CORPUS PUBLISHERS

Environmental Sciences and Ecology: Current Research (ESECR)

Volume 2 Issue 6, 2021

Article Information

Received date : November 03, 2021
Published date: November 16, 2021

***Corresponding author**

L Ponyaev, Moscow Aviation Institute, 4, Volokolamskoe, shosse, Moscow, 125993, Russia

Keywords

Worldwide Ecology Program; E-Airship; Hybrid Electric; Passenger Capacity; Airports Areas; Green Tech Air; Geometry; Weight and Engine; Transportation Infrastructure; Solar E-Dirigibles

Research Article

Optimal Design of Green Tech Hybrid Electric Integrated Aircraft and Solar Disk Airships for Short Arctic Air Transport Corridors

L Ponyaev[1]*, M Kuprikov[1], N Kuprikov[1] and R Loos[2]

[1]*Moscow Aviation Institute, Volokolamskoe shosse, Russia*

[2]*SolarXplores SA, Rue Galilee, Switzerland*

Abstract

The Ecology Decarburization issues decision may focus priority to the complex Design Analysis of the more Optimal Structure of the Large E-Aircraft and E-Airship for decrease of the Weight and Engine Power with Hybrid Electric Propulsion (HEP) systems 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. Calculate Method is proposed for the synthesis of new circuit solutions for an Aircraft passenger compartment and may be use to any Solar E-Dirigibles 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 E-Aircraft and Lighter-then-Air (LTA) Vehicles with cover of Solar Film Component Systems will be more innovation projections for High Safety Green Tech Air Transportation.

Introduction

The new trends of Siberian and Arctic Routes are focus to grow of any Long Range Air Transportation and as the fact may be priority development to the more Ecology Engines as the Hybrid Electrical Power (HEP) System for decrease Weight and Fuel Level for low toxic Green Tech in Sky and near Airports areas. The goal of minimize influence to Ecology 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 Hybrid E-Aircraft or E-Airship, one can distinguish a group of limitations that are conceptual in Nature and have a priority influence on the generating process of Aircraft/Airship 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 E-Aircraft or E-Airship Design. The solution of the problem of the ACD 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 $F(X^*)$. The main Decomposition Method of the Vector system as the main target functions, project parameters and constraints is very important. This circumstance is connected with the fact that the layout of the Hybrid E-Aircraft or E-Airship 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 Siberian and Arctic Russian Air Transportation Corridors Conceptions or Transpolar International Routes as the new Vision for EC INEA Programs.

Airship Can Be More Cheap and Ecology Effective Substitute for Short Arctic Air Transportation

Many scientists are concerned about the problem of atmospheric pollution and global warming, so they are studying various ways to prevent the crisis [2]. We have confirmed the possibility of using New E-Airships again but at a Higher Technological level as a more efficient air transportation system, as an alternative to Sea/Ocean Shipping, with certain economic and environmental advantages as Multifunctional Complex for Flyght and Ground Hangar Basing as show on (Figure 1). Transport accounts for about a quarter of all anthropogenic carbon dioxide emissions, while Maritime Transport accounts for about 3% of this volume, and this New Trend is gradually increasing. Therefore, it is profitable to use Airships again to transport for Siberian and Arctic Lines and future between Continents.

Figure 1: Airship New Project Concept as: a-Vision of the Complex (Multy Cigares) Body, b-Hangar Maintenance Services for Steel Body Sky ship.

Airships rely on clearly directed air flows at any altitudes, so they have clear advantages over cargo ships in terms of both efficiency and reduction of carbon dioxide emissions. Associated air flows move in a westerly direction with an average speed of about 165 km/h. With such winds, a Lighter-Than-Air (LTA) Dirigibles can fly across Russia and around the globe in about two weeks (while a ship will need 60 days) and use only 4% of the fuel consumed by a sea vessel. Hybrid E-Airships can be used not only for cargo transportation, but also for Hydrogen LTA Vehicle, which can be used both as Lifting Gas and in Liquefied Cryogenic form as fuel. As the Hydrogen economy develops, this will bring additional benefits. At the same time, most modern Airships use the Helium instead of Hydrogen as a Lifting gas. Since Helium is an Inert Gas, its use is Safer, but it is less effective, since such vessels are heavier and many times more expensive than Hydrogen. However, some companies in the coming years plan to start using Helium balloons to deliver Cargo to remote regions of Siberia and Arctic. According to safety requirements, the risk of fire is significantly reduced when using new Materials that are lighter, more durable and resistant to fire, including high-strength Graphene. It is proposed to lay flight routes bypassing densely populated areas, as well as provide an additional system for safe Cargo descent using Parachute Systems of future Airships Transport. The most energy-intensive part of the workflow is reduction, when the lifting gas of the airship must be under pressure. If the energy released during pressure relief (during ascent) can be collected, stored, and reused for descent, this will significantly reduce energy consumption. In this case, the hydrogen fuel on Board can be supplemented with solar panels on the upper surface of the hull. However, if you use balloons to transport cargo right now, it will be 10-50 times more expensive to use ships, which are a well-known technology that has been developing for hundreds of years. In order for airships to compete with conventional shipping, the cargo industry will need to invest at least $50-100 billion in developing this area over the next two decades. Additionally, airships could be the backbone of the regional Internet. Instead of launching communications satellites into high orbits, you can hang a blimp at an altitude of 20 km. There is nothing civilian flying and there are no clouds, and it can function from solar panels for the sake of a long flight duration.

Features of the Layout Limiting Space and Minimize Sounf Level from Hybrid Electrical Power Engine

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 [3], its decomposition according to the characteristic features and the identification of a critical factor for the Long-Haul Aircraft (LHA) innovation project.

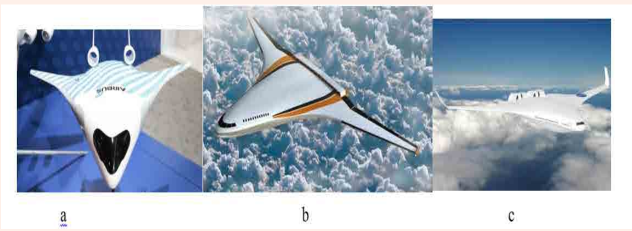

Figure 2: Any Optimal Design Concepts of Integral Wing Body Versions: a- Airbus Model, b- Boeing Project and c- MAI Design Vision.

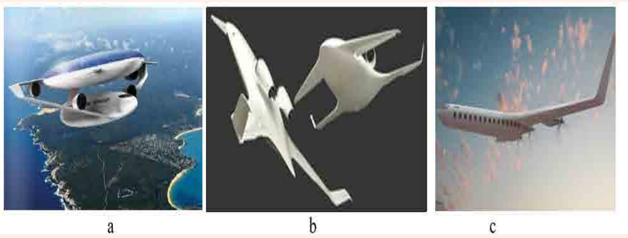

Figure 3: New WB Aircraft Concepts: a- Crioplane Disc Body with LH 2, b-Canard WB Version and c-T-WB Hybrid E-Aircraft.

If we consider the whole issue, from the point of view of the 3D Volume-Weight-Noise Integral Aerodynamic Wing-Body (WB) Configuration as show on (Figure 2), 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 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 Influence Waves area of Power Engines Positions as view on (Figure 3).

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]. In (Figure 4) 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). 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 where calculations were made in MAI Design LAB.

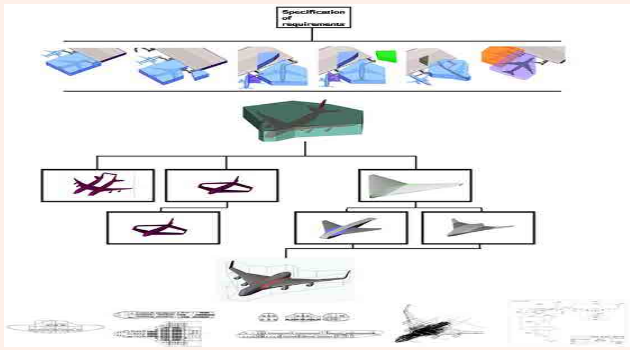

Figure 4: Influence of infrastructure restrictions on the Geometric shape of the Long-Haul Aircraft Flying Wing Scheme and the Usual Classic Scheme.

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 m3, 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.

The Optimal Dimension of a Long-Haul Aircraft Design and Adaptive reduction of Noise Level

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:

Table 1: Analysis of the Aircraft Concept basis.

Aircraft	Usual scheme		"Wing" scheme		Absolute difference		Percentage difference	
Iteration	Svol (m2)	V (m3)	Svol (m2)	V (m3)	Svol (m2)	V (m3)	dSvol %	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

a) Circumferential fuselage,

b) Twin-fuselage scheme,

c) Flying wing and Disc Plane,

d) Drop-shaped Fuselage as WB version, etc.

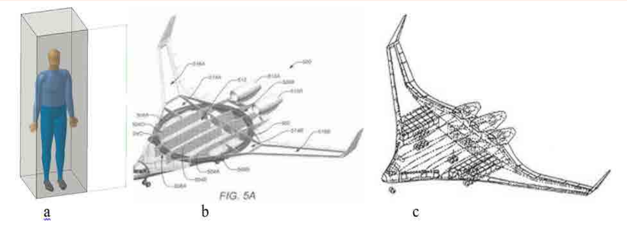

Figure 5: Geometrical model: a- of the Passenger and b,c-3D Disc Wing Body Plane Design Concepts.

Some alternatives are graphically represented at the fourth level as results of CAD/CAM R&D on the MAI Aircraft Engineering Graphic Department may be introduce of the (Figure 5). But let's analyze it. At the first CAD Stage, we determine the required volume for placing one passenger. 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 Disc-Wing Integrate Shape and having a circular cross-section, has a minimal mass. On the (Figure 6) show a change in the Geometric shapes of the cross section of the Cylindrical-shaped to Transform '8' Fuselage Shape with the influence of excess pressure is given.

Figure 6: Change of Geometric shapes of the a-cross-section of the b-Cylindrical-shaped fuselage from excess pressure and sound inside diffraction and c - Disc Shaped Wing + LH 2 Crio plane conception.

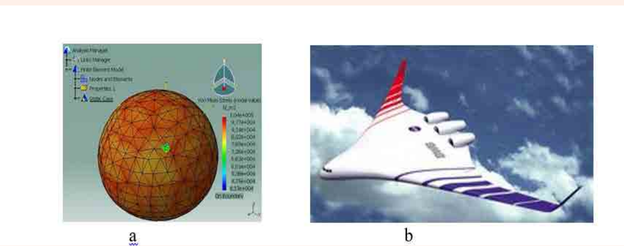

Figure 7: a - Sphere equivalent to the fuselage 3D Volume of the b-long-haul WB Aircraft.

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. 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 as show on the (Figure 7).

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 WB MAI equal WB Airbus later Design (Figure 8). 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 for Passenger Saloons #1 and #2 versions in Table 2 and Test Research of Crio-Management System for use the High Temperature Superconductor Effect of Low Resistance and High Energy Technologies of Board Electric Components of the E-Aircraft and E-Airship as view on (Figure 9).

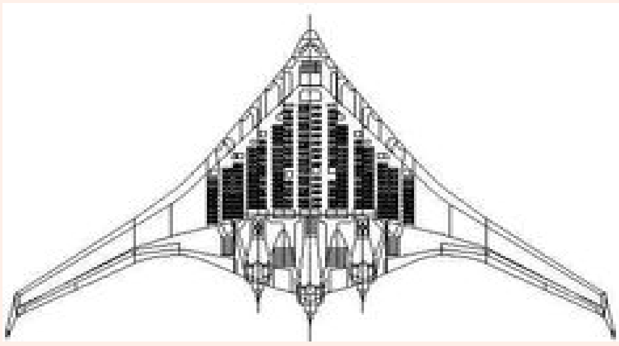

Figure 8: The fuselage PAX Cabin Design of WB Aircraft.

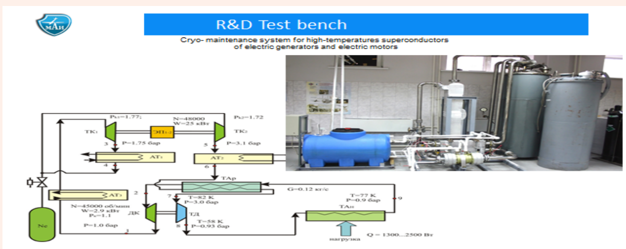

Figure 9: The Cryo-maintenance system for high-temperatures superconductors of electric generators and electric motors for Hybrid Electric Aircraft and Airship.

The perspective Disc Shaped Geometry for Minimum Structure Weight and Aerodynamic Efficiency the Aerodynamics of Discs Shaped of Dirigible was use for Innovation Projection in MAI. It's the MAI Light-then-Air (LTA) Disc Shaped THERMOPLANE (Figure 10) 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 real test flight E-Aircraft SOLARSTRATOS (Switzerland) and more Electrical Sky ships by THALES (France) as see on Figure 11 for development the new PAX & Cargo Transportation for Flight and Rescue Operation with complete the LHA as High Ecology Air Transport Aircraft & Airship conceptions to Future Mobility Development [5].

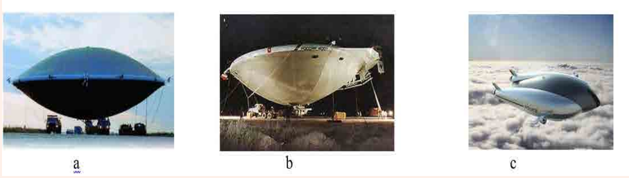

Figure 10: The patented Airship projects: a, b - Disc Shaped LTA THERMOPLANE Project by MAI Design and-3D Vision of the Multi FuzDisk Solar Skyship Concept.

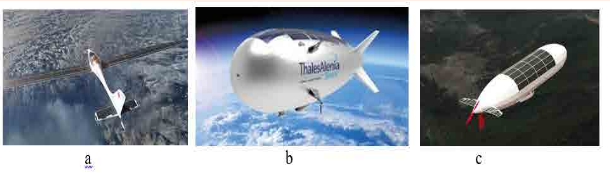

Figure 11: The Solar Concepts: a – SOLARSTRATOS High Altitude Swiss Aircraft and b, c-Solar Airship Concepts by THALES (Alenia).

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 Disc and Drop Shapes 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 [6]. The variants of the internal layout of passenger cabins 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 to provide the specified volumes, height and width of passenger compartments requires an increase in the Internal Minimum Weight & Volumes of the Flying Wing and Solar Disc Large Airship for better Air Transportation PAX & Cargo Corridors in Siberian and Cross Arctic New Shortest Flight future. 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.

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 as need to new Air Fleet in Siberian and Arctic Regions. So, the greater value of the target load and the flight range is the better application of this new Integrate Optimal Design of Aircraft Scheme. In comparison with the base Aircraft of a Normal Aerodynamic Scheme, the Weight and 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 to Disc Shaped Airship. The Computer Digital Structural & Parametric Analysis of the influence of infrastructural requirements on the 3Dimention Complex Syntesis of Long-Haul E-Aircraft and Solar Disc Shaped E-Airship Projection to use also More Electrical Power Ecology Systems with stream to near Zero-Noise Level.

References

1. Dolgov O, Kuprikov M (2008) Momento-inertial factor in the formation of the shape of the Aircraft. Moscow MAI-PRINT Publishing House 180.
2. (2019) Dirigibles may be more low cost and high efficiency Air Transport as change Cargo Sea Ship. Yandex Internet Science View.
3. Dolgov O, Kuprikov M, Kuprikov N (2010) Features of detecting the moment-inertial appearance of perspective aircraft, in the early stages of design Bulletin of the Moscow Aviation Institute 2(17): 1-4
4. Avedian A, Kuprikov M, Markin L (2012) The layout of aircraft. Moscow MAI Press. 294.
5. Ponyaev L (1997) Thermoplane ALA-40/ALA-600 Catalog Brassey's World Aircraft & System Directory. 545.
6. Ponyaev L (2018) Scientific Technologies, S&P Journal PSSN 223-2966 Moscow, Russia, Natural & Technical Science 9: 60-65.