



Getting mobility off the ground

**Urban air mobility is poised to take
off as a premium service option in the
world's largest, most congested cities**



Meet the authors



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Fly me to the moon (or, at least, the airport)

Around the world, companies are developing small, quiet electric-powered vertical takeoff and landing (eVTOL) aircraft to take mobility services from the roads to the skies. Urban air mobility (UAM) is for real. Our analysis finds that it will start as a premium mobility option—mainly for those who will pay a little more to save time traveling to the airport, getting to important meetings, or beating the traffic to a weekend home. We’ve identified a set of global megacities where the conditions to support a UAM market will likely soon be in place, based on current rates of urbanization, economic growth and projected increases in traffic congestion. Our analysis concludes that by 2050, UAM could spread to regional service and provide more than 400 million passenger enplanements per year, or 4 percent of domestic trips. To win in UAM, aircraft manufacturers, developers of navigation and propulsion technologies, and other players will need to choose their markets and partners carefully.



Mobility takes to the sky

A futuristic vision of flying taxis—and even flying family cars—crisscrossing urban skies has captured the imagination. That future remains in the distance. But a market exists that can serve as the launchpad for a new urban air mobility (UAM) industry that is forming around the compact electric-powered vertical take off and landing aircraft (eVTOL) now in development.

We're talking about following the market path of short-haul helicopter service—but going much further. As soon as helicopters became commercially available in the 1950s, they were put to use by corporations and airport shuttle services to reduce local travel time for executives and affluent consumers. But in most places, helicopter service has found a limited market, because helicopters are costly to operate and customers usually must travel on the service's timetable.

A convergence of technologies promises to make UAM more practical and popular than helicopter service. The key breakthrough is the eVTOL aircraft design, which uses multiple electric-powered rotors, rather than the single large rotor found on the typical helicopter. This makes eVTOLs more economical to operate and maintain and quieter, too, which could make them welcome in more landing and takeoff sites.

With the addition of autonomous control—which still must be approved by regulators—and the subtraction of labor costs, eVTOL - based urban transport service can become more cost competitive with premium ground mobility options such as business-class rail and black-car services. And, because compact eVTOL aircraft can takeoff and land on small helipads or flat roofs, a convenient ride-hailing option may evolve.

The emergence of a new mobility option



We believe the first step in developing the UAM market will be building services for a narrow, but potentially lucrative, market segment—people who don't want to waste their valuable time in traffic and are willing to pay a little more than they now spend on other premium local-travel services. By marshalling data on congestion, transportation costs, economic growth, and wealth concentration—and using cell phone data to pinpoint likely routes for target customers—we identify about 70 urban centers where UAM services can flourish.

According to our model, UAM services will grow in three stages, starting with intra city airport shuttles in the 2030s, followed by on-demand and scheduled air-taxi services (with driver and autonomous). By the 2050s, we foresee UAM competing as a regional intercity transportation option. As a result, we estimate that UAM can capture 4 percent of domestic air traffic in 2050. Therefore, we believe UAM equipment and service developers should aim initially at the local premium travel market and build longer-range plans around commuter and intercity service.

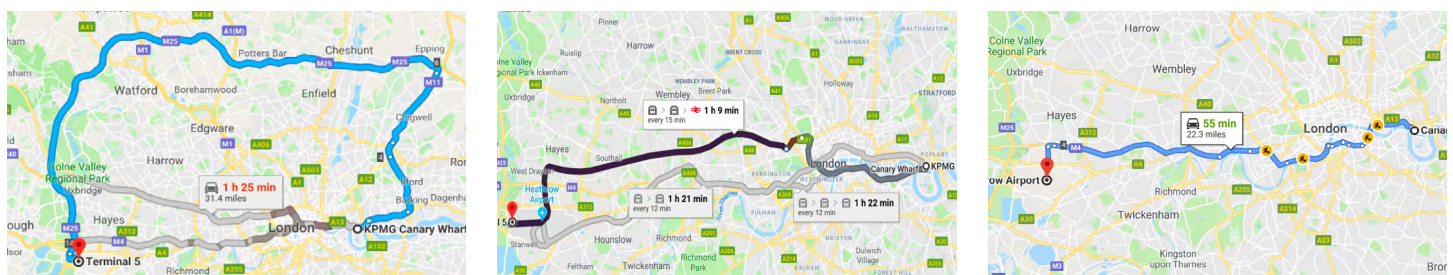
How to get from here to air

Once the basic technology, infrastructure, and regulatory environment matures, the evolution and growth of the UAM market will ultimately be driven by three interconnected factors: speed/convenience, affordability, and appropriate route coverage.

 <p>Speed and convenience</p> <p>Decidedly faster door-to-door trips—including wait times, delays, security checks, and congestion—and the intangible value of an alternative travel option</p>	 <p>Affordability</p> <p>A total cost per mile based on consumer time/price elasticities relative to other premium mobility options (the cost of which will continue to fall)</p>	 <p>Origin and destination (O&D) passenger/route density</p> <p>Routes tailored to business and high-income individuals traveling to common destinations</p>
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Critically, this market will depend on reliably and safely delivering speed at a “not-too-premium” cost versus other mobility services. At the start, that will depend on the price sensitivity of regular airport shuttle passengers. For example, eVTOL service between London’s Canary Wharf and Heathrow Airport could offer significant time savings over black cars and rail at a very competitive cost. By analyzing smartphone movements between business centers, airports, and high-income residential areas, we have identified hundreds of potential O&D route opportunities around the world.

London route: How UAM could compare from Canary Wharf to Heathrow



Black car: 70–150 minutes
US\$120–\$180

Rail: 60–80 minutes
US\$35–\$40

UAM could cut travel time by half or more, for a price just above other premium mobility services

Source: KPMG 2019

The “not-too-premium” cost will be a moving target

Clearly, the central challenge in developing this market will be affordability. Today we peg the “not-too-premium cost” to black-car services that charge \$3 to \$5 per mile. But those prices could drop dramatically: Our model takes into

account the impact of autonomous-mobility services—self-driving limousines and ride-hailing vehicles—which could reduce the cost of ground-based competition by as much as 60 to 70 percent by the 2030s.¹

¹Source: KPMG research

Where UAM will fly

While the technology behind UAM seems to be moving straight ahead, the speed and pattern of adoption will likely be more complex—determined by demographic and economic factors that vary across markets.

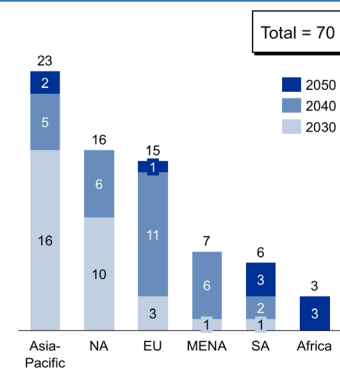
As we observed in “Islands of Autonomy,” a KPMG report that explored likely adoption patterns of autonomous vehicles, autonomous mobility adoption won’t be like that of technologies such as smartphones, which spread nearly simultaneously around the world. Rather, acceptance and implementation of self-driving vehicles and UAM will likely come location by location, starting where population density and congestion are most pronounced and there is a sufficient supply of relatively well-heeled travelers.²

Our research has turned up about 70 large cities around the world where the conditions will be in place for UAM service to take root and flourish. This includes cities such as London, New York, Los Angeles, Mexico City, and São Paulo (already a strong market for helicopter service due to the dangers of road travel). But our data indicates that many of the best markets will be in Asia’s megacities—Tokyo, Beijing, Shanghai, Seoul, etc. Such cities dominate our list of promising UAM markets because of projected population and economic growth, as well as increasing road congestion.

By 2050, UAM could fully emerge in ~70 large cities globally



Top cities for UAM to emerge by 2050



Source: KPMG research



An idea whose time has come again

In 1953, using a fleet of military surplus helicopters, New York Airways launched air-shuttle service between Manhattan and Idlewild (now Kennedy) Airport. In those days, the cost ranged from \$5 to \$9 (about \$47 to \$86 in 2019). Unfortunately, the fatal crash of a New York Airways helicopter on the Pan Am Building’s helipad effectively grounded New York City–based corporate helicopter travel. Tourist helicopter charters flourished in New York City in the 1980s, but widespread noise complaints led to extensive flight reductions. Today, helicopter platforms like Blade in the United States and Voom in Brazil and Mexico feature on-demand mobile app booking, as well as scheduled flights, and seek to replicate the pricing of local black-car limousine service. But noise is still an issue. These and other services are counting on eVTOL technology to take short-distance aviation to the next, quieter level.³

² Islands of Autonomy, KPMG, 2017.

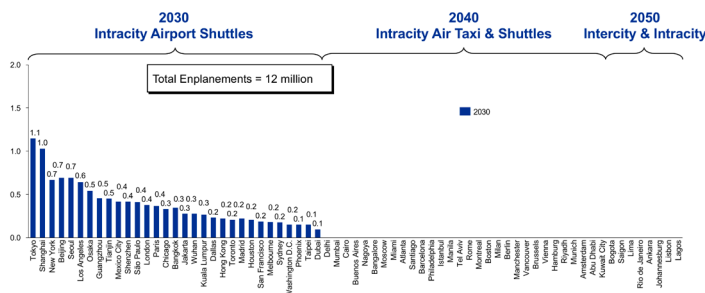
³“The Death and Life of Helicopter Commuting” (Bloomberg), 2017.

Theory of UAM evolution

Based on our model of potential demand, the question is not whether UAM will emerge as a feasible ride-sharing option for a slice of the urban population. Rather, the question for aerospace and defense (A&D) companies and others who plan to participate in UAM is when. We expect UAM's technology, infrastructure, and regulatory underpinnings to converge quickly around the world. Therefore, we estimate that UAM service could account for 12 million passenger enplanements per year globally as soon as the 2030s, rising to more than 400 million

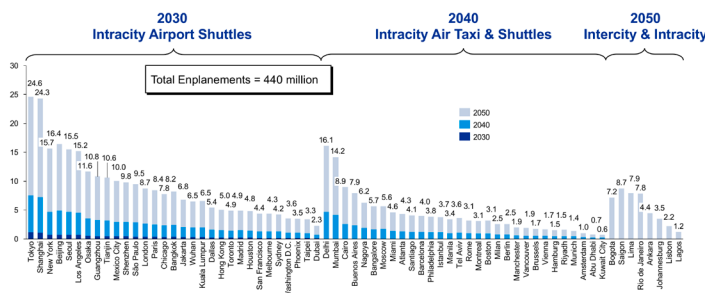
2030–2040

Initially, UAM will likely target high-density business-travel routes used by a relatively less price-sensitive customer base.



2050

There is significant additional opportunity if technology can extend eVTOL ranges to compete in intercity short-haul markets.



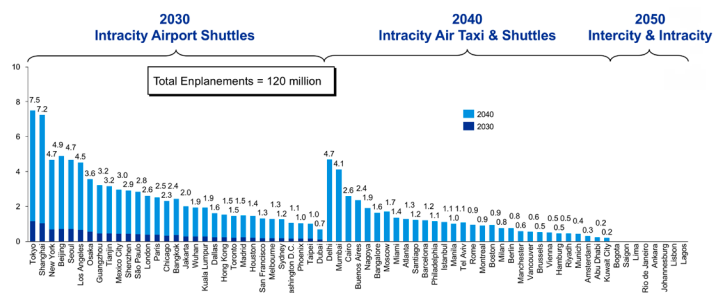
Source: KPMG research

by 2050—or 4 percent of domestic global passenger enplanements.

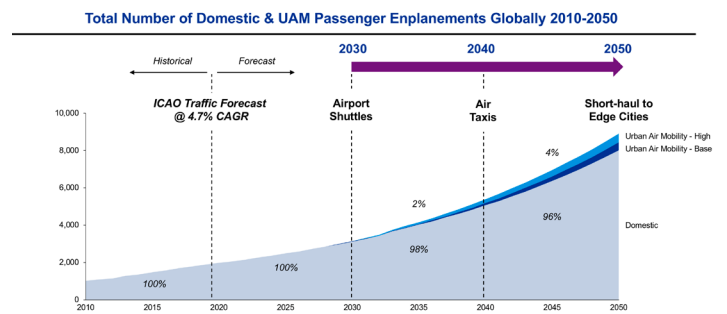
The following charts illustrate how we project the evolution of UAM growth by decade. It shows how UAM service would extend from airport shuttle routes to commuting routes and air taxis, and then to intracity flights (of up to about 120 miles). As this evolution proceeds across major urban areas around the world, UAM will likely become an element of an integrated ground and air transportation ecosystem.

2040–2050

UAM usage expands beyond airport shuttle service to include air taxi and commuter service (for affluent consumers).



Based on our analysis of the demand potential of this market, UAM services could grow to represent 4 percent of all domestic air traffic by 2050.



Sizing the UAM market

KPMG has developed a model to understand how UAM demand could grow based on the economics and travel time constraints anticipated to evolve in cities around the world.



City-based economics/demographics forecasted through 2050

Considerations

- City GDP and GDP growth
- City population and population growth
- City population density
- City change in income distribution through 2050
- Wealth concentration



Mobility/Transportation economics

Considerations

- Intracity travel times and level of surface congestion
- Alternative modes of transportation
- Share of the population utilizing limousine services that would pay for a 30-minute reduction in travel time
- Origin and destination pairs within 120 miles by 2050
- Approximate cost premium over alternative modes of transportation



Demand (number of enplanements)

Take action: Making UAM a reality

Congestion and other travel challenges in and around the world's largest cities create a compelling environment for UAM services. Dozens of players across the public and private sectors are collaborating to perfect eVTOL aircraft

designs and other technologies, clear the regulatory path, and make possible a safe and convenient air transport option.

This requires action from two broad constituencies.



Operators

- Get clarity on UAM pricing versus travel time elasticities
- Nail down the cost-per-seat-mile target that will make UAM attractive to enough passengers to capture 400 million enplanements by 2050
- Determine what it will take to enlist passengers in specific cities, each of which has distinct characteristics
- Explore additional takeoff/landing infrastructure, beyond existing helipads, to support the expected increase in UAM passenger density



Manufacturers

- Create platforms that will help A&D companies secure a fair share of the premium business travel market in competition with autonomous ground mobility services in the 2030s and 2040s
- Ensure that current mechanisms for certifying software systems will scale to the complexity and criticality of the software that will be used in autonomous UAM services
- In collaboration with national regulators around the world, define operating standards for autonomous UAMs
- Engage airport authorities and national regulators to define shared airspace protocols for UAMs operating in and around airports and heliports, and on approach paths for these busy hubs
- Work with local regulators in target markets to identify flyover noise and safety requirements and establish preferred routing to minimize impact on quality of urban life

UAM is not a new concept—urban helicopter transport options are available worldwide. What's new are emerging aviation and digital technologies—battery improvements and distributed electric propulsion, eVTOL aircraft, advanced autonomy, and ride-hailing platforms. These are

what will likely bring urban aviation into the 21st century and make it competitive with other premium transportation options.

This is where futuristic urban mobility begins.

How KPMG can help

In 2012, TechCrunch lamented that the world had yet to realize the sleek, bubble-domed flying cars suggested 50 years earlier by the iconic animated series *The Jetsons*. True, we're still not there, but the innovation and promise of UAM is equally exciting. As a market around this new means of transportation grows, aviation original equipment manufacturers (OEMs) and technology developers must contemplate the business model enhancements and partnerships they'll need to pursue to succeed in this space. The committed professionals across KPMG's Industrial Manufacturing, Strategy, and A&D practices have the perspective, specialized knowledge and resolve to collaborate with you on the most appropriate strategy and tactics.

Industrial Manufacturing

KPMG's Industrial Manufacturing practice helps clients transform customer-facing activities and operating models by leveraging intelligent automation and advanced data analytics to align back offices, shop floors, and supply chains. Through our innovative approaches and alliances, we are breaking new ground to help clients create value by improving the customer experience and delivering growth, cash flows, and consistency.

Strategy

KPMG Strategy group works with a wide range of private, public, and not-for-profit organizations. We know the imperative of continually reviewing and updating strategy to reflect today's dynamic markets to create opportunities and respond to threats. From industry-disrupting changes such as the rise of the empowered consumer and digital enablement to the pressures of intensified regulatory requirements and finding ways to operate more efficiently, we bring insights, ideas, and perspective to every client engagement.

Aerospace & Defense

KPMG's network of dedicated A&D professionals understands the realities of new market entry and combines global experience with local insight to help A&D organizations grow their footprints. Our deep experience transforming business processes and driving innovation enables us to help clients create forward-looking product and service portfolios.

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