NOISE LEVELS AND MITIGATIONS AT HURGHADA AIRPORT AND IT'S SURROUNDING

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ABSTRACT

Aviation is a part of worldwide environmental problems. Airports face several environmental constraints including noise, local air quality, water quality, waste management systems.

Aircraft noise is the most significant environmental problem arising from arriving and departing of aircrafts. Therefore, airport related noise as an important issue that affects the passengers and the surrounding communities and nearby residential areas

Hurghada airport is one of the key drivers of the economic growth of Egyptian Airport Company (EAC). Over seven million passengers travelled through Hurghada airport every year. The expected increase in 2030 is twelve million. It is generally accepted that significant improvements to the environmental impacts of aircraft noise will be needed if the long-term growth of air transport is to be sustained.

The main goal of this study is the reduction of noise levels and it's mitigations at Hurghada airport and surrounding area; to manage negative impacts of noise to make the right balance with positive economic and social benefits of the airports.

Reduction of noise levels can be achieved through effective implementation of noise abatement procedures. This reduction in noise levels reduces noise footprint towards sustainable development.

Keywords: Noise levels, airport, noise abatement procedures

INTRODUCTION

Noise is a variety of sound, it means unwanted sound according to WHO regardless of its intensity or duration (Bruel and Kjaer; 2008). Sound is any pressure variation that the human ear can detect physically. There is no difference between sound and noise; the difference is one of human perception. Noise pollution is an often forgotten environmental problem that is steadily growing in developing countries (Nchemanyi; 2006)

Environmental pollution has been one of the major topics over the last decades as the earth's population increases rapidly, so protection of the environment for further generation is vital.

Environmental noise is a worldwide problem (Joseph and Alfered, 2005). The relationship between environmental noise and public health is perhaps the most significant reason why environmental noise has emerged as a major issue in environmental legislation and policy in recent years (European Communities, 2002; Berblund *et al.*, 1999; WHO, 2002).In Egypt the predominant contribution of this high burden of environmental noise arises from transportations. (Kamal, M. 2004). Noise pollution has always been a problem, but nowadays it has become a major problem. Although there is several noise sources like industry, trains, planes and cars.

Aviation is a critical component of the global economic infrastructure. If there is to be growth in aviation, however, the environmental impact of aviation must be mitigated (Clarke 2003).

Aircraft noise is an important parameter of degradation of the soundscape environment in the immediate area of airports (Konstantinos,Vogiatzis,

2012). The operation of airports results in environmental impacts associated with high levels of noise and vibration (Mato *et al.* 1999). In recent years, concern about airport noise and its impact on surrounding communities has been spurred by the continual growth in air traffic together with urban development in close proximity to many airports around the world (Arafa *et al.* 2007).

High levels of noise exposure can influence mankind productivity and social behavior in a negative way (2002/49/European community). Noise can cause both short and long-term health problems, the most important of these are annoyance (Michaud *et al.*, 2005) and sleep disturbance (Carter, 1996; Ohrstrom and Skanberg, 2004). It may also lead to poorer physical and mental condition, reduced work and learning performance, or cardiovascular effects. The World Health Organization (WHO) recommends a noise level of less than 35 dB (A) Leq. During the restorative process of sleep (Mufuruki 1997). It is also often asserted that noise reduces output and efficiency affects morale. The study area is concerned with Hurghada airport on Hurghada city. Hurghada city as a tourist Centre extends approximately between latitudes 27◦ 25_ N and longitudes 33◦ 55_ E on the Red Sea coast of Egypt. It is the administrative capital of the Red Sea Governorate (RSG) and is served by Hurghada International airport.

The airport is located about 6 km to the south of the city of Hurghada:

The airport is considered one of the famous international airports of peak capacity 12 million passengers /year. The current runway (16/34) is 4000 m long and 45 m wide which operates in two modes arrival and departure.

A new runway (13/31) with 4000 m long and 45 m wide has been constructed parallel to the old one. At the future, landing will take place on the new runway, whereas departure use the existing runway, see (Figure1).

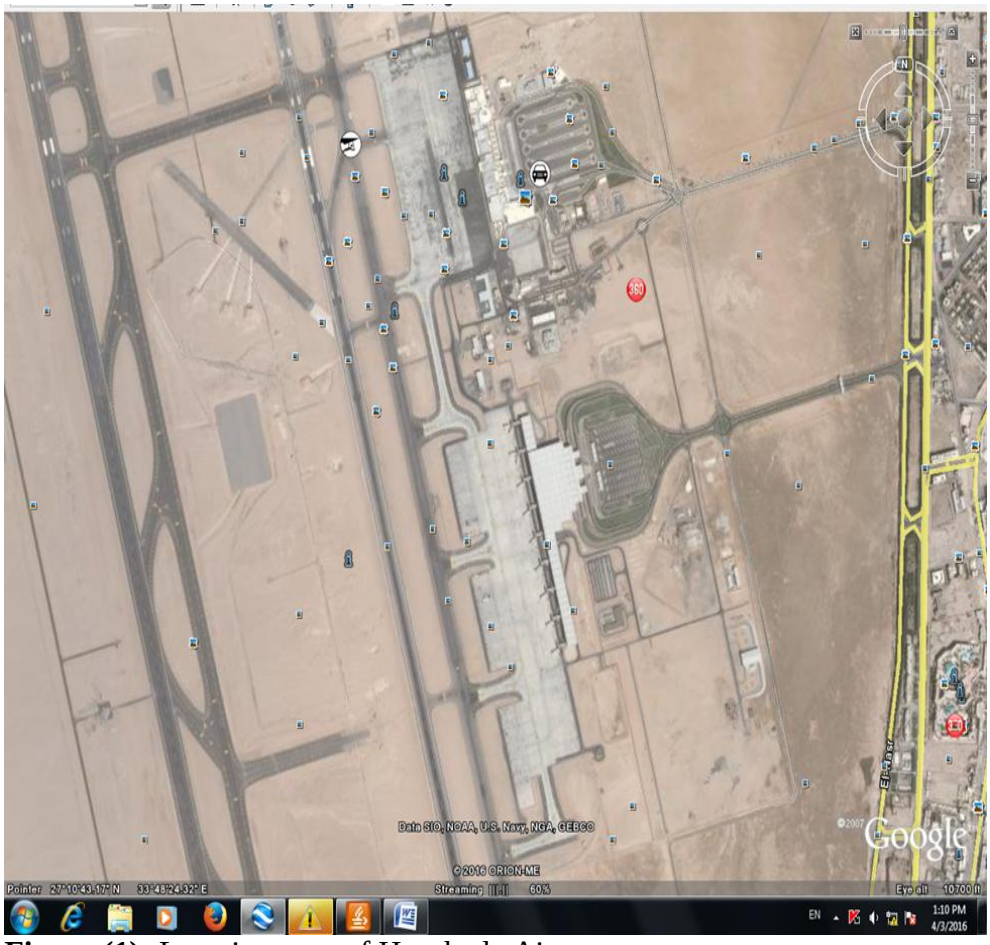

Figure (1): Location map of Hurghada Airport

AIM OF STUDY

This study aims to monitor the noise level at Hurghada international airport and assessing noise exposure levels at different locations inside as well as areas surrounding airport, and predict environmental noise impacts in order to mitigate such noise impacts arising from arrival and departure of aircraft flight operations.

MATERIAL AND METHOD

The noise measuring instrument used in the current study is Modular precision sound analyzer Bruel & Kajer Type 2250, Calibrator Type 4231, Microphone Type 4819, Frequency Weighting: A- Weighted, Frequency 1⁄3 Octave (16HZ-16 KHz).

All noise measurements taken according to ICAO standards volume1 annex16 and ISO3891 standards

To achieve the objective of this study a total of 10 locations were measured and weighted. Background noise is taken before measuring. Noise was recorded in terms of LA_{eq}, LAF_{max} and LAF_{min} and third octave analysis (spectrum) performed to identify the spectral content of noise.

Measurement Locations:

Measurement locations were chosen at potentially affected areas along flight paths of Hughada city. Six of measurement locations are carried out outside the airport while four of them are located inside the airport premises.

Table (1) presents measurement sites were selected as follows:

1. Three measurement locations at the sideline of the departure and arrival paths in order to measure the noise levels at residential areas located in the airport environs.
2. Three measurement locations selected at the further north and south of airport along the departure and arrival flight tracks; to assess noise levels at more distant sites.
3. Four measurement locations inside airport at potential sources of noise

All measurements are identified in terms of location, description and its coordinates E, N and tabulated as shown in Table.(1)

Table (1): Noise measurements locations inside and outside Hurghada airport.

	Remarks	Location	Longitude	Latitude	Description
LOC1	OUTDOOR MEASUREMENTS	Jasmine village Resort	27° 10	33°82	To the south of airport
LOC2		Medical center El-Hejaz street	27° 26	33° 79	To the north of airport
LOC3		TEZ Tour	27° 22	33° 78	Cairo road
LOC4		Airport road	27° 10	33° 82	2km south airport
LOC5		El Batros resort	27° 17	33° 80	Qura road
LOC6		Grand seas hotel	27° 09	33° 47	Qura road
LOC7	INDOOR MEASUREMENTS	In front of domestic arrival hall	27° 11	33° 47 8	inside the airport
LOC8		In front of domestic (Departure hall)	27° 11	33° 47 7	inside the airport
LOC9		In front of VIP hall	27° 11	33° 480	inside the airport
LOC10		Ground service station	27° 11	33° 48 2	inside the airport

Measurements at specified locations outside Hurghada airport:

Each table presents the maximum, minimum, the average values of sound pressure in decibels and duration during measurement period of all 10 locations.

More than one reading has been taken in each location. Each aircraft type and the airline cause the event were recorded.

The results of the measurements are presented in the following tables Nos. (2-7)

Table (2): Noise measurements, Location No.1 outside Hurghada airport.

	Event	Aircraft type	LA eq dB	LA max dB	LAF Min dB	Duration second
Location 1	No.1	A321	70.3	73.9	68.9	17
	No.2	B752	68.2	70.4	69.5	18
	No.3	E170	67.1	69.1	67.8	19
	No.4	A320	68.9	70.6	69	16
	No.4	B763	69.4	73.8	67	15

Table (3) Noise measurements, Location No.2 outside Hurghada airport.

	Event	Aircraft type	LA eq dB	LAF_{Max} dB	LAF_{Min} dB	Duration second
Location 2	No.1	E170	68.1	69	64	12
	No.2	A321	68.4	72.1	63	13
	No.3	A320	65.2	66.9	59	17
	No.4	A320	65.5	67.6	58	18
	No.5	B738	69.2	72.3	67.6	11
	No.6	A320	65.2	67.6	56	14
	No.7	A320	67.3	70.3	60	12
	No.8	A320	67.7	72.9	62	17
	No.9	T204	65.6	68	60	19
	No.10	B738	67.2	69.9	63	11

Table (4): Noise measurements, Location No. 3 outside Hurghada International airport.

Location 3	Event	Aircraft type	LA_{eq} dB	LAF_{max} dB	LAF_{Min} dB	Duration second
	No. 1	B763	71.1	75.9	70	23
	No. 2	T204	70.3	73.4	69	17

Table (5): Noise measurements, Location No.(4) outside Hurghada airport.

Location 4	Event	Aircraft type	LA_{eq} dB	LAF_{Max} dB	LAF_{Min} dB	Duration
	No.1	B738	56.4	63.4	54	16
	No.2	B743	59.7	67	54	17
	No.3	B752	53.6	58.8	53	22
	No.4	B743	57.5	67.6	56.5	19

Table (6): Noise measurements, location No.(5) Outside Hurghada airport.

Location 5	Event	Aircraft type	LA_{eq} dB	LAF_{Max} dB	LAF_{Min} dB	Duration Second
	No.1	E170	68	72	66.5	19
	No.2	B737	66.5	75	66	13
	No.3	A321	63	73.8	61	19
	No.4	A320	65	74	64	20

Table (7): Noise measurements, location No. 6 outside Hurghada airport

Location 6	Event	Aircraft type	LA_{eq} dB	LAF_{Max} dB	LAF_{Min} dB	Duration second
	No.1	B752	59.7	73	55	18
	No.2	B763	60	76	57	16
	No.3	A320	57.5	69	53	18

Measurements at specified locations inside Hurghada international airport

The results of the measurements are presented in the following tables Nos. (8-10).

Table (8): Noise measurements, location No.7 inside Hurghada International airport in front of domestic arrival hall.

Location 7	Event	Aircraft type	LA_{eq} dB	LA_{max} dB	LAF_{Min} dB	Duration second
	No.1	A320	76	80.8	74	12
	No.2	A320	77	84	76	15
	No.3	B738	75.4	82.3	75	17

Table (9): Noise measurements, location No.8 inside Hurghada International airport in front of domestic departure hall

Location 8	Event	Aircraft type	LA eq dB	LA_{max} dB	LAF_{Min} dB	Duration second
	No.1	B738	67.1	77.5	63	22
	No.2	DHC7	68.2	77.5	66	14
	No.3	B737	82	89	80	18

Table (10): Noise measurements, Location No.9 inside Hurghada International airport in front of VIP hall.

Location 9	Event	Aircraft type	LA_{eq} dB	LA_{max} dB	LAF_{Min} dB	Duration Second
	No.1	B7432	56.9	66.2	55	23
	No.2	B738	60.7	68	59	12
	No.3	A320	65.8	74	64	16

Table (11): Noise measurements, location No.10 inside Hurghada International airport at Ground Service Station on Tarmac area near the runway

Location 10	Event	Aircraft type	LA_{eq} dB	LA_{Max} dB	LAF_{Min} dB	Duration second
	No.1	B737	83	91.9	83	19
	No.2	B743	86	97	82	22
	No.3	B738	85.2	94.3	84	19

Table (12): Summary of results of all 10 locations with the profile recorded

No	Location	Description	L_{Aeq}	$L_{AF\ MAX}$	$L_{AF\ MIN}$	Aircraft profile
1	Jasmine village Resort	south of airport	70.3	73.9	68.9	Arrival
2	Medical center El-Hejaz St.	north of airport	69.2	72.3	62	Departure
3	TEZ Tour	Cairo road	71.1	75.9	70	Departure
4	Airport road	2km south airport	59.7	67	67	Arrival
5	El Batros resort	Qura road	68	72	66	Arrival
6	Grand Seas Hotel	Qura road	60	76	57	Arrival
7	In front of Domestic Arrival Hall	Inside the airport	77	84	76	Departure
8	In front of Domestic Departure Hall	Inside the airport	82	89	80	Departure
9	In front of VIP Hall	Inside the airport	60.7	68	64	Arrival
10	Ground Service Station on Tarmac Area	inside the airport	101.3	104.4	82	Departure

Measurements results:

1. Locations inside the airport, like domestic & halls, show high levels of noise because it highly affected by planes during departure and approach as their locations become near the runway.
2. Locations located to the south of the airport along with their approach the flight track are highly affected by aircraft noise (jasmine village)
3. Locations on the eastern or northern areas, vary in noise levels, are moderate where the traffic noise dominant in downtown, rather than aircraft noise.

Analysis of the results

The Noise measurement points that approach flight track:

1. Residential areas and hotels which located at south of the airport are highly affected with noise from aircrafts. They are exposed to extremely high noise levels coming when aircraft approach the runway, jasmine village, El Batros.
2. Areas located further to the south from the airport are slightly affected with noise.

The Noise measurement points at departure flight track:

1. Resorts and hotels to the east of airport are slightly affected with noise.
2. Coastal resorts on the north and northern – east are slightly affected with noise as the aircraft rise over 3000 feet above the ground through departure flight track.

Results in the light of local regulation

According to Egyptian Environmental law 9\2009, and the annexes of the executive regulation (Annex 7), as shown in the following Table (13), one can detect the following.

Table (13): The maximum permissible noise levels inside places of productive activities.

No.	Place and activity	Maximum permissible limits (dB)
1	Work place up to 8 hours shifts aiming to limit noise hazards on sense of hearing	90 dB
2	Work place where acoustic signals and good audibility are required	80 dB
3	Work rooms for follow up, measurement and adjustment of high performance operations.	65 dB
4	Work rooms for computers, typewriters or similar equipment	70 dB
5	Work rooms for activities requiring routine mental concentration	60 dB

One of the measurements in location 10; this place include workers of Ground Service Station on Tarmac Area where the noise level was 101.3 dB, noise event is high due to it released from a combination of aircrafts during take-off and landing at the same moment and also noise from equipment's and tools of station so, workers should wear an ear muff in this location. Airport authority committed to providing means for occupational health and safety and secure work environment in the workplace (suitable hearing protectors) in order to ensure the prevention of risks, in particular, noise and vibrations.

The workers exposed to relatively high noise level location must reduce exposure period to 4 hours/day. According to work law number 12 /2003.as shown in table (14),

Table (14): Noise intensity and period of exposure,

Noise Intensity Level dB (A)	95	100	105	110	115
Period of exposure / hour	4	2	1	1/2	1/4

International Regulation

1) (WHO)

The World Health Organization (WHO) recommends a noise level of less than 35 dB (A) Leq. During the restorative process of sleep (Mufuruki 1997). Long-term exposure to noise levels of about 90 dB (A) may lead to permanent hearing loss while prolonged exposure to sounds of 100dB (A) may cause serious damage to the auditory organs. A noise level of about 120 dB (A) is considered painful and may cause instantaneous loss of hearing; while more than 140 dB (A) may produce insanity.

2) ICAO regulatory framework

The International Civil Aviation Organization (ICAO) is the United Nation's body that oversees the worldwide civil aviation industry. The ICAO's regulatory framework aims to make a balance between the need to reduce aircraft noise around airports and the needs of airlines and aircraft manufacturers to grow. This is called the 'balanced approach'.

Local Regulation (Civil aviation)

There are no limits of airport Noise in Egyptian civil aviation law; however it recommends the Noise abatement operational procedures of ICAO, as other international civil aviation.

Mitigation schemes for Hurghada Airport

As can be seen, the result obtained shows that it exceeds the maximum daily critical level of sound pressure of LA_{max} = 90 dB in one location (No10) measured. The sound pressure level was higher than the maximum noise level (which is 85 dB in the daytime) allowed for sound pressure caused by air traffic.

Since 2001 the ICAO Assembly has required to adopt a "balanced approach" to aircraft noise management. All airports must comply with noise abatement procedures, ICAO 2004 annex 16, to achieve the goal of addressing the noise problem in the most cost-effective manner. The noise problem at an airport identified and then analyzed through the various measures available to reduce noise according to principal elements, namely:

•Reduction at source (quieter aircraft).

•Noise abatement operational procedures.

•Operating restrictions.

•Land-use planning and management.

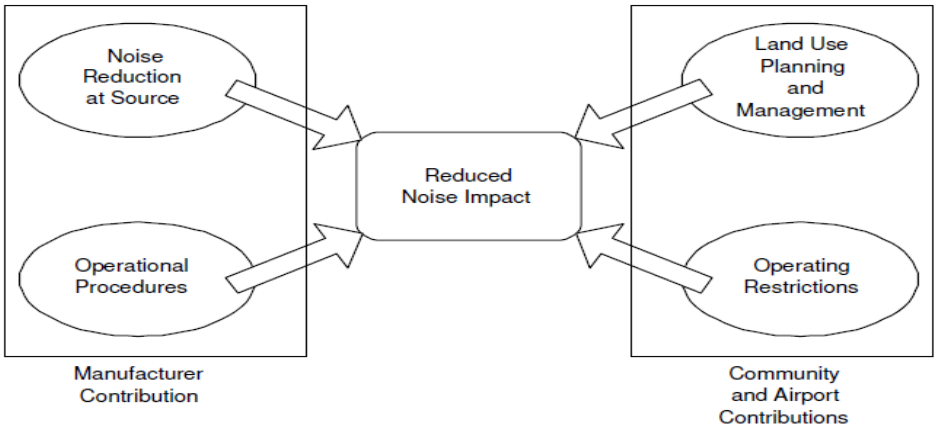

Figure (2): The Balanced Approach of International Civil Aviation Organization (ICAO), (source: Sustainable Aviation 2004)

The ICAO Balanced Approach: successfully reducing the noise impact of commercial aircraft on communities must include contributions from the manufacturers, airports, and communities. (See Fig. 2).

The ICAO Assembly has endorsed the concept of a 'Balanced Approach' that aims to address noise issues by working simultaneously on four parameters: reduce aircraft noise at the source, flight and operating procedures, operating restrictions airports, as well as land-use planning and management. While the focus of this study is firmly on second, third and fourth parameters, because with respect to the first parameter, reduction at source, there is no control on accepting old aircrafts that cause nuisances and this will depend on aircrafts types and rate of penetration of newer quieter aircrafts.

Noise abatement operational procedures

Noise abatement operational procedures can make a measurable contribution to reducing noise levels in the vicinity of airports; it can be broken down into three categories:

1. Noise abatement flight procedures
2. Spatial management
3. Ground management

Table (15): Summarizes all Noise abatement operational procedures employed to provide noise relief to communities around airports from both arriving and departing aircraft.

Noise abatement flight procedures (See Fig.3)	Spatial management (See Fig.3)	Ground management
Continuous Descent Arrival (CDA)	Noise preferred arrival and departure routes	Engine run up management
Noise Abatement Departure Procedures (NADP)	Flight track dispersion or concentration	Auxiliary power unit management (APU)
Modified approach angles, staggered, or displaced landing thresholds	Noise preferred runways	Taxi and queue management
Minimum use of reverse thrust after landing		Towing
Minimum use of reverse thrust after landing		Taxi power control (Taxi with less than all engines operating

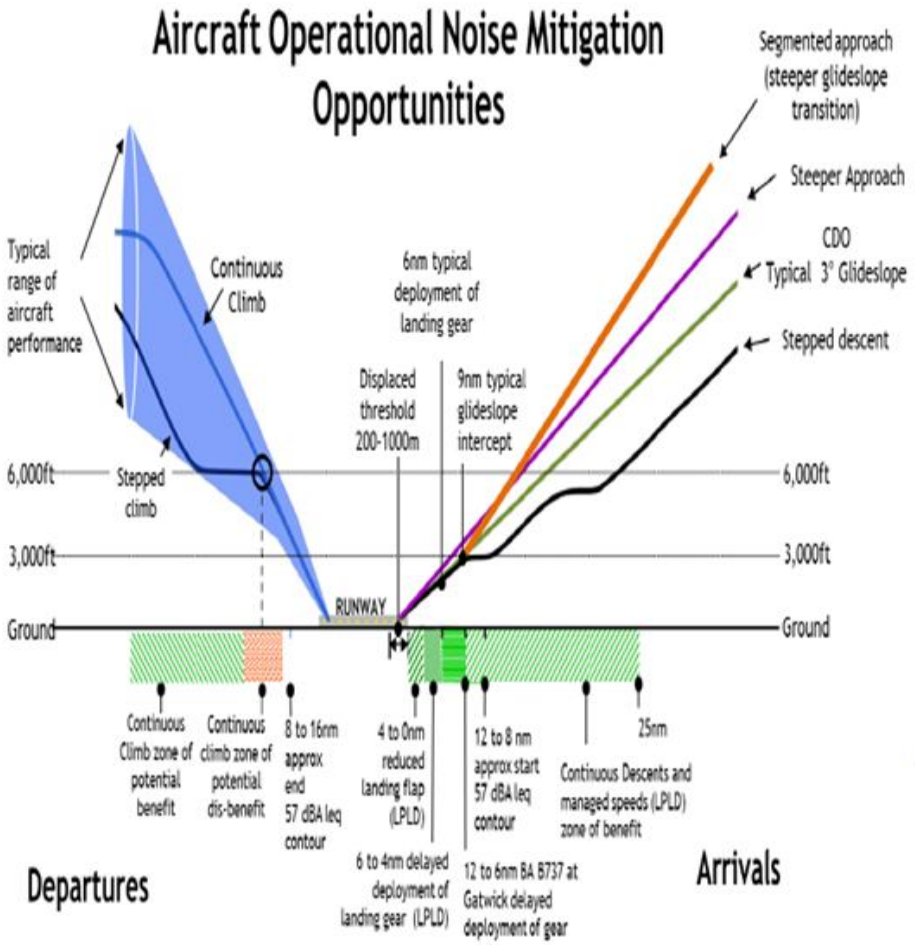

Figure (3): Shows some of Noise abatement flight procedures

source: sustainable aviation

The conventional approach:

An aircraft would be given clearance by (ATC) air traffic control with an altitude of 6000- 7000 feet to an altitude of typically 3000 feet .The aircraft would then fly for several miles before intersecting the final 3degree glide path to the runway. During this period of level flight, the pilot would need to apply additional engine power to maintain constant speed.

The continuous descent approach (CDA):

In contrast to a conventional approach when a CDA procedure is flown the aircraft higher for longer, descending continuously from the level of the bottom of the stack (or higher if possible) and avoiding any level segments of flight prior to intercepting the 3 degree glide path. A continuous descent requires significantly less engine thrust than prolonged level flight.

The benefits of CDA

1. The aircraft flying a CDA is higher above the ground for a longer period of time; the noise impact on the ground is reduced in certain areas under the approach path.
2. A CDA simply provides a noise benefit compared to the conventional approach procedure, in certain regions under the approach path. The noise benefits that a CDA offers are restricted to locations typically around 10 to 25 miles from the runway. While there is no difference between a CDA and a conventional approach, once the aircraft using the latter joins the final 3 degree glide path. Noise on the ground is reduced further because a CDA eliminates the period of level flight when additional engine thrust would have been used.

3. Depending on the locations and aircraft type, the noise benefit from a CDA compared to a conventional approach could be up to 5 dB
4. There can be significant fuel savings for the final arrival phase of flight with a CDA because less engine power is required this also means that aircraft emissions will be reduced
5. Finally, these operational procedures give pilots, air traffic controller's airport operators' guidance on techniques to minimize noise from aircraft landing at airports. Although noise abatement procedures may have quantifiable environmental benefits, implementation to all procedures may be difficult. The computer simulation of the noise level at Hurghada Airport and surrounding area is conducted using the Integrated Noise Model version 6.1(INM), The noise prediction map for year 2027 drawn to evaluate the impact of aircraft noise at Hurghada Airport and surrounding area see figure (4).

Figure (4): show the Noise prediction contour map for estimated flights For year 2027 produced by (INM) model.

Table (16): identifies colours of contour lines of prediction map.

Noise level	Colour coded
55dB	Turquoise
60dB	Blue
65dB	Green
70 dB	Dark Green
75 dB	Yellow
80 dB	Red

Whereas, areas enclosed by contour maps are colour-coded, each contour line identifies the noise level as shown in table (16).

Land use planning and management can play an essential role in noise abatement; the surrounding areas around Hurghada international airport from east and northern east, there are resorts and residential area parallel to shoreline (see figure1) However areas from the southern west and northern west are desert categorized by lack of population. (See Figure1).

Some land use mitigation measures establish airport-compatible uses of the affected properties; hence Area that needs to be used for the land use planning is the red area only in fig. (4).so, there are two choices; First using noise barriers or acoustic shielding in buildings of this area. Second; stop building structures having noise sensitive uses in this are (i.e., schools, private residences, hospitals, mosques, churches, public buildings, mall.

CONCLUSIONS

The purpose of noise monitoring is to inform the airport and aviation authority as well as local community and government about noise pollution. According to noise monitoring results and noise modeling, noise maps can be drawn.

In Hurghada international airport the environmental benefits of some operational procedures are straightforward and easy to visualize: preferential runways or flight tracks move aircraft away from more noise sensitive locales. As the Egyptian Airport Company implements a program of monitoring noise (ANOMS) Airport Noise and Operation Monitoring System, so from noise monitoring results and noise modeling noise maps can be drawn. The noise monitoring system can control that aircraft to proceed in its trajectory.

The Egyptian airport Company, measures aircraft noise at four noise monitors stations where noise events (flyovers) are recorded as dB (A). The noise monitors feed into the Airport Noise and Operations Monitoring System (ANOMS), which allow the Airport's Environment Team to monitor noise and track-keeping.

Hurghada international Airport has one Runway, which operates in two modes (Runway 16 and Runway 34); the direction of operation is dependent upon meteorological conditions. A new runway parallel to the old one currently has been constructed and completion in March 2016. Both runways could define Standard Instrument Departure Procedures and Noise Preferential Routes. There is no terrain or manmade obstacles around airports that could limit implementation of noise abatement operational procedures at airport.

The magnitude of the noise reductions depend on aircraft operator and environmental team who is responsible for adequate resources to support development, analysis, modeling, implementation of simple and effective noise abatement procedures. Effective implementation of noise abatement procedures depends upon a collaboration of knowledgeable and technically competent stakeholders, including representatives from communities and local governments around the airport. It can be expected to reduce noise between 1-5 dB at various points along the arrival flight path. For land use mitigation we recommend to stop building in area impacted by noise to protect the environment of nearby communities.

RECOMENDATIONS

Combining several operational noise procedures can together reduce noise about 2.8 to 4 dB. Further optimization and development of new operational procedures show a promise of additional benefits.

In conclusion, it should be kept in mind that significant reductions in acoustic nuisances around airports can be achieved through land use planning and management which are in need for certain regulations.

Land use planning suggested in area impacted by noise (Golf area, garden, public parks and recreation areas such as public and private golf courses.

Actual noise measurements and actual flight data should be utilized by airport operators to create noise maps in order to predict noise loads in and around airport. Making an action plan depending on the results to examine efficacy of noise mitigation based on ICAO's balanced approach.

Airport authorities review the action plan to estimate the noise loads every 4 or 5 years in accordance with air traffic growth.

REFERENCES

ICAO Standards, Annex 16 (2004): "Environmental protection" vol.1, Aircraft Noise Certification.

Affenzellern Josef and Alfred Rust (2005): "Road Traffic Noise-A topic for Today and the Future" VDA –Technical Congress 2005. Ingolstadt conference, Germany.

Arafa, M.H., (2007): "Noise Assessment and Mitigation Schemes for Hurghada Airport," Applied Acoustics 68, 1373-1385

Barbosa, W; (2001): Environmental noise pollution in residential areas of the city of Curitiba. Acta Acustica united with Acustica 87, 1–4

Bruel, A and Kjaer, S; (2008): Sound and vibration Measurements A/S Skodsborgvej DK 2850, Naerum / Denmark "Environmental noise".

Carter, N.L. (1996): 'Transportation noise, sleep, and possible after-effects' Environment International, 22, 105-116.

Clarke, J.P., 2003, "The Role of Advanced Air Traffic Management in Reducing the Impact of Aircraft Noise and Enabling Aviation Growth", Journal of Air Transport Management, 9, (3) 161–165.

Environmental Law (2009): The Egyptian Environmental Protection No4/1994 revised by Law No.9/2009.

European Commission (2002): Directive 2002/49/EC relating to the Assessment and Management of Environmental Noise. *Official Journal of the European Communities*, (189), 14.

European Directives, (2002): "The Assessment and Management of Environmental Noise", 2002/49/EC Official Journal of the European Communities, vol. I.

International Civil Aviation Organization ICAO; (2004): "Guidance on the Balanced Approach to Noise Management"; Doc 9829 Environment and Energy Noise Division

Konstantinos Vogiatzis; "An Assessment of Airport Environmental Noise Action Plans with Some Financial Aspects": The Case of Athens International "Eleftherios Venizelos" International Journal of Acoustics and Vibration, 17, 4, 181190)

Kamal.M (2004): "Impact of Noise Levels on the working Environment in Different Activities in Greater Cairo. Egypt" M.Sc. Thesis, IESR Ain Shams University.

Mato, R.R. and Mufuruki, T.S. (1999): Noise pollution associated with the operation of the Dares Salaam International Airport. Transportation Research Part D, pp. 81-89.

Michaud D S, Keith S E, McMurchy D.(2005): Noise annoyance in Canada.

Noise Health 7: 39-47

Mufuruki.T.S ; (1997): "Noise Assessment and mitigation Schemes" Air Transport and the Environment , 232.

مستويات الضوضاء وطرق الحد منها في مطار الغردقة وما حولها

[٢]

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المستخلص

الطيران هو جزء من المشاكل البيئية في جميع أنحاء العالم. تواجه المطارات العديد من المعوقات البيئية بما في ذلك الضوضاء ونوعية الهواء المحلي، ونوعية المياه وتغير المناخ ونظم إدارة النفايات.

ضوضاء الطائرات هي المشكلة البيئية الأكثر أهمية التى تنشأ من القادمين والمغادرين من الطائرات. لذلك فإن ضوضاء المطار ذات الصلة باعتبارها قضية مهمة تؤثر على الركاب والمجتمعات المحلية المحيطة بها والمناطق السكنية المجاورة.

مطار الغردقة هو أحد العوامل الرئيسية للنمو الاقتصادي للشركة المصرية للمطارات، يسافر أكثر من سبعة ملايين مسافر عبر مطار الغردقة كل عام، ومن المتوقع أن تزيد عن اثنى عشر مليون مسافر فى عام ٢٠٣٠.

ومن المسلم به عموما أن سوف تكون هناك حاجة إلى تحسينات كبيرة على الآثار البيئية لضوضاء الطائرات إذا كان النمو طويل الأجل للنقل الجوي أن يكون مستداماً.

وتهدف هذه الدراسة إلى الحد من مستويات الضوضاء و التخفيف من آثارها على مطار الغردقة والمناطق المحيطة به حتى يمكن تقليل الآثار السلبية للضوضاء لجعل التوازن الصحيح مع الفوائد الإقتصادية والإجتماعية الإيجابية التى تعود بالنفع من المطار.

وأخيراً الحد من مستويات الضوضاء يمكن أن يتحقق من خلال التنفيذ الفعال لإجراءات الحد من الضوضاء، هذا الانخفاض في مستويات الضوضاء يقلل من انبعاثات الضوضاء من أجل تحقيق التنمية المستدامة.

كلمات البحث: مستويات الضوضاء، المطار، إجراءات الحد من الضوضاء.