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Fantasy Transportation: New Rail-Powered Flying Coach

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Abstract: To address the challenges of long commuting times, traffic congestion, high energy consumption, and emissions in inter-city travel, a new type of flying coach has been developed. This innovation aims to significantly shorten inter-city commuting times, enhance travel efficiency, and simultaneously reduce energy consumption and emissions. The flying coach integrates rail power supply technology, an intelligent operating system, and advanced new materials, comprising a catenary power supply guide rod and various sensor components. Based on analysis of traditional aircraft design principles, the research team simulated the design of the rail-powered flying coach using software such as AutoCAD and SolidWorks for three-dimensional modeling. The analysis results indicate that, compared to traditional aircraft and rail trains, the design of the new flying coach reduces its overall weight while maintaining carrying capacity, thereby improving commuting efficiency and environmental performance. This development lays a solid foundation for creating a greener, more efficient, and convenient inter-city transportation network.

Keywords: Public transportation; Rail power; Flying coach; Carbon emission reduction; New energy supply methods

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1. Introduction

With the development of the social economy, traditional modes of transportation are increasingly unable to meet the growing demand for travel. Issues such as traffic congestion and environmental pollution are becoming more prominent. As a result, the research, development, and application of new modes of transportation have become crucial for alleviating traffic pressure, improving transportation efficiency, and promoting green travel.

New modes of transportation must not only achieve higher speeds and longer travel distances but also contribute significantly to energy saving, emission reduction, and environmental protection. As an innovative form of transportation, flying coaches have the potential to ease the burden on ground transportation, reduce traffic noise and pollution, and provide strong support for sustainable development.

In the medium and long-term plan for Transportation Science and Technology Innovation, jointly formulated

by China's Ministry of Transportation and the Ministry of Science and Technology, the research and development of flying coach have been identified as a key focus area. Furthermore, the Civil Aviation Administration of China (CAAC) has announced that by 2035, China plans to establish a passenger-oriented unmanned air transportation system [1–3].

2. Overview of the study

2.1. Background of the study

As the global population grows, road transportation faces increasingly severe congestion, which has become a significant bottleneck restricting economic development and improving people's livelihoods. The rising frequency of movement for people and goods between urban clusters has created an urgent demand for fast, efficient, and safe modes of transportation. Flying coach offers a solution by enabling rapid connections within and between urban clusters, thereby promoting regional economic integration and fostering the development of city clusters [4].

2.2. Current status of domestic and international research

Currently, extensive research on flying cars is being conducted worldwide, including innovations such as rotor-based flying cars, wing-retractable flying cars, and wing-foldable flying cars [5]. The study of flying cars is a critical area of technological development.

In China, companies like Geely and Xiaopeng, along with academic researchers, are exploring the development of flying coaches. However, progress has been slow, and theoretical foundations remain immature. Meanwhile, other countries, such as Russia and Japan, are also working on levitation and flying train technologies. For example, the Russian company Dahir Insaat has proposed an innovative transportation concept—the flying high-speed train. Inspired by the shape of a unidentified flying object (UFO), the design resembles a flying saucer and features four large turbines on the upper body for wind energy, along with two smaller turbines at the tail. This futuristic flying high-speed train represents a bold and challenging transportation concept. Its unique design and advanced technological features offer new possibilities for the future development of the transportation sector.

3. Rail-powered flying coach structural design

3.1. General structure of the flying coach

The new rail-powered flying coach studied in this paper is mainly composed of body, wings, contact network power supply system and other parts. The overall structure of the flying coach is shown in **Figure 1**.

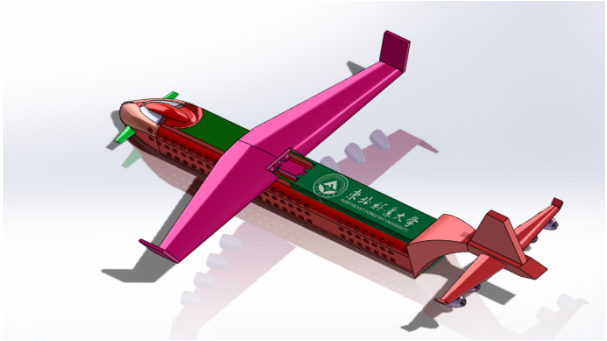

Figure 1. Top view of the structure of the new rail-powered flying coach

3.2. Structural innovations in flying coach

3.2.1. Energy supply system design

The flying coach is powered by contact grid power supply system consisting of viaducts, traction substations, contact grids, contact wires, and return circuits. The viaducts are laid continuously at equal intervals along the route.

Solar panels are installed both on the top of the flying coach and along the energy supply rail. The photovoltaic panels on the top of the flying coach absorb solar energy during the day, storing it for use in powering the operation desk, restroom, control system, and other onboard electric facilities. Additionally, solar panels installed along the energy supply rail absorb solar energy during the day and store it in the contact grid power supply system. This stored energy is then used to power the flying coach's operation [6].

A hydrogen fuel cell is installed at the rear side of the body, which can generate electricity through the electrochemical reaction of hydrogen in cloudy and rainy weather, thus realizing the energy supply for the operation of the flying coach. Hydrogen fuel cell is characterized by no noise and high efficiency. Hydrogen fuel cells do not pollute the environment.

3.2.2. Bodywork

Flying coach is affected by air resistance during flight, so measures such as streamlined design, optimized wing shape, and reduced surface roughness are adopted to reduce air resistance and energy consumption during operation, thus realizing energy saving and emission reduction.

Flying coach utilizes advanced lightweight, high-strength composites to improve energy efficiency and operational performance [7]. The use of these materials not only significantly reduces the overall weight of the coach, but also reduces energy while maintaining its structural integrity and safety. By utilizing these materials, not only can the overall weight of the coach be significantly reduced, but energy consumption is also decreased while maintaining its structural integrity and safety.

Energy-efficient lighting systems, such as light emitting diode (LED) and intelligent lighting are used in the interiors of the flying coach. Energy-efficient lighting systems have lower energy consumption and longer service life, which helps to reduce energy consumption and minimize environmental pollution [8].

3.2.3. Intelligent system design

The intelligent power management system realizes the efficient management of multiple power sources, such as solar panel power supply, hydrogen fuel cell, and contact grid power supply system, by integrating these power sources. The intelligent power management system can dynamically mobilize and optimize the performance of various power sources under different operating environments and flight speeds, so as to rationally plan the energy consumption and ensure the efficient use of energy [9]. The intelligent power management system can dynamically mobilize and optimize the performance of various power sources under different operating environments and flight speeds, so as to rationally plan the energy consumption and ensure the efficient use of energy [10].

In terms of energy selection and utilization, the intelligent power management system gives priority to solar panels and hydrogen fuel cells as two types of clean power energy. As a renewable energy source, solar panels can directly convert solar energy into electricity, while hydrogen fuel cells directly convert the chemical energy of hydrogen into electricity through electrochemical reactions, both of which have zero-emission characteristics and help reduce environmental pollution. Through the intelligent power management system, this clean power

energy can be effectively managed to avoid excessive consumption and waste of energy, which is in line with the requirements of sustainable development [11,12]. The system is in line with the requirements of sustainable development.

4. Rail-powered flying coach working process

The working process of the new rail-powered flying coach is mainly divided into three stages: vertical take-off, horizontal flight and vertical landing.

4.1. Vertical take-off phase

Before the vertical takeoff begins, the coach performs a series of self-tests and calibration operations to ensure that all systems are in optimal condition. At the same time, the coach establishes communication with the ground control system to obtain takeoff instructions and flight data.

The new rail-powered flying coach is electrically powered via rails [13]. During the vertical take-off phase, electrical power is mainly used to drive vertical take-off and landing systems, such as rotors or tilt rotors. These rotors or tilt rotors are capable of generating enough lift to raise the flying coach vertically from the ground [10].

After receiving the take-off command, the rotor or tilt rotor of the flying coach starts to rotate, generating lift. With the increasing lift, the coach gradually detaches from the ground and realizes vertical takeoff. In this process, the coach will constantly adjust the rotor or tilt rotor speed and angle to maintain stability and balance.

4.2. Horizontal flight phase

Once a flying coach reaches a certain altitude and speed, it will begin to enter the horizontal flight phase. In this phase, the flying coach needs to transition from a vertical take-off and landing system (e.g., rotor or tilt-rotor) to a fixed-wing mode in order to perform high-speed, long-distance horizontal flight. See **Figure 2** for a view of the horizontal flight phase.

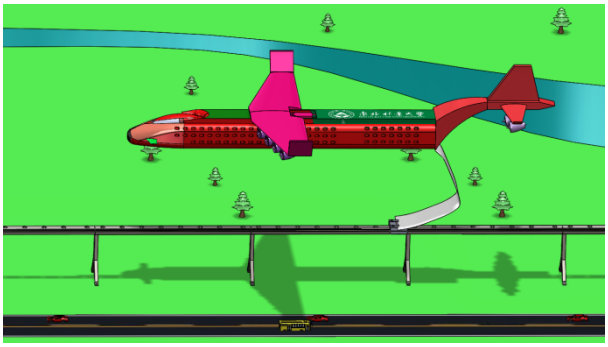

Figure 2. View of the horizontal flight phase of the flying coach

In fixed-wing mode, the flying coach relies on the wings to generate lift while the engine provides thrust. By adjusting the angle of the wings and the thrust of the engine, the flying coach can perform stable horizontal flight in the air. During this process, the flying coach also needs to maintain communication with the ground control system to obtain flight data and commands to ensure safe flight.

During the horizontal flight phase, the flying coach can perform cruise flight or perform maneuvers. During cruise flight, the flying coach will maintain a certain speed and altitude to save energy and reduce flight

time. During maneuvering, the coach can accelerate, decelerate, climb, descend, etc. to adapt to different flight requirements and scenarios.

4.3. Vertical landing phase

Upon completion of the flight mission, the flying coach enters the vertical landing phase. This process is similar to the vertical take-off phase, but in the opposite direction. The flying coach will adjust the angle and rotational speed of the rotor or tilt rotor to generate a downward thrust, which will gradually reduce the height of the flying coach and eventually land on the ground. During this process, the flying coach also needs to maintain communication with the ground control system to ensure a safe landing [15].

5. Conclusion

The new rail-powered flying coach, as an innovative means of transportation, has significant advantages such as high efficiency, environmental protection, energy saving, etc., which are of great significance for easing urban traffic congestion and improving transportation efficiency [16]. It is of great significance to alleviate urban traffic congestion and improve transportation efficiency. Through in-depth research on the key technologies of the new rail-powered flying coach, the study can provide new solutions for the future development of urban transportation [17]. The key technologies of the new rail-powered flying coach are studied in depth to provide new solutions for future urban transportation development.

In terms of the design and optimization of the flying coach, the study has successfully designed a flying coach with a highly efficient power system and an advanced flight control system to achieve stable and safe flight. For the rail power supply system, the study has proposed a new power supply scheme, which significantly improves the safety and stability of the system. In addition, the study has successfully realized the seamless connection between the flying coach and the rail system, ensuring the synergy between the two.

At present, the technical maturity of flying coaches still needs to be improved, laws and regulations have not yet been perfected, and public acceptance has yet to be enhanced. In the future, we should continue to study the key technology of the new rail-powered flying coach, promote technological innovation and industrial upgrading, strengthen communication and cooperation with relevant departments, and promote the improvement and implementation of relevant laws and regulations. Improve public awareness and acceptance, and make greater contributions to the sustainable development of urban transportation.

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Disclosure statement

The authors declare no conflict of interest.

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