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DECREASE OF SOUND PRESSURE LEVEL AND NOISE INSIDE HYBRID ELECTRIC WING BODY PLANES AND DIRIDGABLES

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Abstract

The analysis of the find Optimal Structure of the Large Aircraft and Airship for decrease of Sound/Noise Pressure Level inside and outside the Cabin Saloon are very actually today for Worldwide Ecology Program. The Method of Aircraft layout from the virtual mass center is given, which allows us to obtain the Aircraft layout from the conditions of Infrastructural Constraints in the terminal configurations of the Modern Air Transportation Infrastructure and IATA/ICAO Regulation. A Method is proposed for the synthesis of new circuit solutions for an Aircraft passenger compartment and may be use to any Diridgables Projections future. A Geometrical representation of the concept of LHA with large passenger capacity made with a Drop-Shaped Fuselage in the Aerodynamic balancing Flying Wing Body Scheme is given.The new Body Plane LHA and Lighter-then-Air (LTA) Vehicles with cover of Solar Electro Systems will be more innovation projections for Worldwide Security Air Transportation with reduce Noise and CO Pollution Level.

Keywords: *aircraft, bodywing, airship, solar, structure, sound, noise*

1. INTRODUCTION

The Worldwide Grows of any International Long Range Air Transportation will be priority focusing to the more Ecology Engines and Electrical Power System for decrease Noise/Sound Level in Sky and near Airports areas. The goal of minimize influence to Ecology Noise Level is need to find the optimal new Geometry of the Large Aircraft and Airships. The famous Aircraft Conceptions and Dialectical Contradiction between the constantly improving new types of future Aircraft Design and the continuously aging Big Hub Infrastructure arose from the very first days of the advent of Aviation and it is of a fundamental Air Industry, Airlines Facilitation and infrastructure complex [1].

The main R&D Design Strategy for a certain class of Aircraft, one can distinguish a group of limitations that are conceptual in Nature and have a priority influence on the generating process of Aircraft Conceptual Design (ACD).

A significant impact on the satisfaction of Infrastructure Requirements is provided by structural and layout solutions. The ACD taking into account the infrastructure requirements, will allow them to be taken into account in the early Stages of Aircraft Design [2-7]. The solution of the problem of the ACD [4] as a problem of mathematical Digital Modeling Software by CATIA5 of CAD/CAM/CAE System does not always lead to success because of the considerable dimensionality of the vector of constructive parameters X*, the complexity of the set of constraints U, as well as the large time required to compute the objective Optimal Function Vector. The main decomposition of the vector system of target functions, project parameters and constraints is very important. This circumstance is connected with the fact that the layout of the Aircraft is the result of Compromise Solution of Design tasks, which is typical for new R&D Optimal Versions and Patenting ACD of the Future Ecology Air Transportation.

2. FEATURES OF THE LAYOUT LIMITING SPACE AND MINIMIZE SOUND LEVEL

Any Structure and Sound Level Analysis of the Modern Aircraft are basing on the main Complex Data. Let's consider the identification of the layout Limiting Space and Noise Level around/inside Large Aircraft [7], its decomposition according to the characteristic features and the identification of a critical factor for the Long-Haul Aircraft (LHA) innovation project.

If we consider the whole issue, from the point of view of the 3D Volume-Weight-Noise Configuration, the optimal solution will be an Aircraft for which the external contour was obtained as a result of positioning of individual aggregates taking into account the criticality of the layout both with respect to the three axes of coordinates and in three planes, and for any arbitrary radius-vector, starting from the center of mass of the Aircraft and kvasy-center of Noise/Sound area of Engines.

A characteristic feature of the layout with "hard" dimensional constraints is the possibility of carrying out spatial coupling of many units in the first iteration, which allows us to build layout from a certain virtual center. It is convenient to choose the origin of the associated coordinate system, which coincides with the real center of mass of the Aircraft. Therefore, the layout problem is reduced to the location and interconnection of units in the layout space due to infrastructure constraints from the condition of bringing the real center of mass (RCM) to the virtual mass center (VMC) and providing characteristic features for Aircraft Design MAI SW, as show on Figure 1, that satisfy both infrastructure requirements and others, for example, Aerodynamic and Aqustic efficiency [4,5].

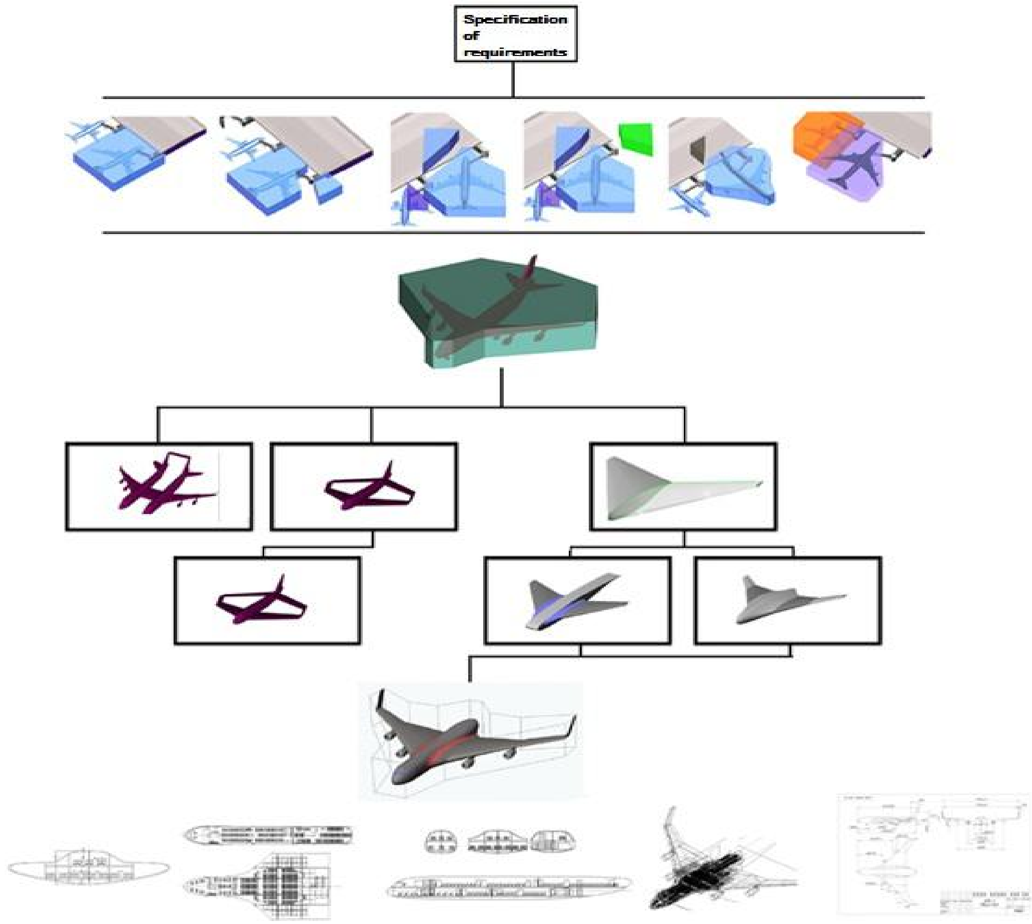


Fig.1: Influence of infrastructure restrictions on the Geometric shape of the Long-Haul Aircraft

In Figure 1l shows a three-dimensional image of the layout inside 3D Airspace for the LHA, obtained from the results of the structural-parametric analysis of Airport terminal configurations, the Comp-Digital Method of Aircraft Design parking and taking into account the Aircraft height limitations from the condition of PAX ability to the parking shelter Gate (23 m). Of course, in this case, the issues of antennas and equipment layout at the top of the surface are taken into account. The second level shows conditionally the range of permissible placement of passenger decks of the LHA. Their layout is determined by the dimensioning height (3.8 m), the length (20-25 m, and in prospect – 40-50 m) and the Limiting deviation angles in the vertical plane (10%) of the terminal slot hand-bridges.

We make a comparative analysis of the Aircraft as the basis of the Flying Wing Scheme and the Normal Scheme. The data are given in Table 1 (calculations were made by the MAI student A. Patrakov [6]).

Aircraft	**Usual scheme**		**"Wing" scheme**		**Absolute difference**		**Percentage difference**	
iteration	**S_{vol} (m^2)**	**V (m^3)**	**S_{vol} (m^2)**	**V (m^3)**	**S_{vol} (m^2)**	**V (m^3)**	**dS_{vol} %**	**dV %**
1	1412.71	2515	1315.86	2515	97.71	0	-7	0
2	2493.88	2895.23	2576.34	3290.28	82.46	395.04	3	14
3	2916.54	2994.31	2704.68	3307.23	-211.8	312.92	-7	12
4	**3181.94**	**3084.06**	**3147.74**	**3426.84**	**-34.19**	**342.78**	**-1**	**11**

Tab.1: Comparative analysis of the Aircraft made on the basis of the Flying Wing Scheme and the Usual (Normal or Classical) scheme

As a base, the passenger compartment of the LHA (comp-digital first iteration) was adopted. The second comp-digital iteration is the wing and fuselage. Third iteration is the wing, fuselage and tail. And the fourth comp-digital iteration is the whole composition of the aircraft aggregates, which corresponds to the complete washable surface (taking into account the engine nacelles).

And so, the specific Volume per passenger (average in all cabins) was 2.485 m^3, which is 1.17 times worse than for the base Aircraft (as Normal Aerodynamic Scheme), but its 1.30 times better than for the Aircraft in the Lifting Fuselage Scheme, and 2% better than for the Aircraft with a Triplane Scheme with an articulated wing.

The developed Method of the Aircraft layout from the layout inside Airspace made it possible to obtain the Aircraft layout that meets all infrastructure requirements, with take-off mass of 30-40 tons less than that of the Prototypes.

3. THE DIMENSION OF A LONG-HAUL AIRCRAFT AND NOISE REDUCTION IN SALOON

Within the framework of the Research work at the MAI University, a Comp-Digital Structural-parametric Analysis of alternative layouts of the long-haul Aircraft with large passenger capacity was carried out. The analysis shows the advantages of the layout carried out according to the above Method (LHA-5 Flying Wing Scheme) in relation to other non-traditional Schemes and a minor loss to the base Aircraft. At the third level, the Geometric shape of the layout inside Airspace is revealed as a result of the structural-parametric analysis of the LHA infrastructure constraints.

Further, there are many ways again, but we must take one of the World Patenting hypotheses:

- Circumferential fuselage,
- Twin-fuselage scheme,
- Flying wing
- Drop-shaped fuselage, etc.

Some alternatives are graphically represented at the fourth level as results of R&D on the MAI Aircraft Engineering Grafic & Comp-Modelling Department may be introduce of the Figure 2. But let's analyze it. At the first stage, we determine the required volume for placing one passenger.

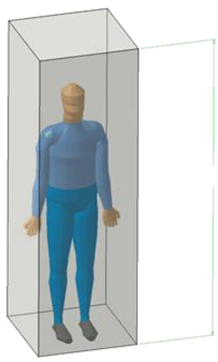


Fig.2: Geometrical model of the Passenger

Traditionally, the layout of the passenger compartment of the LHA is realized from the cross section, which is replicated in length as a model, taking into account the nuances of kitchens, wardrobes, toilets, etc. However, the excess pressure causes a circular cross section.

The fuselage, made in a cylindrical shape and having a circular cross-section, has a minimal mass. On the Figure 3 show a change in the Geometric shapes of the cross section of the cylindrical-shaped fuselage from the influence of excess pressure is given. In order for the section to keep the shape in the beam fuselage structure in the frame, in addition to the longitudinal force elements, the formers are installed, as transverse power elements.

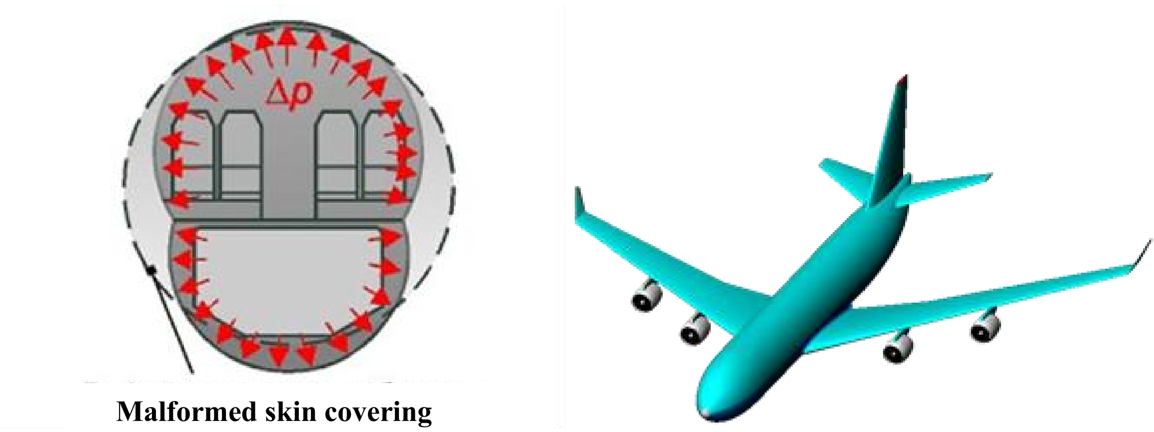


Fig. 3: Change of Geometric shapes of the cross-section of the cylindrical-shaped fuselage from excess pressure and sound inside difraction

At the second stage, the number of passengers is taken from the specification of requirements, which multiplied by the volume of one passenger allows us to determine the Minimum required Volume of the Aircraft. If the volume is known, then the minimum area of the washable surface has a body equivalent to the Sphere (see Figure 4).

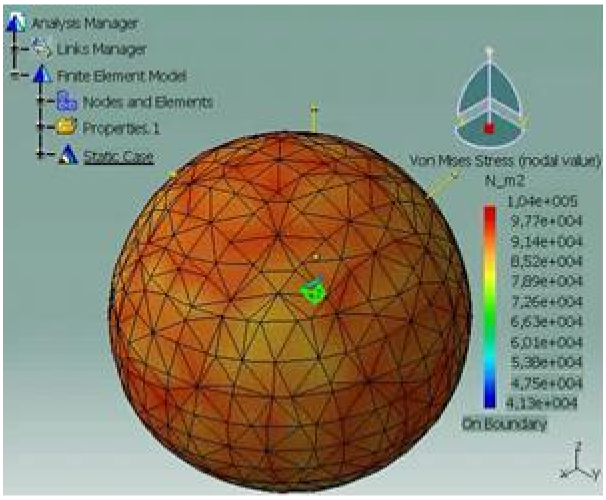


Fig. 4: A Sphere equivalent to the fuselage 3D Volume of the long-haul Aircraft

Excess Optimal pressure of Weight and Sound Loads, which suppresses the shell from the inside, gives a uniform distribution of the stress-strain state. However, for a flight in the Atmosphere, the Spherical shape is not suitable. The Geometric shape for subsonic flight should be stretched and be more like an Aerodynamic profile.

Performing the Geometric operations of affine extension-compression with an equivalent Sphere in 3D Volume, we obtain the Disk (see Figure 5). The structural-parametric analysis of the stress-strain state shows a pronounced anomalous zone. For its compensation, a power element connecting the two poles is needed.

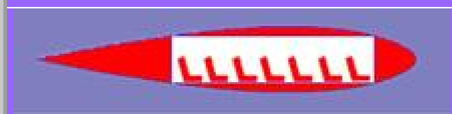
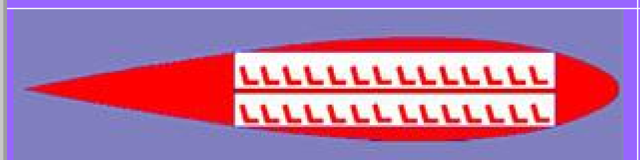
Comparison of interior layouts by S_{vol}			
Parameters Passenger compartment configuration	Number of passengers	S_{vol}	S_{vol} per one passenger
	100	330 m^2	3.3 m^2
	800	1315 m^2	1.644 m^2

Fig. 5: The fuselage in the form of an Aerodynamic profile equivalent to the fuselage 3D Volume of the Long-Haul Aircraft

4. THE PERSPECTIVE DISC SHAPED GEOMETRY FOR MINIMUM STRUCTURE VIBRATION LOADS

The Aerodynamics of Discs Shaped of Dirigable was use for Innovation Projection in MAI. It's the MAI Light-then-Air (LTA) Disc Shaped THERMOPLANE *(Fig.3*) is the unique and patented Project or other version as the ROSAERO USA Project with the new Laminar Flow Control and Solar Nano Film Upper Surface System for more Electrical Skyships PAX & Cargo Transportation for Flight and Rescue Operation with complete the LHA as High Ecology Air Transport Aircraft & Airship conceptions to Future Mobility Development [8-9].

Fig.6: The patented Disc Shaped LTA THERMOPLANE Project by MAI Design

The LTA are oriented to a long time flight, so a high priority in the formation of the washable surface is a High Aerodynamic Quality. And it is the higher, the lower the resistance and the greater the bearing capacity is. The Drop Shape of the bearing fuselage and the washable surface of the LHA Aircraft made according to the more efficiency Integral Formation with minimum Noise/Sound Interferences and influence to Ecology.

The variants of the Internal layout of passenger cabins, presented in Figure 1, are obtained for the case of transportation of 616 passengers in a three-class layout of cabins for a distance of 13 700 km. At the same time, the degeneration of the Flying Wing Scheme is clearly visible. In this dimension a developed fuselage part already appears. This fact is connected with the peculiarities of the layout of passenger cabins. The need to provide the specified volumes, height and width of passenger compartments requires an increase in the Internal Volumes of the Flying Wing. For example, the increase in overall heights in the central part of the wing is due to the provision of a Minimum height of the Passengers Cabin Saloon and decrease inside/outside the 3D Volume of Noise Engines Level. Therefore, in the central part of the wing the chords are enlarged to provide the necessary overall heights.

5. CONCLUSION

The advantages of aircrafts designed according to the Flying Wing Scheme in relation to other schemes rise with the increase in the Dimension of the Aircraft. So, the greater value of the target load and the flight range is the better application of this new Integrate Aircraft Scheme. In comparison with the base Aircraft of a Normal Aerodynamic Scheme, the Noise Level decrease up to 84%, and in comparison with a Tree Plane Scheme with an articulated wing - 94% from the Classical Version of Aircraft and Cigar Shaped Airship. The Computer Digital Structural & Parametric Analysis of the influence of infrastructural requirements on the 3Dimention Complex Syntesis of Long-Haul Aircraft and Solar Disc Shaped Airship Projection to use also More Electrical Power Ecology Systems with stream to near Zero-Noise Level.

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