

Assessment of the Effectiveness of the Airport Rescue and Fire Fighting (ARFF) Department in Sam Mbakwe International Cargo Airport, Owerri, Imo State, Nigeria

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Abstract-Recent pressure on airports to operate as commercial entities has presented a degree of conflict between the objectives of an airport which include reducing costs and maximizing profits and those of the Airport Rescue and Fire Fighting (ARFF) service which is to save lives. This paper examines the efficiency of the Airport rescue and fire fighting (ARFF) Department in African Sub-region with particular reference to Sam Mbakwe International Cargo Airport, Owerri, Nigeria. Areas such as the safety environment within which commercial air transport operated; ARFF standards at the international level as well as the national regulations in Nigeria, the adequacy of the afore-mentioned standards and regulations; and the costs associated with meeting current ARFF standard Information was gathered using a variety of sources, namely trade publications, studies, accident databases and variety of regulations. Likewise structural questionnaire were administered to the industry personnel, students and lecturing staff of the ARFF in Owerri. Results indicate that despite inherent logistic difficulties and physical limitations at the airport the critical responsibility of the safety department requires it to act within its limit of available resources to save human lives in case of emergency.

KEY WORDS: Airport, Efficiency, Fire Fighting, Rescue.

I. INTRODUCTION

Although commercial aviation is a relatively safe mode of transport, the potential threat to this sector is perhaps greater than to all other transport sectors. No other form of transportation has to deal with toxic smoke or fumes and passenger compartment fires that reach lethal levels in just a matter of three minutes. In fact, post impact fires associated with aircraft accidents can reach as high as 2,500F. Furthermore, it only takes one minute before the aluminium skin is burnt through. Experiments conducted by the Federal Airport Authority of Nigeria (FAAN) on the effects of fuel fires on airframe structures show that a typical aircraft structure can only withstand an external fire for 30 to 60 seconds. Once the airframe has been breached, it only takes another two to three minutes before the temperature inside the aircraft reached 1,800F. The fire spreads quickly because of the high level of ambient thermal radiation which presents ideal conditions for the life of the fire. The most significant threats to the cabin from the fire burn through are the intense heat, smoke, smoke obscuration and toxic fumes from the materials in the cabin furnishings and trim which quickly

pyrolyse and ignite. According to Macey (1997), the atmosphere inside an aircraft on fire can have a wide range of effects on people.

These include the following:

- The high temperature can cause serious burns, particularly to the respiratory tract
- Smoke can seriously restrict vision and this can reduce the chances of a person escaping the aircraft to a safer environment;
- Smoke and narcotic gases can cause rapid incapacitation and death;

➤ Hypoxia induced behavioral changes may result from the low oxygen levels and this in turn may result in increased respiration of the toxic atmosphere within the cabin; and

➤ The toxic environment and irritants in the atmosphere can result in painful symptoms to the eyes as well as the upper respiratory tract and the lungs.

The narcosis that is likely to occur to someone as a result of an aircraft accident involving fire is particularly dangerous because of the relatively short time between that person exhibiting near normal behavior and falling unconscious. Whilst the body is able to adapt to narcotic environmental conditions, exposure to such conditions beyond a certain level can cause the body's defense mechanism to collapse and this can lead to rapid and severe deterioration. The sequences of events in human narcosis are behavioral changes such as lethargy or euphoria, poor physical co-ordination (which can severely restrict a person's ability to escape), unconsciousness and finally death. Persons trapped in a burning aircraft are therefore more likely to succumb to the aforementioned threats rather than to the impact of the crash. Actually, research indicates that in many survivable aircraft accidents involving fire, 75% of the deaths that occur annually are due to the effects of the fire (Macey, 1997).

Aviation is defined as the design, manufacture, use, or operation of aircraft. The term aircraft refers to any vehicle capable of flight. Aircraft can either be heavier-than-air or lighter-than-air craft. Lighter-than-air craft include balloons and airships while heavier-than-air craft include airplanes, autogiros, gliders, helicopters, and ornithopters.

For centuries man has dreamed of soaring like the birds. Famous inventors such as Leonardo Da Vinci, John string Fellow, and Lawrence Hardgrave (Global Aircraft-History of Aviation- 2002) conjured up ideas on how to get so some of the strangest machines to fly long even before the Wright brother famous first flight at Kitty Hawk.

An analysis of the chronological pioneering history of Aviation is recorded thus:

The first form of an Aircraft was the Kite, designed in the 5th century BC. Later on, in the 13th century, Roger Bacon, an English Monk, performed studies, which later gave the idea that air could support a craft just like water supports boat. In the 16th century Leonardo Da Vinci studies birds' flights, and later produced the aircrew and the parachute.

Aviation history in Nigeria actually began in 1925 when the first Airplane was said to have landed in Calabar, since then several commercial airlines ranging from the ADC, Okada Air, Bellview, EAS, Chanchangi and Albarka etc has been flying in Nigeria. (Edeaghe, Okoro and Idioidi, 2006).The Nigeria aviation industry enjoyed rapid growth from the oil boom period of the early 1970's till the era of military exploitation. During the pre-military era, the industry metamorphosed into a multifaceted, profit driven sector of the national economy. There were tremendous growth in the numbers of operators, airports and passenger traffic. However, the industry witnessed serious decline due mainly to growing cost, poor management, bad policies and unfriendly investment environment during past administrations.

creation of the Department of Civil Aviation in the public service of Nigeria. By independence in 1960, the department was relocated as a portfolio in the Ministry of Transport, subsequently, it become a separate ministry.



Figure 2 Map of Nigeria showing Imo state



Fig 3 Map of Nigeria showing major domestic and international airports



Figure 1 Map of Nigeria exhibiting its 36 states and the federal capital territory.

With the restoration of democratic ideas, genuine demonstration on the part of government to deregulate the economy and, growing investor confidence in the nation, the stage is set for vibrant and profitable aviation sector. Before 1950, aviation matters were treated as part of the public work department. That year however, saw the



Figure 4 Sam Mbakwe International Cargo Airport, Owerri.

Nigeria has a large topography that is dotted with over twenty airports, five of which are international and the others in the domestic category. With the deregulation of the domestic airline industry, private sector initiative has intensified in the Nigerian civil aviation industry. Presently, there are over 29 airlines flying the domestic

route in different service categories ranging from charter cargo service, oil support service, charter passenger service and scheduled passenger service.

This positive development has led to intense competition amongst the key airline operators in the industry, especially in the area of value-added service, customer care and safety facilities available. According to statistics made available by the Federal Airport Authority of Nigeria (FAAN), aircraft movement to and from Abuja (for domestic airline only) in the year 2002 was 32,403 which was 14% higher than the 2001 figure which stood at 27,954. The FAAN statistics further show the 5 most busy airports with highest passenger movements (for year 2002) in descending order as Murtala Mohammad Airport Domestic wing, Lagos, Nnamdi Azikwe Airport, Abuja, Port Harcourt Airport, Mallam Aminu Kano Airport, Kano and Kaduna Airport with 1,879,164.00, 1,334,873.00, 667,422, 194,696 and 146,050 respectively.

In terms of safety, the Nigeria airline operators have enjoyed a spell of accident free periods. But, recent developments especially in the last two years have drastically reversed this situation with 2 crashes recorded in early 2001 and May 2002 from EAS Airline alone. Though, in a swift and highly commendable manner, the Accident Investigation and Preventive Bureaus (AIPB) after concluding its investigation into the crashes revoked EAS Air operator certificate (AOC) for negligence and lack of regard for safety conditions. This move ought to serve as a deterrent to other private airline operator. Also, much is expected of the Aviation Ministry in overseeing the affairs of these airlines, though the ministry has ordered the use of better safety compliant plane like the Boeing 737 airplanes for local routes.

All these incidents call to question the importance and effectiveness of the two key regulatory agencies saddled with the responsibility of monitoring the activity of these airlines.

I The Nigeria Civil Aviation Authority (NCAA), which is responsible for regulating the methods of entry and conduct of air transport business should ensure the safety of aircraft operations, monitor aircraft operating environment and play advisory roles to the Aviation ministry. More so, based on the recent audit of private airlines in the country conducted by the NCAA as at April 2003, only 29 airlines out of a total of 34 were cleared and were able to retain their Air operator certificates (AOC) for two years.

II The Nigeria Airspace Management Agency (NAMA) is principally mandated to regulate air traffic control, visual and non visual aids, aeronautical telecommunications services, and secure safety, efficiency and regularity of air navigation. The agency needs to be more proactive as they determine the fate of planes during takeoff and landing. Also, there is the need for the agency to acquire state-of-the-art navigational equipment to boost their activity. (NigeriaBusinessinfo.com, 2003). It is worth saying that

the Nigeria aviation industry has experienced steady growth since the gradual liberation of the industry by government. The liberation policy has led to significant increase in air transport activities evidenced by the growing number of airline operators (domestic and foreign), increased movement of passengers, cargo and mail, increased utilization of airport facilities and growing number of companies providing allied services.

The situation has equally increased the challenges facing the industry in terms of regulatory framework, manpower, airport and air navigation infrastructural facilities, etc. in response to these, the Nigeria government embarked on a comprehensive exercise to harmonize and integrate these developments in the various sectors of the industry through an aviation master plan with the assistance of International Civil Aviation Organization (ICAO) (Focus on Aviation Safety in Nigeria, 2006).

There have been numerous efforts within the air transport industry to reduce the likelihood of aircraft accidents occurring. Continued work conducted in the field of engineering has sought to ensure that aircrafts are more structurally sound and that performance is enhanced. In spite of these efforts however, one has to be cognizant that air transport accident, fatal or otherwise, are inevitable aspect of the industry. None-the-less, injuries and fatalities can be reduced significantly with the implementation of appropriate and adequate secondary measures such as Airport Rescue and Fire Fighting (ARFF) standards, regulations and practices. As the majority of all aircraft accidents take place during the take-off or landing phase.

An emergency service at airport is of the most critical ways in which safety within the industry may be enhanced.

II. THE STUDY AREA

Imo State is one of the seven states created by the Federal Military Government on February 3, 1976 during the Mohammed/Obasanjo regime. It was part of the defunct East Central State which was one of the twelve states initially created by the Federal Military Government (General Yakubu Gowon's regime) in 1967. It has Owerri as its capital and largest city. Other major towns are Okigwe, Oguta, Nkwerre, Orlu, Mbaise, Mbano, Mbieri, Ideato, Awo-Idemili, Ohaji, Obowo, Ngor-Okpala, Uzoagba, Emekuku, Orodo, Mgbidi.

Abia State was carved out from Imo State. Imo State is divided into twenty seven local governments' areas (LGAs), and three senatorial zones. It has population of 3,934,899 (2006 Estimate) **Alias:** Eastern Heartland. Situated in south eastern Nigeria, Imo State covers an area of 5,530 square kilometres. Imo State shares boundaries with Enugu and Ebonyi States to the north, Anambra State to the west, Rivers State to the south and

in the North Cross River and Akwa Ibom States to the east.

The inhabitants of Imo State are Igbo. The official language of the state is Igbo alongside English. Imo State has a rich cultural heritage. This is manifested in dressing, music, dance, festivals, and arts and crafts. Imo State derives its name from Imo River, which takes its course from the Okigwe/Awka upland. It lies within latitudes 4°45'N and 7°15'N, and longitude 6°50'E and 7°25'E. Imo State has many rivers. The main rivers in the state are Imo, Otamiri and Njaba. The major lakes are in Oguta and Abadaba in Obowu local government area. The main streams draining the state are Imo, Otamiri, Njaba and Orasi rivers, all of which have very few tributaries. With the exception of Imo River, which runs through the area underlain by the Imo Shales, other rivers rise within the coastal plain sands? Generally, river valleys constitute the major physical features, which are often marshy. The vegetation is tropical rain forest.

The indigenes are predominantly Christians of different denominations. Some people in the state still practice traditional religions. The State is blessed with abundant natural resources. These include crude oil, lead, zinc, white clay, fine sand, limestone and natural gas in commercial quantities. The state also produces agricultural produce such as palm produce, cocoa and rubber. The main staple crops are yam, cassava, cocoyam and maize.

Sam Mbakwe International Cargo Airport located at Imerienwe in Ngor Okpala Town, Ngor Okpala Local Government Area, Imo State, Nigeria.

III. METHOD OF INVESTIGATION

The study was carried out in Sam Mbakwe International Cargo Airport. This study by its nature did not permit the use of large sample size.

Simple percentages were used. The method involved the administration of questionnaires to 150 respondents in the Airport. The first part of the questionnaire sought to obtain demographic data such as age, sex, educational level, occupation, description of duty and job position at the Airport. The second part was to obtain information on Effectiveness of the Fire Fighting Service at the airport: how often does training occurs, how often are the equipments for the service change? Means of financial support to the fire service and is air traffic safe in Nigeria? Of the 150 questionnaires administered 132, were received given 78% response. Staffs of the airport were interviewed about the airport rescue and fire fighting standard adopted by the Nigeria airport especially Sam Mbakwe Airport. Concerns of government and that of the management were investigated. Incidents of death of human beings and domestic animals, and potential for landslide and rock fall were investigated to assess environmental safety within and around the Airports. Field observations were recorded. Applicable safety measures were investigated,

and recommendations made, based on economics of scale and affordability.

IV. RESULTS AND DISCUSSION

The socio economic characteristics of the respondents are presented. In figure 1, the male accounted for 72 percent while 28 percent were female. The high percentage of the male is as a result of sampling of the departmental heads. The proportion of the age distribution in the study area is between ≥ 30 to 51 and above years. The age range with the highest value is 31 – 40 years which accounted for 37.9 percent of the respondents while those above 50 years accounted for 17 percent. This implies that respondents are in their active age and therefore can work to earn, more income which can affect their decision to willingness to work for improved safety and rescue services in the aviation industry.

About 13 percent of the respondents represent those without formal education while only 2 percent of the respondents had tertiary education. This revealed that the respondents in the study area had at least formal education. Education helps to enlighten the respondents on the need to keep our airport clean, free from accident causative agents and safety for all. The occupation of the respondents revealed that 42 and 47 percents engaged in civil service and business respectively while only about 5 and 6 percent were involved in non income activities such as students and dependants respectively.

Figure 5 present the distribution of the duties of the respondents in the airport rescue and fire fighting department and the willingness for the potential emergency operation. The result revealed that 39 percent of the respondents were fire suppression officers, while 12 percent claimed to be fire prevention operator, and 39 percent administrative officers. This is an indication that majority of the respondents are combatant ready for any potential fire accident eventuality in the department services. However Figure 6 shows, 25 percent of these categories of respondents are fire chiefs willing to pay the cost to render the deserved service while 6 percent is the deputy fire chiefs, 11 and 14 percent of them are the assistant fire chiefs and fire fighters respectively. Given the advantages of improved services, most airport rescue and fire fighting department in the study are a proportion of their duty, to sanitise their immediate environment.

Figure 7 presents how effective are the Fire Fighting Service at the airport. The results showed that 53 percent of the respondents believe that Fire Fighting Service at the airport is good while 33 percent believe it is poor. This indicates that as effective as the airport rescue and fire fighting Service increases the tendencies to adopt and improved services will also increase. The respondents reaction on how often does training occurs expenditure, a proxy for training is also positive, an indication that increase in training will increase the probability that airport rescue and fire fighting department would be

willing to perform its operation and services promptly and diligently. This is confirmed by figure 8, the result reveals that the marginal effect on probability of training airport rescue and fire fighting department for the service with respect to weekly and monthly is 16 and 6 percent respectively while yearly is 77 percent. This implies that for every training increase in weekly or monthly basis, the likelihood of better operation will increase.

38 percent said it is changed yearly, particularly when it is going to be an improvement on the existing means of services. The Respondents reaction on means of financial support to the fire service, shows that non-government organization contributes 45 percent while 38 percent is personal contribution and bank contributes 17 percent only, its reliability as well as the consistency for steady fund is very slimy as presented in Figure 10. A binary response to how safe is air traffic in Nigeria showed that 58 percent said it is not safe. However, 42 percent of this category of respondents said it is safe. Ranking in order of importance in causing accident 19 percent of respondents said hailstorm while 17 percent said dust storm, 15, 14, 12 and 10 percent said it is high altitude, dean calm, lighting and storm respectively.

Figure 5: Distribution of respondent's gender

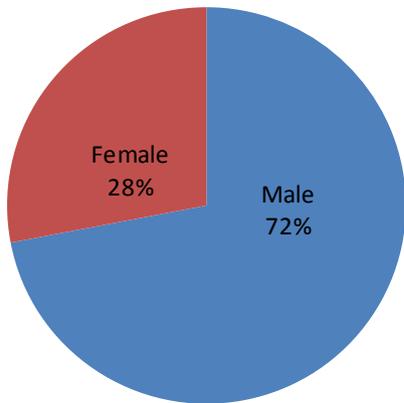


Figure 6: The Respondents age distribution

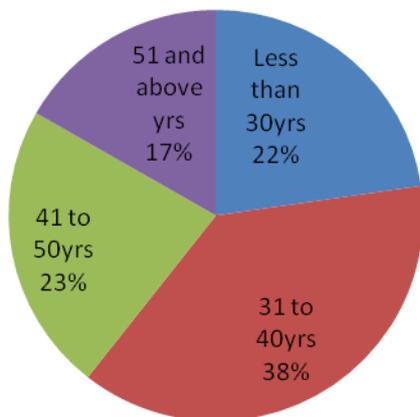
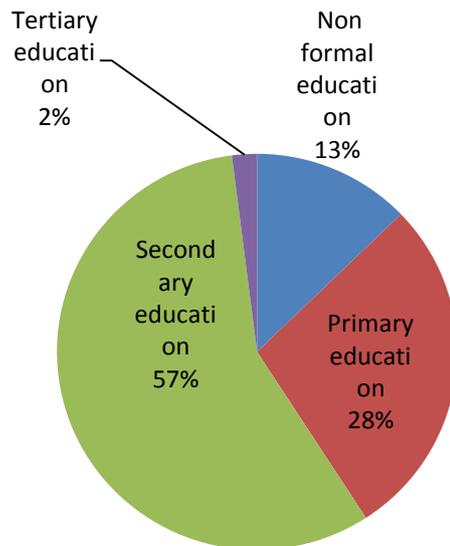


Figure 7: The Respondents' level of education



The Figure 9 revealed that change of equipment for rescue operation is not a new idea in the study area, however, 45 percent of the respondents revealed that the equipments for the service is change every month while

Figure 8: The Respondents occupation

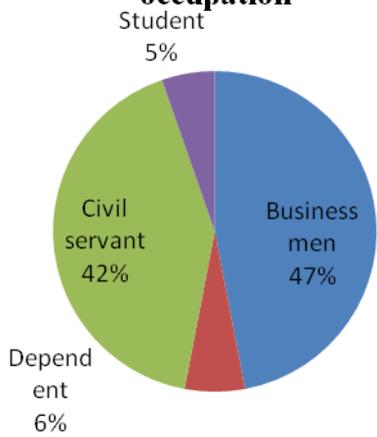


Figure 11: The Respondents job position at the Airport

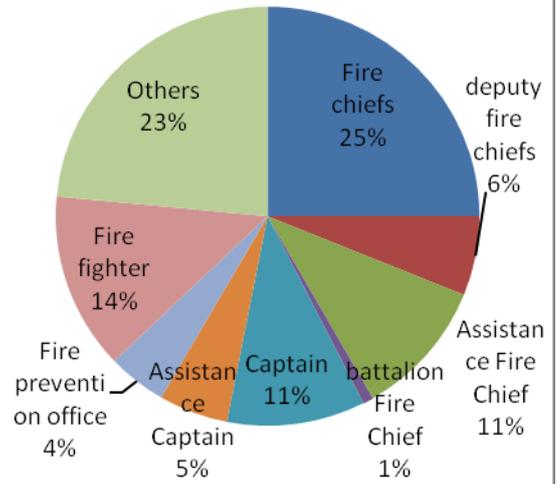


Figure 9: The Respondents description of duties

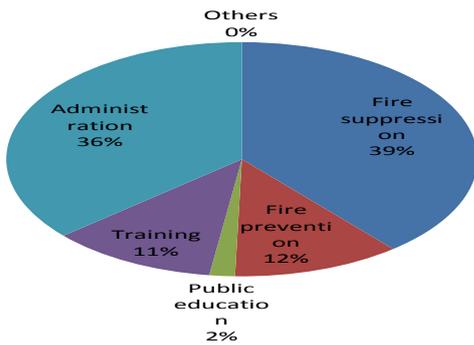


Figure 12: The Respondents reaction on how often does training occurs

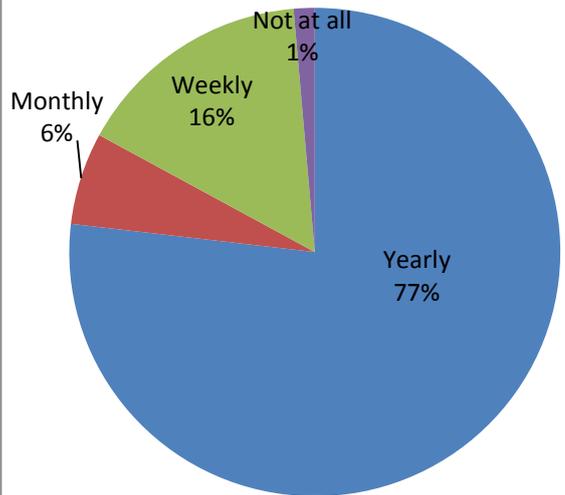


Figure 10: How effective are the Fire Fighting Service at the airport.

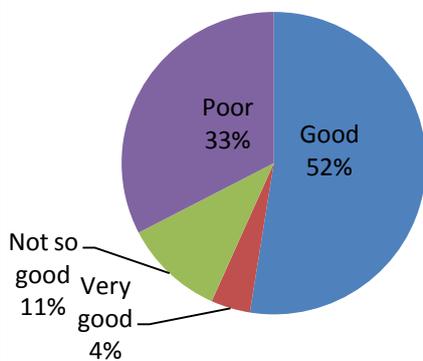


Figure 13: The Respondents reaction on how often is the equipments for the service change?

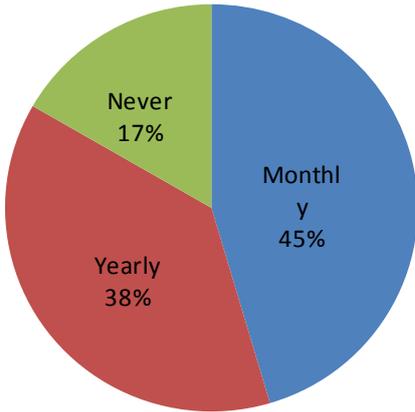


Figure 15: The Respondents reaction on means of financial support to the fire service

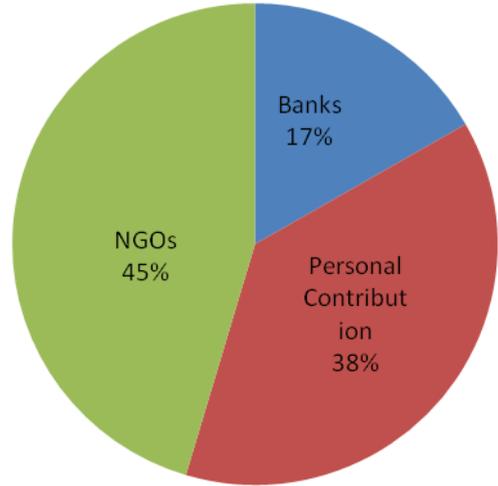


Figure 14: The Respondents reaction on how safe is air traffic in Nigeria

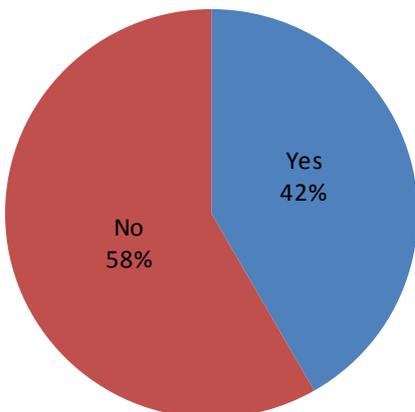
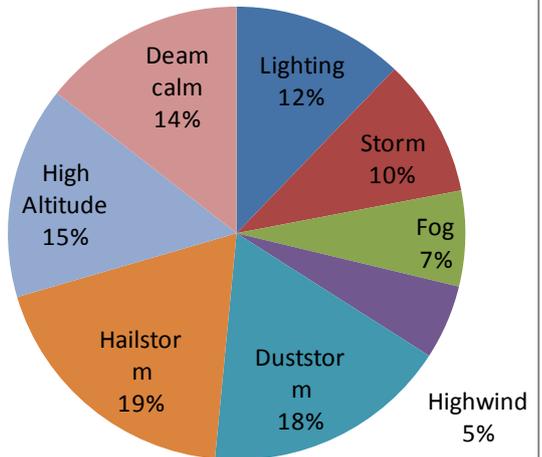


Figure 16: Ranking in order of importance in causing accident



V. CONCLUSION AND RECOMMENDATION

In conclusion, lack of effective Airport Rescue and firefighting department is a threat to Aviation industry. The major problems that threaten Airport Rescue and firefighting department at the African sub-region and Sam Mbakwe International Cargo Airport, Owerri Imo State in particular and other airports in Africa in General include logistic difficulties, physical limitations and accuracy in weather forecast.

It is recommended that there should be an uninterrupted power supply should be provided in all the Airports. A twenty four hours pilot weather centers at all the Airports, manned by experienced professionals who will provide pilots on the en-route and terminal aerodrome with current weather conditions. And an aircraft should be equipped with instruments to detect wind shear. The training and re-training of Airport Rescue and firefighting department and other airport personnel should be vigorously pursued, regular inspections, audits of aviation gadgets and engagement of professionals in the management of the airstrip.

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