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ANALYSIS OF ACCIDENTS IN THE SUDANESE CIVIL AVIATION DURING THE LAST 20 YEAR

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Abstract: WW1 and WW2 played the main role on having aircrafts fly in the Sudan skies. During the history of aviation in the Sudan, 91 accidents occurred leaving 606 fatalities. The first accident was on 25/2/1920, and the worst time for aviation in the Sudan was from 26/2/1996 to 07/10/2012 when 442 persons lost their lives in a series of accidents.

The number of accidents in the last 20 years was 41 accidents killing 284 persons. 39 accidents occurred in the first 13 years and only 2 accidents occurred in the last 7 years leaving no fatalities. The main reason of accidents is found to be human error, the mode of flight of most accidents is landing and the next is take-off. Russian aircrafts made 80% of the accidents. The year 2003 was the worst year for aviation in the Sudan of 129 fatalities due to 2 accidents.

The efforts done by the Aviation Safety in Africa (AFI Plan) between 2008 and 2012 has shown tangible results by reducing the number of accidents in the last 7 years to only 2 accidents

Keywords— Accident, Investigation, Mode of Flight, Civil Aviation, Heavy Aircraft, ICAO

I. INTRODUCTION

Lessons learned from safety occurrence, incident, and accident investigations, as well as any other activities, are shared throughout the ICAO members to increase the aviation safety. Sharing of lessons learned will lead to the identification of unacceptable hazards and result in the implementation of steps to mitigate the hazard, making the aviation safer.

The cost of Aviation accidents is typically measured both in terms of aircraft damage along with the human cost i.e., fatalities/injuries. In addition to the intangible costs as people become more fearful of flying as the number of aviation accidents increases.^[1]

The history of flight in Sudan really begins on May 14th, 1916, in Darfur, when a biplane dropped a collection of little green handbills and several 20-pound bombs on a family near

Mellit as part of The First World War since The Sultan Ali Dinar had been duped by Turco-German propaganda.^[2]

During WW2 military aircrafts played a major role in the battles all over the world, and many air bases were built to serve them, among these was Wadi-Sayedna air base north of Omdurman as the first airport in the Sudan in 1942.^[3]

Sudan Airways was found in February 1946 with the technical assistance of Airwork Limited, and the commercial support of Sudan Railways as the first airline in the Sudan, and one of the first airlines in Africa. Khartoum airport became Sudan Airways' hub from the very beginning, being the main civil airport, became the international airport of the Sudan.^[4]

The ICAO established the Aviation Safety in Africa (AFI Plan) in January 2008 to support African States in addressing aviation safety deficiencies.

The AFI Plan established the Association of African Aviation Training Organizations (AATO) that trained over 2,193 trainees from various States in Africa including the Sudan, benefitted from 66 courses conducted from 2008 to 2012 throughout the Continent.

The Plan also promotes the establishment and strengthening of regional safety oversight organizations.^[7]

II. AIRCRAFT ACCIDENTS IN SUDAN

A. General

Throughout the history of aviation in the Sudan, about 91 accidents took place among them were 40 fatal accidents and 606 fatalities. The first accident occurred on 25/2/1920 near El Shereik by Handley Page Transport Co. The first fatal accident occurred on 16/6/1943 by a RAF 414 Hudson aircraft, killing 17 persons.

This number of accidents includes military transport accidents, but it does not include accidents due to aircrafts shot during war, terrorist, or helicopters and agricultural aircrafts. Table (1) below summarize the accidents showing the operators, number of fatalities, number of accidents and number of fatal accidents.

During the period between 1996 and 2012 the aviation industry in the Sudan had a very hard time from safety point of view. Within this period, A total of 442 fatalities occurred within 16 years and 8 months (200 months) that is 2.21 fatalities per month in a country of very low flight density.



The average cycles per year in the Sudan was about 25000 cycles, the fatality rate for this period was 722.4 fatalities every million cycles compared to 0.8 fatalities every million cycles worldwide for that period, this comparison reflects the declining of Sudanese aviation safety indicators during the mentioned period. The two military accidents were not count for in this fatality rate.

Table -1 Summary of Aircraft Accidents in Sudan

Operator	# of accidents	# fatalities	Fatal Accidents
Ababeel Av.	01	4	1
Airline Trans.	02	9	2
Air West	02	7	1
Alfa Airlines	01	32	1
Alok Air	02	1	1
AZZA	02	015	1
El Magal Avi.	03	7	1
Fed. Airlines	01	53	1
Juba air	03	16	3
Libyan AF	01	0	0
Mid Airlines	02	0	0
Others	23	49	6
RAF	06	38	3
Sarit Airlines	07	17	2
Sudan AF	06	173	4
Sudan Air	23	168	6
Sun Way	01	11	1
TAAT	02	0	0
Tarco Air	02	6	6
USAAF	01	0	0
Total	91	606	40

B. Accidents in the last 20 years in the Sudan:

Table (2) shows all accidents occurred during the last 20 years involving scheduled commercial passenger flights and cargo companies and charter flights only.

From table (2), to comment on safety issues we came to:

- Sudan Airways recorded 8 accidents during the last 20 years as the highest accidents record compared to other operators, 3 of them leading to fatalities. The worst accident experienced by the company took place in July

2003 near Port Sudan, when 116 people lost their lives on an emergency landing and one injured.

- Juba Air had 3 accidents all of them were fatal accidents, number of fatalities was 16 during 4 years.
- Airline Transport had 2 accidents both of them were fatal accidents, number of fatalities was 9 during 3 and a half months.
- Sarit Airlines had 7 accidents within 13 and a half months 2 of them were fatal accidents, number of fatalities was 17 with 5 aircrafts Hull-loss.
- The total number of accidents during the last 20 years was 41 accidents 19 of them were fatal accidents leaving 284 fatality.

Table -2 Accidents occurred during the last 20 years, operators, fatalities and fatal accidents.

Operator	# of accidents	# fatalities	Fatal Accidents
Ababeel Av.	1	4	1
Aerovista Air	1	0	0
Airline Tran.	2	9	2
Air West	2	7	1
Alfa Airlines	1	32	1
Alok Air	2	1	1
Asia Air	1	0	0
AZZA	2	15	1
El Magal Avi	3	7	1
Juba air	3	16	3
Mid Airlines	2	0	0
Others	1	0	0
Sarit Airlines	7	24	3
Sudan Airways	8	152	3
Sun Air Co.	1	0	0
Sun Way	1	11	1
TAAT	1	0	0
Tarco Air,	2	6	1
Total	41	284	19

III. ANALYSIS OF THE ACCIDENTS OCCURRED DURING THE LAST 20 YEARS

A. Number of accidents per Year

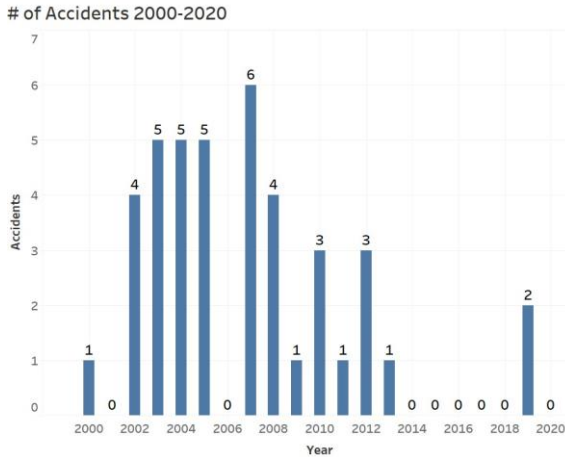


Fig-1 No of accident per Year for last 20 Year in Sudan

In Fig. (1) the total number of accidents during the last 20 years was 41 accidents, 39 accidents occurred in the first 13 years, and 2 accidents occurred in the last 7 years, this was due to the effort done by the Aviation Safety in Africa (AFI Plan), in addition to the important decisions concerning the registration of aged aircrafts and other fundamental organizational decisions maintaining the CAA top management.

These efforts have already shown tangible results. The Sudan have met the target of 60 per cent of effective implementation of the critical elements of a safety oversight system on 2012, on the other hand since 2012 the occurrence rate reduced to the international standard.

B. The Reasons of Accidents:

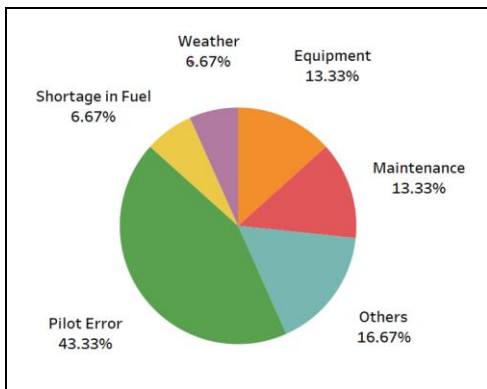


Fig-2 Reason of accidents for last 20 years in Sudan

From fig. (2), 43.33% of accidents occurred due to pilot error, maintenance and equipment being the second reason of accidents having 13.33% each, maintenance and equipment errors are also due to human errors.

Globally from 70% to 80% of accident causes are human error.

Accidents related to human factor can be greatly reduced by continuous training, maintaining physical fitness and

physiological condition of personnel and promoting teamwork spirit.

Most of Russian aircraft pilots and engineers are from former Soviet Union countries, they are not familiar with the weather and the unpaved airstrips of the Sudan. From the other hand to gain more money they do extra effort so they get into fatigue that leads to accidents.

C. Number of accidents Vs Mode of Flight:

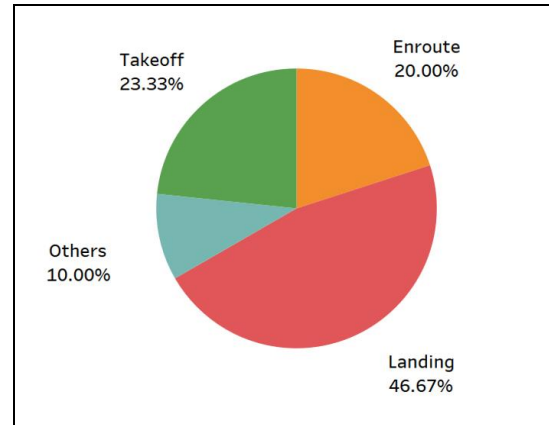


Fig-3 Number of accidents Vs Mode of Flight

Figure (3) shows that 46.67% of the accidents took place during landing, the second mode being take-off for 23.33%. enroute 20% and others being 10%. Three fourths of all accidents occur during takeoff and climb or during approach and landing.[14] While during take-off the pilot puts maximum power from engines, at landing he needs maximum concentration, if he was fatigued, he is likely to get in accident.

Take-off and landing needs healthy engines, relaxed crew and well-equipped airports.

Khartoum International Airport was equipped with modern operational facilities, but by the early 1990s, Khartoum and seven other airports had paved runways. Now about 15 airports had paved runways, but the operational facilities are generally poor.

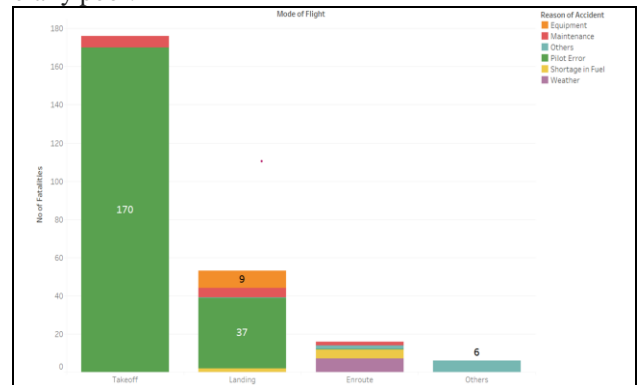


Fig-4 Number of fatalities vs Mode of Flight

C. Number of accidents vs Manufacturers:



From fig. (5) below, Russian aircrafts made 80% of the accidents, the European made 13.33% and the American made 6.67% because most of Russian aircrafts in Sudan were aged aircrafts. The two key processes that lead to aircraft ageing are fatigue and corrosion.

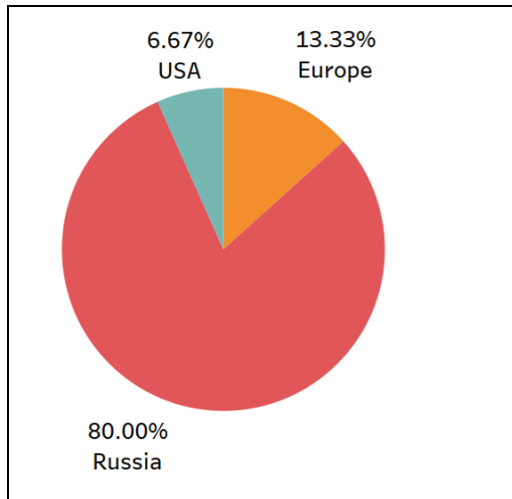


Fig-5 Number of accidents vs Manufacturers

D. Number of Fatalities:

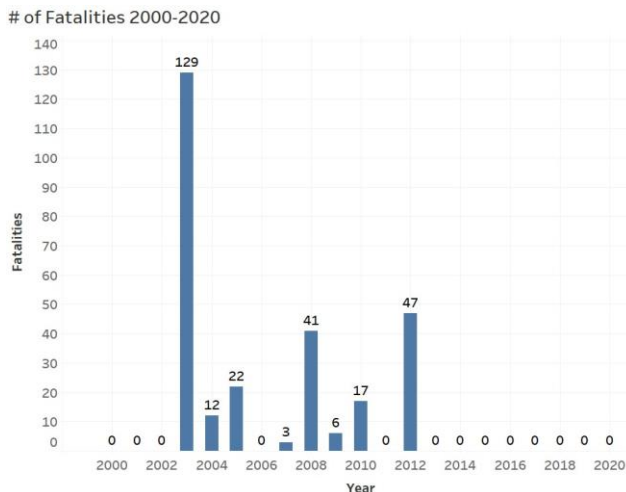


Fig-6 Number of Fatalities for last 20 years

From fig. (6) the number of fatalities was 277 occurred during the first 12 years. The last 8 years are free of fatalities, this was due to the efforts done by the Aviation Safety in Africa (AFI Plan), in addition to the development took place in the CAA top management.

These efforts have already shown tangible results. The Sudan have met the target of 60 per cent of effective implementation of the critical elements of a safety oversight system, on the other hand since 2012 the occurrence rate reduced to the international standard, even though it is recognized that the continuous support of ICAO, states, industry and donors is still required for safety concerns to be fully addressed and resolved

IV. DISCUSSION

The root causes behind the accidents in last 20 years in Sudan which led to fluctuation of safety indicators are

- Effect of American sanction and trade embargoes in last 20 years as the Sudan often arises for aircraft and jet engine lessors that require their lessees to comply with U.S. economic sanctions and export control programs.
- Corruption and mismanagement: The lost of the slots previously held by Sudan Airways at Heathrow airport was a good example of that corruption. Corruption was hitting the civil aviation sector every where.
- Absence of effective and efficient accident investigation and its effect of whole safety system.

EU bans all airlines from Sudan over safety concerns due to a poor safety performance of the civil aviation authority of Sudan resulting from persistent non-compliance with international standards in the area of oversight.

Most ICAO Member States in Africa including the Sudan continue to face challenges in the effective implementation of SARPs (Standards and Recommended Practices), resulting in safety deficiencies that pose challenges to the growth of civil aviation in the region. The Comprehensive Regional Implementation Plan for Aviation Safety in Africa (AFI Plan) was established in January 2008 to support African States in addressing aviation safety deficiencies. The AFI Plan has supported numerous initiatives to assist States in enhancing their civil aviation systems. In the area of training, the AFI Plan supports the establishment and evolvement of the Association of African Aviation Training Organizations (AATO) and over 2,193 trainees from various States in Africa including the Sudan benefitted from 66 courses conducted from 2008 to 2012 throughout the Continent. The Plan also promotes the establishment and strengthening of regional safety oversight organizations.^[15]

These efforts have already shown tangible results. The Sudan have met the target of 60 per cent of effective implementation of the critical elements of a safety oversight system, on the other hand since 2012 the occurrence rate reduced to the international standard.

After the separation of South Sudan, much of the aviation local cargo market was gone and many cargo companies changed to be passenger airliners. From these were Air West became Sun Air, Sarit Airlines became Badr Airlines, and new airlines were born like Tarco Airlines and others. Although Air West and Sarit Airlines had bad reputation as far as safety is concerned, Sun Air and Badr Airlines succeeded to be successful airliners, it is clear that the operators learned the lesson.

Largely shut off from the airline manufacturing industry by a U.S. trade embargo, Sudan Airways is down to six Airbus, Boeing and Fokker aircrafts, most of them over 15 years old.



More over it was suspended to wide corruption during the last 20 years that push it back to the third airliner locally with a huge body of employees that count to 2362 at April 2000. Now the company is operating only 4 aged aircrafts and is struggling to maintain an orderly domestic and regional schedule to where the airline can still fly.

The airliners fly about 32 aircrafts 21 of them are B737 covering the local and regional market.

The secret word of aviation industry is continuous training effective regulation and a strong safety culture, together with the spirit of teamwork.

V. RESULTS & IMPROVING SUGGESTIONS

- Importance of establishment and adoption of ecosystem in achieving high records of safety in Sudanese civil aviation.
- Strategic planning (clear safety records targets) considering participation of all stakeholder in planning and implementation of the strategic plans.
- The role of Sudanese civil aviation authority in supporting and enhancing the aviation community toward one and unified objective (safe Sudanese skies)
- Importance of data as a valuable asset and supporting the initiatives and activities toward data driven decisions which can be achieved by well-defined roadmap (accident investigation, data gathering, data analytics...etc.
- Bench-marking with neighbors countries regarding safety records and indicators through activation of researches related to aviation safety.

VI. CONCLSIONS & LIMITATION OF THE STUDY

1. Throughout the history of aviation in the Sudan, about 91 accidents took place among them are 40 fatal accidents and 596 fatalities. However, most of the accidents have lack of descriptive database and information that limits the study.

2. Most causes of accidents are studied by the preliminary reports, the final reports are either not found, or they are not completed. However, the research study adopts the use of preliminary reports and considers its report conclusions to be true.

3. Information like flying hours and passenger kilometers are not available for the period of the study (20 years) that limits the study.

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