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Post-Independence Evaluation of Air Transport Safety in Nigeria

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ABSTRACT

This research evaluates air transportation safety in Nigeria. Records of aircraft crashes in Nigeria were extracted from different archives to create a database of air traffic incidences within the air space of Nigeria since Independence. Statistical overview of air transportation accidents in Nigeria using accident data to examine a national trend in air transportation disasters was carried out. Results of the analysis showed that air traffic accidents in Nigeria have increased per decade with 2 incidences between 1960 and 1969, 27 incidences between 2000 and 2009 with an increasing trend in the preceding decades. Impacts of season on aircraft accident in Nigeria were less significant. Airplanes constitute larger proportion of aircraft involved in accident with 86% incidences, and 14% for helicopter. Passenger plane constitute the largest proportion with 46 incidences occurring in the commercial plane category while 8 and 2 crashes occur in Military and Cargo operation. Majority of the accidents in Nigeria occurred in Lagos with 14 crashes involving plane majorly, followed by Abuja (FCT) and, Kano and Rivers with 4 each. Year 2005 however has the highest number of plane incidences in Nigeria with 11 crashes.

Key words: Air Transportation, Aviation, Database, Helicopter, Airplanes, Plane Crash.

1.0 INTRODUCTION

1.1 Background

Air transport is one of the safest forms of travel. Commercial air transport operations involve the transportation of passengers, cargo and mail for remuneration or hire (EASA, 2011). Air travel today is undoubtedly safer than it has been at any time in the past five decades. Worldwide commercial aircraft hull loss rates have been steadily decreasing since 1996 (ABTS, 2009).. In air transportation the most crucial issue is safety (Trogeler, 2010). The threat of air traffic accidents on our airways has called for sober reflection at the local, national, and international levels. This is due to the resulting losses, of both human and material resources. However, there has been a sizeable amount of literature on air traffic accidents in developed countries; however, researches on aircraft incidence are extremely sparse in the developing world like Nigeria. Safety is the primary concern of the world aviation community at the present time (Abeyrante, 1998). In Nigeria, airway safety has received little attention and the attempts made to date across the entire transportation segment have mostly centered on the highways and manufacturing industry (Adebiyi, 2008). Historically, aviation safety has been built upon the reactive analysis of past accidents and the introduction of corrective actions to prevent the recurrence of those events. Moreover, enhancing overall safety in the most efficient manner requires the adoption of a systems approach to safety management (Bayuk, 2007). Safety is a very complex, multi-faceted activity that encompasses all fields of aviation and affects every single individual involved in aviation. Accidents are the result of an undesirable chain of events. To prevent the repetition of such events, the investigation process requires an effective safety occurrence reporting system, which means that all relevant accidents and incidents are reported and comprehensively documented by aviation professionals. Therefore, aviation professionals must be dedicated and contribute fully to the safety investigation of the reported occurrences. 'One of the most valuable tools in practice for the improvement of safety is the ability to learn from mistakes'. Safety investigation reacts to the need to learn from accidents and incidents, and to take appropriate remedial actions to prevent similar occurrences (Trogeler, 2010). However, the object of a safety investigation is to enhance safety (ABTS, 2009). Hence, this research aims to provide a statistical overview of air transportation safety (accidents) in Nigeria since independence using accident data to examine a national trend in air transportation disasters involving aircraft from 1960 to 2012.

1.2 Aviation Safety in Africa: A General Perspective

Commercial air transportation has become one of the fastest growing sectors of the world economy. Generally, it is expected to grow over the next two decades at an average annual rate of 5% in the passenger and 6.5% in the freight demand (Airbus, 2006; Boeing, 2007; ICAO, 1994). Such growth has created both positive and negative effects on the society and environment. Generally, the positive effects have included additional employment within and around the sector, and consequent provision of stimulus to the local (regional) and global (country and international) economy and welfare. In particular, commercial air transportation has acted as a driving force by strongly supporting globalization of the industry, business and long distance tourism, and consequently contributing to the global welfare. The negative effects have included both direct and indirect negative (damageable) impacts of the system on the society and environment (Callum, 2000; Janic, 2007). Direct impacts have embraced aircraft noise around airports, air pollution at the local-airport-, and global- airspace- level, congestion and delays, land use (take), waste, air traffic incidents/accidents, and contamination of sources of drinking water and soil (Janic, 2010). In Africa, the situation with aviation in general and more specifically aviation safety seems much worse than elsewhere in the world (De Beer, 2005). Air traffic in Africa has been growing, although fewer routes are being served. Lack of competition keeps costs relatively high, and the safety record remains very worrisome.

According to the African Airlines Association, the age of the fleet is the greatest concern: nearly one-third of the total fleet of 750 aircraft is more than 20 years old, with a prevalence of ex-Soviet types in certain countries. That view is not widely accepted. Although most accidents in 2006 involved old, Soviet-built turboprop aircraft, more recent, devastating crashes have involved mainly Western-built aircraft. Worldwide averages suggest that, vintage for vintage, Russian-built aircraft are as safe as Western-built aircraft if properly maintained and operated. The problem is that many small carriers acquire one or more old aircraft on the non transparent aircraft supply market and operate them without supervision by the civil aviation authorities. In general, the International Air Transport Association identifies poor regulatory oversight as the top threat to safety in Africa, followed by inadequate safety management systems. Similarly, the International Civil Aviation Organization's Universal Safety Oversight Program shows that safety implementation in Africa is very deficient. For example, West and Central Africa, and East and southern Africa perform below the world average in all the critical elements of safety implementation. The U.S. Federal Aviation Administration and the European Union also rate air safety in many African countries as poor. Because of the interaction between national systems, air safety is a regional problem that needs to be addressed regionally. According to ICAO (2011), Africa has the highest regional accident rate, it also accounts for the lowest percentage of global traffic volume, 3% of scheduled commercial traffic. The Asian region has the lowest accident rate, yet it features the largest overall number of accidents which result in fatalities, 38% of the accidents were fatal accidents. The accident rate for the European region is slightly below the global accident rate and is characterized by a relatively small percentage of accidents (8 %.) which result in fatalities, Latin America and the Caribbean have higher than average accident rates, 31% of which result in fatalities. This region also has a small percentage of global traffic, 13% of scheduled commercial traffic. North America has an accident rate below the world average and, despite having the highest number of accidents; it experienced no fatal accidents for the year 2010. The Oceanic region has the lowest accident record and, similar to North America, had no fatal accidents in scheduled commercial air transport for the year 2010. The considerable variance in traffic volume among regions is a factor which needs to be considered when drawing broader conclusions from accident rate information. However, Statistical data highlights that the effective implementation of the critical elements related to safety oversight systems is instrumental to the achievement of positive and industry-wide safety outcomes.

1.3 Aviation Safety in Nigeria

Air traffic in Nigeria comprises, of passenger traffic, aircraft movements, freight traffic and mail traffic. Recently available statistics and data show an increase in the use of air transportation (Ladan, 2012). In Nigeria, the demand for air transport services has been on the increase within the past three decades. There has been growth in passenger, aircraft and freight traffic as a result of physical and economic development of cities in different parts of the country. The creation of states and the need to develop state capitals for them to perform their socio-economic responsibilities has fuelled the tempo of physical development in the country. Fast connections between the diverse economic spaces of Nigeria are better achieved through air transportation (Aderamo, 2010). The growth of the aviation industry in Nigeria has also led to a concomitant rise in aviation disasters (Edeaghe et al., 2006). The constant increase of air traffic volume causes the requirements for development and implementation of numerous measures that will enable monitoring of the safety level in the aviation organizations (Cavka and Cokorilo, 2012). In Nigeria, this is facing problems which arise as a result of factors militating against efficiency of the system. These factors include absence of a coherent air transport policy, bad management, decaying facilities, loose security, closure of airports and intermittent air crashes. Figure 1 shows airports and their location in Nigeria.

According to Edeaghe et al. (2006), commercial air transport developed in the 1920s and expanded rapidly between 1930 and 1939. With the development of commercial air transport, the potential for human casualties from plane crashes increased drastically. Other than the high mortality, the grand scale destruction of property and the attendant socio-economic costs have made air crashes a feared event. Because of this, aircraft design is concerned with minimizing the chance of failure, pilots are trained with safety as a primary consideration, and generally air travel is closely regulated. Governments and regulatory agencies worldwide play a major role in ensuring air safety and in conjunction with airlines act to preserve the public trust and belief in the safety of air travel. Despite this, accidents still occur. The International Air Transport Association (IATA), states that 71% of aviation accidents are due to human error, with other causes being ageing aircraft, poor weather and deficiencies in safety management systems. Nigerian aviation history has recorded black days a number of times due to plane crashes which have led to severe loss of lives and property. The first major air crash in Nigeria's aviation history is that of a Federal Government owned VC-10 aircraft on the 20th of November, 1969. It was flying in from London and crashed as it prepared to land at the then Ikeja Airport. All 87 passengers and crew were killed. The IATA states that Africa accounts for only 4% of global aircraft and yet, its accident rate is way up at 25% making it six times less safe than the world rate. A combination of skyrocketing costs of maintaining old aircraft and Europe's strictly enforced aviation regulations are forcing aircraft out of European airspace and into developing countries like Nigeria. Hence, Nigeria has a lot of 'Tokunbo' planes (old aircraft). A notable example is the recently crashed Sosoliso DC-9 aircraft that was 32 years old. It had been sold to Sosoliso Airline by JAT Airline when it could no longer meet European aviation standards due to loud noise levels. Likewise, the Bellview Boeing 737-200 aircraft that crashed was 24 years old. The effect of plane crashes on the people and the economy of a country are usually enormous especially in a country like Nigeria where there is no functional search and rescue organization capable of rising to the challenges at a moment's notice after an air crash. In fact the dramatic outcome of plane crashes is one reason why they always make headline news.

With safety as the primary concern of aviation industry these days, various efforts have been put in place to mitigate against the increasing trend of aircraft accidents. However, human error and accidents will continue to challenge the aviation industry (Lu et al., 2011). George Santayana, a philosopher once said 'Those who do not learn from history are doomed to repeat it' (Piven et al., 2006). The Nigeria aviation Industry seems not to be learning from history as fatal accidents keep occurring. Nigeria's aviation industry, which had one of the world's worst safety records before 2006, worked to improve it after the ADC Airlines crash (Martinez and Kay, 2012). However in Nigeria, air transportation suffers from poor reputation for operational efficiency and safety. This is attested by the present state of the industry in the country (Ladan, 2012). This safety record is on the decline as there are increasing numbers of crashes in Nigeria involving planes and helicopters. The Nigerian government seems to have underscored the need to carry out a decent safety oversight by passing into legislation, the requisite legislative and regulatory framework (NIGAV, 2007).

2. MATERIAL AND METHOD

2.1 Study Area

The study area is the Federal Republic of Nigeria. However, the overall sub-regional, regional and continental effort will be a focus of the study. Nigeria is located in the West Africa sub-region. It is bounded in the north by Niger Republic, south by Atlantic Ocean, east by Cameroon and Chad and west by Benin Republic. She is the most populous country in Africa. With respect to National population Commission (NPC, 2006), Nigeria accounted for more than 140 million and by August, 2011 estimated to be about 167 million. Nigeria is located within the longitude 3⁰E and 150⁰E and latitude 40⁰N and 140⁰N of the equator

(Afolayan et al., 2012). Figure 2 shows the Map of Nigeria showing Major Towns, Roads, Airports with Latitudes and Longitudes Plotted on it.

2.2 Data Source

A search was conducted on the air traffic incidents in Nigeria. Air transportation accident data from various databases were examined to create a comprehensive database of aircraft accidents within the Nigerian Airspace. Air transportation accident analyzed in this research focuses air craft crashes (Plane and helicopter) that were sourced from three different local databases (primary data source) considering records from 1960 to 2012. Records of air transport incident in Nigeria were investigated online using internet. Data were obtained from different websites ranging from social website to online newspaper. Records of accident obtained from social websites and online newspapers were cross-checked with standardized database of aircraft accidents and where missing data existed they were included in the database created for this analysis. In all, three database of air incidences in Nigeria were selected and assessed based on comprehensiveness of the data available on the websites, however, only record of air incidences in post-independence Nigerian air space were considered. This ranges from those that were fatal to those that were minor.

Database of recorded of air incidences in Nigeria as explored in this study are as follows:

- History of Plane Crashes in Nigeria (www.sunnewsoline.com)
- Brief History of air disaster – Crashes in Nigeria (Nigerianelitesforum.com/ng)
- Catalogue of air crashes in Nigeria (Naijaforum.com)

The records obtained were compared to make verifications of the occurrence of air disaster. In cases where data were missing in a particular database, other data from the other websites visited were used and a comprehensive database created.

Database used as secondary source for missing data and verification of the correctness of data obtained locally were obtained from the following websites:-

- i. Planecrashinfo.com
- ii. 1001crash.com
- iii. Skybrary.aero/index.php/Aviation_safety_statistics

This database created from the records examined was then analyzed in statistical analysis software known Microsoft Excel. Years in which the most air incidences occurred in Nigeria were analyzed. Similarly, the types of air craft as well as the proportion of the aircraft type involved in the air accidents were analyzed. Places of crash, ownerships and mode of operation were also analyzed.

3. RESULTS AND DISCUSSION

3.1 Aircraft Accident Trend

Air traffic accident is on the rise in Nigeria. Crashes have been on the increase since 1969 when the first crash occurred after Nigeria took over its territorial control. Several factors have been attributed to these crashes but not a lesson has been learned from past occurrences to mitigate against future occurrence. Hence, history repeats itself and crashes occur resulting in great loss of properties and lives. The first decade (1960-1969) after Nigeria's independence, two aircraft crashes were experienced. This Trend remained constant in the proceeding decade with a record of two crashes experienced between years 1970- 1979. The low rate of accidents experienced in Nigeria within the first two decades after independence can be attributed to less popularity of air travel in Nigeria. However, as civilization increases and the importance as well as the benefits of air travel in Nigeria became known and affordable to people, crashes experienced within the shores of Nigeria increased. Between 1980 and 1989, only 3 aircraft incidences were experienced.

This plummeted to 15 in the preceding decades i.e. between 1990 and 1999. A similar increase in the number of crashes in Nigeria was recorded as 27 crashes occurred between 2000 - 2009. Often these crashes were attributed to many causes ranging from Human error, weather, and mechanical failure of the aircraft hence statistic of aircraft incident needed to be evaluated to provide insight to the primary cause(s). Of all the years of aircraft crashes (incidences) in Nigeria, year 2005 (see Figure 4) has the largest proportion with 11 incidences followed by 1995, 1997 with 4 each and years 1991, 2002, 2004, 2006 with 3 each. However on average 1 accident each can be said to have occurred per year within Nigerian airspace from 1960 to 2013. Within the first three years of 2010 to 2019, seven incidences have been recorded which claimed the lives of innocent Nigerians. Hence, precautions needed to be taken to avert the increasing trend in air transportation accidents.

3.2 Aircraft Crashes per Type

Crashes involving aircraft in Nigeria have mainly involved planes and helicopter with majority of them being planes. Over the course of 53 years since Nigeria's independent, 86% of the crashes have involved planes while 14% were helicopters (Figure 5). The high rate of plane involvement can be attributed to increased use of plane as a mode of air transportation as compared to helicopter.

3.3 Aircraft Crash per Operation

In Nigeria, aircrafts are mainly used for commercial purposes such as transportation of passenger and cargo movement while some other use involves the Military. However of all the plane crashes that occurred after Nigeria's independence, passenger plane constituted the largest proportion with 46 incidences occurring in the commercial plane category while 8 and 2 crashes occurred in Military and Cargo operation categories respectively (see Figure 6).

3.4 Accident Occurrence per Location

There has been a high rate of accidents involving aircraft occurring in Lagos, Nigeria. The High Incidence of crashes in Lagos can be attributed to the fact that Lagos is one of the commercial hubs in Nigeria with a major airport (Murtala International Airport, MMA). This can also be attributed to the fact that majority of the flights have their origin or destination as Lagos. This is also confirmed by previous researches conducted by the US embassy stating the proportion of traffic attracted by major airports in Nigeria (Figure 7).

Based on Figure 7, it can be inferred that high numbers of crashes has occurred in commercial hubs with international airports (i.e. Lagos, Rivers and FCT). This is as supported by details of air traffic volume per location of airports in Nigeria (Figure 8) that airports that serve as major hub have high traffic activities. Hence, attention should be focused on air traffic with sources or destination either from Lagos, Rivers, and Federal Capital Territory.

3.5 Impact of Season on Aircraft Accident

Figure 9 shows the cumulative accident per season in Nigeria, weather is thought to be one of the primary causes of aircraft crashes all over the world. While these may be true in some cases and in some territories where adverse weather is experienced, the situation tends to be different in Nigeria. However, air traffic incidence in Nigeria tends to defy the effect of season. Almost the same numbers of aircraft crashes were experienced in the two seasons experienced in Nigeria namely Rainy Season and Dry season.

Also the month of November to March was considered as dry season. In all the cases of aircraft accidents experienced in Nigeria, 28 occurred during the rainy season and 27 occurred during the dry season. However, there was only a slight difference in the numbers of crashes experienced since Nigeria's

Independence. Conversely, categorizing aircraft accident in Nigeria by month, March has the largest percentage of crashes with 14% followed by November, July with 13%, with total percentage crash 11% each for June, January and 10% for September. Similarly, the numbers of crashes that occurred during rainy and dry seasons in each year of occurrence seem to be uniformly distributed across seasons except for years 1969, 1988, 2000 and 2011 when one crash each was experienced in each of the two distinct seasons. 2 crashes were experienced in year 1995 in each season, however there was an outlier year (2005) with 4 crashes occurring during the dry season and 7 occurring in the rainy season (see figure 10).

Figure 11 displays the proportion of accidents by month of occurrence in Nigeria. On the basis of the general statistics of aircraft crashes in Nigeria, the type of season does not have a profound impact on the numbers of crashes that have occurred in Nigeria.

4 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

Based on the analysis of the result obtained in this study, it can be concluded that air traffic accidents in Nigeria will be on the increase if no precaution is taken. Season plays a minimal role in the number of accidents that have occurred in Nigeria. Locations with high air traffic attractions or origins have highest numbers of air traffic incidences. Helicopter is relatively safe in Nigeria as a means of air transportation owing to less attractiveness of the mode as compared to airplane. En route flight phase of aircraft constitute a larger proportion to numbers of casualties recorded in air crashes since Nigeria's Independence.

4.2 Recommendation

It is therefore recommended that;

1. Data base showing air traffic accidents in Nigeria should be created by the government so as to provide proper learning tool for air craft accident study in Nigeria
2. Aviation authorities in Nigeria should focus on Air craft operations and air craft characteristics rather than assuming that weather plays a larger role in air craft incidences that have occurred in Nigeria
3. Attention of aviation regulatory bodies should be focused on air traffic originating from or with destinations as Lagos, Abuja and P/Harcourt.
4. Strict enforcement of aviation safety standards should be enforced on commercial airliners as this constitutes a large proportion of air crashes in Nigeria.



Figure 1: Major Domestic and International Airports in Nigeria.

Source www.mapsofworld.com/international-airports/africa/nigeria.html



Figure 2: Map of Nigeria showing Major Towns, Roads, Airports with Latitudes and Longitudes Plotted on it. Source: http://www.mapsofworld.com/lat_long/nigeria-lat-long.html

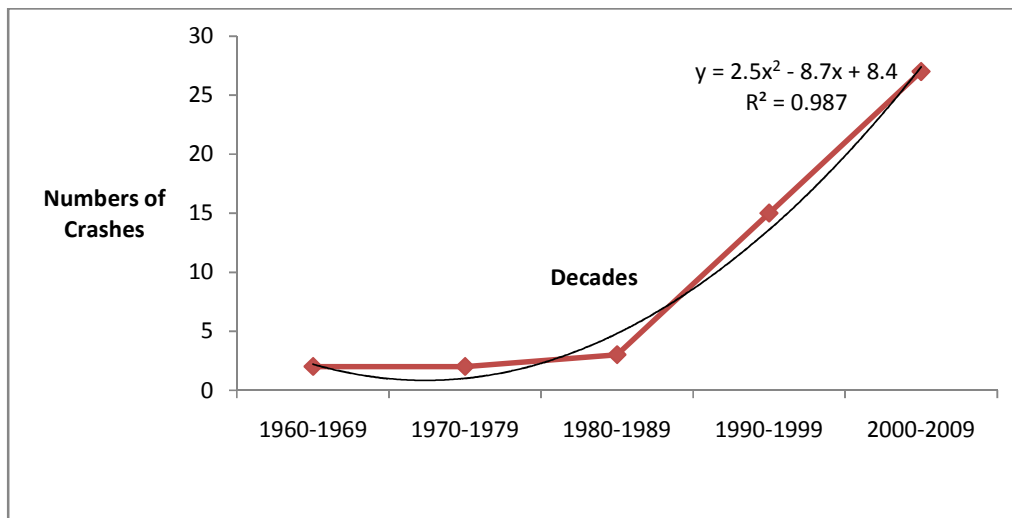


Figure 3: Aircraft Accident Trend in Nigeria

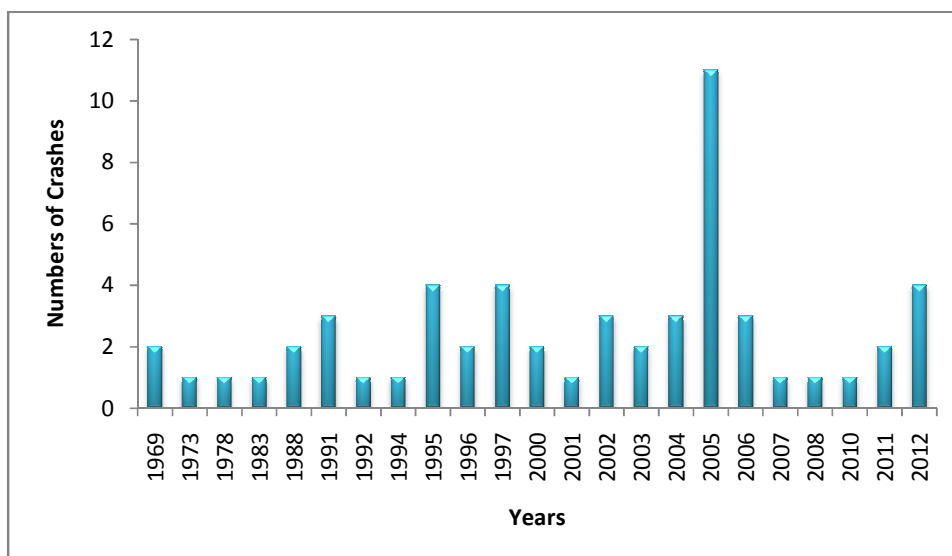


Figure 4: Numbers of Crashes per Year

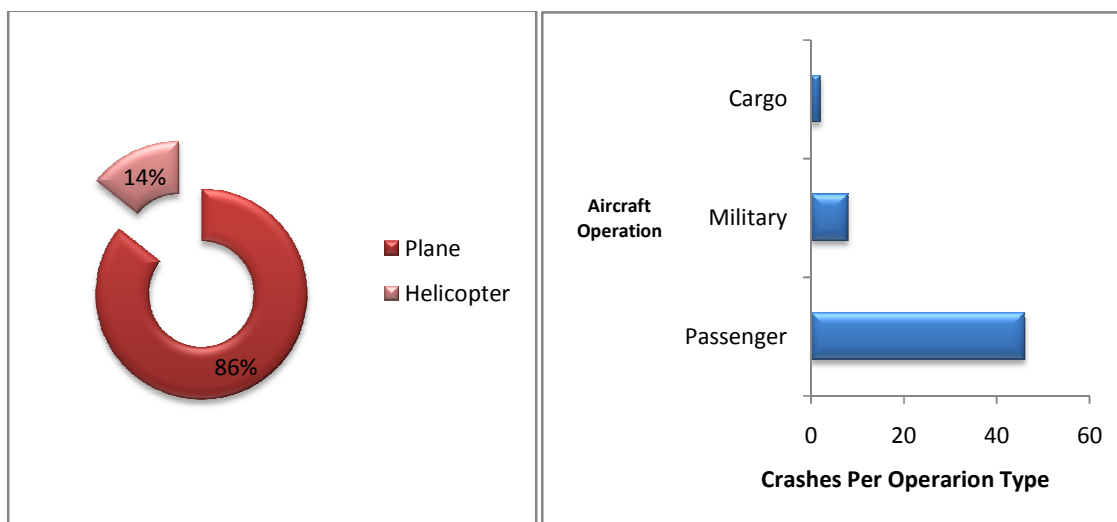


Figure 5: Aircraft Crashes per Type

Figure 6: Aircraft Crash per Operation

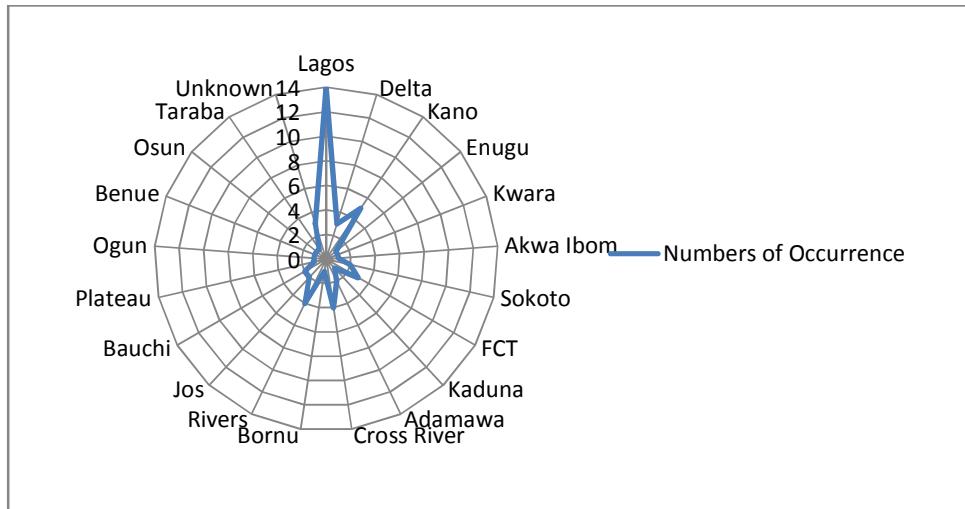


Figure 7: Location of Air Crashes in Nigeria

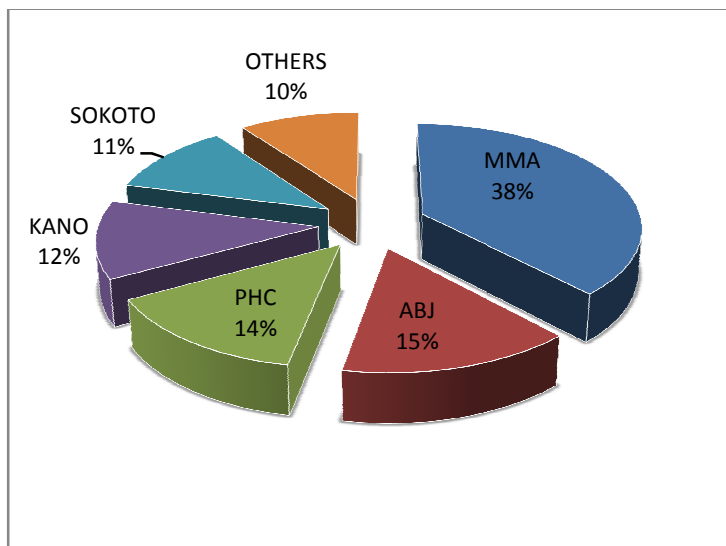


Figure 8: Air Traffic Volume per Location of Air ports In Nigeria.

Source: United States Embassy Nigeria

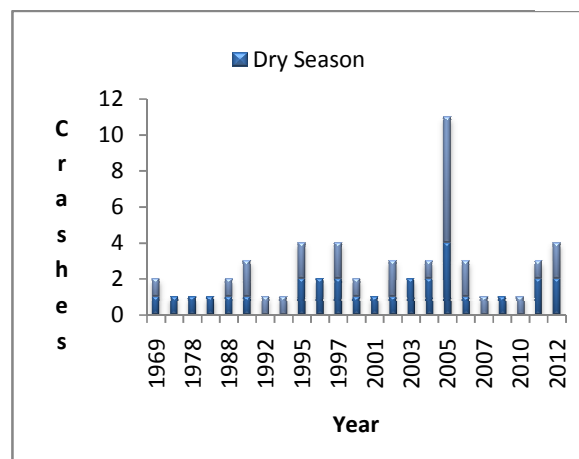
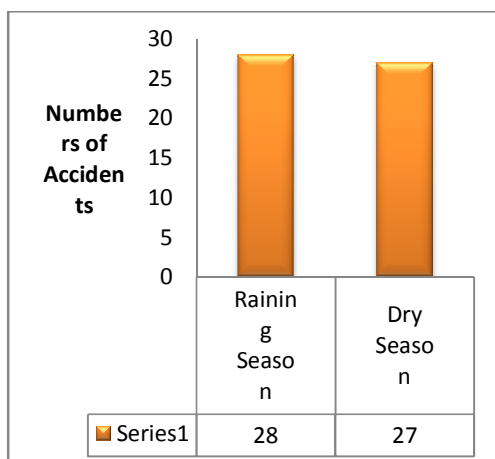


Figure 9: Cumulative Accident per Season. Figure 10: Yearly Accident Based on Season

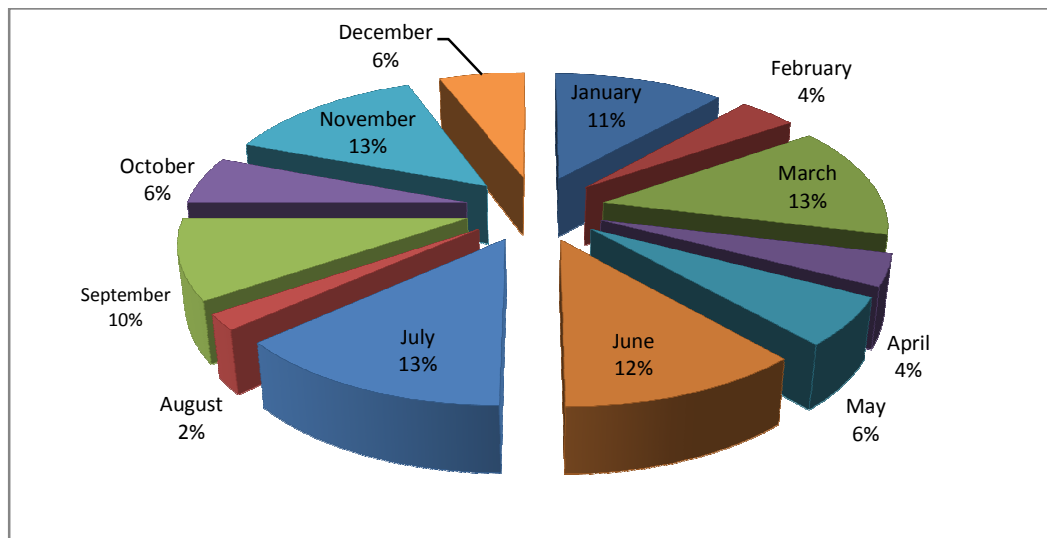


Figure 11: Proportion of Accidents by Month of Occurrence

References

- AIRBUS (2006). Airbus Global Market Forecast. Airbus Industries, Toulouse, France.
- Abeyrante, R.I.R (1998). The Future of African Civil Aviation. *Journal of Air Transportation World Wide*, Vol. 3, No.2, pp.30-49
- Adebiyi K.A. (2008). Estimation of Air Traffic Accident Cost in Nigeria. *Pacific Journal of Science and Technology*, Vol. 9, No.2, pp. 420-425
- Aderamo J.A. (2010). Demand for Air Transport in Nigeria. *Journal of Economic*, Vol.1, No. 1, pp. 23-31
- Afolayan O.S., Malik N.A., and Adedayo A.F (2012). Comparative Analysis in Variability of Aircraft-Passenger Movement in Nigeria Airports. *International Journal of Business, Humanity and Technology*, Vol. 2. No 6.
- ABTS (2009). Runway Excursions: Part 1- A Worldwide Review of Commercial Jet Aircraft Runway Excursion. Australian Bureau of Transport Safety. Report No. AR-2008-018(1)
- Bayuk A.J.(2007) Aviation Safety Management Systems as a Template for Aligning Safety with Business Strategy in other Industry. SMS Briefing for America Association of Airport Executives July 2007 (to be verified)
- Boeing (2007). Current Market Outlook 2007: How Will You Travel Through Life? Boeing Commercial Airplanes: Market Analysis, Seattle, WA, USA.
- Boeing (2011). Statistical Summary of Commercial Jet Airplane Accidents. World Wide Operations 1959 - 2010, June 2011
- Cavka I. and Cokorilo O., (2012). Cost Benefit Assessment of Aircraft Safety. *International Journal of Traffic and Transportation Engineering*, Vol. 2 No. 4, pp. 359-371

- De Beer J. (2005). Developing an Aviation Safety within the Southern African Context: A Stakeholder Perspective. A Thesis in Fulfillment of the Requirements for the Degree of Doctor Litterarum in Philosophiae in Industrial Psychology, Faculty of Humanities, University of Johanaessburg, South Africa
- EASA (2011). Annual Safety Review. European Agency for Aviation Safety.
- Edeaghe E., Esosa O., Idiodi H. (2006). Comparative Analysis Of The Bellview And Sosoliso Air Crashes in Nigeria: Matters Arising. The Internet Journal of Rescue and Disaster Medicine, Vol. 5, No. 2, DOI: 10.5580/2162
- GAMA (2010). General Aviation; Statistical Databook and Industry Outlook. General Aviation Manufacturer Association, Washington, DC 20005
- ICAO(2011). State of Global Aviation Safety 2011. International Civil Aviation Authority. Special Edition
- Janic M. (2010). Developing an Indicator System for Monitoring, Analyzing, and Assessing Airport Sustainability. European Journal of Transportation and Infrastructure Research, Vol.1, No.3, pp. 206-229
- Janic, M. (2007). The Sustainability of Air Transportation: A Quantitative Analysis and Assessment. Ashgate Ltd Limited, Aldershot, UK.
- Ladan S.I (2012). An Analysis of Air Transportation in Nigeria. Journal of Research in National Development, Vol. 10, No.2, pp. 230 -237
- Lu C, Young J. Schreckengast S., and Chen H. (2011). Safety Culture: The Perception of Taiwan's Aviation Leaders. International Journal of Aviation Studies, Vol. 11, No. 1 pp. 27-45.
- NIGAV(2007). Summary and Communiqué. Nigeria Aviation 2007 Conference Abuja Nigeria ,pp. 1-7
- NPC(2006). www.population.gov.ng/index.php/censuses
- Martinez A.R. and Kay C. (2012). Nigeria Deadliest crash in Decades Dents Industry Image, <http://www.bloomberg.com/news/2012-06-04/nigerian-deadliest-crash-in-decades-dents-industry-image.html> date retrived 16/4/2013
- Piven D.J, Borgenicht D., and Marchant P., (2006). The Worst-Case Scenario Almanac: History. Chronicle Books San Francisco
- Trogeler M. (2010), Criminalisation of air accidents and the creation of a Just Culture, European Air Law Association, <http://www.eala.aero/library/Mildred%20Trgeler%20EALA%20prize.pdf>
- National Transportation Safety Board (NTSB)