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FEATURES OF THE GIS FOR MONITORING OF ENVIRONMENT IN AIRPORT VICINITY

Zaporozhets O.I., Doctor of Technical Sciences, National Aviation University, Kyiv, Ukraine

ОСОБЛИВОСТІ ГІС МОНІТОРИНГУ ЧИННИКІВ ДОВКІЛЛЯ В ОКОЛИЦІ АЕРОПОРТУ

Запорожець О.І., доктор технічних наук, Національний авіаційний університет, Київ, Україна

ОСОБЕННОСТИ ГИС МОНИТОРИНГА ФАКТОРОВ ОКРУЖАЮЩЕЙ СРЕДЫ В ОКРЕСТНОСТИ АЕРОПОРТА

Запорожец А.И., доктор технических наук, Национальный авиационный университет, Киев, Украина

Introduction. Airports serve a key role in transportation of people and goods and in regional, national, and international commerce. They are where the nation's aviation system connects with other modes of transportation and where federal responsibility for managing and regulating air traffic operations intersects with the role of state and local governments that own and operate most airports. Significant growth in traffic has left many airport properties severely constrained for space. Airport managers must carefully manage competing needs for revenue-generating facilities and effectively readjust facilities for the ever-changing needs of their tenants. Geographical Information System (GIS) can be integrated with property management applications, improving accuracy and timeliness in responding to property information requests.

GIS comprises the hardware, software, and infrastructure used for the collection, management, analysis, and presentation of geospatial data.GIS is a powerful tool that facilitates linking spatial data to non-spatial information, which is quite necessary for environmental monitoring, particularly in airports and their vicinity. With its embedded relational database component, the system assists in storing, mapping and analyzing geo-referenced data in an organized structure. The database and the geographical base form the two major components of the GIS system that helps in visualizing the data in a map format. Unlike the reports generated by stand alone applications, which summarize the tabular data, these maps illustrate the geographical connections among the spatial variables and visually communicate geo-specific information to a decision maker.

The use of GIS methods for exposure modelling and monitoring has a relatively recent history. Outside inventory and monitoring, the emphasis has mainly been on inventory analysis and dispersion modelling, and a range of so-called second-generation models have been developed (eg, AERMOD, ADMS-Urban) to support air pollution management. To date, however, these models have been rather rarely used for exposure assessment purposes, partly because of their demanding data requirements, and also, no doubt, because of lack of awareness, lack of understanding or distrust by this research community.

Airports are inherently spatial. From planning to maintenance and security, airport managers need to know where events are taking place. GIS adds spatial information and 3D modelling to the airport manager's toolkit to support efficient operations and environment protection. In this way GIS server technology serves maps and other information, such as noise and local air quality monitoring results, to the public via the Internet and to track environmental compliance.

GIS is used in environmental protection (EP) applications are generally developed according to the specific requirements needed to meet the objectives of the airports, airlines and flight control organizations[1]. For example, GIS is often integrated with computer-aided dispatch systems to process or present the nearest available vehicle for an noise event and response to it. Today, technology initiatives in the field have been seen in the following:

- Interactive mapping software;
- GIS mapping capability on mobile devices (smartphones, tablets, etc.);
- Web-based communications;
- High-definition scanners;
- Data transformation software;
- Ground surveillance radar;

- Photography integration, including light detection and ranging (LIDAR);
- Communication and reporting through business intelligence software; and
- Transponders (low/high/ultrahigh frequencies) in use with automated vehicle identification and location.

Analysis of the latest investigations. The conceptual approach of GIS not only provides the capability of querying the spatial data but also, with its inbuilt analytical tools, translates the existing spatial patterns into measurable objectives. These analytical capabilities of GIS offer a dynamic dimension to 'Spatial Analysis' factor in determining the principles of behaviour or illustrating the interrelationships among spatial and non-spatial data.

GIS facilitates the integration of various field-specific applications into its interface and allows integrated ways to conduct research and develop new analytical approaches to relate their information to the terrestrial activities. These abilities (providing fully functional data processing environment) distinguish GIS from other information systems as it results in enhancing the applications with productive findings that are broadened and deepened in a geographic location.

The spatial analysis modelling process involves interpreting and exploring the interactions, associations and relationships among these data types specific to a geographic location. The exploratory process in developing the spatial model is composed of a set of procedures:

• To identify/map the various data layers and describe the attributes associated with the spatial pattern (Representation model);

• To explore/model the relationships, association or interactions between the data layers identified in representation model (Process Model).

Commercial airlines, airports and air traffic control regulators use GIS for airspace planning and routing applications as well as for facilities management applications. Areas where GIS is applied for airport management: Facilities Management; Capital Planning; Property/Lease Management; Land Acquisition; Security and Risk Assessment; Flight Path Management; Airport Layout Planning; Capacity Planning; Pavement Management; Parking Management; Courtesy Vehicle Management; Utility Maintenance; Lighting Management; Noise Monitoring and Modelling; Environmental Assessment, etc. Recent enhancements to three-dimensional GIS allow more advanced airspace modelling applications to be combined with geographic information from local communities such as parcels, land use, building heights, new construction, and modified terrain around the airport. Management of airport properties was the most popular application, but management of infrastructure, noise programs and storm water programs also received very strong support.

The quality of environment is a very important factor in projecting or representing the status of environment and health of any region. Air pollution, electro-magnetic fields (EMF), third party risk (TPR) and noise studies that analyze the quality of environment provide strategic information to the decision making process and play a significant role in the implementation of the policies that influence the environmental quality of a region around the airport in particular. Most of the environmental quality models, in their pollutant and noise levels distribution simulations, consider their physical characteristics such as wind direction, speed, temperature etc., in determining the moving sources of air pollution and noise trajectory. Integrating these models with GIS presents a geographic dimension to the environmental quality information by relating the actual pollution concentrations, noise or/and EMF levels, TPR to the human life in that location. With its numerous analyst tools, GIS can demonstrate the relationship of poor quality of the environment and occurrences of deficient human and environmental health. GIS can portray the spatial correspondence between the environmental quality and the disease (mortality) statistics in the area that is potentially impacted. In this process, GIS can explore:

• The relative spatial phenomenon of the pollutant and/or any other factor of environmental degredation with respect to the geographical distribution in terms of location, extent and distance;

• The spatial extent of the pollutant/noise/EMF/TPR distribution and its intensity at any geographical location under the impact zone;

• The socio-economic characteristics of the populations affected by these factors (pollutants/noise/EMF/TPR).

Providing access to the data is particularly beneficial for the planning, monitoring, and analysis of newly planned facilities and services in regional air navigation plans (ANP). Having this information makes it easier for planning and implementation groups to expedite projects in accordance with ICAO priorities. Examining the relationships between high factor impact across various demographic thematic layers helps in identifying hotspots that are in need of special investigation or monitoring. Data visualization, illustrating such information through a map provides an insight in a more dynamic way that helps the authorities, particularly of the airport and nearby communities, to plan their future strategies.

Formulating the task. A growth of an airport can be controlled by setting up flight safety, operational, economic and environmental limits (Fig. 1) [2]. In addition to the increasing traffic demand, new constraints on the traffic flows have been imposed and limited the capacity and efficiency of air transportation. Apart from airport and airspace capacity issues that need to be resolved to accommodate further growth, the air transport industry is also facing increasing constraints with respect to environmental pollution.

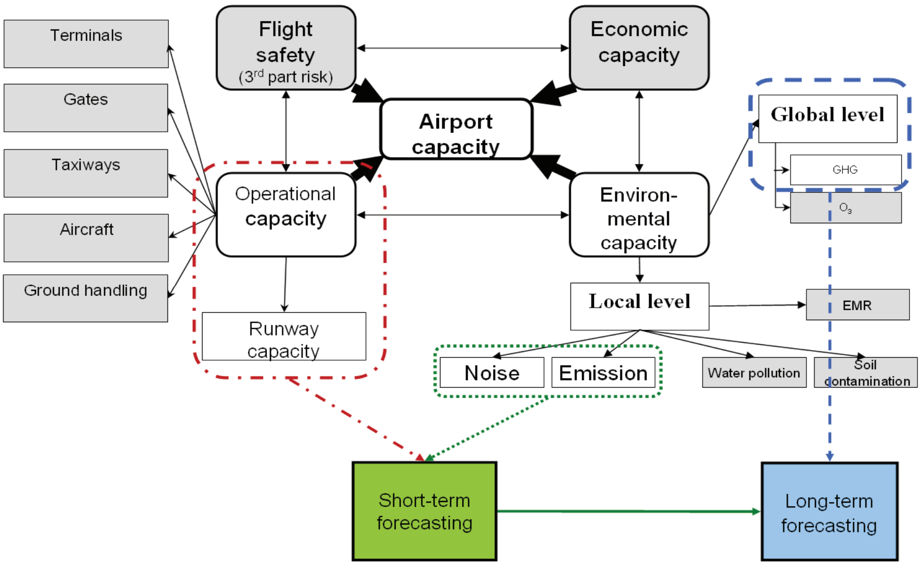

Figure 1. Airport capacity concept

In many cases,the responsibilities imposed on airport operators and EP responders continue to rise,while access to, and timeliness of critical information remains as it always has been. GIS has been traditionally used to support planning, infrastructure development and management activities, for example associated with emergency management and EP functions. In particular emergency management and environmental protection consists of prevention, preparation, response, mitigation, and recovery and at airports it usually involves different agencies.

Main purpose of GIS "Airport-EP" is to protect public health, safety, and welfare by ensuring the orderly expansion of airports and the adoption of land use measures that minimize the public's exposure to excessive noise, air pollution, EMF and safety hazards within areas around public airports to the extent that these areas are not already devoted to incompatible uses [1,2]. For this purpose complex tool **ALFA** – Airport Local Factors Assessment, including PolEmiCa (LAQ), IsoBella (Noise), EMISource (EMF) and 3PRisk (Third Party Risk), was designed to calculate any possible operational scenario in airport under consideration. Specific module **ModIST**quantifies the technical and economic interactions between mitigation measures for the considered factors and fuel burn (plus greenhouse gases – GHG, if necessary). It assesses the simultaneous multi-factor impacts reductions on local environment as well as for selected metrics of GHG (e.g., the global warming potentials) with further economical evaluations. In addition, **ModIST**includes an optimization approach that allows the search for least-cost combination of mitigation measures for all the environmental factors and FB/GHG that meet user-specified constraints (policy targets) for each possible of the environmental endpoints. The optimisation capability of **ModIST** is appliedin **MaxEnt** andenables the development of multi-factor and multi-effect impact control strategies. **MaxEnt** tool is currently under development in NAU for LAQ factors and it was validatedfor operational scenarios at the busiest Ukraine's airports with and shown increase of noise airport capacity up to 10% and 15% for day and night time accordingly; and the implementation of NAPs - 20-25%. Thereby, **ModIST**can identify mitigation strategies that achieve related targets simultaneously at least cost.

A combination of air pollution and noise measurements and stochastic for pollution (and TPR) and deterministic for noise (and EMF) modelling procedures is usually used to assess long term average exposure to traffic related environmental factors and described in detail elsewhere. GIS data on population density and traffic intensity specified for certain buffer zones were used in regression models to predict annual average air pollution concentrations and noise levels at the monitoring sites. As a rule the regression models explain 56–85% of the variability of the annual average concentrations depending on study area and specific pollutants.

Main tasks of Environmental Analysis and Management are the following:

– Management of Storm Water or Storm Water Pollution Prevention Plans;
– Noise, EMF, TPR and Local Air Quality (LAQ) Contour Calculation;
– Analysis of Changes in Noise, EMF, TPR and LAQ Contours;
– Management of Complaints to Noise and LAQ;
– Noise, EMF, TPR and LAQ Monitoring Programs;
– Management of Noise, EMF, TPR and LAQ mitigation programs, etc.

GIS "Airport-EP" must provide:

– To promote compatibility between the airport and surrounding uses;
– To establish land use measures, restrictions and standards to be adopted by local jurisdictions;
– To "rely" upon the guidance provided in the ICAO Airport Land Use Planning Manual;
– To establish the planning boundary (i.e., airport influence area) only after hearing and consultation with the involved agencies (Ministry of Health Protection, Ministry of Environment Protection, State Emergency Service of Ukraine, etc.);
– Be based upon an adopted Airport Master Plan (AMP) or Airport Layout Plan (ALP);
– To have a time horizon of at least 20 years.

"Providing this information online greatly facilitates updating and accessing the latest information for ICAO regional offices and other users," says Gilbert Lasnier, GIS services manager, ICAO.

Main results.GIS organizes geographic data so that a person reading a map can select data necessary for a specific project or task. A thematic map has a table of contents that allows the reader to add layers of information to a basemap of real-world locations. For EP purpose it is mostly important to organize the data for Airport Influence Area (AIA, Tab. 1), which usually encompasses the geographic extent of, at least, si types of compatibility concerns:

– **Overflight**—Locations where aircraft overflights can be intrusive and annoying to many people;
– **Airspace Protection**—Places where height and certain other land use characteristics, particularly uses that attract birds, need to be restricted in order to protect the airspace required for operation of aircraft to and from the airport;
– **Noise**—Locations exposed to potentially disruptive levels of aircraft noise;
– **LAQ**—Locations exposed to potentially disruptive concentrations of air pollution;
– **EMF**—Locations exposed to potentially disruptive levels of electro-magnetic fields;
– **Safety**—Areas where the risk of an aircraft accident poses heightened safety concerns for people and property on the ground – their individual risks (TPR) to be damaged.

Main data for impact factors inside and outside the airports are the results of calculation modeling with usage of calculation tools designe for these purposes (Tab. 2). Their main performances are described as following.

PolEmiCa

PolEmiCa is a combined emissions/dispersion model for assessing pollution at civilian airports and heliports due to the methods [3,4,5]. This model produces an emission inventory of airport sources and calculates concentrations produced by these sources at specified receptors. The system stores emission factors for fixed sources such as fuel storage tanks and incinerators and also for mobile sources such as automobiles or aircraft. PolEmiCa incorporates an emissions model to calculate an emission inventory for each airport source and a dispersion model to calculate pollutant concentrations produced by these sources at specified receptors. PolEmiCa is appropriate for the following applications:

– cumulative effect of changes in aircraft operations, point source and mobile source emissions at airports;
– simple terrain;
– transport distances less than 30 kilometres; and
– 20-minutes and 1-hour to annual averaging times.

Main purpose of the PolEmiCa is to calculate the inventory and dispersion parameters of the aircraft engine emission during the landing-takeoff cycle of the aircraft in airport area. Emissions Inventory for any airport is calculated by PolEmiCa for the following emission sources: aircraft during LTO cycle (Tab. 3); Start-up procedures; ground support equipment (GSE); aircraft and ground power units

(APU/GPU); Power plants; Fuel farms. Fuel flow and EI are used for relative thrust (percentage of rated thrust) of the engine at character power settings due to ICAO LTO definition.

Table 1 Their scopes of the Airport Influence Area

	Concern	Measurement	Scope	Objective
Overflight Annoyance	Annoyance	Frequency Of Overflight And Single-Event Noise Levels	Primary Traffic Patterns	Increase Buyer/Renter Awareness Of Airport Proximity
Noise Impacts	Disruption of human activities	Noise level at points and contours	Varies by character of environs: – 55 db $L_{\text{Aeq night}}$: rural areas – 60 db $L_{\text{Aeq night}}$: suburban areas – 65 db $L_{\text{Aeq night}}$: urban areas	Avoid new noise-sensitive uses in noise-impacted areas
LAQ	Disruption of human activities	Concentrations of air pollution at points and contours	Under the standard limits out the sanitary zone	Avoid human activities inside the sanitary zone
EMF	Disruption of human activities	EMF level at points and contours	Under the standard limits out the sanitary zone	Avoid human activities inside the sanitary zone
Safety	Risk to people and property	Historical nationwide aircraft accident location data and individual risk at specific points and/or risk contours (10^{-4}, 10^{-5}, 10^{-6})	Greatest near runway ends; extends out to about 3-4 km for risk 10^{-4}, usually prohibited for life activities	Limit number of people and risk-sensitive uses in risky areas
Airspace Protection	Hazards to flight physical, visual, electronic	Airspace surfaces and other faa-defined criteria	Mostly within 5-6 km; farther along instrument approach routes	Avoid new hazards

Aircraft engine EI for CO, HC and NO_x are defined from ICAO emission databank. EI for SO_x is equal to 0,005 in accordance with [3]. EI for PM is defined for appropriate values of SN by simple algorithm from ICAO Doc 9889 [5]. The emissions for the single LTO cycle (single flight case – aircraft at departure or at arrival) are then a summa of the individual stages of the cycle. Start-up emissions calculation for the starting sequence there is only HC emissions required for consideration (article 6.53 in Doc 9889 [5]). The results of the aircraft emission inventory are listed in the Tab. 4 below for the ICAO case study [6].

GPU are treated separately from GSE in order to account for its correlation with APU operation (during APU operation GPU is not required and vice versa). APU and GPU operation times were given together with the airport specification. APU and GPU emissions inventory are done in PolEmiCa for CO, HC and NOx for six character groups of the aircraft in accordance with ICAO Doc 9889 [5].

Computation for stationary sources is executed in accordance with [7] for the power plant emissions and [8] for Fuel Farm emissions. Road Vehicle Traffic was realized in PolEmiCa in accordance with National rules [9]. Generally, vehicles are considered that are either travelling on the road (landside or on airside service roads), or are either stationary in the parking lot, or the terminal curbside area. For reasons of simplification and without reducing the capabilities of the models, only landside roads and parking lots were modelled; airside service roads and curbside traffic are not modelled. The following assumption have been defined: Assume that each roadway has the same number of annual movements for each direction.Total inventory results for additional sources are shown in Tab. 5 below. PolEmiCa tool demonstrated good accordance of emission inventory for all emission sources with other LAQ models (tools), which were exeminated at CAEP/8 and CAEP/9 [10]. PolEmiCa calculates the concentration fields in airport area taking into account intensity of flights of airplanes of different types, a loading factor of different taxiways and runways, and there are a lot of other operational circumstances. Basic expression for definition of maximum instantaneous value of concentration in grid point is a solution of turbulent diffusion equation for moving point source with preliminary dilution of contaminant by a jet (or wing vortices) and with jet rise on buoyancy height. Usual practice for the FSU countries that the air pollution must be calculated, first of all, for the stationary sources using the methods of OND-86 and just these data must be taken into account in procedures of zoning around the polluters, in that number around the airports. For this reason the stationary sources in PolEmiCa are calculated by algorithm of the OND-86. For the purposes of the MDG evaluation the 20-minutes averaging data (results of OND-86) transformed to 1-hour averaging data. PolEmiCa dispersion results for stationary and moving sources are shown in Fig. 2. Maximum concentrations of the NOx were calculated at locations of stands and of runway end, where dominant part of the departures are performed in CAEPort scenario.

Table 2 Calculation tools for the factor in module ALFA

Factor	Tool	Description	Input	Output	Source code language
LAQ	PolEmica	Emission inventory calculator (both for certification LTO or real LTO, defined by performance model); dispersion calculation (Euler approach for diffusion modelling) for airport-related pollutant sources	Aircraft fleet/ flight schedule; airport and flight routes layout; non- aircraft sources; meteorology; topography	Emissions inventory results; concentration fields: maximum instantaneous concentrations, short time (20 min) and long time(daily/24 h) means, for each pollutant	Fortran
Noise	IsoBella	Noise level indices at specific points and/or noise contours calculation for airport flight scenarios	Airport and flight routes layout; aircraft flight schedule; ANP database	Noise level indices at specific points and/or noise contours	Fortran
EMF	EMISource	EMF intension at specific points and/or its contours calculation for airport layout	Airport layout with navigation facilities; flight navigation facilities database	EMF intension at specific points and/or its contours	Fortran
Safety	3PRisk	Individual risk at specific points and/or risk contours (10^{-4}, 10^{-5}, 10^{-6}) calculation for airport flight scenarios	Airport and flight routes layout; aircraft flight schedule; accident rates data for groups/types of aircraft	Individual risk at specific points and/or risk contours (10^{-4}, 10^{-5}, 10^{-6})	Fortran

Table 3 Time-in-mode and power settings due to ICAO LTO definition

Operating phase	Time-in-mode (minutes)	Enginet thrust setting (percentage of rated thrust)
Approach	4.0	30
Taxi and ground idle (in)	7.0	7
Taxi and ground idle (out)	19.0	7
Take-off	0.7	100
Climb	2.2	85

Table 4 Aircraft Emission Inventory Results **PolEmiCa (LTO = calculated Cycle ICAO)**

Matter	**Startup**	**Take Off**	**Climb Out**	**Approach**	**Taxi In**	**Taxi Out**	**Total**
CO	0	4312.28	3973.13	17306.70	68080.37	135094.50	**228767.0**
HC	9473.8	428.94	298.17	1483.88	14612.35	24963.62	**41786.96**
NOx	0	149876.06	94733.97	50205.95	13242.71	25685.51	**333744.2**
SOx	0	27084.03	22230.21	26078.33	13176.07	26440.19	**115008.8**
PM10	0	367,75	722,22	435,08	269,18	731,59	**2525.83**
Fuel	0	5416805.50	4446042.50	5215666.50	2635217.00	5287988.50	**23001720**

Table 5 Summary of Airport Emission Source Groups

Matter	Aircraft	Gate Sources	Roadways and Parking	Stationary Sources	Grand Total
CO	228767.0	20634.7	55911.5	5846	311159.2
HC	41787	7539.1	24555.6	491.4	74373.1
NOx	333744.2	39926.8	12088.7	8012.9	393772.6
SOx	115008.8	0	747.3	8255.5	124011.6
PM10	2525.83	2379.1	25.6	68.3	4998.8
PM2.5	-	0	0	1377.4	1377.4
Fuel	23001720	846243.5	1758710.9	N/A	25606674,4

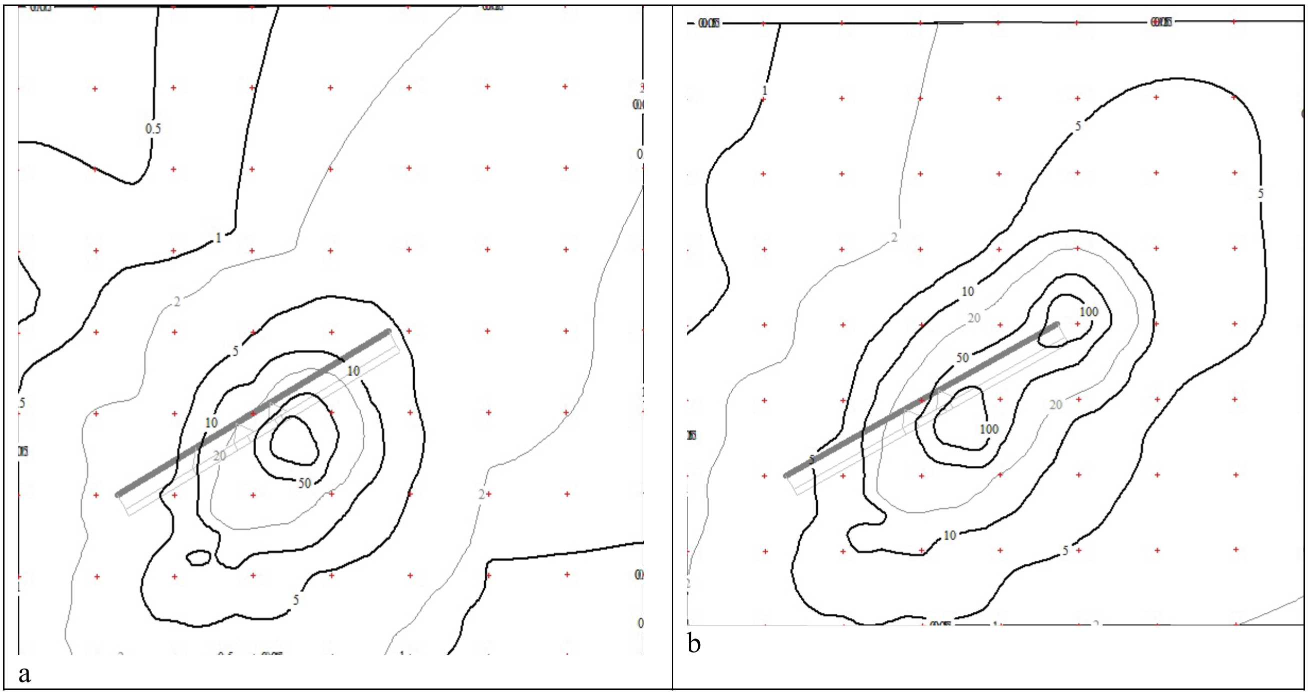

Figure 2. Dispersion results for moving and stationary sources: a- Power Plant+Stands;
b-Plant+Stands+Taxi+TO

IsoBella

IsoBella model has been designed in NAU for calculation of noise levels at specific points and/or noise contours (few types of level indices are calculated) for airport flight scenarios under consideration [1,11]. The elements of the noise calculation process (or "noise modelling system") are illustrated in Fig. 3. The *noisemodel* operates on *input data* describing the scenario - the airport and its air traffic - to produce an output in the form of sound levels at discrete points (usually for a calculation grid) of specified *noise metrics*. These values are the inputs to a *post-processor* which performs further analysis such as contour generation.

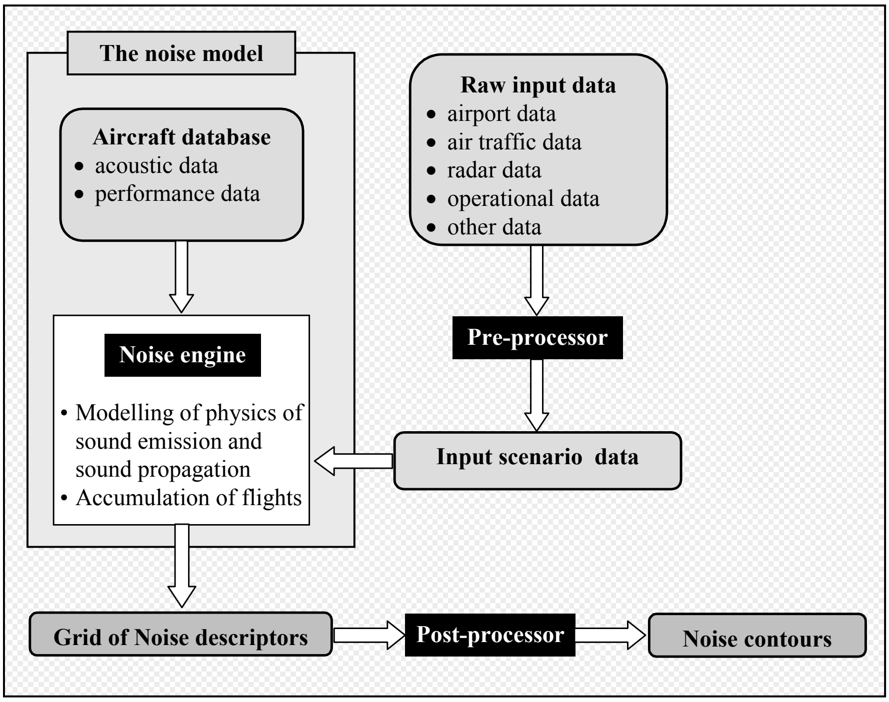

Figure 3. Elements of an aircraft noise modelling system [11]

The input data which are scenario-specific define the airport geometry (i.e. description of runways and ground tracks) and the air traffic using the airport (i.e. the number of movements of particular aircraft or aircraft categories on the particular ground tracks during different time periods). They are generated from the raw scenario information by a *pre-processing system*. This pre-processing is needed since the raw information usually does not conform to the input requirements of the noise model. This pre-processing is one of the most demanding tasks in the modelling process.

The noise model is usually consists of two components, the *noise engine* and an *aircraft database*. Traffic is broken down into aircraft types or categories with different noise and performance characteristics which have to be stored in the aircraft database. The noise engine is the core processor that models the physical processes of sound emission and propagation.

The Aircraft Noise and Performance (ANP) database includes 10 data tables. The contents of the tables are fully described in ECAC Doc. 29 3rd Edition, Volume 2, Appendix G. All of them are available in CSV format as it is prescribed in TEAM_play project for Local Airport Modelling. Currently the IsoBella is almost adapted with ANP database, supervised by Eurocontrol at www.aircraftnoisemodel.org(version 1.0 currently is available). ANP database of version 2.0 is prepared for distribution, it includes bigger list of aircraft types and improved data for engine thrust coefficients. Analyzing trends including the 2006 and 2026 scenarios for airport under consideration the model may predict that the 65dB(A) contour will double its area (consistent with the doubling of the number of movements), Fig. 4.

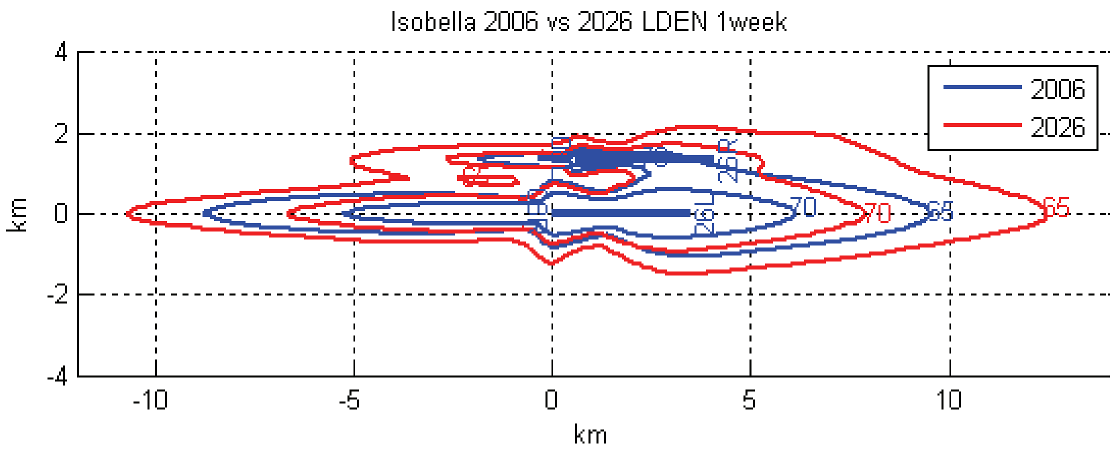

Figure 4. Contours for aircraft noise outside the airport for 2006 and 2026 flight scenarios

3PRisk

For the population living in the vicinity of an airport the involuntary exposure to the risk of aircraft accidents exists and requires for its control. A method to assess third party risk around airports has been developed and recommended by CAEP for usage in grounding of Public Safety Zones around specific runways or airports as a whole [12]. A policy for Public Safety Zones (PSZ) is under development (in UK, The Netherlands, Germany, USA, Ukraine) to replace land use restrictions that have been in place for a number of years [13].

Methods for estimating crash risk contours could be used to define a better shape for the PSZs than at present, as the PSZ could then be the area inside a particular crash risk contour representing the desired proportion of crashes. This would enable the PZ area to be defined more 'efficiently' than at present, as it would then correspond to the minimum area needed to contain the required proportion of crashes. The flowchart of the Third Party Risk calculation is shown in Fig. 5. The IR-contours presented in theTEAM_Play study represent the risk levels at 10^{-4}, 10^{-5}, 10^{-6} and 10^{-7} per year, like they are used elsewhere for TPR analysis and PSZ establishment [14,15].The Fig. 6 and Tab. 6 (2026, 2009 and 2006) provide the result of the calculations with 3PRisk model. A 2009 scenario was added also because of quite small values of TPR in 2006 for comparing with 2026 scenario.

Table 6

Contour areas for 2006 - 2026

IR	Area, m^2					
	2026		2009		2006	
	RW 08R26L	RW 08L26R	RW 08R26L	RW 08L26R	RW 08R26L	RW 08L26R
1E-7	2.5791E7	6.0197E6	2.3438E7	7.8342E6	3.6885E6	0
1E-6	3.1349E6	711280	62.823E6	963760	313400	0
1E-5	224800	35376	211120	45196	12426	0
1E-4	12038	2318.4	10399	0	0	0

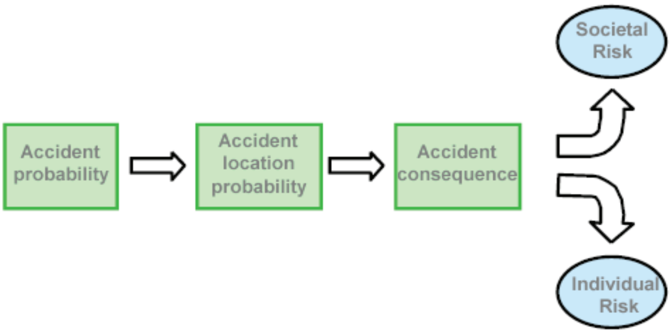

Figure 5. General view flowchart for the Third Party Risk calculation

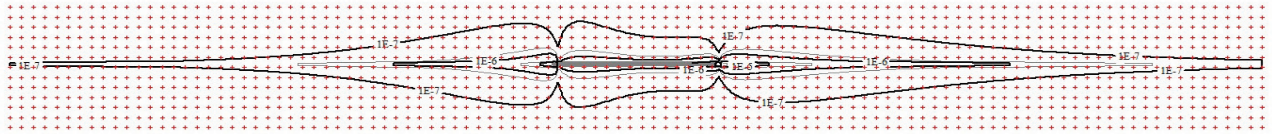

Figure 6. IR contours for 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7} from 3PRisk for 2026 scenario

It can be concluded that for the 2026 scenario the 3PRisk contours are very similar with 2009 scenario and much bigger than the for 2006 contours. It should be noted that the contour areas are relatively small and any difference will thus be “exaggerated” when considering them via %.

Conclusion. All the models model are still under the development, PoleEmiCa is following currently in two important directions: improving of jet/wake transportation modelling by CFD codes and verification of the modelling results with measurement’s data in various airports of the world, which were done with various techniques. The optimisation can be used to search for cost-minimal balances of controls of all the factors under consideration over the various scenarios in aviation sector that simultaneously achieve user-specified targets for human health impacts, ecosystems protection, etc. Thus in addressing the problem of decision making process in possible airport scenariosModIST allows to assess ability of effective using operational procedures,to forecast schedule and aircraft fleet for installed capacity, and to rank environmental problems in the airport vicinity.

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РЕФЕРАТ

Запорожець О.І. Особливості ГІС моніторингу чинників довкілля в околиці аеропорту / О.І.Запорожець // Вісник Національного транспортного університету. Науково-технічний збірник: в 2 ч. Ч. 1: Серія «Технічні науки». – К. : НТУ, 2014. – Вип. 30.

В статті виконано узагальнення та порівнянняная в них відомостей щодо ГІС моніторингу чинників довкілля в околиці аеропорту.

Об'єкт дослідження – процес моніторингу чинників довкілля в околиці аеропорту.

Мета роботи – визначення, порівняння і обґрунтування перспектив моніторингу чинників впливу на довкіллявоколиціаеропорту, оснащеного ГІС та модулями обчислення цих чинників.

Метод дослідження – аналіз, узагальнення та порівняння наявних відомостей про чинників впливу на довкіллявоколиціаеропорту.

Використання методів ГІС для моделювання моніторингу довкілля має відносно недавню історію. Акцент в основному був на інвентаризаційному аналізі і моделюванні розсіювання, також були розроблені ряд так званих моделей другого покоління (наприклад, PolEmiCa, Isobella, 3PRisk) для підтримки управління забрудненням повітря, шумом, безпекою. На сьогоднішній день ці моделі досить ефективно використовуються в цілях оцінки впливу на ГІС-платформах, частково через їх високу вимогу стосовно даних, особливо просторових.

Результати статті можуть бути впроваджені в процесі експлуатації авіатранспортних засобів в умовах інтелектуальних транспортних систем.

КЛЮЧОВІ СЛОВА: АЕРОПОРТИ, МОНІТОРИНГ, ШУМ, БЕЗПЕКА, МІСЦЕВА ЯКІСТЬ ПОВІТРЯ, ЕЛЕКТРОМАГНІТНІ ПОЛЯ

ABSTRACT

Zaporozhets O.I. Aeatures of the GIS for monitoring of environment in airport vicinity. Visnyk National Transport University. Scientific and Technical Collection: In Part 2. Part 1: Series «Technical sciences». – Kyiv: National Transport University, 2014. – Issue 30.

In the paper the synthesis and comparison of the available information on GIS monitoring of environmental factors in the vicinity of the airportis presented.

Object of study - the process of monitoring of environmental factors around the airport.

Purpose - to identify, compare and study the prospects for monitoring of the environmental impact factors in the vicinity of the airport, equipped with GIS and calculation modules of these factors.

Research methods - analysis and comparison of available information on the factors impacting the environment in the vicinity of the airport.

The use of GIS methods for exposure modelling and monitoring has a relatively recent history. Outside inventory and monitoring, the emphasis has mainly been on inventory analysis and dispersion modelling, and a range of so-called second-generation models have been developed (eg, PolEmiCa,

IsoBella, 3PRisk) to support air pollution management. To date, however, these models have been rather rarely used for exposure assessment purposes, partly because of their demanding data requirements, and also, no doubt, because of lack of awareness, lack of understanding or distrust by this research community.

The results can be incorporated into the operation of aviation vehicles in intelligent transport systems.

KEYWORDS: AIRPORTS, MONITORING, NOISE, SAFETY, LOCAL AIR QUALITY, ELECTRO-MAGNETIC FIELDS

РЕФЕРАТ

Запорожец А.И. Особенности ГИС мониторинга факторов окружающей среды в окрестности аэропорта / А.И. Запорожец // Вестник Национального транспортного университета. Научно-технический сборник: в 2 ч. Ч. 1: Серия «Технические науки». – К. : НТУ, 2014. – Вып. 30.

В статье выполнено обобщение и сравнение имеющихся сведений по ГИС мониторинга факторов окружающей среды в окрестности аэропорта.

Объект исследования - процесс мониторинга факторов окружающей среды в окрестности аэропорта.

Цель работы – определение, сравнение и обоснование перспектив мониторинга факторов воздействия на окружающую среду в окрестности аэропорта, оснащенного ГИС и модулями вычисления этих факторов.

Метод исследования – анализ, обобщение и сравнение имеющихся сведений о факторах влияния на окружающую среду в окрестности аэропорта.

Использование методов ГИС для моделирования мониторинга окружающей среды имеет относительно недавнюю историю. Акцент в основном был на инвентаризационной анализе и моделировании рассеяния, также был разработан ряд так называемых моделей второго поколения (например, PolEmiCa, Isobella, 3PRisk) для поддержки управления загрязнением воздуха, шумом, безопасностью. На сегодняшний день эти модели достаточно эффективно используются в целях оценки воздействия на ГИС – платформах, частично из-за их высокой требование относительно данных, особенно пространственных.

Результаты статьи могут быть внедрены в процессе эксплуатации воздушных средств в условиях интеллектуальных транспортных систем.

КЛЮЧЕВЫЕ СЛОВА: АЭРОПОРТЫ, МОНИТОРИНГ, ШУМ, БЕЗОПАСНОСТЬ, МЕСТНОЕ КАЧЕСТВО ВОЗДУХА, ЭЛЕКТРОМАГНИТНЫЕ ПОЛЯ

АВТОР:

Запорожець Олександр Іванович, доктор технічних наук, Національний авіаційний університет, завідувач кафедри безпеки життєдіяльності, e-mail: zap@nau.edu.ua, тел. +38044-497-33-54, Україна, 03058, м. Київ, просп. Космонавта Комарова, 1.

AUTHOR:

Zaporozhets Oleksandr Ivanovich, Doctor of Technical Sciences, National Aviation University, Head of the Chair of Safety of Life Activities,e-mail: zap@nau.edu.ua, тел. +38044-497-33-54, Ukraine, 03058, Kyiv, ave. KosmonavtaKomarova, 1.

АВТОР:

Запорожец А.И., доктор технических наук, Национальный авиационный университет, Киев, Украина, заведующий кафедрой безопасности жизнедеятельности, e-mail: zap@nau.edu.ua, тел. +38044-497-33-54, Украина, 61002, г. Киев, просп. Космонавта Комарова, 1.

РЕЦЕНЗЕНТИ:

Бойченко С.В., доктор технічних наук, професор, Національний Авіаційний Університет, завідувач кафедри екології, Київ, Україна.

Матейчик В.П., доктор технічних наук, професор, Національний Транспортний Університет, завідувач кафедри екології та безпеки життєдіяльності, Київ, Україна.

REVIEWERS:

Boichenko S.V., Doctor of Technical Sciences, Professor, National Aviation University, Head of the Department of Ecology, Kyiv, Ukraine.

Mateichyk V.P, Doctor of Technical Sciences, Professor, National Transport University, Head of Department of Ecology and Human Safety, Kyiv, Ukraine.