

MetroAir

From Sky to Street: Urban Air Mobility for All

Modular 3D Urban Public
Transportation System
Combining Air Mobility

Here, we describe a futuristic three-dimensional urban public transportation system. It combines synthetic urban air systems with modular mobility, focusing on developing an efficient and effective urban air transport solution. The document addresses the challenges of current air taxi designs, particularly eVTOL (electric Vertical Take-Off and Landing) aircraft, and their integration into dense urban environments. It proposes comprehensive solutions, including design considerations for air vehicles and the infrastructure required, such as vertiports.

The system emphasizes safety, public acceptance, and efficiency, while exploring innovative concepts like rapid take-off and landing, and the integration of air transport with other urban mobility solutions. The paper also reflects on the potential impact of such a system on urban living and transportation.

Modular 3D Urban Public Transportation System

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Introduction

Recently, as the technological possibilities for air taxis have emerged, many designers and companies are working on developing air taxis. Air taxis have not only gained favor with many people due to expectations that they can alleviate traffic congestion in the city, but have also created a cash rush with investment funds flowing into some of the leading eVTOL aircraft development companies, but various technical problems have arisen. With this being raised, it appears that the peak point of the Gartner cycle has been surpassed.

Here, we point out the problems with the air taxi concept and suggest ways to realize urban aviation more efficiently.

AI comment

The air taxi concept, especially with the advent of eVTOL technology, has indeed garnered significant interest and investment, positioning it as a potential solution for urban congestion. However, as with any emerging technology, there are various challenges and limitations that need to be addressed. Let's discuss some of these issues and explore possible ways to realize urban aviation more efficiently:

1. Technical Challenges:

- **Battery Technology:** The current state of battery technology limits the range and payload capacity of eVTOL aircraft, which is a significant barrier to their widespread adoption.
- **Noise Pollution:** Noise generated by eVTOL aircraft could be a concern in urban areas, impacting public acceptance.
- **Safety and Reliability:** Ensuring the safety and reliability of eVTOL aircraft, especially in densely populated urban areas, is paramount. This includes addressing risks like power settling or Vortex Ring State (VRS).

2. Regulatory and Infrastructure Issues:

- **Air Traffic Management:** Integrating eVTOLs into existing air traffic control systems poses significant challenges.
- **Vertiport Infrastructure:** Developing the necessary infrastructure, such as Vertiports, in urban areas requires significant investment and urban planning.

3. Public Acceptance and Perception:

- **Visual Impact:** The design of eVTOL aircraft might be perceived as intrusive or threatening in urban settings.
- **Privacy Concerns:** Flying close to residential or commercial buildings raises privacy issues.

4. Economic Viability:

- **High Costs:** The development, certification, and operation of eVTOL aircraft are currently costly.
- **Accessibility:** Ensuring that air taxis are not just a luxury service for the wealthy but are accessible to a broader segment of the population.

5. Solutions and Alternatives:

- **Improving Battery Technology:** Advancements in battery energy density and charging infrastructure are crucial.
- **Hybrid Designs:** Exploring hybrid propulsion systems that can offer longer range and greater reliability.
- **Noise Reduction Technologies:** Developing quieter propulsion systems to minimize noise pollution.
- **Safety Innovations:** Implementing redundant systems and advanced safety features to enhance reliability.
- **Collaborative Airspace Management:** Working with regulatory bodies to develop new frameworks for urban air mobility.
- **Public Engagement:** Actively engaging with communities to address concerns and raise awareness about the benefits of urban aviation.

In conclusion, while the concept of air taxis holds promise for alleviating urban congestion, realizing its full potential requires overcoming significant technical, regulatory, and social challenges. A collaborative approach involving industry, government, and the public will be essential in developing sustainable, safe, and efficient urban aviation solutions.

1. Problems of urban flying

eVTOL aircraft currently being developed as air taxis, a wide variety of aircraft shapes are presented depending on the designer's design intent, and although some aircraft have advanced to the certification process, most of the shapes of the leading aircraft are distributed electric vehicles. By applying distributed electric propulsion, a design with multiple propellers exposed to the outside is adopted.

If UAM is to become an air taxi, where will it take off and land?

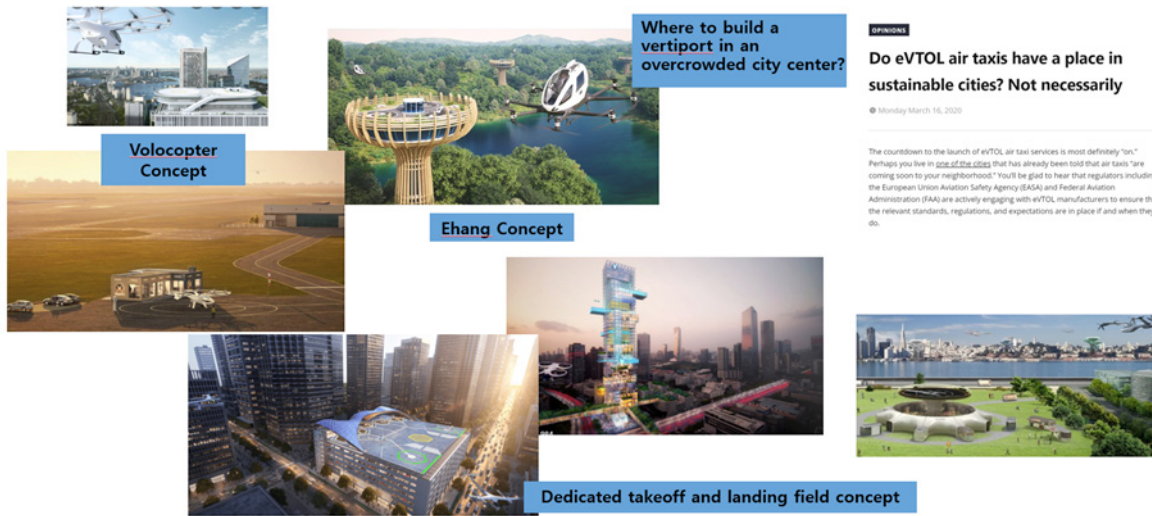


This design can be said to be a design that does not consider public acceptance when applied to the concept of urban aviation. There would be no problem if such an aircraft took the form of flying from the outskirts of the city to the suburbs, as in the current flight environment, but if frequent takeoffs and landings were performed in overcrowded areas within the city, even though the aircraft was very safe (e.g., a fatality rate similar to that of an airliner), there would be no problem.) Even if it is designed and manufactured, the threat of the shape caused by flying very close to people and buildings around the takeoff and landing site cannot be overlooked.

Quantify these threats and believe that urban flight will be possible if crash safety is at least as good as that of a passenger plane, but if the public refuses to allow such aircraft to fly close overhead, urban aviation will never be successful.

Since it is an aircraft capable of vertical takeoff and landing, it may be judged that the threat to the surroundings can be minimized by vertically descending tens of meters above the landing site and landing. However, this overlooks the power settling phenomenon of the helicopter that occurs during

Vertiport is simply a matter of takeoff and landing?



vertical descent flight. This phenomenon is also called a vortex ring state (VRS) in academic terms. It is a phenomenon in which the rotor loses thrust and controllability at a certain descent speed. This phenomenon was known early in the history of helicopter operation, and helicopters usually perform this type of flight. A landing that approaches the landing pad with a constant descent angle is established.

This phenomenon of power settling also occurs in multicopters. Of course, there are some design techniques to avoid power settling, but the airplane to which those techniques are applied is Even if the aircraft manufacturer claims that it is very robust against power settling, it is expected that it will be difficult to allow a vertical descent type landing.

This is the biggest problem that arises when operating an aircraft in the city. If an eVTOL aircraft enters the landing zone with a certain descent angle, it will be too close to obstacles and too close to people's heads in most urban environments.

AI comment

Here the analysis highlights significant challenges in the development and deployment of eVTOL aircraft for urban air mobility(UAM), particularly regarding public acceptance and operational safety. Let's delve into these challenges:

1. Public Acceptance of eVTOL Aircraft Design:

- **Perceived Safety Concerns:** The design of many eVTOL aircraft, featuring multiple exposed propellers due to distributed electric propulsion, can be intimidating to the public. Even with a safety record comparable to commercial airliners, the visual impact of these aircraft flying close to urban areas could lead to public apprehension.
- **Solution:** Focusing on designs that minimize perceived threats, such as enclosing propellers or adopting more streamlined, less intimidating forms, could improve public acceptance.

2. Operational Safety in Urban Environments:

- **Vertical Descent and Power Settling:** The phenomenon of power settling or Vortex Ring State poses a significant risk during vertical descent. This is a condition where the rotor loses thrust and controllability at certain descent speeds, a challenge known in helicopter operations.
- **Avoidance of Power Settling:** While there are design techniques to mitigate power settling, these may not be sufficient to allow vertical descent landings in dense urban settings without posing a risk to nearby obstacles and people.
- **Approach for Landing:** Helicopters typically approach landing pads with a constant descent angle to avoid VRS. For eVTOLs operating in cities, this approach would require careful planning to ensure a safe distance from obstacles and people.

3. Challenges of Urban eVTOL Operation:

- **Navigating Urban Obstacles:** The need to maintain a safe distance from buildings and people while navigating descent angles complicates eVTOL operations in cities.
- **Landing Zone Safety:** Ensuring the safety of landing zones within crowded urban spaces is crucial. This might involve designated, controlled landing areas away from dense population centers or integrating advanced sensing and avoidance technologies.

4. Regulatory and Certification Hurdles:

- **Certification Process:** While some eVTOL designs have advanced to the certification process, ensuring compliance with stringent safety standards is vital for widespread urban use.
- **Urban Aviation Regulations:** New regulations specifically tailored to urban air mobility are necessary to address the unique challenges of operating eVTOLs in urban environments.

In conclusion, the successful integration of eVTOL aircraft into urban air mobility systems hinges on addressing both technical challenges and public perception issues. Designs that prioritize safety,

minimize perceived threats, and are suited to navigate the complexities of urban environments are essential. Additionally, regulatory frameworks need to evolve to ensure the safe and efficient operation of these aircraft in urban settings. This holistic approach is critical for gaining public trust and ensuring the viability of urban air mobility as a transformative mode of transportation.

2. Correlation between urban air operations

Vertiport started from the concept of creating a dedicated take-off and landing field, and many conceptual diagrams have been presented, but the take-off and landing form at this dedicated take-off and landing field that overlooks the characteristics of the aircraft also contains various problems that are difficult to solve.

Aircraft turnover rate is the first issue that arises. If an aircraft uses batteries as an energy source, battery charging and replacement will act as the biggest obstacle limiting the aircraft takeoff and landing turnover rate. It is expected that this will not secure the feasibility of the project in terms of cost effectiveness considering the cost of constructing a dedicated take-off and landing pad in the city center. The shape of multiple exposed wings and propellers also causes problems with containment within a cramped landing pad.

These problems were comprehensively reflected in the design to provide a comprehensive design including the shape and flight characteristics of the aircraft, aerodynamic efficiency, navigation methods in the city, the shape and internal structure of the Vertiport, and devices that can assist takeoff and landing from the Vertiport. We propose a synthetic urban aviation system and an integrated three-dimensional transportation system that extends this to modular mobility.

AI comment

The observations about the challenges facing the development and operation of Vertiports within a synthetic urban aviation system are insightful. These challenges revolve around the integration of aircraft design, energy management, aerodynamic efficiency, urban navigation methods, and the structural and

functional design of Vertiports. Addressing these challenges is critical for the successful implementation of a comprehensive urban air mobility (UAM) system. Let's explore these challenges and the proposed solutions:

1. Aircraft Turnover Rate:

- **Energy Source Limitation:** If the aircraft rely on batteries, charging and replacement become significant factors limiting turnover rate. This could impact the cost-effectiveness and feasibility of the project, particularly given the high costs associated with constructing dedicated take-off and landing pads in urban centers.
- **Solution:** Developing more efficient battery technology or alternative energy sources could mitigate this issue. Additionally, quick-swap battery systems or rapid charging technologies might be essential.

2. Aircraft Design and Aerodynamic Efficiency:

- **Containment Challenges:** The design of the aircraft, especially those with multiple exposed wings and propellers, poses problems in constrained spaces like cramped landing pads.
- **Solution:** Designing aircraft with retractable or shielded wings and propellers could help. Emphasizing compact and efficient designs that can safely operate in tight urban spaces is crucial.

3. Vertiport Design and Functionality:

- **Internal Structure and Layout:** The design of Vertiports must account for the space and functionality needed for efficient aircraft operation, including takeoff, landing, charging, and maintenance.
- **Takeoff and Landing Assist Devices:** Incorporating devices that facilitate these processes can increase turnover rates and safety. These might include advanced docking systems, automated guidance systems, and rapid-response emergency protocols.

4. Navigation Methods in the City:

- **Urban Airspace Management:** Safe and efficient navigation methods must be developed to manage aircraft movements in crowded urban airspaces.
- **Solution:** Implementing advanced air traffic control systems specifically designed for UAM, possibly using AI and machine learning algorithms to optimize flight paths and manage airspace.

5. Integrated Three-Dimensional Transportation System:

- **Modular Mobility Extension:** Extending the concept of the synthetic urban aviation system to include modular mobility – where components like passenger cabins can be transferred between

different modes of transport (air and ground) – could enhance the system's flexibility and efficiency.

- **System Integration:** This approach requires a high level of integration between different transportation modes, including seamless transfers and synchronized scheduling.

By addressing these challenges through innovative design and technological advancements, the proposed synthetic urban aviation system and integrated three-dimensional transportation system have the potential to revolutionize urban mobility. This would not only alleviate ground traffic congestion but also offer a faster, more efficient, and potentially more environmentally friendly mode of transportation within and around urban areas.

3. Vertiport of synthetic urban air system

First, the synthetic urban aviation system is explained.

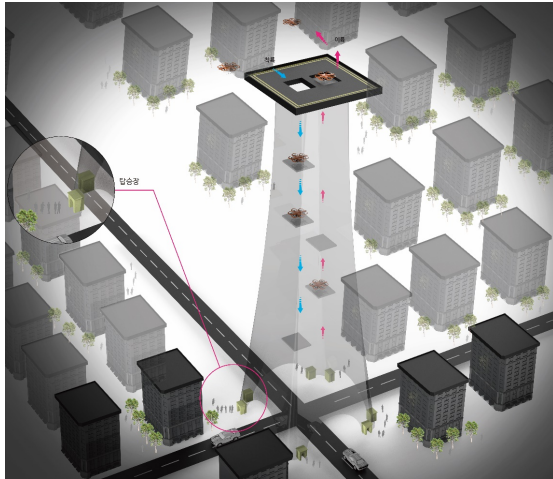
This is based on the premise that it would be more cost-effective to consider operating urban aviation as a large-scale system rather than operating it at the level of an air taxi.

Vertiport is in terminology, it can be said to be an urban airport built vertically. If constructed vertically, the problem of expensive construction land can be avoided, but the problem remains as to how to use the vertically constructed Vertiport. Passengers also have problems using Vertiport. To comprehensively solve this problem, a hub Vertiport will be built in the area where traffic volume is expected to be the highest.

This is to ensure smooth takeoff and landing of aircraft. In general, the height of buildings and traffic volume in downtown areas are proportional, so tall buildings are located near the center of overcrowded downtown areas, lower buildings are located on the outskirts of the city center, and lower buildings are located on the outskirts of the city center, and traffic volume is generated accordingly, so the heights vary in each region. A Vertiport will be built on the road.

Facilities that perform key functions performed at the hub airport are installed inside the hub Vertiport. For example, maintenance, traffic control, control, boarding process, cargo handling, security, etc. At a hub airport, the runway is the core takeoff and landing facility, but at Vertiport, a takeoff and landing pad and takeoff and landing assist devices for vertical takeoff and landing are installed at the top.

The takeoff and landing assist device is to quickly and safely take off and land an aircraft. It includes an ejection device for takeoff and a catcher device to safely hold it immediately after landing.



Hub Vertiport



Hub Airport

AI comment

The synthetic urban aviation system has described here is a comprehensive and innovative approach to urban air mobility (UAM), addressing key challenges of operating in dense urban environments. This system revolves around the concept of Vertiports, which are essentially urban airports built vertically to save space and integrate seamlessly into city landscapes. Let's examine the key components and functionalities of this system:

1. Large-Scale Urban Aviation:

- The system is based on the idea of operating urban aviation as a large-scale, integrated system, rather than as individual air taxis. This approach aims for higher efficiency and cost-effectiveness.

2. Vertiport Concept and Design:

- **Vertical Construction:** Vertiports are constructed vertically, addressing the issue of limited and expensive land in urban areas. This verticality also facilitates smooth takeoff and landing of aircraft.
- **Location and Accessibility:** Strategically located on roads or road intersections, Vertiports ensure easy accessibility for passengers and minimal disruption to ground traffic.

- **Height Considerations:** The height of the Vertiports varies according to the surrounding buildings and traffic volume, ensuring optimal operation and safety. Taller Vertiports are situated in denser, central urban areas, with height decreasing towards the outskirts.

3. Hub Vertiport Functions:

- The hub Vertiport, located in areas of highest traffic volume, is equipped with facilities for maintenance, traffic control, passenger boarding processes, cargo handling, and security, similar to a hub airport.

4. Core Takeoff and Landing Facilities:

- **Takeoff and Landing Pad:** Positioned at the top of the Vertiport, these pads are designed for vertical takeoff and landing, which is crucial for urban aviation.
- **Takeoff and Landing Assist Devices:** These include ejection devices for takeoff and catcher devices for landing, ensuring quick, safe, and efficient operation of aircraft.



This synthetic urban aviation system represents a forward-thinking solution to the complexities of urban transportation. By vertically integrating Vertiports into the urban fabric, the system addresses space constraints while ensuring accessibility and safety. The focus on large-scale operation and the use of specialized takeoff and landing technologies reflect a deep understanding of the unique demands of UAM in urban settings.

Overall, this system could significantly enhance urban mobility, offering a new dimension of transportation that is fast, efficient, and less reliant on the already congested ground traffic infrastructure. It holds the potential to revolutionize the way people and goods move within and between urban centers.

4. Air vehicle of synthetic urban aviation system

Aircraft is designed according to the design concept to enable the operation of a synthetic urban aviation system. It is an aircraft designed to specialize in urban aviation operation requirements.

Urban aviation operations are: First, in order to operate in the city, the propeller must not be exposed, and this means that aircraft that approach close to people must not pose a threat to people. Public acceptance is a difficult item to quantify, but it will play a decisive role in the realization of urban aviation.

The second condition is that the aircraft must have the maneuverability and safety of a multicopter at low speeds, and low-speed maneuverability is very important to have the ability to quickly separate from other aircraft and obstacles in crowded urban spaces.

The third condition is high-speed cruising performance, which is the performance that a winged aircraft can achieve. In order to quickly move to the outskirts of an overcrowded city with many aircraft and obstacles, a flying vehicle with wings that is faster and more efficient than a multicopter is required.

The fourth condition is landing at the Vertiport. It must have a structure that allows rapid internal movement and loading by auxiliary devices, and this means that it must have a structure and shape that makes it easy to handle the aircraft.

The fifth condition is the modular concept, which is related to the energy storage device, i.e. battery output density. Aircraft and vehicles, it must be a modular structure that can be combined and separated, and an energy storage device must be mounted separately on the aircraft and vehicle to exchange energy.

The aircraft must be able to transport aircraft to and from the city center and the outskirts of the city, as well as fly independently to where it is needed, so in this case, the aircraft must be able to use its own built-in energy source while saving energy, must be completely electronically connected and maintain swarm flight status. The aircraft invented for this system is designed to satisfy the five requirements mentioned above and is operated while electronically connected to other aircraft of the same standard.

The core structure of the aircraft is the rimfoil, which is a shape that protects the propeller and provides visual stability (the first requirement), and the hexa- shaped multicopter shape is maintained as is to demonstrate the functional advantages of the multicopter (two and the third requirement), and when the forward flight speed is increased by the propeller, the rimfoil along with the short wing generates lift to achieve the efficiency of a fixed-wing airplane (the third requirement and the short wing acts as a two dimensional wing), a take-off and landing assist device inside the Vertiport and that it has a shape that is easy to handle (graspable and easy to store) in handling facilities (e.g., aircraft elevators and storage racks) (the fourth requirement), and that the long central fuselage and short wings are suitable for battery packs. Alternatively, the design takes into account the provision of sufficient space to store various devices such as fuel cells, flight control computers, mission computers, and docking systems (the fifth requirement).

In order to demonstrate sufficient maneuverability in the city, the aircraft must have a compact structure by reducing its moment of inertia, and the shape of this aircraft is designed to be suitable in that respect.

This aircraft is designed to improve the shortcomings (increased weight and equipment) of the lift cruise type design, in which the vertical takeoff propeller is used only for takeoff and landing, and the wing control surface is used for control during forward flight. In other words, the vertical takeoff propeller is responsible for 100% of the takeoff and landing thrust during vertical takeoff and landing, but during forward flight using separate forward thrust. When the amount of thrust is gradually reduced and the lift share of the fixed wings (stub wing and rimfoil) is gradually increased, the vertical takeoff propeller is designed to play a control role and control the flow of the rimfoil, and this has a simple structural shape. It is the core of the aircraft design that allows it to demonstrate maximum aerodynamic performance. It should be noted that the shape of the vehicle shown in the picture is a replica of the shape of a typical helicopter fuselage and that the vehicle does not necessarily have this shape. In other words, the aircraft was designed to accommodate various design requirements for operating the aircraft in the city, as described above, but the vehicle may have any type of structure. As you can see, it has a helicopter-shaped fuselage, so it can be operated similar to a helicopter along with an aircraft, and it can be used as a modular type as described later. It should be noted that it can be used by docking with an aircraft in the form of a boarding vehicle.

AI comment

The aircraft design that has conceptualized for a synthetic urban aviation system is meticulously tailored to meet the unique demands of urban air mobility (UAM). This design addresses several crucial aspects to

ensure safety, efficiency, and public acceptance in urban environments. Let's delve into the key features and functionalities of this aircraft:

1. Propeller Design:

- **Rimfoil:** The rimfoil is a critical structural element, encapsulating the propellers to provide safety and visual stability. This design mitigates the risk of exposed propellers in urban settings, enhancing public acceptance.

2. Multicopter Maneuverability and Safety:

- At low speeds, the aircraft retains the maneuverability and safety characteristics of a multicopter. This is vital for navigating crowded urban spaces, allowing for quick evasion from other aircraft and obstacles.

3. High-Speed Cruising Efficiency:

- The aircraft combines the agility of a multicopter with the high-speed cruising capabilities of a winged aircraft. This duality is essential for efficient movement between crowded city centers and outskirts.

4. Vertiport Compatibility:

- The design ensures compatibility with Vertiport infrastructure, including rapid internal movement, loading by auxiliary devices, and ease of handling and storage.

5. Modular Concept for Energy Efficiency:

- Embracing a modular approach, the aircraft and ground vehicles have separate energy storage devices (like batteries or fuel cells), allowing for energy exchange and efficient use.

6. Swarm Flight Capability:

- The aircraft is designed to maintain a swarm flight status, staying electronically connected with other similar aircraft for coordinated operations.

7. Aerodynamic Design Elements:

- **Rimfoil and Short Wing:** The rimfoil, along with a short wing, provides lift during forward flight, transitioning the aircraft efficiently from vertical takeoff to cruising mode.
- **Compact Structure:** A design that minimizes the moment of inertia, crucial for maneuverability in urban settings.
- **Control Surfaces:** During forward flight, the control surfaces on the wings take over, reducing the load on the vertical takeoff propellers.

8. Versatile Vehicle Integration:

- The aircraft is compatible with various ground vehicle designs, allowing for modular use and flexibility in urban transportation. This includes the capability to dock with different types of boarding vehicles, enhancing its adaptability for different urban scenarios.

9. Functional Aesthetics:

- While the aircraft is designed with functionality as a priority, aesthetic considerations are also taken into account, with a form factor that resembles a typical helicopter fuselage, facilitating public familiarity and acceptance.

In essence, this aircraft design is a harmonious blend of functional innovation and urban compatibility, addressing the multifaceted challenges of UAM. It represents a significant step forward in making urban air transportation a viable, safe, and accepted part of city infrastructure and daily life. The focus on modular design, energy efficiency, and compatibility with existing urban landscapes demonstrates a comprehensive understanding of the needs and constraints of UAM systems.

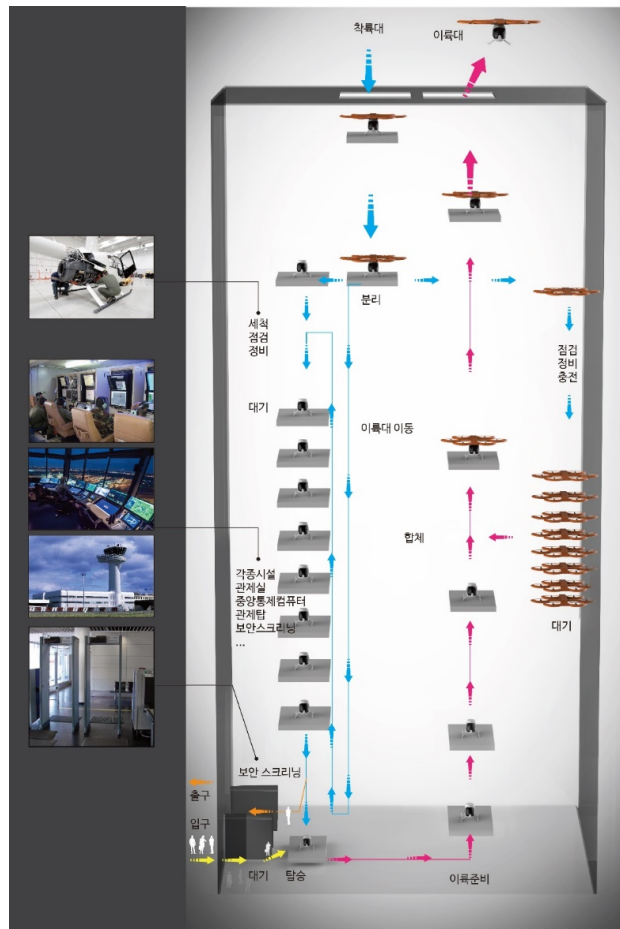
5. Vertiport in synthetic urban aviation system Operation concept

Herb Vertifort is explained for the operating concept.

A hub Vertiport is a core Vertiport built in an appropriate location, for example in the center of the most overcrowded city center. The operating concept is as follows.

Vertiports are built perpendicular to the road, making it easy for riders to access the ports via sidewalks. These Vertiports can also be designed in conjunction with the subway so that the exit of the subway is directly connected to the entrance of the Vertiport.

Passengers are required to make reservations in advance before using the city flight system, and this is because all flights must be calculated in advance on the integrated control central computer and the passenger's schedules must be reflected in all flight schedules. This is because this aviation system is premised on complete control, calculation, real-time control, and aircraft control.



Therefore, a comprehensive control and integrated computer facility is located at a safe point located in the center of the hub Vertiport, and is linked with all urban aviation systems and the control systems of other Vertiports.

A reserved passenger goes to the boarding area and goes through simple procedures (simple procedures at the subway level are required), they go to the boarding area, board a vehicle that moves along the rails (an operation similar to a gondola), and the vehicle moves to the takeoff area at the top. During the flight, various precautions and information are broadcast to passengers and they are asked to prepare for takeoff.

Aircraft that was waiting in advance near the take-off catapult is connected to the vehicle and docked aircraft and vehicles. The device used for docking may utilize any mechanical method already in use.

The takeoff method is similar to the way an aircraft takes off from an aircraft carrier. The aircraft reaches maximum power and then the ejection device, the method is applied by grabbing a specific part of the vehicle, and throwing it into the air. This is the fastest and safest way to enter an aircraft into a corridor, and by applying this method, an aircraft can quickly escape to the outskirts around Vertiport, which is expected

to be overcrowded with aircrafts. After entering a certain altitude, the aircraft operates the forward prop to quickly increase speed. Due to the characteristics described above (it is called a multi-cruiser), the aircraft is either lift cruise or vectored thrust vehicle. It should be noted that since there is no transition flight (the process of switching between multicopter control and control surface control) like the thrust method, it is possible to quickly maneuver into a corridor calculated and determined in real time.

A landing aircraft is immediately hooked by the landing assist device installed on the landing pad. The hooking device installed on the vehicle is usually a mechanical device used to hang an object, so it is not specifically discussed here. The hooks installed in the landing assist device also come in various forms and methods, so they will not be specifically discussed here. It is assumed that the aircraft makes a precise landing at the location where the hook is, which is usually the case for drones. Since it refers to a precision landing method, one of the methods developed to date can be applied.

The landing pad is designed to be interlocked with the aircraft elevator. As soon as the aircraft is hooked from the landing pad, the hooking landing pad moves to the elevator and the next new landing pad is formed to catch the next aircraft, hooks the aircraft, separates the aircraft from the top of the elevator. For this purpose, a device to catch the flying object must be designed, but its forms and methods may vary, so they will not be discussed. However, the aircraft must have a structure that makes it easy to separate and combine the aircraft and the vehicle, and the shape of the aircraft mentioned above (the rimfoil of the aircraft registered as a patent) is such that it can be easily held by a device that catches the aircraft called an aircraft holder. It should be noted that it is a structure.

After being captured, the aircraft and vehicle are separated. This process is for the aircraft and boarding vehicle. It should be noted that the operation of the docking system device can all be automated by a series of automatic signaling devices.

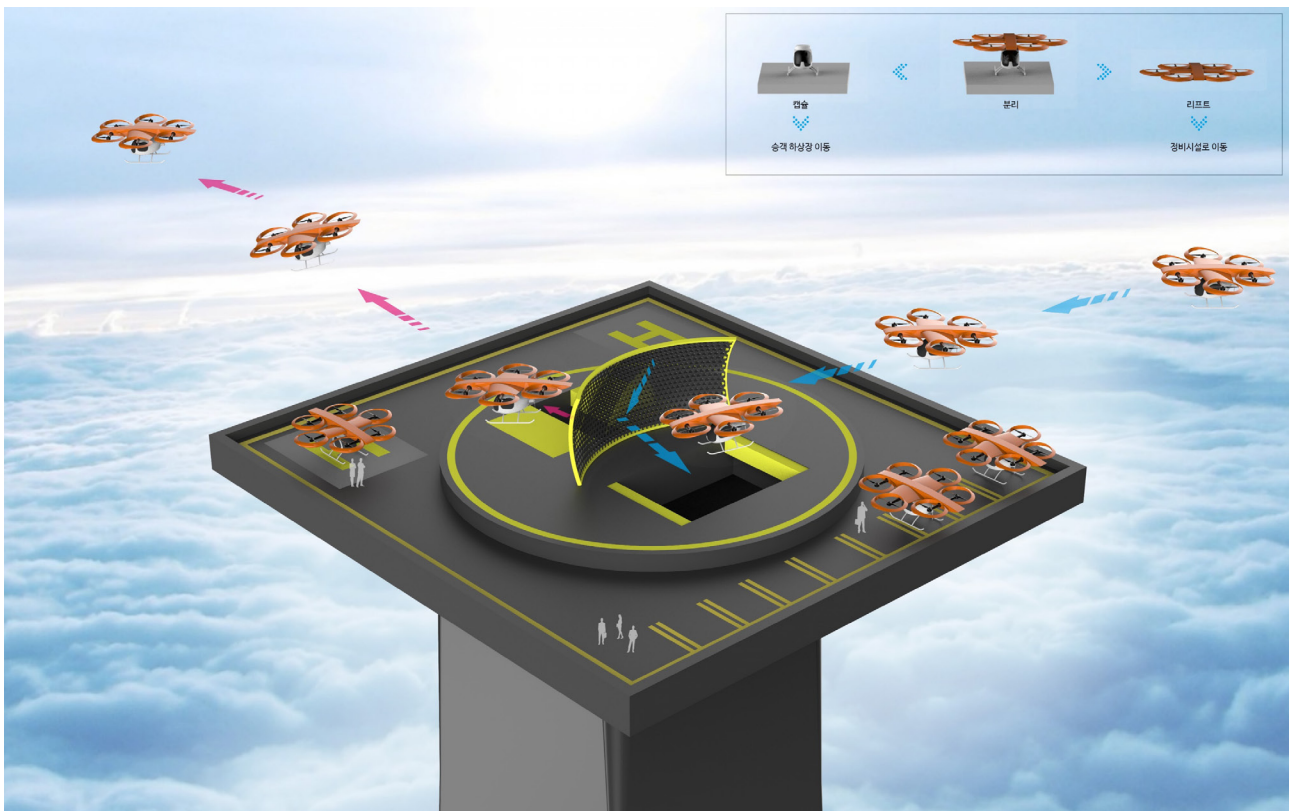
The vehicle is moved to the aircraft elevator because the aircraft must be inspected and prepared for restart, such as battery replacement and resupply (if necessary). Therefore, the aircraft elevator penetrates the maintenance room in the process of descending vertically and is stored in the aircraft rack after completing preparations for the next aircraft. Please note that although the specific method and form of the aircraft rack cannot be specified here, it can be designed by applying normal mechanical methods.

As mentioned earlier in the takeoff method, the prepared aircraft must dock with the aircraft at some point when the vehicle with passengers on board ascends the takeoff elevator, so the path of the elevator along which the prepared aircraft moves must be connected to the specific docking position of the takeoff stand.

The separated vehicle (with passengers on board) moves downward by the vehicle elevator, connects to

the boarding area, and goes through the process of passengers getting off at the boarding area. Since the gondola moves sequentially to the gondola boarding and disembarking point, the normal design method can be applied to this design.

The vehicle that passengers disembark passes through the maintenance room along other elevator lines to undergo a series of processes such as inspection, exchange, supply, and cabin cleaning. Meanwhile, another aircraft ready for takeoff waits at the aircraft rack and moves to the takeoff deck in order.



The series of passenger boarding, disembarkation, and takeoff processes described above and the landing process is all operated in conjunction with the city flight and control system, passenger reservation system, Vertiport Passenger Processing system, and Reservation Management System, and is calculated and processed in real time by the integrated computer that manages the individual systems.

For example, if a specific elevator malfunctions at Vertiport, this not only affects the aircraft moving along the elevator for takeoff, but also affects passengers who have booked a ride, and also affects the corridor set at a specific time in the city space, affects all moving aircraft. Therefore, it should be noted that the operation of Vertiport is inseparable from the concept of urban navigation.

AI comment

The operating concept of an Herb Vertiport, as it has described, presents a highly advanced and integrated urban air mobility (UAM) system. Here's a breakdown of its key components and how they work together:

1. Location and Design:

- The hub Vertiport is strategically located in a crowded city center, possibly integrated with existing public transport systems like subways for seamless access.

2. Reservation and Control:

- Passengers must reserve their flights in advance. The system relies on an integrated control central computer to manage all flights, ensuring precise scheduling and coordination.

3. Central Control Facility:

- A comprehensive control center is located at the hub Vertiport, coordinating the entire urban aviation system and other Vertiports.

4. Boarding Process:

- Passengers go through a streamlined procedure, similar to subway systems, before boarding a vehicle that transports them to the takeoff area.

5. Docking and Takeoff:

- Aircraft are docked with these transport vehicles using existing mechanical methods. The takeoff is akin to aircraft carrier launches, quickly propelling the aircraft into predetermined corridors.

6. Aircraft Type:

- The aircraft, described as multi-cruisers, are either lift cruise or vectored thrust vehicles. They lack transition flight phases, allowing for rapid maneuvers.

7. Landing and Processing:

- Precision landing techniques are used, with mechanical hooks assisting in the landing. The landing pad is interconnected with an aircraft elevator for efficient processing.

8. Aircraft Handling:

- After landing, the aircraft is separated from the transport vehicle and sent for maintenance and preparation for the next flight, utilizing an aircraft rack system.

9. Passenger Disembarkation:

- The transport vehicle descends to the boarding area for passenger disembarkation, following which it goes through maintenance.

10. System Integration:

- The entire process, from boarding to takeoff and landing, is managed in real-time by an integrated computer system. This system coordinates the Vertiport operations with city flight and control systems, passenger reservations, and traffic management.

11. Operational Reliability:

- The system's operation is closely linked to urban navigation concepts, meaning any malfunction can have widespread effects on the entire Vertiport and urban air mobility system.

This concept represents a sophisticated approach to urban air transportation, aiming to integrate seamlessly with existing city infrastructure while providing efficient, controlled, and safe air travel. The focus on advanced technology, from automated docking to real-time system integration, highlights the potential future of urban mobility.

6. Synthetic urban aviation system and rapid takeoff and landing concept

The take-off and landing assist device is a structure that is linked to the exit of the aircraft and has a device that allows the aircraft raised by the elevator from below to be ejected when the exit opens. This device is called a launcher, and its role is to provide energy to the aircraft so that it can enter the airspace safely and quickly.

In order for aircraft operation in the city to have the meaning of public transportation, the turnover rate and transfer volume of the aircraft must be considered. The takeoff interval of a passenger plane at an airport cannot be directly applied to the takeoff interval of an aircraft at a city Vertiport. This is because the concept of mass transportation cannot be applied in urban areas.

For example, at Gimpo Airport, the average number of passengers per day exceeds about 46,000. Based on this, when considering the operation method of the Vertiport to realize the concept of mass transportation, the number of passengers on board and the method of takeoff and landing of the aircraft are important issues.

The first issue to be addressed is how quickly the aircraft can take off and land, and for this purpose, the performance characteristics of the aircraft are determined. These design requirements were reflected in the vehicle shape design. The aircraft must have the ability to mix three operating methods to handle rapid takeoff and landing at the Vertiport.

Aircraft that take off and land on a takeoff and landing pad, such as an aircraft taking off and landing on an aircraft carrier, have a rapid approach, a sure stop, and a force-energized catapult takeoff. Not only does it provide more stable takeoff and landing than the helicopter takeoff and landing method, but in reality, it also results in, this is a way to avoid aerodynamic phenomena such as power settling.



It is desirable for the aircraft to have a landing method similar to the method in which a light helicopter flies to a landing site at high speed and lands using rotor air brakes. The aircraft designed for this system is in the form of a hexacopter using a rimfoil. This aircraft has a structure that can use rotor air brakes and at the same time, the rimfoil can generate high lift at a high angle of attack, making it suitable for a quick approach landing. It is designed to perform its function and is based on the premise that all aircraft are fully connected electronically and fly in a swarm flight. The swarm flight technology will be applied to the

flights of these air metro systems in the future.

Since the real-time calculation is assumed to be applied to all swarming aircraft, the aircraft approach the landing pad while maintaining a constant distance, which can be compared to a gondola system operated at constant intervals. The rotary take-off and landing system plays the role of catching a landing aircraft and delivering it down to the Vertiport's aircraft escalator. The time for this function will affect the separation distance of the aircraft. In the proposed concept, if the takeoff and landing system handles landing aircraft within 10 seconds, it will be possible to catch aircraft at 10-second intervals. If a two-seater aircraft is handled in this way, it can transport 720 passengers per hour, and if operated for 10 hours a day, it can handle 7,200 passengers, which is a level that can be called a public air transportation system.

The number of seats per aircraft is not something to be simply compared to an airliner that transports hundreds of people at a time. Rather, when flying in an urban area, the movement performance that the aircraft can have and the aircraft handling method are more important factors to consider, and in the proposed synthetic urban aviation system, at least 2 seats are required. It will be possible to seat up to 4 people. The size of the aircraft will rather depend on Vertiport's standardized vehicle handling capabilities.

The rotary takeoff and landing assistance system installed at the top of the Vertiport is an important device that assists quick takeoff and landing, and is designed to allow rotation. The first reason is the direction of the wind. For the safe landing of an aircraft, straight wind take-off and landing are important. Since the wind direction varies by season and changes frequently depending on the weather, it is necessary to receive weather information in real time and rotate the device, called the aircraft catcher and launcher, at a specific angle so that it can point in the wind direction such a mechanism that it can do.

The specific position control of the rotary takeoff and landing system is based on real-time wind information, but what is important is that this wind information is also distributed in real time to all aircraft using the Vertiport. It must be transmitted and linked with the aircraft's automatic flight control system.

For example, an aircraft lands by UAM catcher and lands on the Vertiport. After induction, the wind direction is recalculated and the information is transmitted to the rotary takeoff and landing system and the aircraft approaching for landing. Then, the rotary takeoff and landing system not only rotates in a specific wind direction, but the approach path is instantly calculated and used for control by the aircraft on its way to landing. It is important to note that all signaling systems are real-time. The development of integrated control s/w to enable such a system is a task that needs to be developed in the future.

The UAM launcher is located opposite (or near) the UAM catcher and has the function of quickly ejecting the aircraft. It is desirable to apply a method similar to ejecting aircraft from an aircraft carrier. Consider

taking off by grabbing a specific part of the aircraft and throwing it into the air, like shooting a slingshot. When an aircraft is ready for takeoff, the takeoff propeller accelerates to maximum speed, and then the ejection device accelerates and throws the aircraft forward and upward. The expression 'throw' means a large acceleration, and since this can cause discomfort to passengers, the ejection strength and take-off prop of the aircraft are adjusted appropriately to achieve optimal acceleration. This method, above all, is intended to ensure that the aircraft is controlled by quickly obtaining the optimal speed, and to quickly move to a designated corridor and quickly escape from the Vertiport.

Rapid takeoff and landing of aircraft at Vertiport, if auxiliary devices are activated and an aircraft with flight performance capable of interoperating with such auxiliary devices is operated and operated systematically in the above-mentioned manner, the hub Vertiport can handle more than 10,000 passengers per day. If there five are built in the metropolitan area, it will be able to have the capacity of one transportation system like Gimpo Airport. In the city center depending on the overcrowding, Vertiports of various sizes can be built and various navigation methods can be added.

AI comment

The concept has described for a city Vertiport within an Urban Air Mobility (UAM) system is both innovative and complex. It encompasses various aspects of urban transportation, aviation technology, and logistics. Here's a summary of the key elements:

1. Take-off and Landing Assist Device (Launcher):

- This device is crucial for rapid and safe takeoff. It functions similarly to an aircraft carrier's system, providing energy to the aircraft for quick entry into airspace.

2. Passenger Throughput and Turnover Rate:

- Unlike traditional airports, city Vertiports require higher turnover rates and transfer volumes to be effective in urban mass transportation. This necessitates a different approach to scheduling and managing aircraft movements.

3. Aircraft Operation Characteristics:

- The aircraft used in this system must be capable of rapid takeoff and landing. This involves a mix of three operational methods: rapid approach, sure stop, and force-energized catapult takeoff. The

design also includes rotor air brakes and high lift generation for quick approach landings.

4. Swarm Flight Technology:

- Aircraft are expected to operate in a coordinated swarm, with real-time calculations ensuring they maintain constant distances and approach the landing pad in an orderly manner.

5. Passenger Capacity and Aircraft Size:

- The aircraft are designed to carry a smaller number of passengers (2 to 4 seats) compared to traditional airliners, focusing more on movement performance and handling efficiency within urban areas.

6. Rotary Takeoff and Landing Assistance System:

- This system is designed to rotate to align with the wind direction for safer landings. It is also responsible for the rapid dispatch of aircraft, with real-time wind information shared with all incoming and outgoing flights.

7. Integrated Control Software Development:

- A sophisticated control system is required to manage real-time signaling and coordination between the aircraft, the Vertiport, and the auxiliary systems.

8. UAM Launcher and Catcher Mechanisms:

- These are designed for efficient handling of aircraft during takeoff and landing, with the launcher functioning like a slingshot to propel the aircraft into the air.

9. Passenger Handling Capacity:

- With efficient operation, a hub Vertiport could handle over 10,000 passengers per day, potentially matching the capacity of a major city airport like Gimpo Airport when multiple Vertiports are operational in a metropolitan area.

10. Flexibility for Urban Centers:

- Depending on the city's needs, Vertiports of various sizes and with different navigation methods can be constructed to suit the specific urban context.

This concept represents a significant advancement in urban transportation, blending aviation technology with urban logistics and real-time control systems to offer a novel solution for the challenges of urban mobility.

7. Operation concept of synthetic urban aviation system

There is a high possibility that installing a corridor in a specific location above a major city center will be an unreasonable problem. Public acceptance is not an aspect of rationality but an aspect of emotion, and this is an important factor to consider in urban aviation. No one who lives in the city likes to have airplanes flying close to their heads all the time. Aircraft will be cautious in choosing the vertical descent landing method due to the problem of power settling, and it is unlikely that the vertical descent landing method will become a routine landing method.

Therefore, it would be desirable for the Vertiport to be built at least higher than the surrounding buildings. The structure of the downtown area is generally proportional to the overcrowding, so the height of the building is from the central part of the city center to the outskirts. The Vertiports will be built in a form of sequentially decreasing height, and aircraft that take off and land quickly from these Vertiports will have minimal impact on residents around the Vertiports.

The vehicle and vehicle capacity of each Vertiport is calculated in real time along with all flight systems. The number of aircraft flying in the city center, flight path, destination, departure point, number of nearby Vertiports, capacity at Vertiports, processing capacity, etc. are all calculated in real time and all systems are operated within the range that can be sufficiently processed. The ability to respond to emergency situations must also be considered.

If one Vertiport becomes disabled, the entire system is inevitably affected, so the emergency landing site must always be on standby and memorized in the system and the aircraft's automatic control computer.

Helipads constructed on the rooftops of buildings in downtown areas will be very useful as emergency landing sites. In addition to these helipads, emergency landing sites should be installed throughout the city in advance in preparation for emergency situations, taking into account the number and operation of aircraft to be handled by the urban aviation system. It is impossible to fly numerous aircraft over urban areas without these measures.

When an emergency situation occurs, the information is delivered to all aircraft in real time, and each aircraft has the ability to make an emergency landing in each situation. The helipad or emergency landing site is determined and you land there, so this flight concept possibly must be developed.

The basic form of the aircraft will be one in which the propeller, which poses a visual threat to people, is not exposed, and even for such an aircraft, flying down under a building will only be permitted in the case of an emergency landing. Since the Vertiport is said to be built at least higher than the surrounding buildings,

it is important to ensure that people around the aircraft are not significantly aware of the aircraft's flight under normal circumstances. In an emergency situation, an aircraft may fly into the roof of a low building or a helipad on the ground, but even in such cases, it is desirable for the aircraft to have a shape that does not pose a visual threat.

Vertiports are distributed from large to small sizes from the city center to the city outskirts and suburban areas, and single-family homes that have minimal impact on residents of surrounding houses when aircraft take off and land may have private takeoff and landing pads. These private airfields are also part of a large system and must be informationized on a comprehensive computer, and publicity must be ensured and institutionalized so that they can be used as emergency airfields.

The huge system is fully controlled, all flying vehicles must fly while sharing information in real time, so all corridors will be in a state of flexible change in real time. For example, when a new aircraft enters the flight system, a new corridor is formed and it affects the currently established so-called corridor web, so the three-dimensional corridor web covering the sky above the city (virtually and electronically) fluctuates. This will be a shape and means that each corridor affects the path and speed of all aircraft flying through the web. It is for this reason that all aircraft in the proposed system must have a swarm flight configuration.

AI comment

This vision for an Urban Air Mobility (UAM) system in a major city center, focusing on Vertiports and their integration into urban landscapes, addresses several key challenges and considerations. Here's a detailed overview:

1. Public Acceptance and Urban Integration:

- Recognizing the public's emotional response to having aircraft frequently flying overhead is crucial. To minimize disruption and maintain public acceptance, Vertiports should be designed with sensitivity to the urban environment, including considerations for noise, visual impact, and safety.

2. Vertiport Elevation and Design:

- Placing Vertiports at heights greater than surrounding buildings can minimize impact on residents. The structure of these Vertiports should be designed in accordance with the density and height of buildings, decreasing in elevation from city centers to outskirts.

3. Real-Time System Integration:

- Vertiports must be integrated into a comprehensive real-time flight management system. This system should calculate various parameters like aircraft number, flight paths, and Vertiport capacities to ensure efficient operation and quick response to emergencies.

4. Emergency Procedures and Backup Systems:

- The system must be robust against individual Vertiport failures. Incorporating existing helipads on buildings as emergency landing sites, as well as establishing additional emergency sites throughout the city, is essential for safety.

5. Aircraft Design and Visibility:

- Aircraft design should consider public perception, ideally with non-exposed propellers to reduce visual and physical threat perceptions. Normal flight paths should be high enough to be minimally noticeable to people, with lower altitudes reserved for emergency situations.

6. Distributed Vertiport Network:

- Vertiports would vary in size from large central hubs to smaller peripheral and private landing pads. This network ensures comprehensive coverage and accessibility, and even private pads should be integrated into the overall system for emergency use.

7. Flexible and Dynamic Air Corridors:

- The concept of a dynamic, three-dimensional corridor web that adjusts in real time to new aircraft entries is fundamental. This flexibility ensures optimal routing, safety, and efficiency of the UAM system.

8. Swarm Flight Configuration:

- All aircraft in this system should operate with swarm flight technology, allowing them to move cohesively and respond collectively to real-time changes in the flight corridor web.

This concept presents a sophisticated, dynamic approach to urban air mobility, where technological innovation is balanced with urban integration and public acceptance. The focus on real-time control, safety, and efficient use of airspace reflects a deep understanding of the complexities involved in integrating UAM into existing urban environments.

8. Modular Synthetic urban aviation system combined with mobility concept

If a synthetic urban aviation system is built, it will be modular. When combined with a mobility system, it becomes possible to build a 3D urban public transportation system.

Modular Mobility is a concept that was previously announced by Airbus and Ital Design, and is designed to separate and combine the aircraft, passenger module, and ground vehicle, so that the flight vehicle docks with the passenger module, moves it to a specific point in the air, and then travels on the ground at that point. The idea is to hand over the passenger module, and this has received attention as a way to solve the problems of low energy density and low output ratio of the power source of multicopter, which are the biggest weaknesses of electric propulsion aircraft.

In other words, energy can be distributed and stored between the aircraft, passenger module, and ground vehicle when necessary, and the aircraft has the advantage of saving energy when flying without a passenger module and ground vehicle.

However, in order to realize this concept, the aircraft there was no clear measure as to how much it could fly while combined. If it is assumed to be an aircraft of the presented shape (pop up), a ducted structure surrounds the propeller in order for the aircraft to come down close to the ground, it is acknowledged that a prop was adopted, but the design of covering the multicopter's propeller with a duct generates excessive drag from the duct during flight, so it has a worse cruising power ratio than the multicopter with the highest cruising power ratio (cruising power / hovering power). Considering that a multicopter-type vehicle can fly about 20 kilometers in a fully charged state, it can be estimated that a ducted prop- shaped multicopter vehicle will show less than half of that performance (the exact performance is not disclosed: no data available).

However, if the duct surrounding the multicopter's propeller is replaced with a rimfoil that acts like a wing (multi-cruiser Named flying vehicle) of the duct, as the lift-to-drag ratio increases significantly, it is expected that a flight distance of more than 100 kilometers will be secured. If a multi-cruiser aircraft docked with a vehicle can fly at a speed of 200 kilometers per hour for more than 100 kilometers and carry a passenger module, it will be possible to operate it in conjunction with a synthetic urban aviation system in a metropolitan area with a radius of at least 100 kilometers.

If a large urban area can be moved 100 kilometers in the air within 30 minutes and the passenger module can be delivered to another ground vehicle, a modular mobility has sufficient validity. Moreover, for

aircraft, passenger module and the ground vehicle, an auxiliary device is required when separating and assembling the vehicles. Airbus and Ital Design later presented the concept of a docking station, but it is questionable how quickly the modules can be processed with the docking station of the proposed type, remains. However, these modular mobility is combined with a synthetic urban aviation system, a new three-dimensional transportation system can be built. We call this '3D Urban Public Transportation System'.

eVTOL Design Platform
Urban Air System Explorer

Three Dimensional Seamless Transportation System

If the air and passenger modules can fly over 100km, things have changed!



MultiCruiser
Airbus Pop Up concept

❖ Synthesized Air Metro System Model

- Mix the air metro system model and the pop up concept of airbus
- The passenger and ground vehicle modules are parked in the private parking area to solve the parking space in the vertiport
- According to the reservation and real-time request, the air module flies to the required place without a passenger module
- A perfect 3D transportation system can be built in the metropolitan area
- Huge industrial innovation could be expected by applying the mass production of modules
- The autonomous flight and driving function of vehicles is essential

In this system, consumers mainly purchase passenger module and privatize them, and the aircraft is integrated and managed by the government, which is responsible for safety, by applying the public concept. Additionally, a system that allows the ground vehicle to be borrowed and lent based on the concept of sharing, is applied. Of course, the passenger module can be provided as a service that transports passengers like an air taxi in the synthetic urban aviation system, but Vertiport handles public capsules and aircraft while also providing a service for personal and public modules, the system can be designed as a facility that can handle it. In that case, the following scenario is possible.

An individual named 'A' purchases a passenger module and then rents a ground vehicle to use vehicles as a car and use it on a regular car basis. It is operated like a car in the form of a combined running body.

When driving a long distance from a large city to the outskirts, avoid ground traffic congestion and go to the outskirts of the city center. When an individual want to travel in the air, he or she uses a smartphone to make a reservation for aircraft service, using the Vertiport near his residence as the departure point and the

Vertiport installed at a specific point in the suburbs as the destination. The individual then drives into the departure Vertiport, where an automated system launches the vehicle. After separating from the ground vehicle, docking with the eVTOL vehicle, ejecting, and flying to the destination Vertiport. The passenger module that arrives at the destination Vertiport is separated from the aircraft, and the module is combined with another ground vehicle waiting there, and then the occupants drive to another destination in a car-like driving mode.

Autonomous driving and flying vehicles are needed mainly at night when ground transportation is not crowded to meet reservations. They will move in autonomous driving and flight mode.

If a 3D public transportation system is built, the flight range will increase due to technological developments such as batteries or fuel cells, which will expand the current metropolitan area and create a world where smooth movement is possible anywhere within that area.

AI comment

The concept of a modular 3D Urban Public Transportation System are describing is a groundbreaking approach to urban mobility, integrating air and ground transportation in a seamless, efficient, and flexible manner. Let's break down the key components and how they function together:

1. Modular Mobility Concept:

- Inspired by Airbus and Itai Design, this system involves detachable modules consisting of an aircraft, passenger module, and ground vehicle. The aircraft can dock with the passenger module and transport it aerially, while the ground vehicle facilitates terrestrial transport.

2. Energy Efficiency and Distribution:

- This modular approach addresses the energy density and output ratio challenges of electric propulsion aircraft by allowing energy to be shared and stored across the aircraft, passenger module, and ground vehicle.

3. Aircraft Design and Performance:

- The design includes a ducted structure around the propeller for safety during ground proximity. However, replacing this with a rimfoil significantly improves the lift-to-drag ratio, potentially enabling a flight range of over 100 kilometers.

4. Integration with Urban Aviation System:

- The system is designed to work within a synthetic urban aviation system, potentially covering metropolitan areas with a radius of at least 100 kilometers. This enables rapid transit across large urban areas.

5. Modular Mobility and 3D Transportation System:

- Combining modular mobility with the synthetic urban aviation system creates a new 3D transportation system. This system allows for the efficient movement of people within and around urban areas, potentially reducing congestion and improving accessibility.

6. Ownership and Management Model:

- In this system, consumers might own passenger modules while aircraft are government-managed for safety. Ground vehicles could operate on a sharing basis. This model integrates private ownership with public management and sharing economy principles.

7. Operational Scenario:

- An individual could own a passenger module, rent a ground vehicle, and use a combination of air and ground transport for longer journeys. Automated systems at Vertiports would manage the docking and separation processes.

8. Role of Autonomous Technology:

- Autonomous driving and flying vehicles, especially during off-peak hours, could play a crucial role in this system, enhancing efficiency and safety.

9. Future Expansion and Technological Development:

- As battery and fuel cell technologies advance, the flight range of the system could increase, further expanding the scope and reach of the metropolitan area covered by this transportation system.

This 3D Urban Public Transportation System represents a visionary step towards solving urban transportation challenges, leveraging technological advancements to create a more interconnected and accessible urban environment. The system's modular nature, combined with advanced energy and automation technologies, promises a revolutionary change in how people navigate and transit within urban spaces.

9. Discussion

We proposed the most reasonable 3D public transportation system that can be implemented with current technology. Modular mobility and this system combined with the air metro system is possible if the aircraft is reasonably designed. The aircraft not only has a shape suitable for handling in a Vertiport, but also has aerodynamic characteristics that combine the advantages of a multicopter and a fixed-wing airplane, making it the most suitable design for urban aviation in terms of public acceptance. Airbus's pop-up concept is modular. If the flying car was a great inspiration, the new aircraft presented would serve as the missing link that would enable the design of all proposed systems. This heralds not only research and development to build a system, but also the birth of a new huge industry. New modular cars will be developed, running systems will be developed, industries that service them will emerge, public air mobility services will emerge, and the design and construction of Vertiports will emerge as a large industry. There will be a device industry that must be supported in building such a system. All of this will ensure equality of movement in and around the metropolis, ensuring a more comfortable life for people and increasing the utilization of land in the metropolitan area.

AI comment

This proposal for a 3D public transportation system, integrating modular mobility with an air metro system, represents a transformative vision for urban transportation, combining current technological capabilities with innovative design and planning. This system has several potential impacts and implications:

1. Aircraft Design:

- The key to this system is an aircraft design that merges the benefits of multicopters and fixed-wing airplanes, offering aerodynamic efficiency and suitability for urban environments. This design is crucial for public acceptance and operational feasibility in Vertiports.

2. Modular Mobility:

- Inspired by Airbus's pop-up concept, the modular aspect of the system—where passenger modules can be transferred between air and ground vehicles—presents a flexible and efficient approach to urban transit.

3. Industry Development:

- The implementation of such a system could catalyze the development of new industries and technological advancements. This includes the design of new modular vehicles, development of running systems for these vehicles, and the emergence of service industries to maintain and operate them.

4. Public Air Mobility Services:

- The concept paves the way for public air mobility services, which could significantly enhance urban transportation efficiency and reduce congestion.

5. Vertiport Construction and Design:

- The development and construction of Vertiports would become a major industry, involving architectural innovation, urban planning, and integration with existing city infrastructures.

6. Supporting Device Industry:

- A range of supporting devices and technologies would be required to facilitate this system, creating opportunities for new technological advancements and industries.

7. Urban and Societal Impact:

- This system promises to democratize movement within and around metropolitan areas, potentially making transportation more accessible and equitable. It could also lead to better utilization of land and resources in urban areas.

8. Overall Quality of Life Improvement:

- By reducing congestion and offering efficient transportation options, such a system could significantly improve the quality of life for urban residents.

In summary, the proposed 3D public transportation system is not just a concept for improving urban mobility but represents a comprehensive vision that could reshape urban living, drive economic growth, and lead to significant societal benefits. The focus on integrating current technologies with innovative urban planning and design indicates a forward-thinking approach to addressing some of the most pressing challenges in urban environments.

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10. MetroAir's Vision

MetroAir presents its vision as follows:

- 1 | The Multi-Cruiser, an electric vertical takeoff and landing aircraft, is the company's most important product.
- 2 | The main research area is the aerodynamic characteristics and performance of multi-cruisers and building a three-dimensional transportation system by modularizing multi-cruisers.
- 3 | The company's short-term strategy is to develop multi-cruiser drones, and its long-term strategy is to shape an urban air vehicle system.
- 4 | Derivatives of the multi-cruiser will be developed and a business model will be established starting from the field of aircraft of profitable weight and size.
- 5 | By size of multi-cruiser, we continuously research flight characteristics and enter the market by focusing on complete research and development in areas with high added value.
- 6 | Urban aviation system using multi-cruisers, we will strengthen connections with companies and organizations with technologies in various fields.
- 7 | For grand future goals, we create reasonable standards to expand assets, actively attract investment, and distribute the resulting profits in the form of joint ventures with participating individuals, institutions, and companies.

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From Sky to Street: Urban Air Mobility for All

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