The Performance of Ground Aviation Systems

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Abstract - Management scientists have classified that nuclear power, space shuttle and aviation systems as complex and critical systems because of the risk always around which is not easily expected causing unexpected crisis, as a result business will be lost at all in case of poor expectation to the potential risk. A critical system is any system whose 'failure' could threaten human life, the system's environment or the existence of the organization which operates the system. The requirements of these systems change over time due to the technical development when the technical system is both complex and critical. Ground Aviation Systems play a great role in completing aviation processes, so it is very important to improve performance of ground aviation systems to be sure that all ground aviation processes are done correctly from the first time without any failures or wrong actions.

Index Terms - Ground Aviation Systems, Ground Support Equipments (GSE), the Performance, Airport Ground Services, Aircraft Accidents, Aviation Statistics

1 Introduction

Ground Aviation Systems play a great role in completing aviation operations and losses due to them are very expensive. According the Flight Safety Foundation statistics, the losses from apron damage are costing the world's air carriers in the vicinity of 4 billion dallar every year. Add to this the costs of apron damage to the corporate and bussiness aircraft fleet and the price tag goas up an additional 1 billion dollar per year, the total cost of apron damage consists of direct costs and indirect costs as follows: (Vandel, 2004)

Direct costs: the total cost due to damages in aircraft or GSE, the costs of aircraft losses is very expensive because the huge cost of repairing the damaged parts of the aircraft, figure (2-20) as an example shows costs of damage parts on a Boeing 737 (Vandel, 2004). GSE is very expensive because it has a special design and many of the replacement parts needed for this equipments are specialized.

Indirect costs: includes (Vandel, 2004): Lost direct revenue (ticket sales and cargo revenue), Aircraft diversions (replacements), Flight cancellations, Passenger food and lodging, Replacement labor and overtime, Damage to public image, Management and supervision time, Incident investigations, Purchasing seats on anther airline to accommodate passengers, Pain and suffering for those injured and their families, Adverse impact on operations, Employee relations/ overall company moral, Regularity agency reactions, Total costs of workplace injuries.

2 Ground Aviation Systems

Ground Aviation Systems can be defined as special systems in airports that provide services to the aircrafts to ensure the completion of the aviation process in an efficient, accurate form and in the shortest time possible. (Young, 2011), the Ground Aviation Systems are used in different stages of flight before taking off, during landing, taxing and during testing, inspection and maintenance. Ground Aviation systems can be divided into 4 sub-systems:

1) Navigational Aids Systems.
2) Lighting Systems.
3) Arresting Systems.
4) Ground Support Equipment (GSE).

2.1 Navigational Aids Systems

Navigational Aids Systems are responsible for assisting and guiding aircrafts during flight time, most of these systems depend on wireless communication technology; data exchange between aircrafts and Navigational aids systems is done by electromagnetic waves, (Kayton & Walter, 2007). Navigational Aids Systems can be classified as follows:

1) Non-Directional Beacon (NDB): this system use to guide the aircrafts to the runway of the airport by transmitting data (electromagnetic waves with 150:1750 KHz) through the antenna and the aircraft receives these waves and then detects the distance and the direction of the runway, this system consists of two beacons; inner NDB and outer NDB. The inner NDB place in 1 Km before the beginning of the runway and the outer NDB place in 4 Km before the beginning of the runway (singh, 2012).

2) Directional Finder (DF): this system gives the aircraft data about its angle according to directional finder beacon to magnetic north (electromagnetic waves with VHF 115:150 MHz and UHF 225:400 MHz) through the antenna and the aircraft receives these waves and then detects its direction, the directional finder beacon placed near to the outer NDB about 4 Km before the beginning of the runway, (Eismin, 2014).

3) Instrumental Landing System (ILS): this system provides safe landing on final approach for aircrafts if pilots are unable to establish visual contact with the runway during instrument metrological conditions (IMC) such as low ceilings or reduced visibility due to fog, rain or snow, (singh, 2012). ILS provides the horizontal and vertical guidance that necessary for an accurate landing by using radio signal that transmitted from ILS ground systems in the airports and received by boarded systems that equipped in the aircrafts. ILS system consists of 4 subsystems; (Geise et al, 2008).

Localizer system; handle the horizontal guidance for the air-

craft, **Glide slope system**; provide the vertical guidance (angle of descent). **Marker beacons**; provide the distance of the aircraft from runway. **Approach lighting system**

4) Tactical Air Command And Navigation (TACAN): this system gives the aircraft some necessary data such as: the angle of the aircraft according to TACAN station from magnetic north, the distance between the aircraft and the TACAN station and ID of the airport, (Rodrigus and Cusick, 2012).

5) Automated Weather Observation System (AWOS): this system is important for accurate weather forecasting and therefore safe and efficient aviation operations by providing continuous, real time information and reports on airport weather conditions, (Burden et al, 2002). The main idea of (AWOS) is the same as ordinary meteorological systems; an automated meteorological station collects data from wide range of sensors and instruments, this data are saved in a database and presented in various displays. Basic meteorological parameters in an airport meteorological system are: (FAA, 2012)

wind speed and direction, visibility, temperature, dew point, icing, cloud coverage and ceiling, air pressure, precipitation detection and intensity, snow cower thickness.

6) Ground Control Approach (GCA): is a type of service provided by air-traffic controllers whereby they guide aircraft to a safe landing, by providing precision approaches with vertical and horizontal guidance. GCA uses information from a Precision Approach Radar (PAR) or an Airport Surveillance Radar (ASR), (Neufville et al, 2013).

2.2 Lighting Systems

Lighting systems are very important to help aircraft during taking off, landing and taxing in night or in bad sight due to bad weather. Some lighting systems can also work as auxiliary systems to Navigational Aids like Precision Approach Path Indicator system (PAPI) (Young, 2011).

Precision Approach Path Indicator system (PAPI) is a visual aid that provides guidance information to help a pilot acquire and maintain the correct approach) to an airport. It is generally located beside the runway approximately 300 meters beyond the landing threshold of the runway. The PAPI is a light array that consists of four light units with red and white colors to provide a visual indication of an aircraft's position relative to the designated glide slope for the runway, (Lampkins, 2015). The ratio of white to red lights seen is dependent on the angle of approach to the runway. Above the designated glide slope a pilot will observe more white lights than red (3 or 4 white ●●●●), at approaches below the ideal angle more red lights than white will be seen(3 or 4 red ●●●●). For the optimum approach angle the ratio of white to red lights will remain equal (2 red to 2 white ●●●●), (Lampkins, 2015).

2.3 Arresting Systems

Arresting systems are very necessary to help the aircraft to land safely; it may be some mistakes from the pilots or some malfunctions in the aircraft system and this cause wrong landing, this wrong landing cause by missing the touch point in the runway or landing with high speed and this cause insufficient runway length for safe landing, so arresting systems used to stop the aircraft and reduce the damages, arresting systems divided as the following: (Barsotti et al, 2009)

Cable systems: strong cable fixed with two engines in both sides of the runway place in the beginning of the runways, when the aircraft is landing, it extrudes a big hook which interlock with arresting cable and make the aircraft stops safely in short distance (Bachtel, 2010). These systems are used in military air bases or in large carriers with jet engine aircrafts.

Net systems: big net with strong materials place at the end of the runways, when the aircraft is landing, it hits the arresting net which stops the aircraft safely, (Bachtel, 2010)

2.4 Ground Support Equipment (GSE).

All vehicles and equipments in the airports fall into two broad categories; Land-side vehicles and equipments that are used on the passenger/entry side of the airport, air-side vehicles and equipments that are used principally on the tarmac, Ground Support Equipments are restricted to Air-side equipments (Kinnison and Siddiqui, 2013).

The definition of Ground Support Equipments as mentioned in ISO 6966-1 and ISO 6966-2 is "any piece of mobile equipment, whether or not powered or self-propelled, purpose designed, built and used for ground handling, servicing or field maintenance of civil transport aircraft on the ramp area of an airport", they also call Ground Support Equipments as ramp equipments (ISO 6966-1, 2005). Ground Support Equipments are supporting equipments that are used to service and prepare the aircraft between flights (Steward, 2012). ISO 6966-1 and ISO 6966-2 list the typical aircraft ground support equipments as mentioned in Annex A as follows:

TABLE 1: LIST OF AIRCRAFT GROUND SUPPORT EQUIPMENTS

1	Air conditioning unit	13	Heater
2	Air starting unit (ASU)	14	Hydrant servicer
3	Aircraft tractor	15	Hydraulic tail stanchion
4	Axle jack Baggage and equipment tractor	16	Lavatory service equipment
5	Catering truck	17	Maintenance stair
6	Container/pallet dolly	18	Maintenance platform
7	Container/pallet loader	19	Oxygen or nitrogen unit
8	Container transporter	20	Passenger boarding bridge
9	Conveyor belt vehicle	21	Passenger stair
10	De-icer	22	Potable water vehicle
11	Disabled passenger boarding equipment	23	Refueling vehicle
12	Ground power unit (GPU)	24	(Aircraft-) Tow bar

Next, a brief explanation for some of ground support equipments according to their great effect on the performance:

1) Refueling vehicles: aircraft refueling vehicles are used to provide the aircraft with necessary fuel for the flight, there are two types for refueling the aircrafts: tank truck and hydrant truck, (Steward, 2012). Tank trucks are self contained which typically containing up to 10000 gallons of fuel and have their own pumps, filters, hoses and necessary equipments. Hydrant trucks or hydrant dispensers which hook in to a central fuel pipeline network and provide fuel to aircraft.

2) Tugs and tractors: have several purposes and represent the essential part of ground support equipments, these tugs and tractors use to move all equipments that can't move itself such

as baggage carts, lavatory carts, ground power unit and mobile air conditioning units (Kinnison and Siddiqui, 2013). Pushback tugs are very important tugs used to push the aircrafts away from the gate when it is ready to leave, it can also be used to pull aircrafts in various situations as to a hangar, different size tugs are required for different size aircrafts, and they also must be heavy.

There are two types of pushback tractors; conventional and towbarless, Conventional tugs use a tow bar to connect the tug to the nose landing gear of the aircraft, each aircraft type has a unique tow fitting, so the tow bar also acts as an adapter between the standard tow pin on the tug and the specific fitting landing gear on the aircraft. Towbarless tractors do not use a tow bar; they scoop up the nose wheel and lift it off the ground, allowing the tug to maneuver the aircraft with high speeds.

3) Container / pallet dolly: is designed to carry heavy duty cargo loads with different weights and different sizes, it also can be end towing or side towing, the dollies are designed so that they can stand the atmospheric abuse, there are dollies for unit load device (ULD) and cargo pallets that are standard sized flatbed trolley or platform, with many wheels, roller bars or ball bearings protruding above the top surface for easy loading and unloading of (ULD) and cargo pallets respectively, (Kinnison and Siddiqui, 2013).

4) Container / pallet transporter: is rugged and heavy duty vehicle that designed to transport and transfer containerized and palletized cargo loads with different weights to and from container / pallet loaders, dollies and racks, this transporter can optionally be fitted with open or closed cabin, powered shift system, and special front roller mechanism for automatic transfer of pallets and containers to and from dollies for safer and quicker operation, (Kroes. and Nolan, 2013).

5) Container / pallet loader: is used for the loading and unloading of containers and pallets into and out of aircraft, the loader has two platforms which raise and descend independently, the containers or palettes on the loader are moved with the help of built-in rollers, wheels or dollies, (Kroes, M. and Nolan, 2013). For military transport planes special container and pallet loaders are used, some military applications use airborne loaders, which are transportable within the transport plane itself, also there are special types of loaders are used to armed military airplanes with weapons or extra fuel tanks, (Kroes. and Nolan, 2013).

6) Ground power unit: is a trailer or truck that uses to supply power to the aircraft during the preparing to next flight, many aircrafts require 28V DC and 115V AC with 400 Hz.

7) Air starting unit: is a power source used to provide the initial rotation to start aircraft engines; it supplies necessary quantity of air at specified pressure through hoses attached to the aircraft's under belly.

8) Conveyor belt vehicle: is a vehicle with conveyor belts for unloading and loading of baggage and cargo onto aircraft. A belt loader is positioned at the door sill of an aircraft hold baggage compartment during operation, belt loaders are used for narrow body aircraftm (Steward, 2012).

9) Buses: are used to move people from the terminal to an aircraft or another terminal, airport buses are usually normal city buses or specialized terminal buses which have very low floor and wide doors for most efficient passenger movement and flexibility in depot parking, (Steward, 2012).

10) Lavatory service equipment: is used to empty and refill lavatories onboard aircraft, waste is stored in tanks on the aircraft until these vehicles can empty them and remove the waste. After the tank is emptied, it is refilled with a mixture of water and a disinfecting concentrate, commonly called 'blue juice', instead of a self-powered vehicle, some airports have lavatory carts, which are smaller and must be pulled by tug, (Steward, 2012).

11) Catering trucks: catering includes the unloading of unused food and drinks from the aircraft, and the loading of fresh foods and drinks for passengers and crew. The meals are typically delivered in standardized carts. Meals are prepared mostly on the ground in order to minimize the amount of preparation, (Kroes. and Nolan, 2013).

12) Anti-icing vehicle: is vehicle with booms to allow easy access to the entire aircraft, a hose sprays a special mixture that melts current ice on the aircraft and also prevents some ice from building up while waiting on the ground, (Kinnison and Siddiqui, 2013).

13) Aircraft rescue and firefighting: is a special category of firefighting that involves the response, hazard mitigation, evacuation and possible rescue of passengers and crew of an aircraft involved in an airport ground emergency.

14) Disabled passenger boarding equipments: are equipments with special design used to help disabled passengers to board or disembark from the aircraft, these equipments are: accessibility air stair which is a wheelchair stair lift that can lift wheelchair to the door of the aircraft, passenger boarding ramps that allows easier access for all passengers, disabled and non-disabled, disabled passenger lift that allows easy boarding for disabled passengers directly by wheelchair.

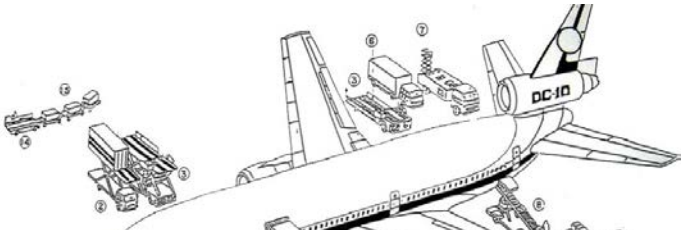
15) Passenger boarding stairs: provide a mobile means to traverse between the aircraft doors and the ground; because larger aircraft have door sills 5 to 20 feet high, stairs facilitate safe boarding and deplaning. Smaller units are generally moved by being towed or pushed, while larger units are self-powered, most models have adjustable height to accommodate various aircraft, optional features may include canopies, heating, supplementary lighting, (Kroes. and Nolan, 2013).

16) Passenger boarding bridge (PBB): is an enclosed, movable connector which extends from an airport terminal gate to the aircraft allowing passengers to lead to and from the aircraft without going outside in safe and comfortable way.

3 AIRCRAFT GROUND SERVICES OPERATIONS ANALYSIS

Aircraft ground services is a multi-task procedure, so to reduce the aircraft servicing time and reduce costs, it's important to perform simultaneously as many operations as they can, figure (1) shows the necessary ground support equipments to aircraft ground services. (Moore et al, 2013)

FIG.1: AIRCRAFT GROUND SERVICES OPERATIONS



When aircraft is landing and touch down the runway, it decreases its speed gradually and goes through taxiways until reaches the airport apron which is the area of an airport where pre-flight activities were done. Either passenger boarding bridge or passenger stairs are used to get off passengers from the aircraft and embark other passengers for the next flight, if there are disabled passengers, the destination airport would be informed later so that when the aircraft lands, any of disabled passengers boarding equipments like lift or accessibility air-stair would be used (Kazda and Cavas, 2010).

Containers or pallets that contain passenger's baggage are unloaded from the aircraft by loaders and in small aircrafts the conveyor belt vehicles are used, then the baggage are transported by vehicles or dollies cart to the airport terminals. Catering truck unloads the unused foods and drinks from the aircraft, and loads the fresh foods and drinks for passengers and crew for the next flight. Hydrant servicer or refueling vehicle is used to refuel the aircraft and ground power unit are used to charge it with power. After finishing boarding passengers and baggage, the aircraft tractor is connected to the front wheels and pulls the aircraft to the runway to take off.

4 Ground Aviation Services Companies in Egypt

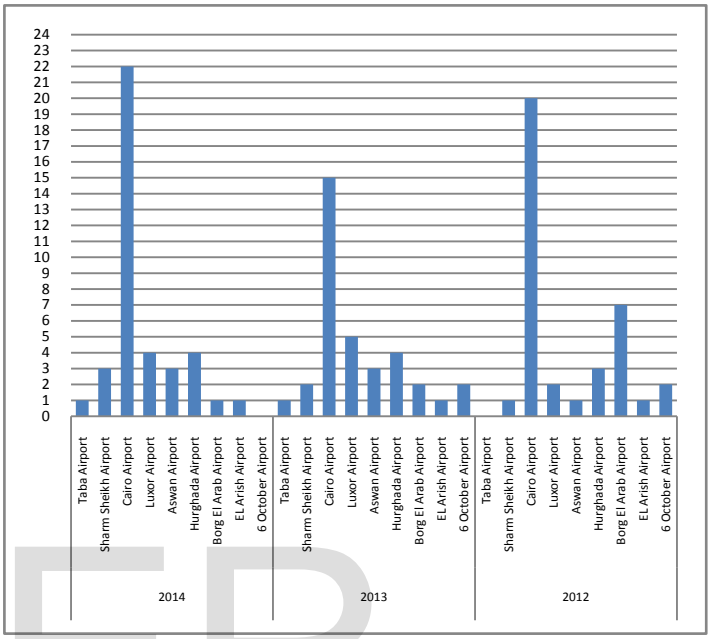
Ground Aviation Services Companies provide a wide scope of services for aviation clients, these services includes:

1) Ramp and Passenger Services
2) Engineering Services
3) Airport Technologies
4) Station Management
5) Aircraft Handling & Supervision
6) Global Flight Support
7) Flight Permits & Slot Coordination
8) Executive & General Aviation Services
9) Lost and Found Services
10) Fuel Supply
11) Security Services
12) Maintenance Arrangements
13) Aviation Training Centers
14) In- flight Services
15) Hotel Accommodation & Transportation
16) Cargo Handling

4.1 Aircraft accidents statistics in Egyptian Airports

Aircraft accidents statistics in Egyptian airports due to Ground Aviation Systems especially Ground Support equipments (GSE) during 2012, 2013 and 2014 according to Central Directorate of Aircraft Accident Investigation of Ministry of Civil Aviation as mentioned in appendix A, appendix B and appendix C.

FIG.2: AIRCRAFT ACCIDENTS STATISTICS IN EGYPTIAN AIRPORTS DURING 2012, 2013 AND 2014



From figure 2, the most aircraft accidents occurred in Cairo International Airport about 19 accidents per year, and this normal because Cairo International Airport is the main and the biggest airport in Egypt, and has the most of flight movements international or local according to statistics that published by Central Agency for Public Mobilization and Statistics (CAPMAS) through the issuance of annual report for air transportation statistics which describe the Egyptian airports movements for international and local flights.

There are about 133500 aircraft movements, 61600 aircrafts for international movement with percentage 46.1% and 71850 aircrafts for local movement with percentage 53.9%.

FIG.3: INTERNATIONAL AND LOCAL AIRCRAFT MOVEMENTS IN EGYPTIAN AIRPORTS

Airport	Cairo	Alex	Hurg.	Luxor	sharm	others	Total
International Flight movement	45598	1890	5233	2476	4680	1729	61606
Local Flight movement	22778	11423	7136	11783	11329	7397	71846

FIG.4: INTERNATIONAL AND LOCAL AIRCRAFT MOVEMENTS IN EGYPTIAN AIRPORTS

Work injuries due to Ground Aviation Systems accidents in Egyptian airports according to Central Directorate of Aircraft Accident Investigation of Ministry of Civil Aviation in 2012, 2013 and 2014

FIG.5: WORKING INJURIES DUE TO GROUND AVIATION SYSTEMS IN 2012, 2013 AND 2014

Injury type	2012	2013	2014	Total
Cure	15	6	10	31
Disability	2	1	3	6
Death	1	3	-	4
Under treatment	7	3	5	15
Total	25	13	18	56

Cost of losses due to Ground Aviation Systems accidents in Egyptian airports according to Central Directorate of Aircraft Accident Investigation of Ministry of Civil Aviation in 2012, 2013 and 2014.

FIG.6: COST OF LOSSES DUE TO GROUND AVIATION SYSTEMS ACCIDENTS IN 2012, 2013 AND 2014

	2012	2013	2014
Aircraft	1.5 million $	1.7 million $	2 million $
GSE	900,000 $	1 million $	500,000 $
Others	200,000 $	400,000 $	700,000 $
Total	2.6 million $	2.2 million $	3.2 million $

5 CONCLUSION

Ground Aviation Systems are a main part in completing aviation processes and the main cause of aviation accidents in airports. The more flight movements in airports, the more aviation accidents happen. Aviation accidents due to ground aviation systems cost a lot; direct costs and indirect costs.

It is very important to reduce the aviation accidents by improving the performance of ground aviation systems and increase efficiency, effectiveness and safety.

5 APPENDICES

APPENDIX A:

Aircraft accident statistics in Egyptian airports during 2012

	Date	Location	Aircraft type
1	9/2/2012	6 October Airport	CESSNA 185
2	12/2/2012	Cairo Airport	A300-B4
3	29/2/2012	Borg El Arab Airport	A320
4	4/3/2012	Luxor Airport	E170
5	8/3/2012	Cairo Airport	B777-300
6	11/3/2012	Cairo Airport	A320
7	24/3/2012	Cairo Airport	B777-300
8	15/4/2012	Cairo Airport	B777-300
9	5/5/2012	Borg El Arab Airport	A320

10	7/5/2012	Sharm Sheikh Airport	E170
11	12/5/2012	Borg El Arab Airport	A320
12	27/5/2012	Hurghada Airport	HEL AS350-B2
13	1/6/2012	Cairo Airport	A320
14	4/6/2012	Cairo Airport	HEL EC-132
15	17/6/2012	Cairo Airport	E-170
16	19/6/2012	Borg El Arab Airport	A320
17	2/7/2012	EL Arish Airport	CESSNA 175
18	13/7/2012	Cairo Airport	B737-800
19	13/7/2012	Aswan Airport	B737-800
20	23/7/2012	Cairo Airport	MD 83
21	27/7/2012	Cairo Airport	E170
22	10/8/2012	Cairo Airport	B737-800
23	16/8/2012	Hurghada Airport	EC135
24	23/8/2012	Cairo Airport	B777-300
25	30/8/2012	Borg El Arab Airport	A321
26	16/9/2012	Luxor Airport	B737-500
27	17/9/2012	Cairo Airport	A320
28	17/9/2012	Cairo Airport	A320
29	21/9/2012	Cairo Airport	A320
30	26/9/2012	Hurghada Airport	A320
31	2/10/2012	Cairo Airport	B777-300
32	7/10/2012	Cairo Airport	B747
33	7/10/2012	Cairo Airport	A330-200
34	20/10/2012	Borg El Arab Airport	A320
35	3/11/2012	Borg El Arab Airport	B737-400
36	24/11/2012	Cairo Airport	B777-300
37	2/12/2012	6 October Airport	C114B

10	9/5/2013	Borg El Arab Airport	E170
11	12/5/2013	EL Arish Airport	B737-800
12	18/5/2013	Cairo Airport	A320
13	19/5/2013	Hurghada Airport	A340-313
14	20/5/2013	Luxor Airport	B737-800
15	12/6/2013	6 October Airport	SD HK36TS-80
16	25/6/2013	Cairo Airport	A320
17	4/7/2013	Borg El Arab Airport	A320
18	9/7/2013	Cairo Airport	B737-800
19	10/7/2013	Taba Airport	Bell212
20	1/8/2013	Cairo Airport	A321
21	10/8/2013	Sharm Sheikh Airport	B737-800
22	6/9/2013	Cairo Airport	A321
23	11/9/2013	Cairo Airport	A320
24	30/9/2013	Aswan Airport	B777-300
25	7/10/2013	Hurghada Airport	PW6
26	20/10/2013	Luxor Airport	B737-400
27	20/10/2013	Cairo Airport	B737-800
28	26/10/2013	Cairo Airport	A320
29	3/11/2013	Sharm Sheikh Airport	B777-300
30	9/11/2013	Hurghada Airport	B747
31	15/11/2013	Cairo Airport	A330-200
32	21/11/2013	Cairo Airport	A320
33	1/12/2013	Aswan Airport	AS350B2 HEL
34	13/12/2013	6 October Airport	PW6
35	29/12/2013	Luxor Airport	B737-400

APPENDIX B:

Aircraft accident statistics in Egyptian airports during 2013

	Date	Location	Aircraft type
1	6/1/2013	Luxor Airport	LBL600
2	19/1/2013	Cairo Airport	E170
3	30/1/2013	Cairo Airport	B737-800
4	26/2/2013	Luxor Airport	Ultra Magic N-425
5	28/2/2013	Hurghada Airport	A321-231
6	5/3/2013	Cairo Airport	B737
7	15/3/2013	Aswan Airport	B737-800
8	11/4/2013	Cairo Airport	B737-800
9	25/4/2013	Cairo Airport	MD 83

APPENDIX C:

Aircraft accident statistics in Egyptian airports during 2014

	Date	Location	Aircraft type
1	3/1/2014	Cairo Airport	LBL600
2	4/1/2014	EL Arish Airport	SD HK36TS-80
3	1/2/2014	Cairo Airport	A320
4	2/2/2014	Aswan Airport	Ultra Magic N-425
5	7/2/2014	Hurghada Airport	A321-231
6	7/3/2014	Cairo Airport	B737
7	1/4/2014	Cairo Airport	B737-800
8	3/4/2014	Hurghada Airport	A320
9	13/4/2014	Cairo Airport	A340-313
10	15/4/2014	Borg El Arab Airport	B737-800

11	30/4/2014	Sharn Sheikh Airport	Cessna 172 R
12	5/5/2014	Cairo Airport	A320
13	9/5/2014	Cairo Airport	A340-313
14	28/5/2014	Cairo Airport	B737-800
15	2/6/2014	Hurghada Airport	SD HK36TS-80
16	17/6/2014	Cairo Airport	A320
17	23/6/2014	Sharm Sheikh Airport	A320
18	24/6/2014	Cairo Airport	B737-800
19	3/7/2014	Luxor Airport	Bell212
20	7/7/2014	Cairo Airport	A320
21	7/7/2014	Taba Airport	A340-313
22	16/7/2014	Cairo Airport	B737-800
23	30/7/2014	Cairo Airport	SD HK36TS-80
24	1/8/2014	Aswan Airport	A321
25	10/8/2014	Cairo Airport	A340-313
26	21/8/2014	Luxor Airport	B737-500
27	4/9/2014	Cairo Airport	B737-800
28	11/9/2014	Cairo Airport	A320
29	18/9/2014	Sharm Sheikh Airport	B737-800
30	26/9/2014	Luxor Airport	Bell212
31	30/9/2014	Cairo Airport	A321
32	14/10/2014	Cairo Airport	A340-313
33	20/10/2014	Aswan Airport	AS350B2 HEL
34	21/10/2014	Hurghada Airport	PW6
35	22/11/2014	Cairo Airport	B737-400
36	24/11/2014	Cairo Airport	A321
37	4/12/2014	Cairo Airport	Cessna 172 R
38	20/12/2014	Luxor Airport	A320
39	25/12/2014	Cairo Airport	A340-313

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