UDC 378.14:658:339.5(076.5)

Tetiana Kuznetsova
PhD (Economics), Associate Professor,
National Aviation University of Ukraine, Kyiv, Ukraine
1 Komarov Ave, Kyiv, 03058, Ukraine
kuznetsova_nau@ukr.net

3D-MODELLING IN ANGSTROM-MANAGEMENT TECHNOLOGY OF AIR ENTERPRISES

Abstract. In the aviation industry, the problem of managerial decision-making completely eliminating aircraft crashes and save human lives is particularly acute issue. Consequently, the author introduced new economic concepts and determined the role of 3D-modelling in angstrom-management technology of air enterprises from their point of view. Successful managers are trying to «program» as many as possible management decisions to improve management effectiveness. The author made 3D-modeling of decision-making in airspace issues, which can be regarded as a small-scale version of the simulation in Flexible Time Scale (FTS) using angstrom-management technology. The study defined means of mathematical modelling of managerial decision-making in air industry problems, consisting of software modules that are used to meet the needs of airspace designers. Modelling tools typically do not use curved segments. The exact description of the arrival and departure routes defined by curved segments could be determined using approximated linear model segments. The same method is proposed to use for describing standby areas. The conceptual model of information system by angstrom-management technology of air enterprises was developed and the formula of three-factor forecasting model of angstrom-management impact on air enterprises' decision-making effectiveness was derived.
The conclusions indicated that angstrom-technological model is a convenient tool of air enterprise's manager and powerful analytical tool in general. Through their usage one can not only store and integrate data, but also reflect the process of objects' operation on 3D-models.
Keywords: modelling; technology; enterprise; angstrom-management.
JEL Classification: A11, C52, L86, L93, M12, R15

Т. В. Кузнєцова
кандидат економічних наук, доцент кафедри менеджменту зовнішньоекономічної діяльності підприємств,
Національний авіаційний університет, Київ, Україна
3D-МОДЕЛЮВАННЯ В ТЕХНОЛОГІЇ АНГСТРЕММЕНЕДЖМЕНТУ АВІАПІДПРИЄМСТВ
Анотація. У статті введено нові економічні поняття (ангстремменеджмент, ангстремекономіка, ангстремтехнології), зроблено авторську класифікацію видів економіки. За технологією ангстремменеджменту автором проведено 3D-моделювання прийняття управлінських рішень у разі виникнення проблем повітряного простору, яке можна розглядати як немасштабну версію моделювання у прискореному масштабі часу (FTS). Автором розроблено концептуальну модель інформаційної системи за технологією ангстремменеджменту авіапідприємств та виведено формулу трифакторної прогнозної моделі впливу ангстремменеджменту на ефективність прийняття управлінських рішень авіапідприємств.
Ключові слова: моделювання, технологія, підприємство, ангстремменеджмент.

Т. В. Кузнецова
кандидат экономических наук, доцент кафедры менеджмента внешнеэкономической деятельности предприятий,
Национальный авиационный университет, Киев, Украина
3D-МОДЕЛИРОВАНИЕ В ТЕХНОЛОГИИ АНГСТРЕММЕНЕДЖМЕНТА АВИАПРЕДПРИЯТИЙ
Аннотация. В статье введены новые экономические понятия (ангстремменеджмент, ангстремэкономика, ангстремтехнологии), сделана авторская классификация видов экономики. С использованием технологии ангстремменеджмента автором проведено 3D-моделирование принятия управленческих решений при возникновении проблем воздушного пространства, которое можно рассматривать как немасштабную версию моделирования в ускоренном масштабе времени (FTS). Автором разработана концептуальная модель информационной системы по технологии ангстремменеджмента авиапредприятий и выведена формула трехфакторной прогнозной модели влияния ангстремменеджмента на эффективность принятия управленческих решений авиапредприятий.
Ключевые слова: моделирование, технология, предприятие, ангстремменеджмент.

Introduction. Successful managers are trying to «program» as many as possible management decisions to improve the effectiveness of its management. In aviation industry the issue of making managerial decisions completely eliminating air crashes and saving lives is extremely acute. This is why the author has introduced new economic concepts and from their point the role of 3D-modeling in angstrom-management technology of airlines has been determined.

Brief Literature Review. At present, the extent of the national problem development is absent completely. In foreign countries and Russia, there are only 6 scientists (K. Arrow, G. Kleiner, B. Konoplev, G. Baharev, A. Inshakov and T. Liubimova) working on approaches and methods of nanoeconomics, used to solve problems of intellectual capital in general, and knowledge management in particular. But there are no researches and publications either in Russia or in foreign countries in the sphere of aviation and airline management.

The lack of theoretical positions and practical recommendations for angstrom-economics, angstrom-management and angstrom-technologies of air enterprises considering the specifics of modern economic development of Ukraine determines the particular urgency of the problem.

The purpose is the introduction of new economic concepts, author classification with economic laws and properties following from it, defining the role of 3D-modeling in angstrom-management technology of air enterprises.

Results. In the educational literature the term «nanoeconomics» was first introduced by the scientist Kenneth Arrow (1987). The author worked on various interpretations of this concept [1-8] and on its basis the author's collective determination of nanoeconomics was made and completely new economic concepts were offered.

Nanoeconomics (economics of a man) is a branch of economics that studies the behavior of economic agents in the market

and non-market conditions; this is a level of depth study of economic phenomena, a theory of transactions in the formation of decisions by market participants (collective definition [1; 4; 5]).

Angstrom-economics (economics of thought, gift, and intuition) is a branch of nanoeconomics which studies the effect of the intellectual, moral and spiritual abilities of economic agents of productive management decision making.

Angstrom-management (management of thought, gift, intuition) is a profound management of intellectual, moral and spiritual leaders capabilities of economic systems by selecting from a set of conscious and super conscious aspects for effective decision making.

More precisely, angstrom-management is a science that studies «what» exactly manages the man and «what» does the man manage while making decisions.

To improve the economical and mathematical conceptual apparatus the author has used classification of different types of economics, but not in full compliance with the SI system, but according to the logical interpretation of the author:

10^{-10} – angstrom-economics: economics of thought, gift and intuition
10^{-9} – nanoeconomics: economics of privately held company
10^{-6} – micro-economics: economics of an enterprise
10^{-3} – mini-economics: corporate economics
10^{-1} – economics of art, management art
10^{0}= 1 – system
10^{1}– economical good, economical human factor
10^{3}– mezzo-economics: regional (local) economics
10^{6} – macro-economics: the national economics
10^{9} – mega-economics: world economics
10^{10}– multi-economics: economics of «Freemasons», which govern global economic policy.

From the author's classification some properties and patterns based on disjunction (multiplication, intersection) of the economic categories can logically be noticed:

10^{10} x 10^{-10} (multi-economics on the basis of thought, gift and intuition) = 10^{6}x 10^{-6} (micro and macro-economics crossing) = 10^{3} x 10^{-3} (regional and corporate economics crossing) = = 10^{0} = 1 – system; 10^{10} x 10^{-1} = 10^{9} (multi-economics creates mega-economics); 10^{10} x 10^{-9} = 10^{1} (with the help of enterprise economics multi-economics manages the creation of economic good).

Study of these patterns using mathematical logic and its operations can last long. For this article, this is enough as original ideas and evidences.

Creation of the angstrom-management technology of airlines lies in ensuring the most effective decision-making by airline managers and managers on flight safety at Mission Control Centres in emergency situations. Nowadays, within the current technological and informational economics, consistent patterns of angstrom-management technology of airlines creation are closely associated with forecasting and 3D-modelling.

According to the angstrom-management technology mathematical decision-making modeling in issues of airspace has been conducted by the author, which can be regarded as a small-scale version of the modeling in Flexible Time Scale (FTS). The main objective of this mathematical modelling was to create appropriate routes and structural elements (sectors), as well as analysis of their interaction with different models of air traffic. Mathematical modelling tools should generate 4D-trajectory (location + time) according to flight plans describing the patterns of air movement in the relevant airspace organization. These trajectories and airspace structure elements are used for calculating statistical data such as: load on sectors, load on the route segments, conflicts and so on. Airspace mathematical modelling by angstrom-management technology of air enterprises allows obtaining accurate data concerning load on the sector and its capacity.

Mathematical modelling tools of decision-making in airspace problems have been identified by the author, which consist of software modules used to meet the airspace designers' needs:

- graphical tools used to determine airspace organization and its visualization in 2D and 3D;
- tools for manipulating trajectories used to determine the air traffic model (distribution of air traffic, time for control transmission, 4D-generation of trajectories);
- data analysis and processing tools (distribution of air traffic, load on the sectors, checking for conflicts).

The first step of decision-making mathematical modelling in airspace problems is to convert design project, processed by a airspace design working group, in a simplified for presentation version based on computer technologies. In most cases, the routes are described as 2D-network of segments. These segments may have some peculiarities related to air traffic: direction and type of movement.

Modelling tools typically do not use curved segments. The exact description of the arrival and departure routes defined by curved segments can be determined using approximated linear model segments. The same method can be used to describe the standby areas. Sectors represent the block of airspace, defined by horizontal and vertical contours.

The horizontal configuration of sectors is described as a closed polygon. If the horizontal configuration of sectors is defined by the curved segments, it can be described by approximated linear segments. If the sector has a complex vertical configuration, it should be divided into component parts, i.e. basic geometrical blocks to be connected together for the purpose of analysis.

After completing the simulation by angstrom-management technology of air enterprises, the designer should verify configuration of sectors on the image correctness and absence of holes between sectors in horizontal and vertical plans.

Approval or rejection of each design project can not be based only on the results of quantitative modelling data in flexible time scale without considering prospects of angstrom-management development of air enterprises.

By angstrom-management technology of air enterprises information system refers to a type of effective decision-making systems. Both aircrew of air force and civil aviation are its users. The purpose of the development is to construct not only the flight path of the aircraft (aircraft groups), followed by visualization in three-dimensional computer space, but to have opportunity to take the most effective solution in the case of unforeseen situation (including catastrophic), using initial conditions via the information base, appropriate choice of the necessary data from this database and possible time (Figure) [author study].

Subsystem «Data warehouse» consists of two elements: «Databases» and «File system».

Subsystem «Editing flight paths» consists of blocks «Territory» – adding and change a file of 3D-underlying surface model; «Aircraft» – adding, deleting of file 3D-aircraft model; «Battle array» – creation of new or editing existing fighting system a of aircraft group; «Flight path» – creation of new or editing existing flight path of the aircraft (aircraft groups).

Visualization of the aircraft (aircraft groups) flight subsystem is responsible not only for the formation of three-dimensional images on the screen, but also for the flight visualization. The

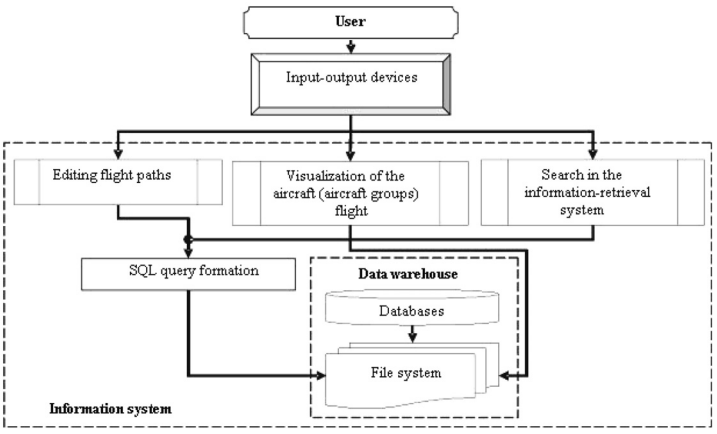

Fig. : **Conceptual model of information system by angstrom-management technology of air enterprises**
Source: Author's development

division into subsystems («Editing flight paths» and «Visualization of the aircraft (aircraft groups) flight») is caused by the fact that the time to run the program and visualize the flight should be minimal (a few seconds). The user builds once the flight path, and then visualizes the flight of the aircraft (aircraft groups) on this trajectory at any time.

Subsystem of search in information retrieval system provides the user with full access to information systems resources: text, graphic, audio and video information, virtual review of three-dimensional air models. User creates a query as a row of descriptors and information retrieval system displays all the information – available, in databases, respond to a user's query.

Thus, information system by angstrom-management technology of air enterprises allows modelling the flight path with execution of all shapes of aerobatics. Information system is universal as it provides the ability to add different resources. For example, a group of fighter aircraft or group of sports aircraft can participate in aerobatics. The task is to add appropriate three-dimensional models to the system and specify them.

The advantage of the system is that it allows creating flight paths and then carrying out their review without fuel costs and costs of other resources. This system demonstrates how a group of aircraft could perform aerobatics shape under various conditions without pilots in aircraft piloting. Using the information system can avoid errors in aircraft group piloting and save pilots' lives. An analogue of such a system has not yet been identified by the author.

The technology of three-dimensional image mapping C3-Technologies practically excludes manual work. To collect information airplanes equipped with high-level digital SLR cameras are used. Four cameras located in the direction of sides of the world, film images of the earth surface at a certain angle. Other cameras, the quantity of which is not named, are located under precisely measured angles; they make shots of the surface in such quantity, which is enough to create three-dimensional models. The last operation is carried out via C3-software solution established by the experts that compares images, determining the depth of objects like the stereoscopic view mechanism of the human brain, and automatically creates highly detailed three-dimensional objects (10-20 cm resolution).

In the age of information technologies and technogenic revolutions effective decision making, and hence inevitable (logical) success of the company in all areas, is a function of «information and choice» like a Marxist production function of «labor and capital». In addition, «work» and «choice» refers to the action, and «capital» and «information» – to cash assets (tangible and intangible). Moreover, undesirability to make a choice is a choice too as a category is always present (in space, time and intellectual-intuitive activity), i.e. completely independent.

For efficient activity of air enterprises functional dependence $EMDM = f(I, C, T)$ – for 3D-modelling has been defined by the author. Where $EMDM$ – effectiveness of managerial decision-making, I – information, C – choice, T – time, period.

In this context information is seen as the knowledge base (conscious) and spiritual base (super conscious), namely ideas, intuition, «tips from the top», gift, charisma, etc.

The author has developed three-factor (factor 1 – information, factor 2 – choice, factor 3 – time) forecasting model of angstrom-management impact on the effectiveness of managerial decision-making in air enterprises:

$$EMDM = \lim_{t \to 0} ((1 - \alpha) \cdot I + C)$$

Herein α is a coefficient of information obsolescence risk.

It is important to take into account that I and C are not numbers (rational and/or irrational), but integrated software (individual specific) systems (matrixes), within which the signals and symbols of the internal and external environment are transformed into knowledge, thoughts, ideas, intuition, etc.

Naturally, wrong, i.e. negative, choice decreases (weakens) $EMDM$ and right (positive) one increases (enhances) it.

The proposed model makes it possible to analyze and forecast dependence of managerial decision-making effectiveness on the information quality (including information obsolescence risk) and the right choice. This in turn is a necessary condition for high-quality development of effective competitiveness and economic development strategies of the air enterprise.

Large international air enterprises using organizational and information technologies are interested in strong air educational system in Ukraine. However, future consumer is important for business, while education of a new generation in the field of organizational-information technologies means the national competitiveness in the global market for the state.

With the implementation of organizational and information technologies proposed in this study angstrom-management of air companies will get not simple effect, but synergy effect in their work.

Conclusions and suggestions. Assessment of the effectiveness of managerial decisions using author technology of angstrom-management is a strong and stable factor in the success and saving lives, preventing air crash.

Angstrom-technological 3D-models are used to facilitate access to project and administrative documentation of air enterprises, as well as operational data by the object in order to take the most effective solutions. They are created through the integration of 3D-models with object-oriented management systems, design and construction document flow and engineering data of air enterprises. In fact, this 3D-model is a three-dimensional interface for data access – user can review the information by selecting and pressing the corresponding model element.

Angstrom-technological models are convenient tools for airline manager and powerful analytical tools. Through their use one can not only store and integrate data, but also reflect the process of object operation by 3D-models.

Currently, 3D-technologies evolve towards increasing the number of coordinates. These solutions are particularly in demand in the modelling design works in aviation industry. According to the author's angstrom-management technology of air enterprises 3D-model includes information, choice and time.

Angstrom-technological 4D-model is formed through consolidation of work by calendar network schedule of design works with corresponding elements of the design three-dimensional model, and thus includes 4 parameters: three spatial coordinates and time. 4D-model can be used both for virtual air building modeling and tracking actual progress of construction and installation air works.

According to the author's angstrom-management technology of air enterprises 4D-model includes knowledge base, intuition, choice and time.

References

1. Arrow, K. (1987). *Reflections on the Essays. Arrow and the Foundations of the Theory of Economic Policy.* UK: Macmillan.
2. Bakharev, G. (2008). *Nanomoney or money of the future.* Moscow: MSU Publ. (in Russ.).
3. Inshakov, O. V. (2007). *Economic genetics and nanoeconomics.* Volgograd: VolSU Publ. (in Russ.).
4. Kleiner, G. (2004). Nanoeconomics. *Voprosy ekonomiki (Economic Issues), 12,* 70-93 (in Russ.).
5. Konoplev, V. A (2007). *Economics of innovations (nanoeconomics): theory, regional models.* Kemerovo: Kuzbassvuzizdat (in Russ.).
6. Liubimova, T. A. (2008). Nanoeconomics: tribute to fashion or image of the future? *Vestnik Irkutskoho universiteta (University of Irkutsk Herald), 4,* 131-133 (in Russ.).
7. Liubimova, T. A (2009). Nanoeconomics as initial level of economic relations analysis. *Vestnik Irkutskoho universiteta (University of Irkutsk Herald), 2,* 88-97 (in Russ.).
8. Liashenko, V. I., Pavlov, K. V., & Shishkin, M. I. (2011). *Nanoeconomics in the Slavic countries of the CIS.* Izhevsk: KnigoGrad (in Russ.).

Received 22.03.2014

References (in language original)

1. Arrow K. Reflections on the Essays. In: Arrow and the Foundations of the Theory of Economic Policy / K. Arrow ; Ed. by G. Feiwel. – UK : Macmillan, 1987. – 734 p.
2. Бахарев Г. Nanomoney или Деньги будущего / Г. Бахарев. – М. : Изд-во МГУ, 2008. – 111 с.
3. Иншаков О. В. Экономическая генетика и наноэкономика / О. В. Иншаков. – Волгоград : Изд-во ВолГУ, 2007. – 94 с.
4. Клейнер Г. Наноэкономика / Г. Клейнер // Вопросы экономики. – 2004. – № 12. – С. 70–93.
5. Коноплев В. А. Экономика инноваций (наноэкономика): теория, региональные модели / В. А. Коноплев. – Кемерово : Кузбассвузиздат, 2007. – 83 с.
6. Любимова Т. А. Наноэкономика: дань моде или образ будущего? / Т. А. Любимова // Вестник Иркутского университета. – 2008. – № 4. – С. 131–133.
7. Любимова Т. А. Наноэкономика как исходный уровень анализа экономических отношений / Т. А. Любимова // Вестник ИрГТУ. – 2009. – № 2. – С. 88–97.
8. Ляшенко В. И. Наноэкономика в славянских странах СНГ / В. И. Ляшенко, К. В. Павлов, М. И. Шишкин. – Ижевск : КнигоГрад, 2011. – 348 с.

Стаття надійшла до редакції 22.03.2014