

BASIC LAWS OF AIRCRAFT DESIGN

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Abstract: Questions of attraction to tasks of aviation technical designing of the regularities of general nature which are earlier not used in this field which are on a joint of basic problems of modern natural sciences, technology, philosophy and the new directions of science which treat, for example, synergy, and others are considered. A conceptual design of civil and transport airplanes with representations of the seven basic laws of the design is offered: 1. Thought or mental associated with the formation of the idea, as well as the visualization of forms and structures designed object. 2. The law of analogies. 3. The Law of Vibration. 4. The law of opposites. 5. The law of cycles and rhythms. 6. The Law of Cause and Effect. 7. Law of design and creativity. The approach to formation of new hierarchy of the criteria of design based on the analysis and synthesis of these laws is also offered. The task of the structural formation and composition of the energy space design, allowing determining the grid of power lines and types of elementary energy and the crystal structures of the elements is considered. Seven basic laws of design are presented and described on a number of examples. The space of design is described with use of the scheme of the Tree of Life divided into ten Spheres of the Worlds which are forming four levels of manifestation: the Design ideas; Realization of Ideas (thinking process); Radiation (including emotions and feelings); Action (implementation), and also division of each of these spheres into sublevels. Possibility of calculation and use of discrete power levels to the description and characteristics of the projected products, and tendencies to replacement of usual options on integrated, hybrid and morphing are shown.

Key words: law; design; analogy, the golden section, magneto-hydrodynamic analogy, electro-hydrodynamic analogy.

INTRODUCTION

By the basic laws of engineering aeronautical engineering constructor is not usually drawn, trying to solve a lot of problems with a variety of conflicting requirements and rules established on the basis of statistics, as well as the rich experience of the previous design, manufacture and operation of aviasrtructure. In aviation, these requirements are: aerodynamic, technology, durability, reliability and service life, operation, optimization, environment and others. Despite the sufficient reliability and testing of the current approach, which is based on theoretical and experimental, as well as the purely empirical regularities, it is not possible to understand the truths of the deeping the nature of the laws, and apply new approaches and solutions in the design process.

THE ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

In the design of modern aircraft structures developer seeks to fulfill the bearing surface maximum aerodynamic efficiency, having a minimum mass, which can accommodate large amounts of fuel, having a predetermined resource was simple, i.e. technologically to manufacture, etc. Project objectives usually multicriteria, but virtually all of the criteria are contradictory, because the art of Designers is the ability to find compromise solutions, which complicates the implementation of the project objectives. Practice establish certain design problems technology that uses a hierarchy of optimality criteria and a number of other methods, in particular, the use of prior experience in the form of statistical data on the prototype [1, 2]. We study the prospects of development and projected changes in the basic flight performance and relative parameters of this type of aircraft in the coming years. To this end, according to the statistical tables built dynamic and static graphics retro series of important parameters of prototypes, Are sought for their function trends to estimate the error of approximation and are pro-its forecasted values [2]. The practice of designing complex technical systems shows that crucial in the effectiveness of the system and its future viability of a design phase and in particular the initial stage - the choice of concept, selection of basic parameters, and that this step can take up to 50-70% of the project's success. Simulate this stage, in view of the inevitable changes in market conditions [3], including the emergence of new systems, change in priorities and logistics, new technologies, materials, equipment, systems, and many others [4] with sufficient reliability is almost impossible.

Therefore, there was the so-called conceptual design [2]. The level of conceptual design of civil and transport aircraft most commonly assessed by weight and aerodynamic perfection, including economic indicators, such as the cost of transportation and the cost of flight personnel hours, environmental requirements for noise and emissions

In the process of building scientific and technical progress, there is a search for new technical solutions, mainly due to the widespread use of methods and means of CAD systems with the use of 3D volumetric and mass layout of the aircraft in accordance with the principles of CALS-technologies [1]. The core of CALS-technologies is a common information space (SIS). The SIS information is created, transformed, stored and transferred from one party to another by means of software. Such tools include automated design and process engineering (CAD / CAM / CAE). Interact with each other in a single

information space is the basis of modern CALS-techniques. But this raises the problem of the structural form and design of the space and energy.

OBJECTIVES

The aim of the article is to prove the possibility of applying the basic laws of design already in the preliminary design stage, and to develop strategies to use these basic laws of a new type, based on a non-traditional approach to the basic concepts that have emerged at the crossroads of new scientific fields of science (synergy), art and philosophy, the design of aircraft as well as models of space allocation for the designing aircraft.

1. BASIC LAWS OF AIRCRAFT DESIGN

Designing any complex natural and technical systems, such as aircraft and other technical facilities: cars, ships, but also technical and society communications - due to the application of certain universal laws that exist in the various branches of science, philosophy and art that reflect basic laws of nature, physical and mathematical aspects of the creation of the aircraft, as well as the creative process of the human mind. The author of the article developed a number of physical and mathematical methods for solving problems of continuum mechanics, allowing to prove some common fields of interaction and communication with the unified field [5-9], but also show the possibility of quantization Macro-media, saying the presence of discrete layers and around the macroscopic [10 - 12], which is confirmed by several other studies [13, 14].

An important novelty of this article is the concept of the use of not only some generalized criteria, but of the world's laws, of which the criteria are derived and explained them. There are seven basic laws of design, according to the number of basic natural laws applied in these areas.

These are the laws: 1. Thought or mental, associated with the formation of the idea, as well as visualization of forms and structures of the proposed facility. 2. The law of analogies. 3. The Law of Vibration. 4. The law of opposites. 5. The law of cycles and rhythms. 6. The Law of Cause and Effect. 7. Law of design and creativity.

1.1 First law - thinking or mentalism, as well as visualization of the designed object

The main content of the law is that, before anything design and build, you need to present in the consciousness itself created object as a complete, reflecting the work in the coordinates of the "here-now" and a vision of how this object It performs the task.

This is the law of priority thinking or creative consciousness, the creation of any new facility. The law allows the designer-thinking designer to concentrate on getting exactly what is the content of the job's technical, and will consist only of those energies and imagery that draws its creator thought. In this law of thought there are two main embodiments. First - this is when the idea of the scheme is the energy, without the inclusion of the senses. The second option - when connected to the realization of

the true feelings and emotions associated with them. Despite its apparent simplicity, is the basic design of the basic law, but it is not taught in our contemporary higher technical institutions and universities.

1.2 Second Law - analogies

The content of the second law states: "What is below is like that which is above; device like the forehead-century structure of the Universe" [1], so the essence of it is in the likeness of the hierarchical structures of matter in form and content.

For example, there is a similarity in structure between the cell, atom and the solar system (Figure 1).

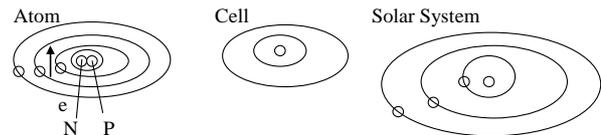


Fig. 1. The similarity between the atom, cell and the solar system

Also, every manifestation of the cell, a piece of manifestation of matter, an element of creative structures has structural parts, repeating through the levels as shown in Fig. 2.

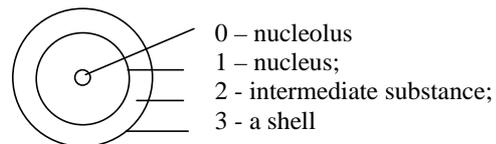


Fig. 2. Typical diagram of the manifestation matter cell structure

In accordance with the law of analogies every object in our world is structurally built on a similar basis. Each object has three structural components (Fig. 2) - this is the core of consciousness, sensation, or simply the core, intermediate medium and the shell adapted to the existence of consciousness in the particular circumstances. By analogy with the structure of the cell, the person also consists of:

- 0 - the highest spark;
- 1 - the spirit (the nucleus);
- 2 - soul (intermediated substance);
- 3 - flesh (shell).

Flesh (shell), in turn, consists of three components:

1. the mind, the intellect (nucleus);
2. staging environment, having three co-constitute:
 - mental,
 - emotional and sensual,
 - energy;
3. the physical body (the shell).

It is obvious that in addition to the separation of man into three components we can talk about the dividing of his own for seven structural component or states: the spiritual; soul; mental; intelligent; psyche; conscious; emotional and feelings (sensual) (category of feelings, emotions and desires); Energy, which includes the state of the field known as well as unknown nature science field;

natural, study, for example, modern medicine, biology, which went over to the medical term "anatomy".

In addition, each object has a higher state, referring to the category "higher consciousness", which is of a different nature to the human and natural objects: animals, plants, minerals. Higher consciousness is connected with the object of special energy fields which we can identify the information-energy channels of communication. Similar channels associated with the human subconscious. They have three structural components: the super-consciousness, a common consciousness and subconsciousness. Separation of the field of consciousness to these three sectors is widely used in modern science (medicine, psychology, philosophy), but in contrast to the traditional, we slightly expanded the concept of ordinary consciousness, adding energy-components.

The reason is the presence of law analogies in the nature of the Unified Field of interaction from which all the rest of the field. Consider some types of analogies that may clarify the structure of the universe and give some idea of the nature of the unified field of interactions existing in nature [2, 5 - 8].

The analogy between the electromagnetic and gravitational phenomena, it may be noted, comparing the record of the laws of Newton and Coulomb (1) for cooperation between the two bodies or charges:

$$F_{gr} = Gx(M_1xM_2)/r^2 ;$$

$$F_e = \frac{1}{4\pi\epsilon\epsilon_0} x \frac{q_1q_2}{r^2} . \tag{1}$$

This analogy allows to compare time-personal processes Continuum Mechanics: stretching the orifice plate (Fig. 3a) with the passage of electrical current through the conductive plate (paper), in which the analogous opening (Fig. 3b), as well as flow around the cylindrical body fluid flow (Fig. 3c).

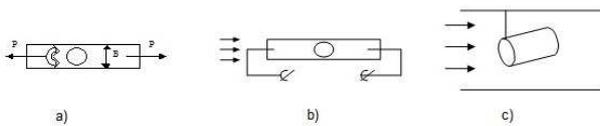


Fig. 3. The analogy between the aeroelastic and electrical phenomena: a) stretching the plate with a hole; b) a conductive plate with a hole; c) the cylinder, blown air flow

By comparing the elastic and aerodynamic variables and processes, we see the analogy between stress (σ) $\sigma \sim \nabla\nabla\Phi$ in the theory of elasticity and speed (v) $V \sim \nabla\varphi$ in aerodynamics (Fig. 4, Fig. 5), which is based on the similarity of the mathematical description of processes with potential functions: biharmonic for voltage and speed, where the ∇ operator (gradient), and φ and F - potential function speeds and voltages, respectively, satisfying the Laplace equation for the harmonic function φ and the biharmonic equation for the function F .

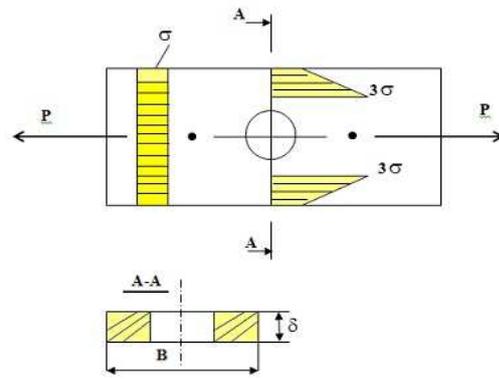


Fig. 4. Stretching the orifice plate

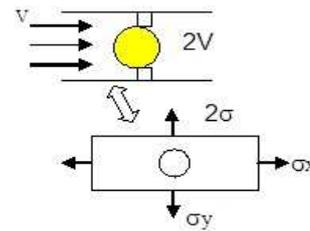


Fig. 5. The analogy between the flow around the cylinder and bilateral tension plate

Electro-hydrodynamic analogy (EHDA) - makes it possible to find a correspondence between the aeroelastic, hydrodynamic and electromagnetic phenomena, and Magda allows to take into account the volume factor and compare the results of studies with an aerodynamic experiment in pipes and dynamically similar models. Magda is performed on the models of aircraft covered by a layer of electrically conductive and placed in an electromagnetic cell (Fig. 6).

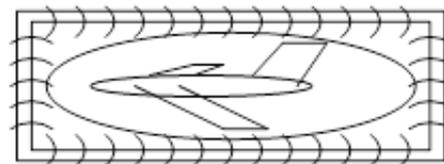


Fig. 6. Scheme of modeling the flow using the method of Magda

In a model of electrical conduction layer is deposited, which allows to measure the strength and potential electromagnetic field.

In the design process of the objects represented by the law of analogy, for example, in the form of analysis of statistical data on the aircraft defined performance characteristics.

1.3 Third Law of Vibration

These law states that every phenomenon has a certain range of vibrations and reflection-pressed in mathematical and physical laws that describe the state and dynamics of the object. In particular, this applies to space flight and exploration. If we want to get to the other space-time field, we need to learn how to change the vibration of the vehicles and sustainably support the new state.

The law of vibration recorded mathematical equations used to describe this picture of the World (PW). In particular, one of the world's species are tensor equations of Einstein's law [15]:

$$T_{ik} = -\mathbf{\kappa} \times G_{ik}, \quad (2)$$

where: T_{ik} - energy-momentum tensor of matter;

G_{ik} - the Einstein tensor, which reflects the metric and the curvature of space.

From this law we can obtain equations of continuum mechanics, are widely used in the calculation of aircraft.

1.4 Fourth Law of dialectic and oppositions

The law of unity and struggle of opposites, on the basis of dialectical, allows us to understand how to achieve harmony by overcoming the conflict demands. At the level of the law introduced the concept of three major bond or forces of the world: the power of activity (rajas), the power of passive (Tamas), as well as the power of harmonization (sattva), which for some reason is not present in our Este-governmental science, and in most Western philosophies. In natural sciences, the law known as Newton's third law: action equals reaction. Taking into account our amendments, action equals reaction only when sufficient neutralizing, harmonizing force (sattva). As for the philosophical laws: unity and struggle of opposites, the transition from quantitative to qualitative changes, the law of the negation, then they also need a new understanding, a new perception that takes into account all the same harmonizing effect on the nature and effect of which is necessary to think seriously, at least in terms of testing and staging of the plan.

The principle of opposites in aviation is related to optimization problems, such as the definition of functional minimum takeoff weight of the aircraft, depending on the geometric parameters of the glider, as well as optimization of finding a minimum weight of structural elements, depending on the geometric parameters of the airframe, the external load, and fatigue life.

1.5 Fifth Law - the cycles and rhythms

This law determines the nature of cyclical patterns in nature, subject to periodic changes that have small periods of change (rate) within large (cycles). Thus, the specified lifetime of the aircraft is usually associated with a resource, which is about 20 ... 30 years for a passenger or transport aircraft. This cycle will be the smallest military aircraft, such as fighters, as well as an easy technique: the life of two - four years.

Rhythm of using aircraft, in particular, it is possible to determine the annual bloom. Each aircraft has its own border, use their rhythm, but if the plaque is more than 4000 hours per year, it will mean the continued use of the aircraft for more than 10 hours each day. In order to properly dispose of the objects of aviation equipment, you need not only the knowledge of the service life of materials, components and assemblies, and the aircraft itself, but also the correlation of external natural cycles with the cycles of operation. Otherwise, it may lead to unnecessary accidents and disasters that could have been avoided if we

start to consider the impact of natural systems and their cycles.

1.6 Sixth Law- causes and consequences

Everything in the world is the law of cause and effect, i.e., everything happens for a reason. For example, 85% of aircraft accidents occur from the destruction of compounds in the area. In this case, the reason NE-one to poor performance of the compounds in the assembly, as a consequence - early failure during operation, the inability to sustain service life. One consequence of this law is the need to act on a reason to avoid the investigation, rather than parrying permanent adverse effects. This requires a system synthesizing synergy approach.

1.7 Seventh law - design and creativity

Act of design and creativity associated with the "golden section" and Fibonacci numbers, which are manifested in a variety of tasks and related to the partition of the interval into unequal parts - $\frac{B}{a} = \frac{a}{A}$ in the following proportion (Fig. 7).

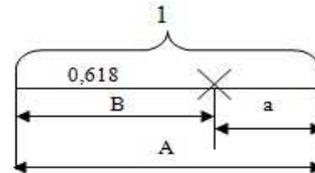


Fig. 7. Splitting lengths in the ratio of the golden section

As shown by research, the structures of living systems are best described pentagonal symmetry, which entered the golden section and the specified number.

Act of design and creativity aimed at balancing and harmonizing inert (Yin) and active (yang) energies of the male and female implementations. From a scientific point of view, we are talking about right-handed and left-handed symmetry vortex tubes and processes in these fields of force. Mathematically this law is supported by a group of equations such as the equation of Schrödinger type. As shown in works [9 - 11] of the author Schrödinger equation type are derived from the joint examination of the dynamics equations of a continuous medium (e.g., the Euler equations) and the continuity equation for the density of the medium. Given that this satisfies the entropy of laws affecting information processes, we can note that in the seventh law provides the possibility of mathematization process of design and creativity, resulting from the analysis of the solutions of these equations, used in quantum mechanics and nuclear physics

2. THE SPACE OF DESIGN

The space design - it is a physical volume within which the process of creativity and design. The idea of considering the design space is not new, but in some cases is more related to matters of purely computer-aided design. For example, a conceptual diagram of the methodology of top-down design provides for multi-tier management structure comprising a tree structure of individual blocks, the model space allocation, model master

geometry of the assembly, interface, interfaces, the kinematics of the various elements of the product, as well as the creation of a virtual layout of the designed products, allowing to formulate the conceptual framework designed product. The space design in this case belongs to the category of virtual and exists in the information field of the computer system.

The question is how to build a true real space and to realize, to besiege the idea of designing an object, not only from a purely technical point - this is an issue that we are presenting to the study. This is important not only for the aircraft designer, but also for the designer cottage, gardens, designer recreation and creativity, as well as in shaping the comfort of their own apartment.

The place that you choose a designer-designer for his work, in this case, must meet certain requirements and have a special structure Fig. 8; Fig. 9. It is known from the popular modern methods of distribution of energy metering parameters of distribution space in the process of design and construction of buildings, structures must be, first of all, take into account the direction of light. Most of Earth's sacred buildings constructed with the account of this principle. At the same time, awareness of the principles of creation, design and construction of new facilities, largely lost, and mostly draws attention to the external criteria for the implementation and use, indoor comfort of the consumer, as well as an acceptable appearance of the design object

Without deep study design factors that must also be taken into account. The author spent a quite long and painstaking research to offer a special division of space design in the form of the Tree of Life scheme. If we are talking about a system that is arranged on the surface of the Earth, every space was originally to be oriented along the axis of the magnetic compass on "North - South" and even then divided into two parts through the "East-West".

This separation may take place, such as maps of the city, settlements. If the dis-regarded three-dimensional picture, then the direction of the north will be directed upwards.

Fig. 8 shows a diagram of the main part of the Tree of Life and the ten spheres of the world, forming the four levels of existence: 1) the idea of the design; 2) realization of ideas (thinking process); 3) radiation (including emotions and feelings); 4) action (implementation). Fig. 9 shows the division of the data fields in the sub-levels.



Fig. 8. Scheme of ten spheres of the world of design space

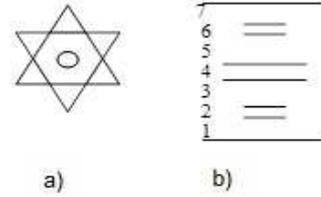


Fig. 9. Scheme of division of space design:
 a) top view, spatial volume as merkaba;
 b) the division of one of the seven-layer model levels

The three higher realms (1, 2 and 3) - make up the upper level, the world of ideas, Plan Design: Crown (1); Wisdom (2) and understanding (3). Further there are three areas of the world thinking process: Scope of Mercy (4) Scope of Severity (5) The scope of Radiance (6), and then - three areas of the World Radiation: Industry senses (7) Scope of Logic, Reason (8) and the world of Inspiration, Ground (9). Last - is the world of action, security sphere (10) (Figure 8).

Center for the construction of a sphere 6 Shine, Splendour - is the main place where the designer has to stay permanently or long enough to be in the process of creativity. The whole space of the Earth is divided into enormous power cubes that make up the cells of the power of space and forming the so-called geopathic zones on the Earth's surface and it is adjacent to the surface of the volume.

Each of these zones has its own characteristics. In particular, the spiritual - it is the first area, the Crown (1), and the most mundane - the physical world, our natural kingdom (10). Applying the fourth basic law of design, in particular the principle of the dialectic of unity and struggle of opposites, we share the design space of each sphere on the top (B), and a lower (H) of the separated wall, diaphragm, and which are further divided each into three and the sum - into seven pieces that fill the energy fields (and the elements of the design). The principle of the triad, which introduces an element of harmonization (through the principle of sattva) is said membrane, average boundary of the zone. Thus, in addition to the vertical division of the Tree of Life in the four areas (Fig. 8), we divided each of the 10 zones of the space design on the top, bottom, and 7 sub-levels (Fig. 9b).

In turn, each of these sublevels concentrates crystalline energy of five types of natural energies, called elements (Fig. 10): Land (2 first-crystal cube), water (4 first-crystal icosahedron), fire (1 first-crystal tetrahedron), the air (3 first-crystal octahedron), ether (5 first-crystal dodecahedron), because in the space design in the process of design may appear resonators and amplifiers special properties of these five elements.

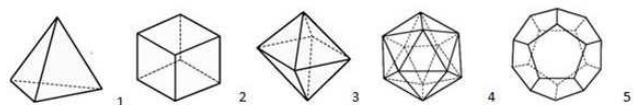


Fig. 10. Main crystal basic elements

Any object contains elements of the crystal structure, even such as the giant planet (Fig. 11).

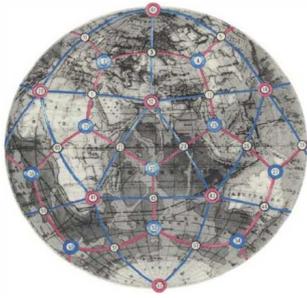


Fig. 11. Earth as a giant icosahedron-dodecahedron crystal [16]

In particular, the planet Earth itself is an icosahedron, dodecahedron crystal, held a more than two-billionth evolutionary growth of the fire tetrahedron to icosahedron and dodecahedron is now passing to the structure. But technical and complex objects, such as modern aircraft integrated circuit (Fig. 12), which also contain a certain power grid, that can be calculated using the patterns shown here.

In particular, the tests of the model "EC-1" in the wind tunnel TsAGI WT-106 showed a high aerodynamic efficiency of the model and the prospect of continuing work on the development of technical proposals aircraft integrated circuit [17].



Fig. 12. The first prototype of the integrated circuit "IC-1" [17]



Fig.13. Morphing wings-13 [18]

This will not only operate and maintain these aircraft at a new level, but also to begin the actual design of integrated structures, seamlessly flat rectangular and cylindrical bodies into each other, as well as using composite materials to stack design with linking power line elements consistent by the power lines energy fields.

Another idea of integrated structures, using the law of analogies living natural systems, this design morph - the transformation of the airplane wings, like living systems: birds, fish (Fig. 13). [18] University of Pennsylvania showed the first results of their research, in which the wings of the aircraft change shape as the wings of a bird, and shut scales like a fish. Wings that can smoothly change its shape in a wide range of interest for commercial aircraft, fighter aircraft and unmanned reconnaissance vehicles (UAVs). Morphing wings, developed at the University of Pennsylvania, and can change their area, and the cross-sectional shape. The basis of these wings - changeable cell or cell power structure, serving as "bones and ligaments" and segmented scaly "skin". Polygonal cell frame disposed along the upper and lower surfaces of the wing can be folded differently by bending, thus the wings up and down. If they transform the concert, the changing span.

CONCLUSION

As a result of the study, consider the use of new concepts in the process of designing a pro-aviation technology is to use earlier in this area is not applied the seven laws of the new type. These laws are universal in nature and may also be useful in other areas of creation and creativity, from the creation of technical devices to design the family and society. In addition, the scheme has been proposed for the structuring of the Tree of Life arrangement implementing the idea and concept design phases from idea before its physical implementation. Also available as space allocation planning, taking into account the factor of the energy distribution. Explore the possibility of the application of the laws of the world of data for the design of specific aeronautical products will significantly improve the physical side of understanding not only the design, but also the manufacture and operation of aeronautical products.

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