➤ Trend of Aerodrome Obstacles in the Study Area

The spatial distribution of obstacles were identified and mapped for seven different obstacle limitation surface (OLS). The surfaces include: the approach surface, the take-off climb, the conical surface, runway, the inner horizontal surface, outer horizontal surfaces and transitional surface. Figure 3 represents the distribution of the aerodrome obstacles on the different surface while the types of obstacles were characterized in Table 1.

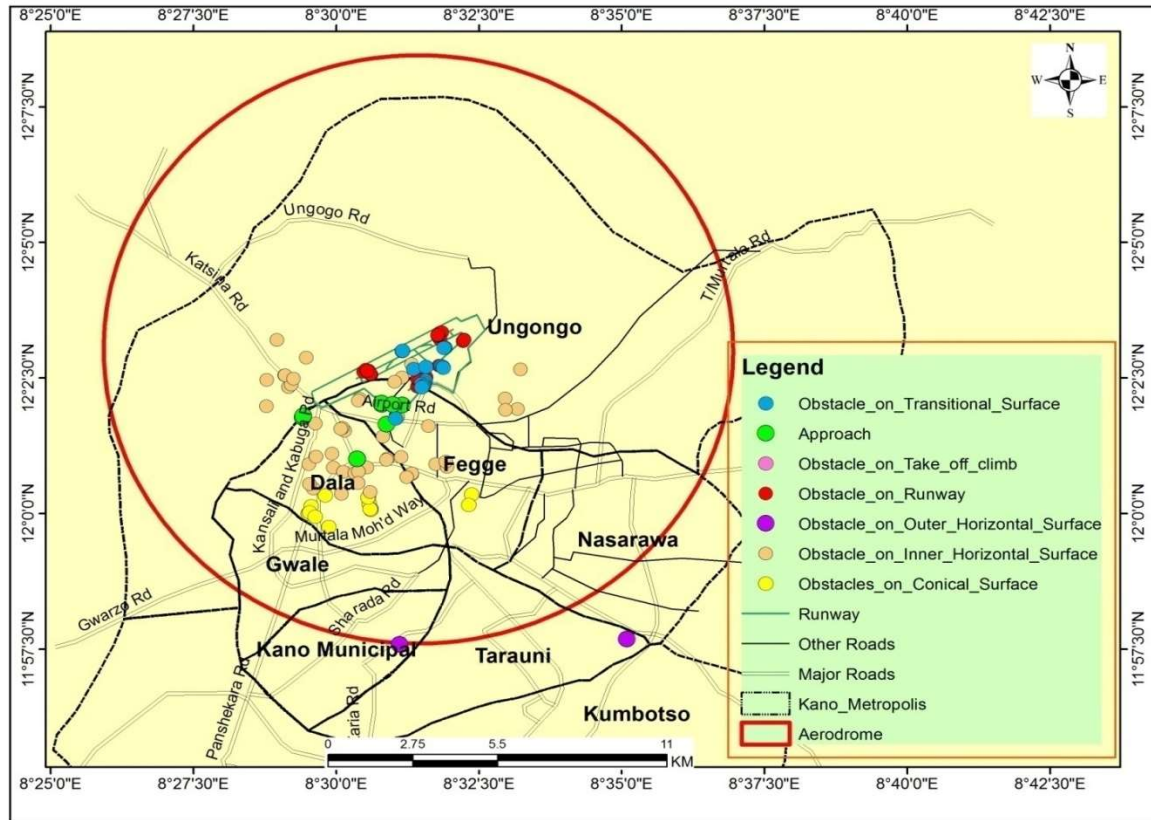


Figure 3: Distribution of Aerodrome Obstacles in the Study Area

Source: Field Survey and Author's Analysis, 2019

Table 1: Types of Aerodrome Obstacles at Mallam Aminu Kano International Airport

Type of Obstacle	Frequency	%
Antenna	2	1.5
Building	4	3.0
Concrete Pillar	2	1.5
Instrument Landing System	36	26.7
Mast	81	60.0
Tree	20	14.8
Hill	1	0.7
Pole	1	0.7
Total	147	100

Author's Analysis, 2019

It can be seen from Table 1 that 60.0% of the obstacles at the Mallam Aminu Kano international airport aerodrome were communication mast which were place for the resident within aerodrome for communication. 26.7% of the obstacles were the ILS (i.e. lighting that aids the landing of an airplane approaching the aerodrome's runway). According to ICAO set recommended practices and regulations stated that if an object or a proposed object which intrudes into navigable airspace requires, or will be required to be provided with, obstacle lighting. It can also be seen that 14.8% of the obstacle constitutes of trees. Only four were building which contributes about 3.0% of the obstruction. Antenna, concrete pillar, hill and pole contributes 1.5%, 1.5%, 0.7% and 0.7% respectively.

Obstacles on Approach Surface of the Aerodrome

The approach surface is an inclined plane or combination of planes which originate from the inner edge associated with each runway threshold, with two sides originating at the ends of the inner edge (ICAO, 2013). The spatial distribution and the type of obstacles on the approach surface of the aerodrome is presented in Figure 4:

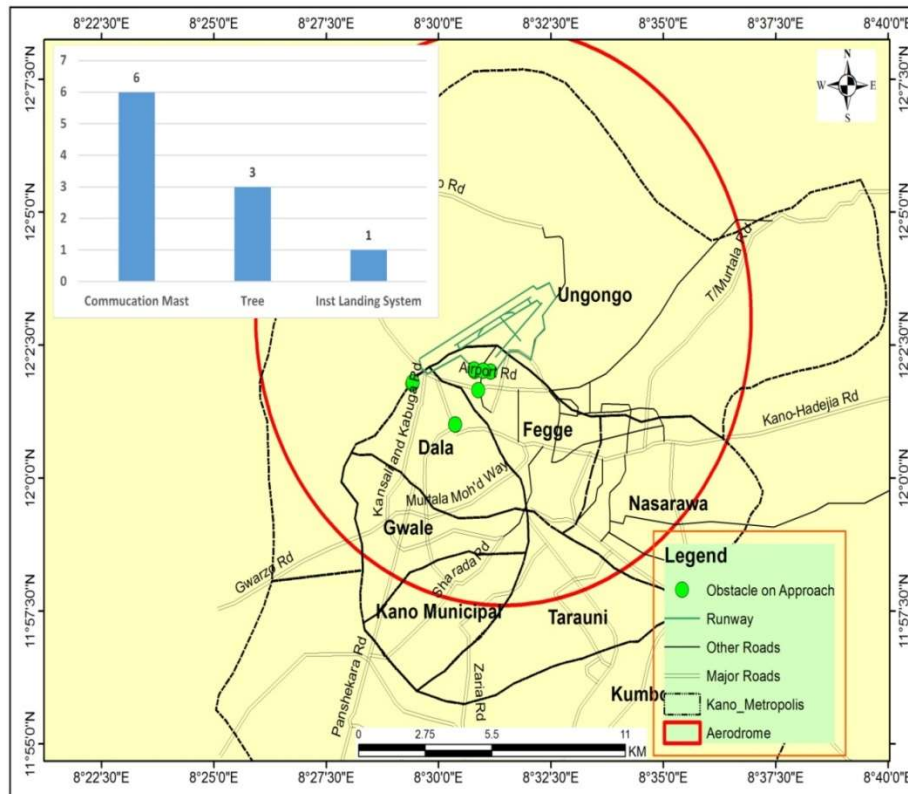


Figure 4: Obstacles on the Approach Surface of the Aerodrome

Source: Field Survey and Author's Analysis, 2019

It can be seen from Figure 4 that 10 obstacles were observed on the approach surface of the aerodrome. Six of the obstacle were telecommunication mast, 3 were found to trees, and 1 was found to be light (Instrument Landing System ILS). According to ICAO any object be it man-made or natural on approach surface of an aerodrome may endanger the safety of an aircraft when preparing for landing.

Obstacles on Take-Off Climb Surface of the Aerodrome

The take-off climb surface of aerodrome is defined by an inclined plane (or other shape in the case of curved take-off) located beyond the end of the runway or clearway. Figure 5 represents the obstacles identified on the Take-off climb of the aerodrome.

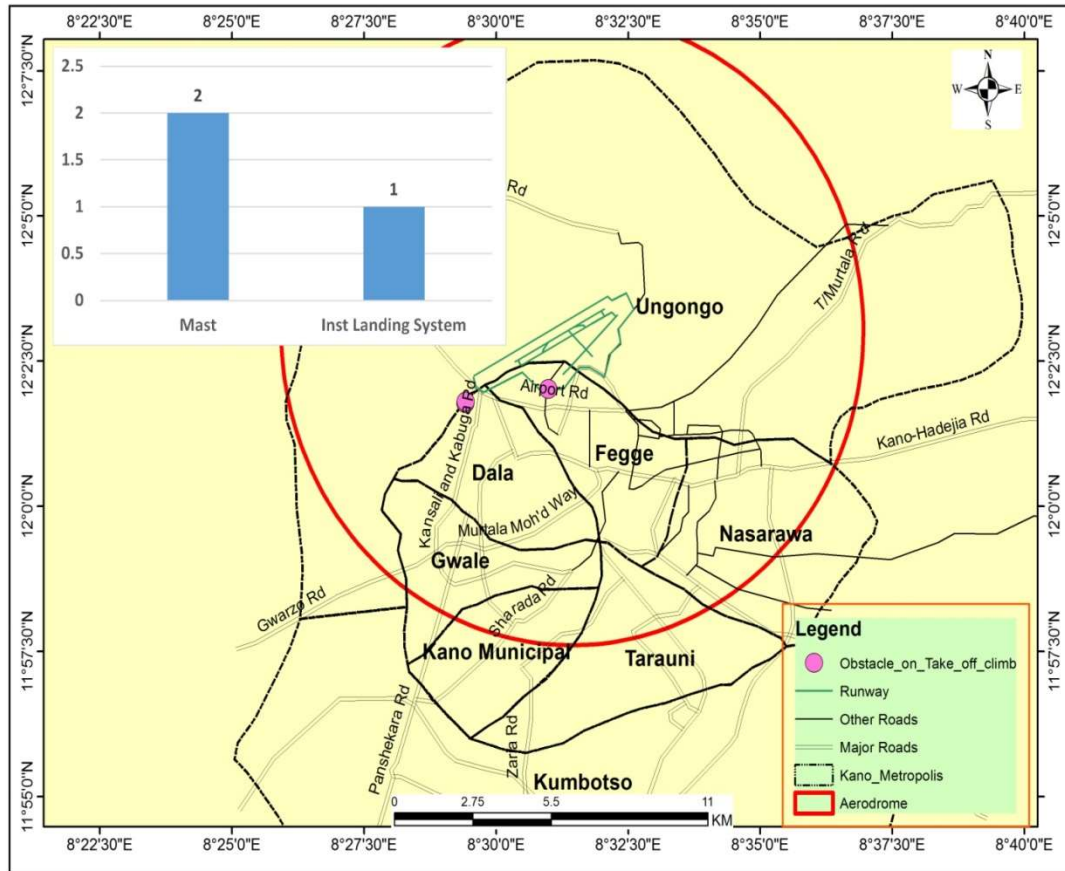


Figure 5: Obstacles on Take-Off Climb Surface of the Aerodrome

Source: Field Survey and Author's Analysis, 2019

Figure 5 shows that three obstacles were found on the take-off climb of the aerodrome of which two of the obstacle were mast and 1 was found to be an instrument landing system (light).

Obstacles on Runway Surface of the Aerodrome

A runway is a defined rectangular area on a land aerodrome prepared for the landing and take-off of an aircraft. The obstacles on the runway of the aerodrome was identified and the result is presented in Figure 5.

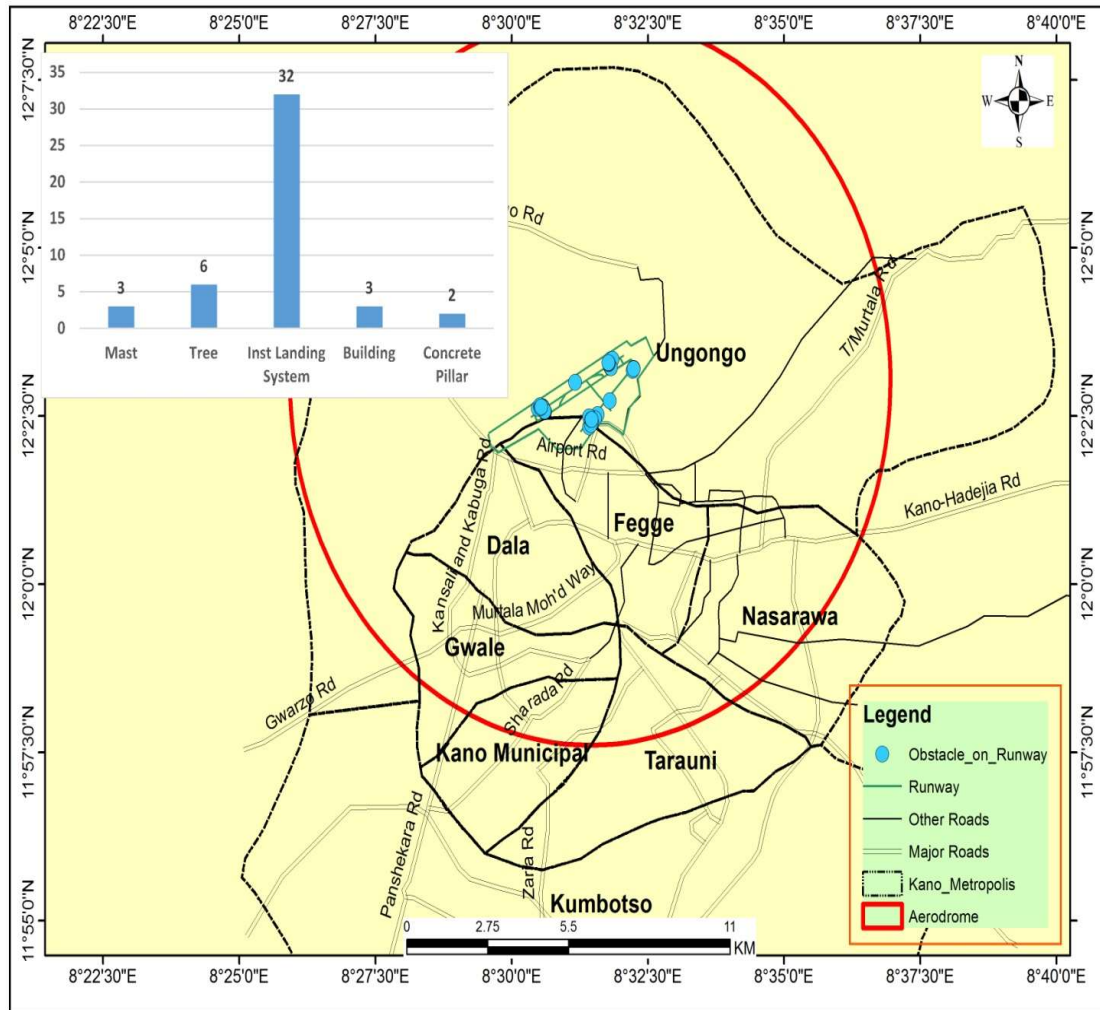


Figure 6: Obstacles on Runway Surface of the Aerodrome

Source: Field Survey and Author's Analysis, 2019

The data Figure 6 showed 46 observed obstacles on the runway of Mallam Aminu Kano International Airport, Kano. 32 of the obstacles identified were Instrument Landing Systems (ILS), (6) were trees, mast, buildings and concrete pillar were identified to be 3, 3 and 2 respectively. The high number of ILS (lighting) could be as a result of the instruction of civil aviation regulations which stated that an object or a proposed object which intrudes into navigable airspace requires, or will be required to be provided with, obstacle lighting (ICAO, 2013).

Conclusion

The International Civil Aviation Organization set Standards and Recommended Practice for obstacle limitation surface in which Contracting States have to comply in order to prevent aircraft from being involved in aircraft / Obstacle collision. However, from the findings of this study and with the rapid development of aviation technology, it has become increasingly necessary for aerodrome operators to review and ease the existing regulations for obstacle limitation surface. Therefore the present study have used remote sensing, GIS and ground surveys for visual

inspections of all areas around the aerodrome in order to be sure that construction activity or natural growth likely to infringe any of the obstacle limitation surfaces is discovered before it becomes a problem.

Recommendations

- Based on the findings of this research, the following recommendations are hereby made:
- The study revealed that Nigeria being ICAO member state be recommended to be ICAO e-TOD compliant (i.e. electronic terrain and obstacle data). The obstacle data acquired from this study can equally serve as a source of data for the ICAO e-TOD concept where the software will be installed in the cockpit for the pilot consumption via the screen. In order to ensure regularity, efficiency and above all safety in aviation industry.
 - The aerodrome operator should make use of the obstacle data collected and conduct periodic data analysis. This will allow the aerodrome operator to review the overall effectiveness of the obstacle control process. Through such analysis, the aerodrome operator will also be able to identify potential risks and hotspots, and develop mitigating measures to address them.

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