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FEATURE

# Change is in the air

## The elevated future of mobility: What's next on the horizon?

Robin Lineberger, Aijaz Hussain, and Vincent Rutgers

Hybrid-electric vertical takeoff and landing (eVTOL) vehicles have the power to transform the air traffic ecosystem. Learn about the challenges aerial transport faces and how companies can take advantage of new opportunities.

## Introduction

A century ago, aviation pioneer Glenn Curtiss debuted the autoplane, a three-seat car-cum-aircraft with removable wings.[1] Ever since, automobile and aviation enthusiasts have dreamed of "flying cars" that can reduce trips that take hours on the ground to minutes in the air, improving productivity and quality of life.

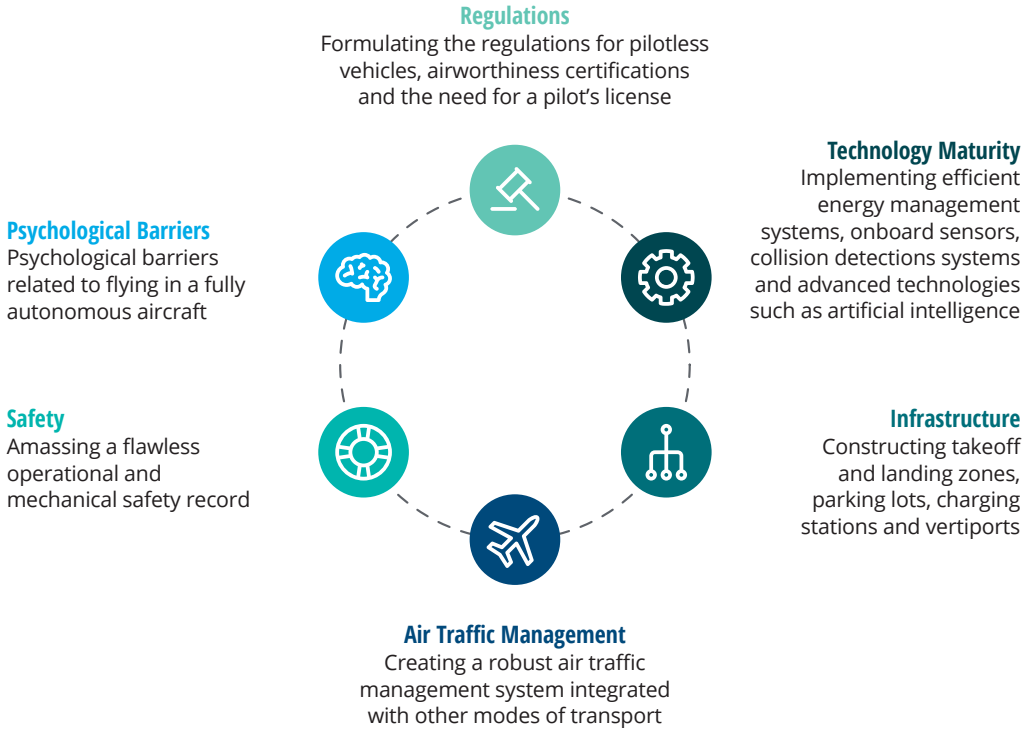
After decades of failed projects and false starts, a new class of vehicle is finally emerging that could to turn these dreams into reality by transforming the way people and cargo are moved in cities. To provide insight into this rapidly progressing space, Deloitte recently published a five-part series on the elevated future of mobility. The findings and implications are summarized in this article.

Almost two years ago, Deloitte published *Elevating the future of mobility*, its initial view on a new class of aircraft that promises to revolutionize inter- and intra-city mobility.[2] These aircraft, generally known as electric or hybrid-electric vertical takeoff and landing (eVTOL) vehicles, have the potential to improve the future of elevated mobility by moving people and cargo more quickly, quietly, and cost-effectively than traditional helicopters. In the initial paper, several challenges and/or barriers that would need to be overcome before seeing the wholesale adoption of eVTOL aircraft were identified (see figure 1).

In a series of articles, the barriers to an elevated future of mobility have been highlighted, with recommended approaches provided for surmounting them. Through this process, we have come to view regulations as a subset of a holistic air traffic management system. The safety of eVTOLs will depend on eVTOL vehicle maturity, ground infrastructure, and the air traffic management system.

FIGURE 1

**Elevated future of mobility challenges**




Source: Deloitte analysis.

## The eVTOL evolution

Much has happened in just the last two years in the eVTOL journey. To tell a complete and timely story, here is a summary highlighting the main findings of the five Deloitte articles published, updating them where appropriate:w

**Overall, there has been rapid progress in the last two years, with many stakeholders believing: "If you build it, they will come."**

1. **Elevating the future of mobility**[3]: Through the cumulative efforts of eVTOL manufacturers, operators, and other key stakeholders, elevated mobility will likely become a reality over the next decade. Despite challenges, manufacturers have begun testing vehicles; ecosystem participants are collaborating on developing a robust regulatory framework; and technology is advancing swiftly.

   Deloitte's initial review focused on the movement of people, but over the course of our research, it became apparent that the movement of cargo is just as important. In fact, it will likely drive the early adoption of eVTOL aircraft. Similarly, while the initial focus has been on the end goal of fully autonomous vehicles, this under-acknowledges the potential that early eVTOL vehicles will most likely be piloted in order to accelerate commercialization. Overall, there has been rapid progress in the last two years, with many stakeholders believing: "If you build it, they will come."[4]

2. **Managing the evolving skies**[5]: As the skies get busier, it is expected to be an ongoing challenge to manage and maintain an increasingly diverse airspace while keeping all air traffic moving safely and efficiently. A key enabler for the future of eVTOLs could be unmanned aircraft system traffic management (UTM), which would have to work in conjunction with existing air traffic management systems.

   This "system of systems" is complicated to establish, but it is being pursued by a diverse group of stakeholders, including eVTOL operators, communication system service providers, data service providers, and regulatory authorities. Success depends upon all stakeholders having trust in the essential elements of the air traffic management system. This will require reliable and available communication, predictable and consistent navigation, and accessible, trusted surveillance. These elements, coupled with tried-and-tested procedures, coordinated teams, redundancy, and continuous training, will be mission-critical in enabling the system to operate reliably and safely.

3. **Psychological barriers to the elevated future of mobility**[6]: Social acceptance, or overcoming the psychological barriers, are expected to play a major role in shaping the eVTOL industry, as consumers are at the core of the elevated mobility ecosystem. For this article, Deloitte questioned a global group of 10,000 consumers about their perception of fully autonomous eVTOL aircraft with respect to safety and perceived utility.

   Nearly half of the respondents viewed autonomous aerial passenger vehicles as a potentially viable solution to roadway congestion.[7] However, 80 percent of the total either believe that these vehicles "will not be safe" or are currently uncertain that they will be safe.[8] eVTOL aircraft can become part of the new mobility ecosystem only when creators and operators convince skeptical consumers that airborne vehicles are both useful and safe. Shaping consumer attitudes will be the joint responsibility of regulators, creators, and operators of this new breed of aircraft.

4. **Technological barriers to the elevated future of mobility**[9]: Several complex technological issues need to be addressed before air taxis and cargo transports take to the skies. These persistent challenges are primarily related to propulsion, situational awareness systems, and advanced detection and collision avoidance systems. While onboard technology is maturing quickly, efficient energy management (including battery capacity, speed of recharging, and cost per kilowatt-hour) remains a limiting factor and is proving to be a difficult challenge to solve. It will likely take a group effort to eliminate the remaining technological barriers to urban air mobility.

   To strengthen collaboration within the ecosystem, participants should develop and work on an integrated framework—spanning manufacturing, operations, and certification—to advance technologies involved in eVTOL aircraft. This framework should provide a structure for encouraging collaboration within the ecosystem, harnessing electric propulsion technology through alliances and partnerships, leveraging advancements in ground autonomy, and investing in cognitive automation capabilities.

**Social acceptance, or over-coming the psychological barriers, are expected play a major role in shaping the eVTOL industry.**

5. **Infrastructure barriers to the elevated future of mobility**[10]: Although pilot projects are underway in major cities around the world, the infrastructure necessary to enable large-scale passenger and cargo transportation in urban and suburban areas is not yet in place. The missing pieces include the ground infrastructure (takeoff, landing, and service areas), a robust communication and UTM system, and a seamless mobility operating system. To pave the way for widescale deployment, eVTOL operators and local authorities (such as cities and municipalities) should start identifying feasible locations for components of the ground infrastructure, such as takeoff and landing, charging/refueling stations, parking facilities, maintenance, and contingency landing sites. They should also enlist the help of information technology providers, who can assist in building a well-connected infrastructure, and regulatory authorities, who can assist in designing a policy and control framework that is robust, safe, and secure.

**The infrastructure necessary to enable large-scale passenger and cargo transportation in urban and suburban areas is not yet in place.**

FIGURE 2

## Aerospace manufacturers, automobile companies, and technology start-ups continue to announce new passenger eVTOL vehicles[11]

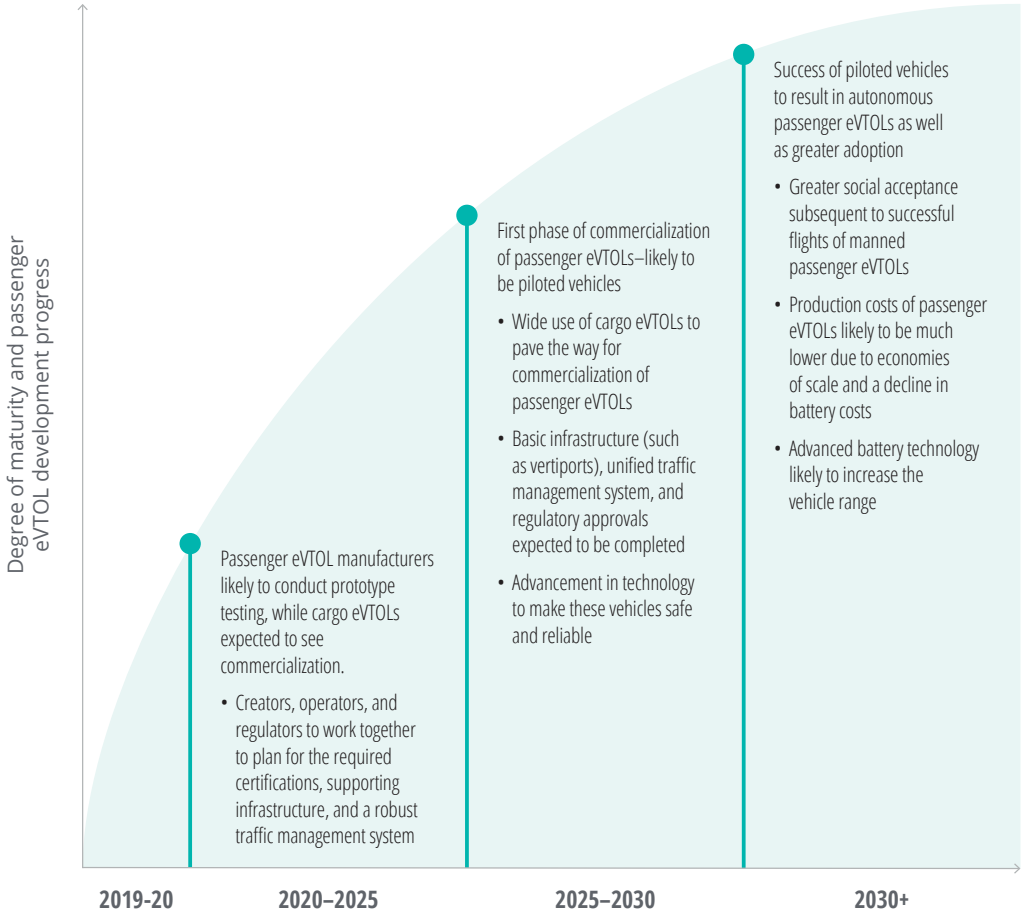
| Manufacturer – Vehicle Name | Announcement | Country | Electric/ Gasoline | No. of Rotors | Max. speed (km/h) | Max. range (km/h) | No. of seats |
|---|---|---|---|---|---|---|---|
| Pipistrel – eVTOL Concept | 2017 | Slovenia | Electric | n/a | n/a | n/a | 6 |
| Airspace X – MOBi | 2018 | United States | Hybrid, Electric | 8 | 240 | 416 | 4 |
| Embraer – DreamMaker | 2018 | Brazil | Electric | 8 | n/a | n/a | 4 |
| Rolls-Royce – EVTOL | 2018 | United Kingdom | Hybrid, Electric | 6 | 400 | 800 | 4-5 |
| VRCO – NeoXCraft | 2018 | United Kingdom | Electric | 4 | 320 | 320 | 2 |
| Bell – Nexus | 2019 | United States | Hybrid, Electric | 6 | 288 | 241 | 4 |

Note: No. of seats may or may not include pilot

Source: Deloitte analysis based on company websites and press releases

FIGURE 3

**Projected passenger eVTOL development timeline (2020–2030+)**




Source: Deloitte analysis.

## Navigating the disruption ahead

Though eVTOLs have yet to be deployed en masse, a number of successful demonstrations have taken place. This suggests that urban and suburban mobility (inter- and intra-city) may be on the precipice of significant disruption.

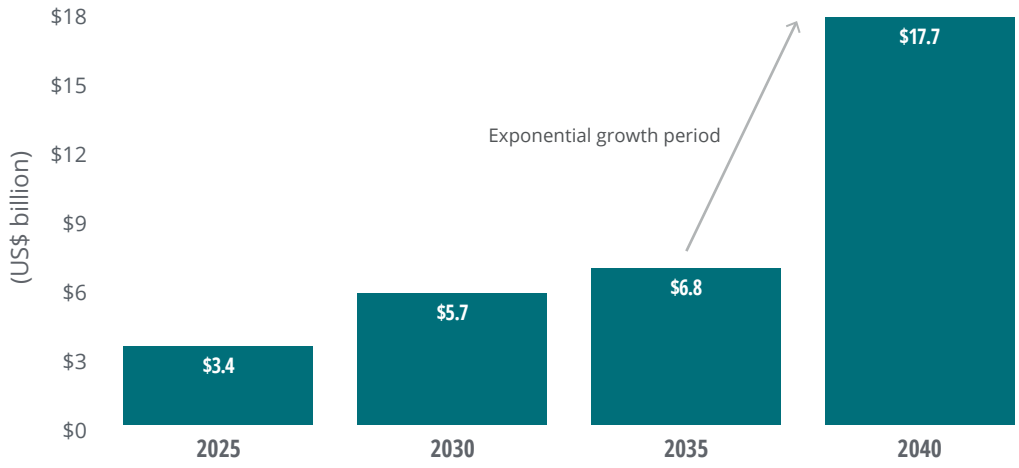
The emergence of eVTOLs could catalyze transformation across many different areas, with these being particularly pertinent:

- **Air traffic management system:** Developing and deploying a new, complete air traffic management system is expected to be key. This system must span airspace allocation and management as well as airworthiness certifications and pilot requirements for unmanned autonomous aerial systems. National governments would need to work together as well as in conjunction with local municipalities to settle upon a common operating concept and establish a universal set of requirements that would allow eVTOLs to be widely deployed. This includes ensuring interoperability with existing air traffic management systems globally.
- **Physical infrastructure:** Significant capital would be required to acquire the land/space necessary for building vertiports and other infrastructure components. Extending existing types of public/private partnerships or establishing new models would be required to secure adequate funding. Without this type of collaboration, infrastructure projects may not get off the ground, thus delaying, limiting, or entirely blocking the widescale deployment of eVTOLs.

FIGURE 4

## US passenger eVTOL market size could reach US$17.7 billion by 2040

US Passenger eVTOL Market Size (2025–2040)




- Intra-city passenger eVTOL market is expected to grow from nearly US$1 billion in 2025 to US$13.8 billion by 2040.
- Meanwhile, inter-city passenger eVTOL market is expected to grow from US$2.6 billion to US$3.9 billion during the same period.

Source: Deloitte analysis based on data from research and analyst reports.

- **Aircraft development:** Current helicopter developers and manufacturers (traditional VTOLs) are at risk of being disrupted, with the implications being similar to those incurred by the automotive sector when new entrants used electrification and autonomous capabilities to re-envision the automobile. Parallels can also be drawn with the taxi and rental car industries when technology companies used apps and geo-location capabilities to reimagine ride-sharing services. The future market for eVTOL aircraft manufactures could be substantial. For example, the estimated market size for the US alone is approximately $17 billion by 2040[12] (figure 4).

## Conclusion

The ecosystem for unmanned aerial transport is vast, with aerospace manufacturers, ride share companies, and technology startups all playing in this space. While the opportunities are relevant to all participants, the risks appear more pronounced for traditional aerospace companies. Developments in the eVTOL arena point to impending disruption for helicopter manufacturers, who will likely need to rethink their business models and how they capture value. Shifting their focus to the evolving markets for unmanned aerial transport may be an option. At the least, they will need to re-examine their product mixes; production rates; and people, process, and technology requirements, as well as where they should play in the value chain, so they are well-positioned to survive and thrive if the eVTOL market takes off as expected.

# Endnotes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