



**CITY OF LOS ANGELES**  
**INTER-DEPARTMENTAL MEMORANDUM**

Date: October 27, 2021

To: Honorable City Council  
c/o City Clerk, Room 395  
Attention: Honorable Mike Bonin, Chair, Transportation Committee

From: Seleta J. Reynolds, General Manager   
Department of Transportation

Vincent P. Bertoni, Director of Planning   
Department of City Planning

Subject: **ADVANCED AERIAL MOBILITY**

**SUMMARY**

Advanced Aerial Mobility (AAM) is an emerging transportation mode. This report provides background on existing AAM regulations, the City's engagement to date, and some early considerations about the role of urban aviation in Los Angeles and provides a framework for the Council to consider for policy and regulatory work related to the future of this issue. (Council File #21-0865)

**RECOMMENDATION**

1. DIRECT the Department of Transportation and the Department of City Planning to report back with a work plan to advance the framework presented.
2. DIRECT the Department of Transportation and the Department of City Planning to report on grant opportunities to support work efforts.

**BACKGROUND**

Urban Air Mobility (UAM) refers to an emerging transportation mode that uses highly automated aircraft to operate and transport passengers or cargo at lower altitudes within urban and suburban areas. Advanced Aerial Mobility (AAM) builds upon the UAM concept by incorporating use cases not specific to operations in urban environments, such as regional transportation, cargo movement, public services, and private or recreational vehicles. AAM is a step forward for the aviation industry that could help cities and regions improve the safety, sustainability, and accessibility of airbound travel. It also presents an opportunity to integrate aviation into the transportation system, providing an alternative mode of travel that could help achieve sustainability goals and relieve congestion.

The City of Los Angeles (City) documented its approach for building a transportation network that provides our community with safe options in the Mobility Plan 2035 and the City's General Plan Transportation Element, last updated by the Department of City Planning (DCP) and Los Angeles Department of Transportation (LADOT) in 2015. The Mobility Plan establishes a framework for reimagining transportation within the City, with a focus on creating streets that are safe and accessible

for all community members. Paired with the Mayor's Sustainable City Plan, LADOT's Vision Zero Plan, and the recently adopted LADOT 2021 Strategic Plan, these documents form the foundation for all mobility planning in Los Angeles.

Recognizing the need to address the evolving nature of the transportation technology industry, LADOT created *Urban Mobility for a Digital Age* in 2016 and released its *Strategic Implementation Plan (SIP)* in 2018. LADOT provided subsequent updates to the SIP in 2019 and 2020 through *Technology Action Plan*.

As specific interest about AAM grew from private industry stakeholders across the country, LADOT executed a task order with DesignWorks and ARUP to develop a policy framework for AAM. That framework, the *LADOT Urban Air Mobility Policy Framework Considerations Report* (Attachment B) was recently finalized and is an available resource to guide future policy discussions.

The World Economic Forum and the Office of Mayor Garcetti also convened a multidisciplinary working group to develop the building blocks of a policy road map for implementing Urban Air Mobility, resulting in the release of *Principles of the Urban Sky in 2020* (Attachment A), which were made up of seven UAM principles:

- Sustainability: UAM must improve environmental outcomes and embrace innovation to achieve more sustainable behaviors
- Low noise: Noise disturbances should be measured and mitigated by a community-first approach
- Local workforce development: UAM is expected to increase jobs on the ground and in the air
- Safety: New forms of air transport must achieve levels of safety performance consistent with conventional aviation operations
- Equity of access: There should be equitable access to mobility for disadvantaged communities
- Multimodal Connectivity: UAM should connect to existing, high-quality transport options, offering seamless travel
- Purpose-driven data sharing: Data sharing should help providers quickly respond to passenger need and market demand

These principles are meant to inform industry leaders, community members, and policy makers as the City considers rules and guidelines for this emerging mode.

In December 2020, Mayor Garcetti announced the Urban Air Mobility (UAM) Partnership, a public-private partnership formed between LADOT and the newly launched Urban Movement Labs (UML). Urban Movement Labs is a non-profit organization that brings together public agencies, businesses, and community members to match technology solutions to mobility problems and test them in Los Angeles' urban contexts. The UAM partnership funded an Urban Air Mobility Fellow who has been working with LADOT and DCP to help inform City staff on the more technical aspects of integrating new aviation technology into the local transportation system. Their scope of work includes facilitating discussions between the city and industry stakeholders, as well as state and federal regulators and research institutions. The Fellow is also leading an outreach effort with key community stakeholders to help educate them on current technology and regulations, and gather their input and feedback to consider in future rulemaking.

In 2021, LADOT General Manager, Seleta Reynolds was appointed to the Federal Aviation Administration (FAA) National Drone Advisory Committee (DAC). The FAA first convened the DAC in 2014 as a broad-based, long-term Federal advisory committee that provides the FAA with advice on key Unmanned Aircraft Systems (UAS) integration issues by identifying challenges and prioritizing improvements. The committee helps to create broad support for an overall integration strategy and vision.

## DISCUSSION

Most airspace regulations are established federally. To date, the only local AAM regulations in Los Angeles focus on preventing conflicts with emergency operations and protecting the privacy of citizens. The Los Angeles Fire Department has successfully used commercially available drones to augment firefighting operations and improve situational awareness. Commercially, the film industry employs drones for filming, which the Los Angeles Fire Department regulates through its safety review of film permits.

A broader deployment of AAM technology will include many different devices and modes, and require new regulations not yet detailed in our municipal code, as well as new infrastructure not yet detailed in existing zoning laws. The following are definitions of key terms used in this report to help policy makers and the public:

**Commercial Drone** - a commercially available unmanned aerial vehicle weighing less than 55 pounds used over a broad spectrum of commercial and government uses.

**Unmanned Aircraft Systems (UAS)** - a small unmanned aircraft, commonly referred to as a drone, and associated elements, such as communications and sensor equipment, that are required for the safe and efficient operation in the national airspace system.

**Electric Vertical Takeoff and Landing (eVTOL)** - a type of aircraft that is electrically powered with the capabilities to hover, takeoff, and land vertically.

**Vertiport** - A generic reference to the area of land, water, or structure used for takeoff and landing of electric and/or hybrid vertical takeoff and landing aircraft, together with associated support building and facilities.

### Existing Regulations

#### *Aviation Regulations*

No current aviation regulations govern vertiports or electric Vertical Takeoff and Landing (eVTOL) platforms. However, there are existing aviation regulations for helicopters at the federal, state, and local level. In California, the California Airport Land Use Planning Handbook, the California Public Utilities Code (PUC), Section 21001, and the FAA Advisory Circular 150/5390-2C provide governing policies. The FAA is currently preparing multiple policy and guidance documents to address the rapidly evolving AAM landscape and has noted that they intend to regulate the industry through the lens of safety. They acknowledge that community engagement will inform their policies.

The FAA is also currently updating its guidance on heliports, with proposed language to clearly communicate that current rules are intended for legacy helicopter infrastructure only. To address eVTOL needs, the FAA is preparing new guidance. This guidance is not expected until 2023-2024. In the interim, the FAA is preparing an engineering technical letter to address vertiport development issues. We expect this letter in mid-2022, after a public comment period.

### *Federal Drone Regulations*

Commercially available drones serve a range of uses including surveying, photogrammetry, infrastructure inspections, emergency management, and videography.

Today, drones are largely limited to commercial uses that operate at a short range in view of the operator, during daylight hours, and not over people or moving vehicles. The Code of Federal Regulations prohibits drone operations at large spectator events and in other restricted areas. The FAA approves operations for uses outside of these restrictions on a case by case basis through a waiver program.

Earlier this year, the FAA published additional guidance for Remote Identification of Unmanned Aircraft, which gives authorities increased oversight for aircraft operated within their jurisdiction. By the end of September 2023, the FAA will require all aircraft over 0.55 lbs to have broadcast remote ID capability, which will give local jurisdictions enhanced visibility and situational awareness. This requirement lays the groundwork for how larger vehicles will operate in the future.

For UAS operations, the FAA released a concept of operations (CONOPS) for AAM / UAM integration, where the FAA stated that, "*...networked information exchange is the cornerstone for stakeholders to plan, manage, execute, and oversee UAM operations*". The FAA and NASA are actively running multiple programs testing a variety of solutions intended to enable routine remote and autonomous operations. As the industry refines its technology, it is important for the City to remain engaged to ensure local interests inform every step in the process.

### *Local Drone Regulations*

Today, Los Angeles experiences urban aviation mainly through helicopters and drones, to a lesser degree. However, the City could see eVTOL aircraft in its skies as early as 2024, based on current industry predictions. An FAA representative recently reported that seven aircraft prototypes are progressing through its aircraft certification process, with an expectation that the first certification occur as early as 2024. Three additional aircraft manufacturers are next in the FAA pipeline. Several industry leaders have referenced their interest in launching AAM as a viable transportation option in Los Angeles in time for the 2028 Olympics. Morgan Stanley also predicts that the market for autonomous urban aircraft could be worth \$1 trillion by 2040.

No existing City department or agency currently governs AAM. It is timely for local decision makers to begin planning and developing regulations for these emerging mobility technologies to avoid state or federal preemption on issues important to Los Angeles, including equity, climate, health, noise, and safety. The City cannot rely on its current helicopter and heliport regulations to manage eVTOLS and vertiports which require additional learning from the industry about the operational and business needs of AAM. The City's current General Plan, containing official land use and mobility policies, also pre-dates

the advent of AAM and needs an update to include direction on AAM. New mobility options have the potential to transform urban patterns similar to the influence of the car on development in Los Angeles. The recent introduction of rideshare and micromobility into the mobility network highlight the importance of local regulations for emerging modes. AAM is expected to be an even more transformative and complex mobility option, with its expansion into air space, requiring thoughtful policy considerations and common sense rule making.

The City has the opportunity to develop an approach and regulatory framework for AAM that aligns with the General Plan policies for integrated land use and mobility policies that provide Angelenos with accessible, healthful, affordable options for traveling in Los Angeles while at the same time advancing the Mayor's vision for a cleaner, greener region. AAM can be an important component of the green multimodal solutions being developed today.

### Policy Considerations

*LADOT's UAM Policy Framework Considerations (Attachment B)* report outlines key issue areas and policy considerations to help regulate AAM. Regulatory considerations include land use and zoning regulations, multimodal connectivity, operator and city indemnification, implementation plans for operators, data and privacy sharing protocols, and an ongoing periodic review of adopted policies and processes. City regulations must also address permit and fee structures, community engagement strategies, and equity considerations.

### *Land Use*

Key issues to address in new mobility and land use policies include assessing AAM's ability to complement the region's multi-billion-dollar transit investments support and enhance economic benefits for local communities. For instance, the City should consider whether to allow or direct AAM in proximity to employment centers, connectivity to multi modal options, and implications for adjacent future development.

The FAA defers to local jurisdictions for land use planning, zoning and regulation, and maintaining compatible land uses in proximity to airports, as well as on matters of local airspace protection. This enables the City to develop further policy guidance for emerging AAM development. Local land use planning to determine appropriate use of properties around airports, heliports, and vertiports should be an integral part of any recommendations for revised land use policy and new regulatory tools. Coordination with federal, state, and local agencies during the formative stages of AAM development will be critical to ensure that land use compatibility, sustainability and equity are integrated into planning for AAM. This coordination must occur before the creation, adoption, and implementation of any policy or regulations.

DCP and LADOT take a collaborative approach to land use and transportation planning. Potential future roles, in addition to facilitating policy adoption, could include DCP providing oversight of vertiport development and permitting, including regulation of airspace rights, and LADOT registering certified AAM operators and vendors.

### *Permitting*

The *LADOT Urban Air Mobility Policy Framework Considerations Report* (Attachment B), identified considerations for AAM permitting from both an operations (vehicle and emissions standards, flight path analysis, data standards) and land use permitting standpoint (vertiport design and safety considerations). Broadly, permitting considerations are grouped into pre-flight considerations, vehicle specifications, and operations. These considerations cover a range of issues from insurance and indemnification, to data privacy and fee structures. A detailed work and outreach plan that engages the public, the industry, and regional, state, and federal agencies would dive deeper into the initial considerations outlined in this report in order to develop recommendations for a local regulatory framework and permitting structure.

### *Fee Structure*

The arrival of AAM will require both new regulations as well as associated fees to provide oversight and ensure safety. Potential fees may include an annual operating fee, deposit fee, and a per aircraft fee. These fees would cover program monitoring software to administer the permit program, permit application review and issuance, ongoing program monitoring for compliance with permit requirements, reporting on program implementation, development of recommendations for improvement of the system and potentially periodic reassessments of any policy or permitting structures in places as the industry evolves and advances. A fee study is necessary to evaluate the nexus with any related departmental needs in order to be able to propose recommendations for a fee structure.

### *Equity Considerations*

A regulatory framework to govern AAM must maximize public benefits and minimize negative impacts. The City has an opportunity to be a global leader in establishing the content and direction of this emerging mode. Policy considerations should be inclusive of all Angelenos recognizing the oversights made in the past in land use and transportation planning that disrupted and uprooted communities, especially marginalized communities of color that have had less representation in the political process.

### *Community Engagement*

Any new work program must include collaborative outreach and engagement. Equity and community engagement are critical priorities for how the City develops recommendations for land use and transportation policy today. As the City learns more and as AAM evolves, our process of engagement must also be flexible and adapt accordingly, providing opportunities for the public to shape policy development early, and provide input as regulations are considered.

DCP and LADOT both have experience developing open dialogues with community stakeholders in order to gather input and address community concerns and have coordinated with the UAM Fellow. Should the City want to continue exploring AAM for Los Angeles, both DCP and DOT would continue working with community stakeholders and expand upon these public engagement efforts.

### Next Steps

AAM is an emerging mode with technology, operations, and infrastructure needs that are expected to evolve rapidly over the next ten years. Based on engagement with other regulators and potential operators, an initial stage of local deployment will demand new regulations to guide existing technology

and operations in the near-term. As increasing vehicles and vehicle types enter a more mature AAM market, cities will need to refine and expand regulations to accommodate the scale of operations and infrastructure demands. Developing an AAM program now and adjusting it over time will ensure the City has comprehensive regulations in place to address the anticipated market.

In order to successfully establish a regulatory AAM framework, the City needs an interdepartmental work plan with staff and budget to further develop recommended rules and guidelines for permitting, fees, and related land-use planning, as well as recommendations for initial, mid-, and long-term regulatory processes.

Developing a thoughtful regulatory framework for AAM requires further analysis and research, discussion with agencies, operators, and the public to deliver equitable AAM opportunities. To accomplish this, LADOT and DCP identified the following requests:

- **New staffing** for DCP and LADOT are necessary to develop, manage, and execute a work program that includes community engagement, policy development technology roadmap and implementation, and the formulation of land use regulations;
- **Consultant support** is needed to take on specialized studies and analysis for the regulation of air space and subsequent environmental assessment and to support authentic community engagement efforts; and,
- **Interdepartmental coordination** is required in order to identify the various roles and responsibilities between DCP, LADOT and other relevant City departments and agencies for a collaborative and cohesive approach.

DCP and LADOT anticipate needing the following staff to effectively establish a new regulatory AAM program in the City:

Resource Need	Duties
(1) Chief Technology Officer (exempt position)	Manages technical roadmap, development operations, and integration of this and other technology initiatives, such as Code the Curb and ATSAC 3.0.
(1) Senior Transportation Planner	Community engagement, policy expertise, engaging with local, state, and federal agencies, coordinating engagement with DCP and other City departments as needed.
(1) Senior Management Analyst	Developing financing model, permitting framework, supporting pilots.
LADOT Consulting Services	Funds development of technical integration alongside permitting
LADOT Consulting Services	Funds permitting and policy related work.

(1) Senior City Planner	Developing policy update, permitting framework, and implementation. Coordinating with local, state, and federal agencies.
(2) City Planners	Developing policy update, permitting framework, and implementation. Coordinating engagement and outreach with DOT and partners.
(1) GIS Specialist	Research, analysis, development of model to allow and site potential vertiports.
DCP Consulting Services	Nexus Study and Fee Study
DCP Consulting Services	Environmental Analysis of vertiport/AAM

If directed to develop a detailed work plan, program scope, and staffing needs, DCP and LADOT can bring forward a more detailed budget that supports the development of creative, innovative, equitable, and sustainable program and policy efforts to address AAM.

**FINANCIAL IMPACT**

There is no fiscal impact from this report.

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attachments

Attachment A: Principles of the Urban Sky

Attachment B: LADOT Urban Aerial Mobility Policy Framework Considerations Report



## Reports

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Published: 15 September 2020

# Principles of the Urban Sky

**The Principles of the Urban Sky are meant for a general audience to consider, for cities to engage with, for industry to apply and for policy-makers at all levels of government to develop further.**



The future of the skies is in development today, as next-generation aviation technologies are tested, certified and piloted for commercial operations in coming years. A different type of aircraft – one better suited to urban transport – is emerging. This reflects a mix of novel designs (combining vertical take-off-and-landing configurations with distributed propulsion), improvements in alternative energy sources, and greater quality and availability of digital connectivity.

The introduction of new mobility segments, commercial intra-regional as well as inter-regional aerial transport, will require new processes and tools based on open and data-driven decision-making to operate and evaluate transport systems. Importantly, these new processes must also involve local governments alongside regional, national and even international agencies to develop the policy foundation for integration of transport in different modes – land, sea and air.

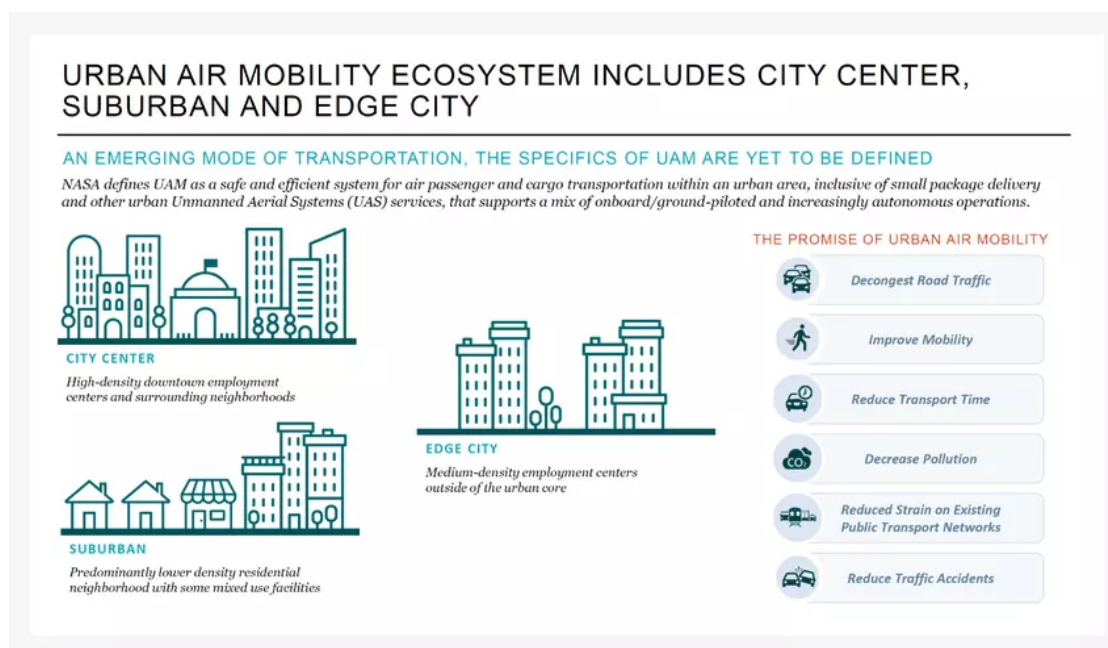
**According to NASA, UAM is likely to be a commercially viable market for air metro services by 2028, assuming the regulations and policies are in place to accommodate it.**

1:6

**For every one job directly needed for air transport, six jobs are generated indirectly.**

Traditionally, government oversight might have emerged in reaction to new transport modes. When innovative technologies disrupt the status quo, policy-makers and governments are often limited by time and resources to react. It is critical for policy-makers to be well apprised of emerging technological innovation by working with leading industry actors and emerging start-ups; together, stakeholders can develop a framework that aligns with the interests of society.

The policy-making framework for these new aviation technologies must be principles-based, ensuring that the framework can evolve during the multi-phased, iterative innovation process. By engaging with vehicle manufacturers, service providers, infrastructure developers, community-based organizations, academics and government stakeholders, public officials can anticipate and even enable new ideas as they create policy and regulations to support the roll-out of new technologies in the public interest to benefit the many, rather than the few.



# Designing the future of urban air mobility in Los Angeles today

Over the past nine months, the World Economic Forum and Los Angeles Mayor Eric Garcetti's Office have worked together, collaborating with Los Angeles Department of Transportation (LADOT) as the transport agency advances parallel technical research. They convened a multidisciplinary working group to develop the building blocks of a policy road map for implementing Urban Air Mobility (UAM) in Los Angeles.

With a view towards sharing this road map with cities worldwide, the collaboration between the Los Angeles Mayor's Office and the Forum has been coordinated with technical and operational efforts led by LADOT in conjunction with United States national governmental agencies: National Aeronautics and Space Administration (NASA) and the Federal Aviation Administration (FAA). What is clear is that parallel strategic and operational planning are necessary for any city preparing for the roll-out of UAM and that this preparation must start well ahead of the first commercial deployments.

These efforts have led to the creation of "Principles of the Urban Sky", which the community believes are fundamentally important to the adoption and long-term success of UAM. These principles should help guide the creation of a UAM policy road map in the City of Los Angeles and can serve to orient policy-making efforts in other cities throughout the world.

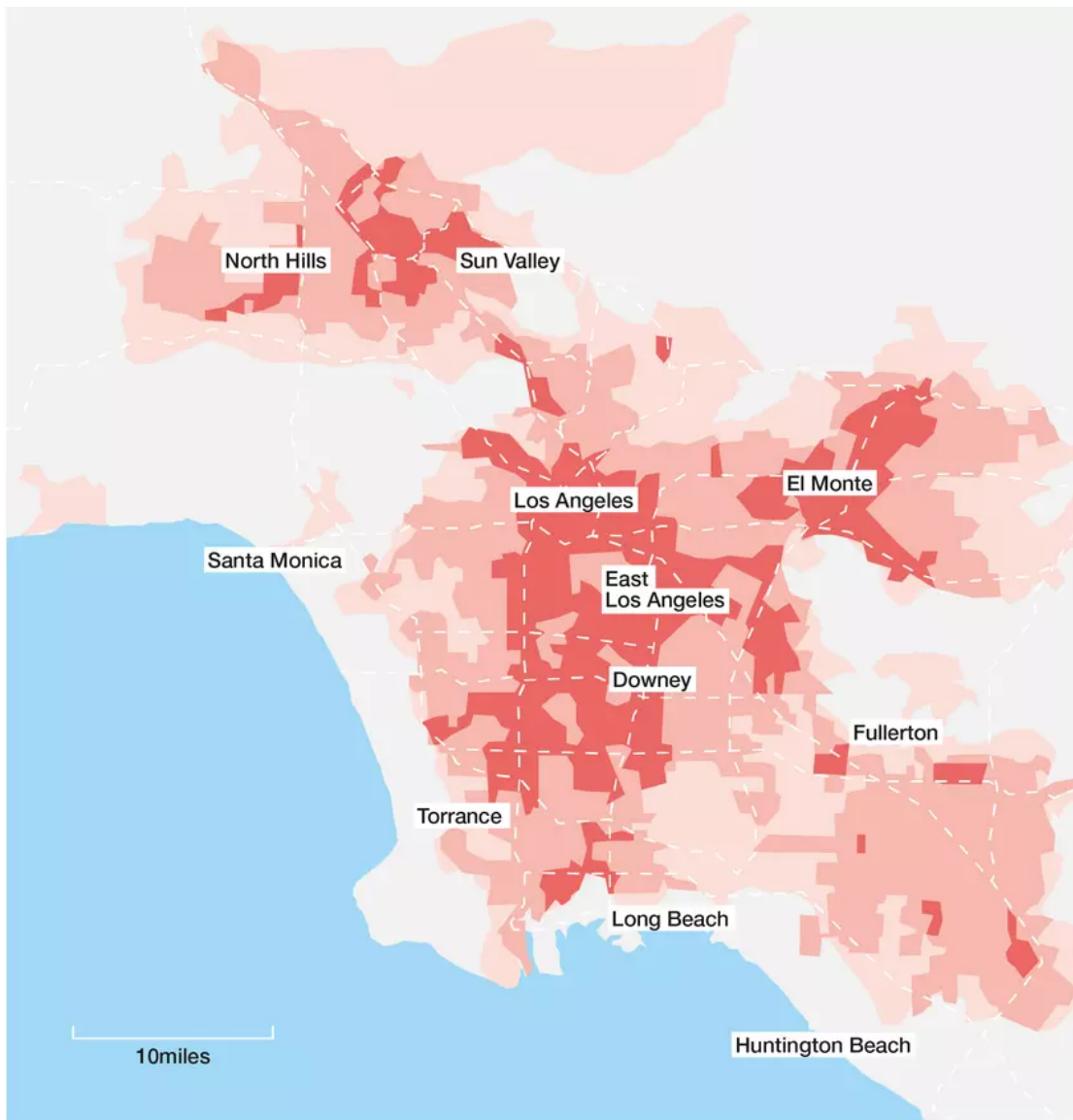
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[Click here for the seven UAM principles](#)



These principles are representative of feedback from public and private interests gathered through direct interviews with leaders in the growing UAM space, workshops (including in-person and virtual) as well as on-going research with leading institutions worldwide.

These principles are inclusive of national airspace authorities, who regulate and ensure the safety of the airspace, while recognizing the unique and increased need for input from state and local governments with respect to a new transport mode purpose-built for urban markets.



*Image: World Economic Forum*

Local land use compatibility and multimodal transport network integration, including planning for noise sensitivity and equitable access, will be critical tools for local governments to ensure outcomes that support liveable communities and benefit society as UAM networks launch and scale up.

Cities hold a vital stewardship role in the public trust and have a responsibility to translate community priorities into policy direction that determines the uses of a new mode of transport. Local government shares a role in facilitating conversations between community members and the private sector, providing a structured forum for transparent and accessible decision-making to advance collective goals, which include fostering a vibrant economy with inclusive benefits.

These “Principles of the Urban Sky” aim to guide local policy-making and can be adapted as transport and societal expectations continue to evolve.

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# It is our hope that these principles will serve as the basis for similar efforts around the world and for further collaboration across partner cities embracing UAM in their own contexts.

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In coming months, the City of Los Angeles and the Forum will release a series of thought leadership pieces, which describe the ongoing collaboration to develop key components of an UAM policy road map. The next piece will illustrate what activities and milestones are anticipated within each distinct phase of UAM development, deployment and public participation in Los Angeles. Future articles will consider the key investments in physical and social infrastructure necessary to get UAM off the ground, logical roles and responsibilities for leading actors in this space, potential funding mechanisms and the impact of UAM on the city's diverse workforce and job creation efforts.

## **What is the World Economic Forum doing about drones?**

The World Economic Forum is partnering with governments and companies to create flexible regulations that allow drones to be manufactured and used in various ways to help society and the economy.

Drones can do many wonderful things, but their upsides are often overshadowed by concerns about privacy, collisions and other potential dangers. To make matters worse, government regulations have not been able to keep up with the speed of technological innovation.

In 2017 the World Economic Forum's [Centre for the Fourth Industrial Revolution](#) teamed up with the Government of Rwanda to draft the world's first framework for governing drones at scale. Using a performance-based approach that set minimum safety requirements instead of equipment specifications, this innovative regulatory framework gave drone manufacturers the flexibility to design and test different types of drones. These drones have delivered life-saving vaccines, conducted agricultural land surveys, inspected infrastructure and had many other socially beneficial uses in Rwanda.

Today, the Centre for the Fourth Industrial Revolution is working with governments and companies in Africa, Asia, Europe and North America to co-design and pilot agile policies that bring all the social and economic benefits of drone technology while minimizing its risks.

Read more [here](#), and [contact us](#) if you're interested in getting involved with the Centre for the Fourth Industrial Revolution's pioneering work in the governance of emerging technologies.

As the work of this partnership continues, these principles and the insights from the thought leadership pieces will also be used to inform the consideration of proposals, deployment of demonstration projects and local government resource allocation. It is our hope that these principles will serve as the basis for similar efforts around the world and for further collaboration across partner cities embracing UAM in their own contexts.



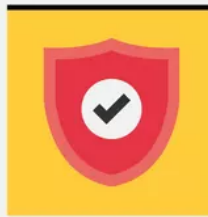
## Principles of the Urban Sky

Published: 15 September 2020



# The principles

## The seven UAM principles



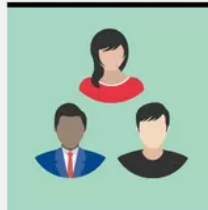
### Safety

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### Sustainability

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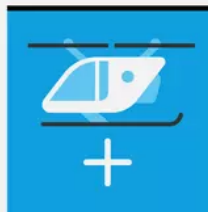
### Equity of access

There should be equitable access to mobility for disadvantaged communities



### Low noise

Noise disturbances should be measured and mitigated by a community-first approach



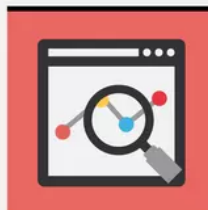
### Multimodal Connectivity

UAM should connect to existing, high-quality transport options, offering seamless travel



### Local workforce development

UAM is expected to increase jobs on the ground and in the air

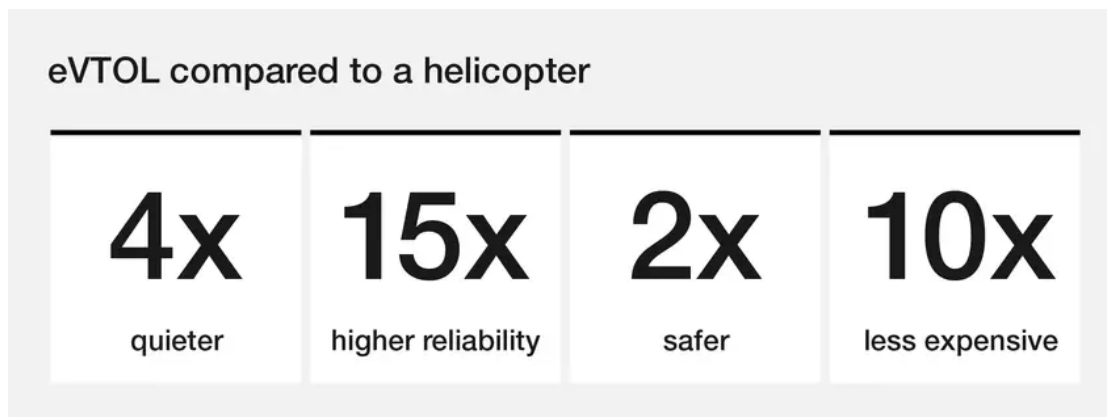


### Purpose-driven data sharing

Data sharing should help providers quickly respond to passenger need and market demand

# Safety

The dawn of the jet age unlocked new possibilities for long-distance travel and commerce, with commercial aviation becoming the world's safest form of travel. The aviation industry's ability to effectively manage operational risk has created expectations among the travelling public, regulatory authorities and other government stakeholders regarding safety. Therefore, to gain acceptance, new forms of air transport will need to achieve levels of safety performance consistent with conventional aviation operations. UAM operations will need to assure safety through adherence to regulatory requirements and industry standards that have contributed to aviation's current safety record.



The advantages of eVTOL over current aerial transport options are significant.

*Image: World Economic Forum, Source: Porsche Consulting*

Included are processes used to certify aircraft, air operators and personnel. In addition, the implementation of advanced safety management systems is essential to proactively identify safety performance and mitigate any associated risks. Keenly aware of this fact, electric vertical take-off and landing (eVTOL) manufacturers who target passenger travel are designing and certifying their aircraft for extremely high levels of safety, reliability and design assurance. Distributed electric propulsion, combined with highly automated decision-making and operational control capabilities, are examples of technological innovations that will enable safe and sustainable air transportation in urban environments.

# Sustainability

Through the process of engaging city and industry stakeholders, one priority outcome became clear – it does not make sense to devote resources, energy and commitment to opening the urban sky to new forms of travel unless these new modes improve environmental outcomes. Policy-makers throughout the process pointed to Los Angeles' commitment to clean energy –



embracing innovations to achieve more sustainable behaviours – and the need to align all transport investments with the net-zero commitments outlined by the city’s commitment to climate action, as spelled out in Los Angeles’ Green New Deal.

Furthermore, sustainability needs to be thought of as a holistic and umbrella term encompassing the effects of UAM on the natural environment, as well as the people, animals and plants that depend on it. It would be short-sighted to focus exclusively on the vehicles’ emissions and energy consumption without also considering supporting infrastructure for sustainable practices.



New forms of travel must improve environmental outcomes.

*Image: Getty Images*

To achieve climate action and environmental protection goals, all-electric solutions are preferable to those that rely on internal combustion engines for vehicle propulsion. A period of transition to refine all-electric vehicle designs can be considered if mobility and public benefits outweigh negative externalities when compared to other transport options. One barrier to widespread adoption of all-electric transport is the need for significant local and regional clean-tech infrastructure investments. For the city, understanding and pursuing investments in power grid capacity enhancements and other critical improvements should be prioritized to provide the clean energy necessary for integrating all-electric transport modes.

## **Equity of access**

The next generation of aerial transport in cities should aim to provide equitable access to mobility for disadvantaged communities and businesses with the greatest need for enhanced mobility and the positive economic benefits of UAM. Designing a new transport mode that is accessible in a fair and equitable manner in multiple dimensions will ensure its public acceptance and longevity, and therefore should take place early to avoid disproportionate negative impacts to certain communities. Equitable access should be factored into business plans as criteria for design and as a factor of success.

Affordability in the long term is an important part of eliminating or mitigating financial barriers to using UAM. Although private stakeholders reiterated that urban aerial mobility will likely operate as a premium priced service at the outset, providers should be able to outline a longer-term plan for affordable consumer pricing. Any new form of transport aiming to integrate into a city's multimodal transport network can only be relevant by offering efficient travel times, inclusive pricing schemes and dignified customer experience.

Market characteristics			
	No. passenger trips	No. vehicles	Price (\$/trip)
First profitable year (2028)	<b>130<sup>m</sup></b>	<b>4.1<sup>k</sup></b>	<b>\$50</b>
2030	<b>740<sup>m</sup></b>	<b>23<sup>k</sup></b>	<b>\$30</b>

*Image: World Economic Forum, Source: NASA*

Societal acceptance – the factor that limits any emerging technology to the margins if not achieved – will only be fostered if the trade-offs to individuals are a net benefit. Needs-based user subsidies, low-cost medical emergency transport or other investments to equitably distribute the benefits of low-altitude aviation should be considered to ensure this new mode can deliver the greatest public good and may act as a catalyst in ensuring support.

Other dimensions of equitable access may include universally accessible system designs that fully accommodate users with unique abilities, such as sight, hearing or physical mobility

impairments. System designers should also consider how people of different genders, ages, cultural backgrounds and lived experiences may interact with the systems.

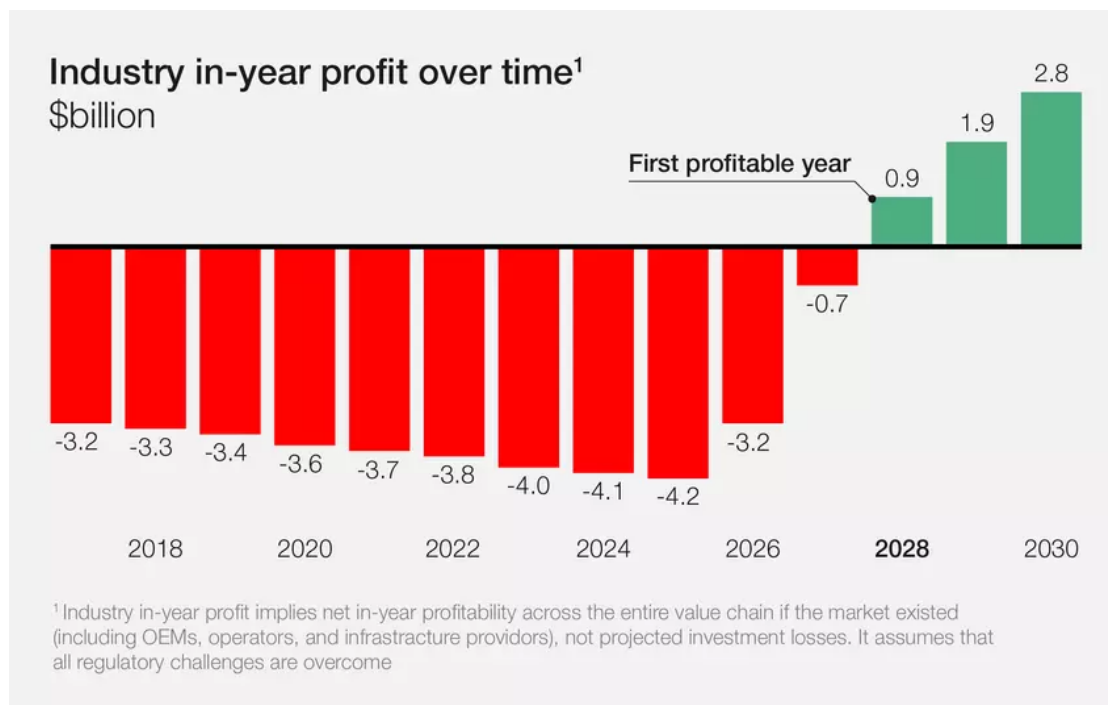


Image: World Economic Forum, Source: NASA

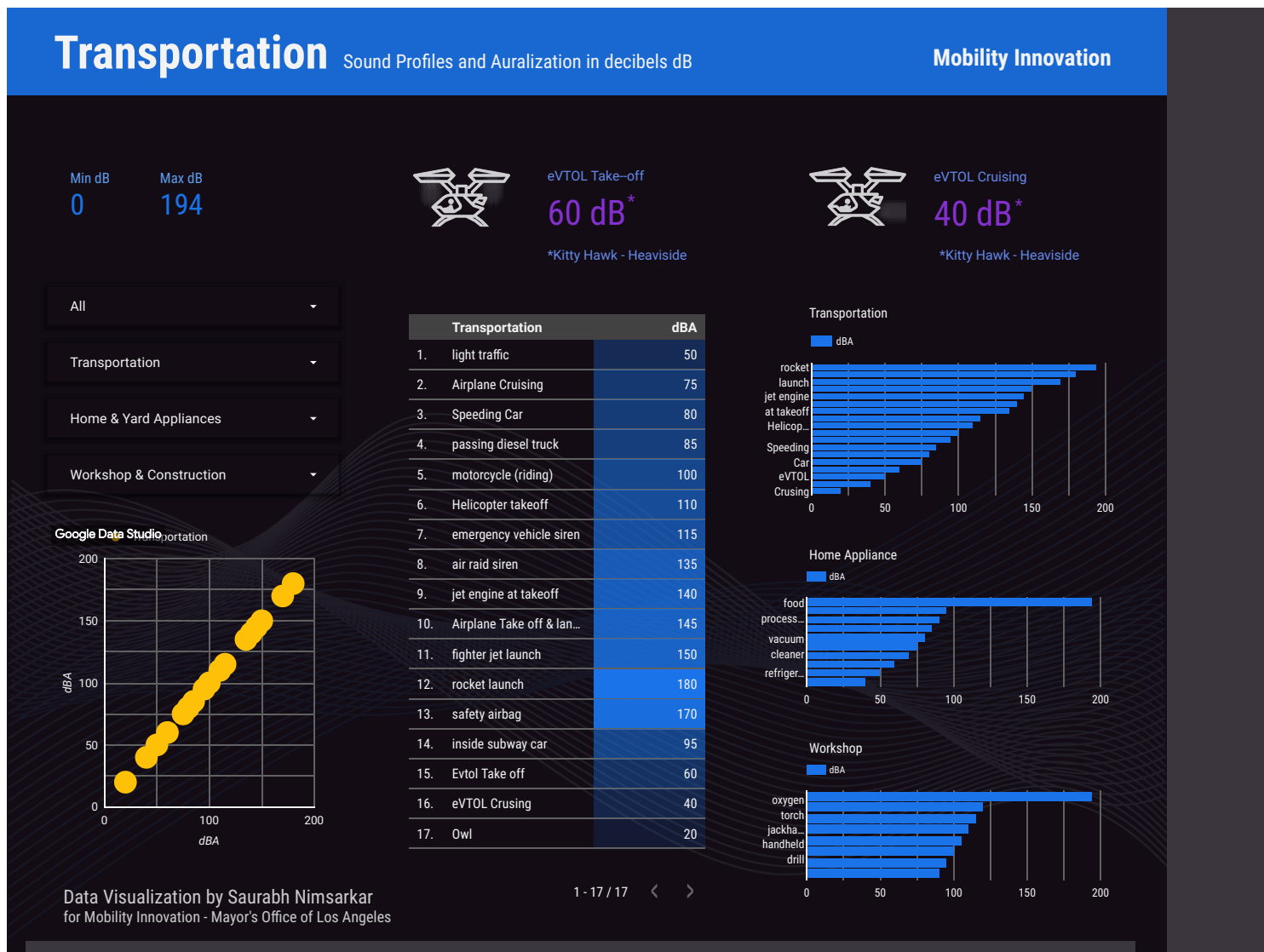
Though a low-cost service for most users in the short-term may not be possible, providing a road map to affordability that considers a three-phased model (crawl, walk, run phases) for development and implementation over the next decade will demonstrate industry actors' commitment to this principle. Proposals that demonstrate a realistic approach to achieving affordability and equitable access should be prioritized and considered for partnerships by the city. Flexibility based on demand or enabling use cases that provide value to the city stakeholders, beyond simple movement of goods and passengers in nominal times, should be considered.

## Low noise

Noise disturbances should be measured and mitigated by a community first approach to vehicle design, infrastructure siting and route planning. Community noise acceptance metrics should be co-created with stakeholders, including city planners, community associations, vehicle manufacturers, service providers and others. Industry partners and government leaders understand that noise disturbances can challenge the expansion of any transport system. These complaints are not unwarranted, as significant study has been done to quantify the impacts of

noise (defined as unwanted sound) on the cognition, well-being and performance of individuals across ages, activities and more, as well as the integrity of natural environments.

Proposed service and vehicle designs must consider adverse impacts on surrounding communities from the beginning. Decision-makers tasked with use designation, zoning and entitling development of private properties must be well informed prior to permitting facilities for flight operations.



## Multimodal connectivity

New transit modes should connect with existing forms of transport and mobility hubs to offer a seamless customer experience and allow for secure, integrated operations. Where possible, UAM should connect to existing, high-quality transport options (public and/or private), offering seamless travel from the air to destinations in populous built environments. City builders and

travellers alike expect urban multimodal transport networks to provide a user-friendly customer experience.



*Image: Getty Images/iStockphoto*

By designing low-altitude urban aviation systems to take advantage of, act as a force multiplier for, and leverage existing groundside transport networks, the value proposition of this new mobility option is more attractive. For example one interest would be to reduce the overall use of single occupancy vehicles for regional or medium-distance trips. If, instead, urban air mobility nodes are planned to replace transport options with higher throughput and fewer negative externalities to provide an exclusive, frictionless option for high socio-economic class travellers, the promise of this new technology will not be realized.

## **Local workforce development**

UAM should create employment opportunities for the residents of cities and the surrounding regions in which there are operations. Unlike other technological developments being considered for the next decade, UAM is expected to increase jobs on the ground and in the air. One new employment opportunity in commercial aviation operations generates multiple jobs in manufacturing, maintenance, flight approval or other related positions down the line.

---

**One new employment opportunity in commercial aviation operations generates multiple jobs.**

---

The introduction of various UAM curriculum to universities, colleges and vocational schools at early stages will serve as a tremendous value add to the ecosystem. With an aim to become global transport technology leaders, industry partners should partner with city management and together engage labour representatives, education and training experts, and community-based organizations to craft a next generation aviation workforce development strategy.

## **Purpose-driven data sharing**

Data sharing that enables all authorized stakeholders to quickly respond to the needs of passengers, communities and market demands is fundamentally important to the success of UAM. Data availability can allow for dynamic urban airspace usage and the operation of supportive infrastructure, like vertiports, in a more connected and efficient way. Cities and other stakeholders seeking enhanced access to data and information should clearly articulate their need for specific data and information and prioritize the protection of individuals' privacy.

Just as the streets of a city are designed, operated, maintained and managed by city officials, local decision-makers will continue to champion clear and transparent decision-making and design capabilities for UAM, including as they relate to the collection of data generated by individuals using this new mode. Cities should consider building internal capacity and promoting awareness of the urban air mobility industry in anticipation of aviation expansion in the urban environment, today, and especially in anticipation of purpose-driven data sharing.



### Principles of the Urban Sky

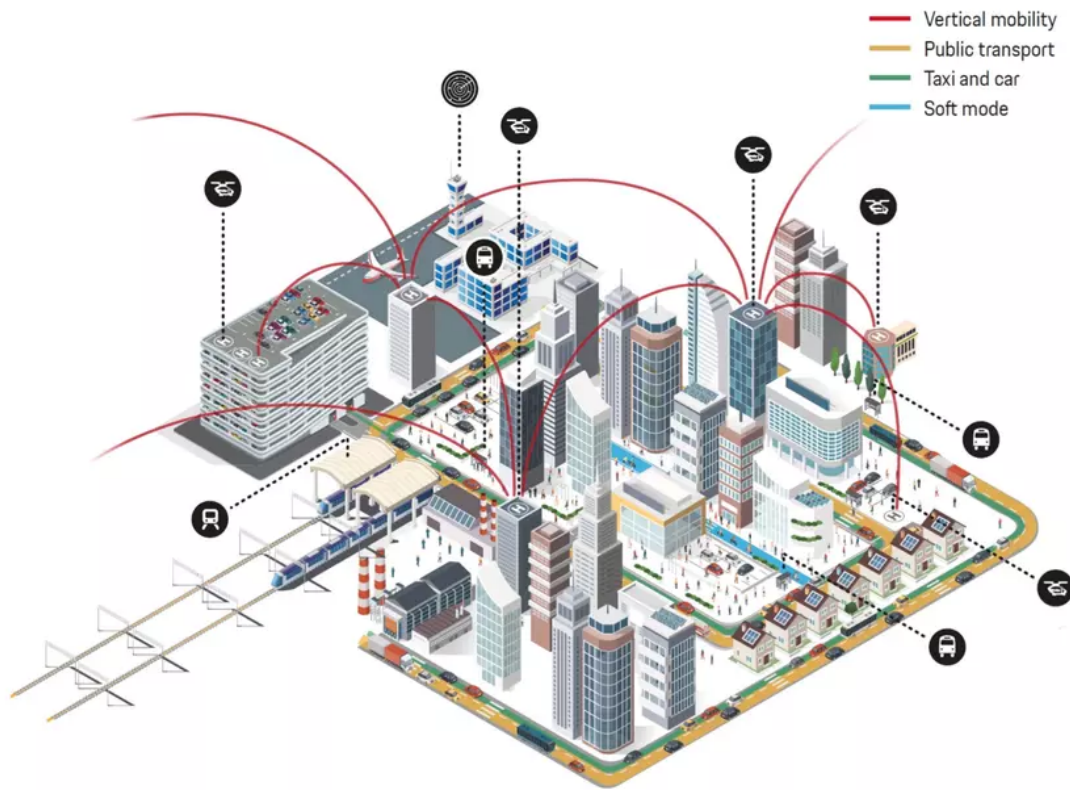
Published: 15 September 2020



## Next steps

### Mapping a route for UAM in Los Angeles and beyond

International organizations and national authorities, in partnership with industry stakeholders, have ensured that aviation maintains the best safety track record of any transport modality in history. The rapidly evolving needs of cities, expectations of, for and by society as well as fast-paced technological advancements are poised to challenge conventional models for input gathering, societal integration and evolution of the overall mobility system.



Pieces of an integrated puzzle: air taxis can make a significant contribution to urban transport networks.

Graphic: Porsche Consulting

*Image: Porsche Consulting*

UAM industry leaders and policy-makers will benefit from an updated policy road map to meet the needs of diverse stakeholders and to design a transport option that can provide a vision for the Fourth Industrial Revolution closer to those who will use the system. This will enable more effective, efficient, equitable, accessible and impactful transport for all.

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**As UAM technologies mature it will be even more important for cities worldwide to come together in the interest of shared learning. The Forum and the City of Los Angeles invite other cities to adopt these principles, on which innovation can move forward rapidly and with the public interest in mind.**

*This publication lays the groundwork for other cities and regions to share their experiences and vision for UAM. The City of Los Angeles and the World Economic Forum are looking forward to advancing work on Urban Air Mobility as part of an [International Coalition of Cities](#) fostering UAM activities.*

Please email [drones@weforum.org](mailto:drones@weforum.org) to express interest in joining this innovative community of cities.



**LOS ANGELES**

**DEPARTMENT OF TRANSPORTATION**

URBAN AIR MOBILITY

Policy Framework Considerations

September 13, 2021

20

21



# Table of Contents

<b>LADOT UAM Policy Brief</b>	<b>1</b>
<b>UAM Framework for LADOT</b>	<b>13</b>
1. Introduction	13
2. Roles and Responsibilities of the City	14
3. Vision for Key Areas of Interest	19
<b>Land Use Policy Considerations</b>	<b>25</b>
1. Purpose	25
2. Background: Current Heliport Design	26
3. Developing a Land Use Policy	26
4. UAM Land Use Policy Elements	43
<b>Future Policy Considerations and Implementation Options</b>	<b>45</b>
1. Purpose	45
2. Permitting Considerations for Vertiport Developers	47
3. Permitting Considerations for UAM Operators	49
4. Permitting Considerations for UAM Service Booking Agencies	54
5. Coordination / Considerations for Cargo UAS	59
<b>Future Considerations</b>	<b>60</b>
<b>Technical Appendix</b>	<b>62</b>
<b>Acknowledgements</b>	<b>77</b>



# LADOT UAM Policy Brief

LADOT is proactively understanding how new air mobility technology can integrate with public transportation, preserve the built and natural environment, and benefit all Angelenos equally in the decades ahead.



## URBAN AIR MOBILITY ALIGNS DEPARTMENT VISION & TACTICS TO DESIGN OUR MOST PREFERRED FUTURE



*Depiction of Downtown LA Vertiport*

### UAM in Los Angeles

Urban Air Mobility (UAM), as referred to by the Federal Aviation Administration or Advanced Air Mobility (AAM) as defined by the National Aeronautics and Space Administration (NASA) is anticipated to expand substantially in the near future as a new mobility option opens up for people and goods to move more quickly around cities. UAM has existed for decades as in helicopters; however, this mode has been very limited in volume of passengers carried, primarily due to expense and noise. Revolutionary new types of quieter and less expensive aircraft currently under development are expected to enable UAM to expand substantially in the United States and around the world for many applications.

The Los Angeles Department of Transportation (LADOT), The Los Angeles Department of City Planning, and the Los Angeles Mayor's office are collectively and proactively developing the policies and procedures to regulate UAM operations in anticipation of greater adoption. These efforts align with the City's broader vision for safety and sustainability, and specifically aims to use UAM and its infrastructure as new tools for equity through choice of mobility.

Los Angeles' approach for UAM implementation considers privacy, workforce development, data, and economic growth while developing policies for site and operation permitting. Achieving equitable access, acceptable noise and emission levels, multimodal transportation integration, understanding UAM impact on land use, density, and safety all require a careful and considerate evaluation of land use policies, permitting, planning, public engagement, and interagency coordination.

UAM services must simultaneously consider the natural and built environment as well as civilian-use airspace. Regulatory gaps between land and air authorities and the varying context affecting vertiports are requiring new types of dialogue and collaboration between City stakeholders, the FAA, developers, and UAM service providers.

UAM has the potential to facilitate movement across the LA area in minutes. Evaluating UAM perceived benefits of greater goods access, enhanced medical, emergency and public safety trips, air-taxi, as well as new and emerging use cases will take years. Many challenges remain ahead with little about UAM in the air or on the ground being certain.

## Alignment with LA's Strategic Work

LADOT's UAM Policy Framework is grounded in the values & goals outlined in the LADOT Strategic Plan Update 2021-2023, the Urban Mobility in a Digital Age Strategic Plan, and the Principles of the Urban Sky.

Therefore, UAM priorities are:

### EQUITY

The UAM framework should establish an equitable process for siting vertiports that considers access and impacts to underserved communities and does not cause additional burdens. Meaningful stakeholder engagement will occur every step of the way, from policy development to vertiport siting to operational frequency, and will be ongoing as the technology develops. Those already disproportionately impacted by transportation infrastructure should not be further negatively impacted. Equity considerations include factors such as geographic coverage for underserved communities, job training programs recruiting underrepresented communities in aeronautics industries, income-based discounts for those at or below federal poverty level, and various payment options such as a cash payment option and non-smartphone option. In addition to equity of access to the benefits of this new technology, the City will have to contend with likely negative externalities such as noise nuisance, traffic impacts, and visual clutter, all of which should be minimized to the fullest extent feasible, particularly in low-income communities and communities of color so as to not worsen habitability.

### HEALTH AND SAFETY

As with any mode of travel that is becoming more mainstream, safety above all is a fundamental requirement. As LADOT has primarily been responsible for transportation on streets, and the FAA typically manages airspace, this new mode more closely interrelates the two and overlaps boundaries, making coordination an imperative. Each agency will need to have clear roles and communication protocols in place, as well as operational and safety requirements that are agreed to and strictly enforced.

### DATA RESPONSIBILITY

UAM can efficiently integrate with the digital infrastructure to receive information on the state of both air and ground movement within the public right of way. (fire, police, congestion, etc.) Cities and other stakeholders seeking enhanced access to data and information should clearly articulate their need for specific data and should prioritize the protection of individuals' privacy. Tools like LADOT's Mobility Data Specification (MDS) can allow operations, compliance monitoring, and help the City make better informed policy updates on an on-going basis.

### SUSTAINABILITY

The UAM framework should set clear guidelines for sustainable infrastructure integration. This may include the adaptive reuse of existing infrastructure to include airports, heliports, and even parking garages. UAM should be considered a part of a multimodal solution for connecting travelers with their destinations (See Multimodal Connectivity). This will enable policy makers to align transportation investments across all modes to achieve more sustainable travel behaviors that are aligned with the net-zero commitments outlined by the city's commitment to climate action. In all modes of transport, all-electric solutions are preferable, which makes all future mobility hubs also energy hubs. Strategically envisioning and planning true multimodal hubs with a UAM component will enable the prioritization of power grid enhancements and other critical investments that facilitate a transition to clean energy.

### MULTIMODAL CONNECTIVITY

New transit modes should connect with existing forms of transportation and mobility hubs to offer a seamless rider experience and allow for secure, integrated operations. Where possible, UAM should connect to existing, high-quality transportation options (public and/or private), offering seamless travel from the air to destinations in Los Angeles' diverse built environments. City builders, residents, and visitors alike expect urban multimodal transportation networks to provide a safe and user-friendly customer experience.

### ECONOMIC GROWTH

Establish LADOT's role in urban air mobility over the city's airspace, consistent with the 7 Principles of Urban Sky, specifically local workforce development. Unlike other technological developments being considered for the next decade, UAM is expected to increase jobs on the ground and in the air. One new employment opportunity in commercial aviation operations generates multiple jobs in manufacturing, maintenance, flight approval or other related positions down the line. Job training programs and public/private partnership opportunities including internships for skilled labor positions in aviation and aeronautics can directly target underrepresented communities.

### TRANSPORTATION NETWORK ADAPTATION

The UAM framework should set clear guidelines surrounding vertiport implementation policies, permitting, and technology that are future-ready and incorporate sustainable practices. As more types of UAM aircraft go into development targeting air taxi services, a flexible land use policy can be developed that is guided by rigid emissions and noise criteria. Safety regulations incorporated into zoning around vertiports and individual vehicles, can be developed to allow new types of use within them. The permitting of vertiports, UAM aircraft, and their data rich infrastructure provide LADOT, and other City departments, with new controls to help reach environmental, economic, and social goals. Such controls can take full advantage of new technology as UAM aircraft move through FAA certification and production in to specifically improve emissions, noise, safety, and community benefit overall.

## Creating a Preferred Future

Looking at the not so distant past demonstrates how yesterday's technologies and their promise of progress created short term decisions. This has resulted in lasting impact on today's residents and visitors. The City is taking a holistic approach so that quality of life concerns of today's and tomorrow's communities are at the center of policy decision making.

### INDUSTRY AND PROFIT DRIVEN DECISIONS

In May of 1927, Charles Lindbergh's famous transatlantic flight helped convince Los Angeles city leaders of the need for a permanent, municipal airport.

Yesterday's aviation technology provided dynamic new services such as airmail and commercial passenger travel between Los Angeles and other aviation-friendly cities.

Regional airports sprouted around the city with land use prioritized by needed long runway infrastructure and accommodation for private industry maintenance or supply companies.

Today's aviation innovations promise similar revolutions and bring with it the risk that industry and profit driven decisions alone can potentially create lasting negative impact for future generations.

Similarly, recent app based mobility providers failed to consider potential negative impact on our public spaces. This oversight required significant public resources to create today's equitable access, safety, and accountability.

The City's proactive and collaborative approach to UAM allows City stakeholders and private industry to jointly create positive, equitable, and lasting benefits to residents, visitors, and industry alike.



/ LAX Circa 1931 originally named Mines Field (LA Times Photographic Archive. under a Creative Commons license)

### IMPACT FROM LEGACY DECISIONS

Yesterday's decisions have unevenly distributed negative impacts from airport and heliport development and operations. Such impacts could have been mitigated had more interdisciplinary policy making been a paramount consideration.

Using technology and lessons learned from the past, UAM Vertiport impact can be more accurately understood, envisioned, and regulated and therefore is much less likely to deliver adverse effects to future generations.

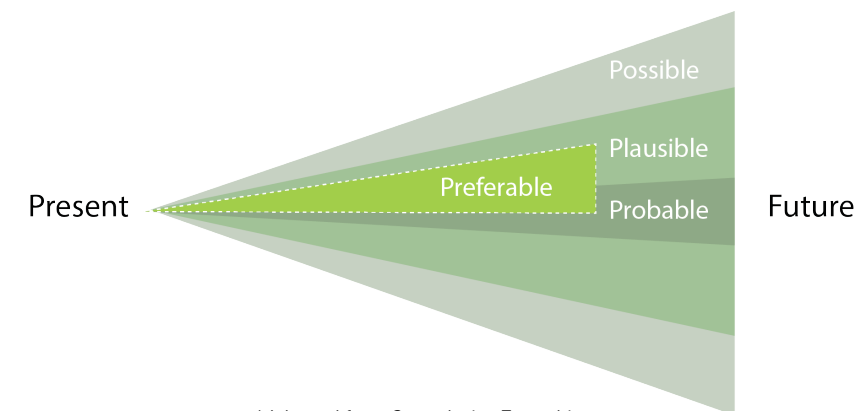
Limitations placed on vehicle specification, time of day access, alternating flight paths, and planned restrictions over sensitive biological areas are a few of the foreseen means to mitigate negative affects for all stakeholders.



/ Los Angeles Noise Pollution map; Bureau of Transportation Statistics/Screenshot / <https://www.volpe.dot.gov/news/national-transportation-noise-map-released>

### MOVING TO EQUITY AND MOBILITY DRIVEN DECISIONS

This new form of transportation can deliver many possible future outcomes. Some are plausible and many more probable if UAM technology alone, similar to historic aircraft technology and services, are the primary drive behind policy decision making. On the contrary, the City's embrace of a proactive and holistic approach helps create Los Angeles' most preferable future. Equitable deployment and integration of UAM technology into Los Angeles' transportation network can be achieved by placing the interest of the entire community, for generations to come, at the center of UAM policy decision making.



/ Adapted from Speculative Everything (Dunne and Raby)

**UNDERSTANDING IMPACT**

To maximize public benefit and an equitable inclusionary approach of UAM into Los Angeles' public transportation system, community engagement is considered an ongoing component of the City's and LADOT's advanced planning and forecasting activities.

In order to facilitate richer dialogue and to better understand UAM's future integration opportunities, stakeholder expectations and sensitivities have been translated into Equity Metrics (Noise Pollution, Visual Pollution, Air Quality, Access, Privacy, and Jobs).

Capturing the diverse needs of residents, business owners, developers, operators, city agencies, and federal regulators helps align expectations with how UAM will be equitably incorporated into the existing transportation network and local workforce.

Equity Metrics can help the City collaborate with established local community groups. These groups can play a key role in the City's community engagement strategy and help gauge where and how residents want vertiports integrated into their communities.

In addition, the creation of stakeholder input groups can provide another high-level community lens in the development of a new UAM policy.

Aligning with Business Improvement District's (BIDs), Neighborhood Councils, and other advocacy groups through stakeholder input groups can extend community geographic districts and may help identify new opportunities of aligning private investment, advocacy goals, and UAM deployment.

Community engagement keeps all Angelenos' interests as the primary focal point during the City's proactive collaboration with State and Federal agencies.

Understanding implications for all stakeholders will improve the outcome of future impact studies conducted by other Departments including but not limited to the Department of City Planning (DCP), and will support more effective dialogue with private industry during LA's on-going impact analysis of Urban Air Mobility.

**STAKEHOLDER UNDERSTANDING**

Considering identified needs, aspirations, and concerns from UAM Stakeholder interviews is one part of the City's on-going community engagement efforts. Positive and negative impacts are compared through a metric system designed to put community interest at the center of near and long term decision making.

In Addition to Los Angeles' local workforce, the following stakeholders' expectations and sensitivities have been included:

- Community Residents
- Residential Developers
- City Stakeholders
- Local UAM Operators
- Local Business Owners
- National UAM Operators
- Local Vertiport Developers
- Local Employers
- National Vertiport Developers
- FAA Employees
- Design and Development community

Source: Stakeholder Interview: Avin Sharma and Jen Cohen Port of LA

## LOCAL WORKFORCE

"UAM technology will provide new jobs."

Eddie lives in West Hollywood and left a trade job to enroll in training to work for the City to support UAM services.

*What they do*

Involved in operations/servicing. Maintain and fuel UAM TOL infrastructure and UAM vehicles.

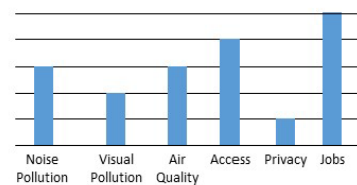
*What they need*

Training, technology culture-shift  
A pipeline of talent for this new technology

*What they think*

UAM mobility will enable me for a new career in an expanding industry.

*Equity Metrics*



*Impact of UAM Services*

- Impact to community on the ground
- Activity created around eVTOL sites
- Jobs creation for emerging industry

*Stakeholder type:*



/ Example of metric system to assist stakeholder understanding (Designworks)

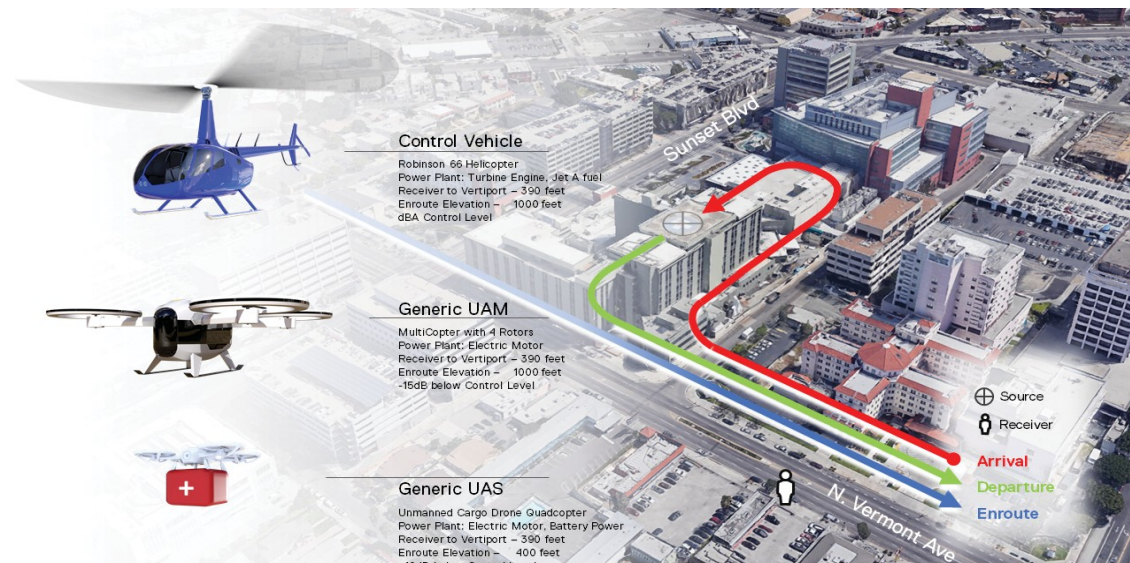
**EXPERIENCING THE FUTURE**

In order to carefully consider the impacts of UAM aircraft and their operations, and to best mitigate potentially damaging impacts from policy or regulation, the City has employed experiential tools to address many relevant and hard questions such as:

- How do community stakeholders experience the noise generated by future UAM take-offs, landings and flyovers today?
- How can the importance of UAM impact be communicated to policy makers that must eventually result in successful integration?
- Do UAM flights layer into the background noise of Los Angeles?
- Can trust between experts and a community be established?
- How do we evaluate it?

State-of-the-art calibrated immersive simulations place community and city stakeholders on the ground of hypothetical UAM sites. Varying context, such as vehicle type and site characteristics allow participants to experience visual and auditory aspects of UAM aircraft take off, landing, and flyby operations. Similar to automobiles, UAM aircraft have varying configurations and styles that are associated with specific performance. Calibrated aural profiles of traditional helicopters are used as a baseline to compare and contrast against large and small UAM aircraft to provide accurate context for viewers of the simulations.

Comparing different scenarios helps understand what is acceptable to a surrounding community. These simulations are built on criteria within a regulatory context to help inform the policies and data parameters needed to regulate UAM far ahead of the deployed technology.



/ Visual and Auditory comparison of helicopter, UAM, and UAS vehicle flight paths experienced in the Arup SoundLab®

Noise contours for typical aircraft need to be established on a site by site basis. The simulation of such contours helps evaluate the height (elevation) of the Touchdown and Lift Off (TLOF) surface, approach/departure flight paths, expected aircraft types and frequencies, and visual impact of operation.

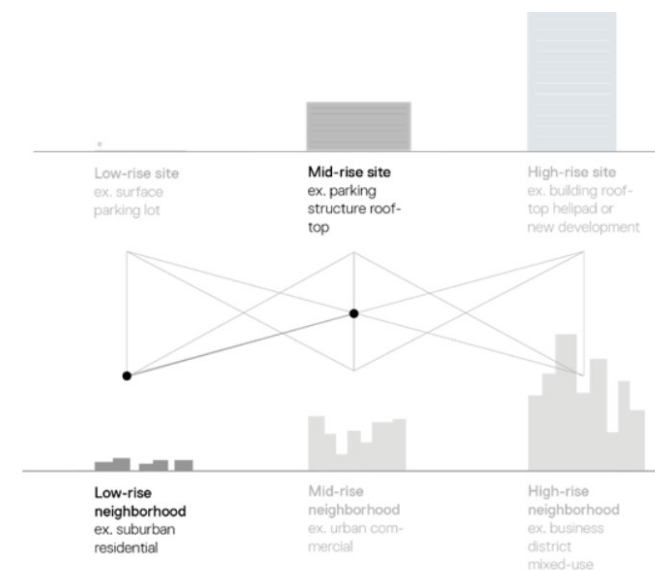


/ UAM context experienced in the Arup SoundLab®

The Community Noise Equivalent Level (CNEL) is an average made up of numerous single noise events. Including CNEL provides the context needed help define aircraft fleet mix, define flight paths or corridors, and determine limits to prevent possible negative aspects from UAM.

These robust simulation tools are helping the City establish threshold levels of impact acceptable to a community, relative to specific land uses and densities, while considering existing public transportation and the surrounding context (urban, suburban, open space, etc.).

Developing regulations and solutions for aircraft noise requires a multifaceted approach. The City's use of new simulation technology helps inform policy makers, and further ensures the community's interests and the preservation of the natural environment are at the forefront of UAM policy decision making.



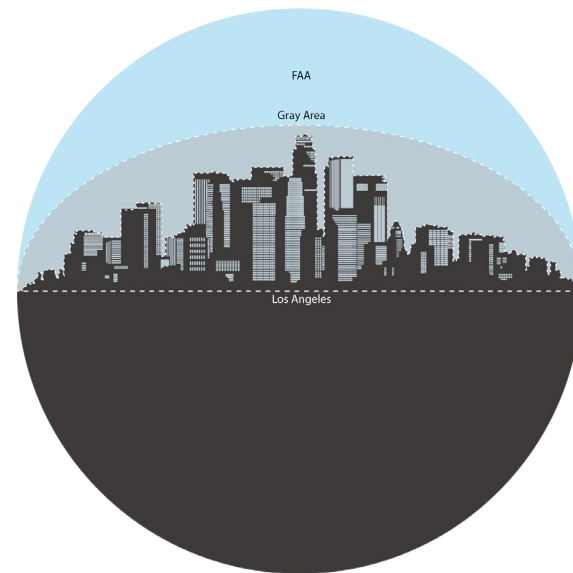
/ Scenario Matrix of low to high rise structures and neighborhoods (Designworks)

## PHASED APPROACH

The City of Los Angeles' early consideration of UAM and its implications helps implement a safe, equitable and sustainable new form of transportation.

An iterative implementation strategy over the next two decades allows stakeholders to evaluate initial UAM trials and partial deployment. This phased approach best informs the construction and scaling of new infrastructure, and helps the community benefit from equitable access to multimodal transportation and its land use.

LA's commitment to UAM has been bolstered by the Mayor's announcement of seating a new UAM Fellow with a keen focus on community engagement, continuing to plan for equitable access, and to ultimately translate UAM implementation into sustained Workforce Development.



*/ City interest defines Land Use and flight paths*

## OVERLAPPING BOUNDARIES

As UAM becomes ubiquitous within the fabric of LA's public transportation and existing land use, regulations limited to airports and the FAA controlled airspace no longer satisfy all needs of Los Angeles. City property, land use, and multimodal integration require the creation of a uniform regulatory framework that works well for the FAA, industry, local government, and the alike.

As UAM technology results in services that require new role definition for regulators and operators, Los Angeles' proactive approach is providing assurance that our collective future is our most preferred future.

## Purpose and Organization of Document

The priorities stated above, coupled with the aims of UAM, will be the basis of a framework for a UAM policy that considers both land use and permitting. It is LADOT's aspiration that this framework document could serve as a model to help other cities establish their own policies around UAM.

The document is organized in four sections:

- **ROLES AND RESPONSIBILITIES**

What is the City's role in UAM, and how does it fit into a larger aviation picture that includes state and federal agencies such as the CTC, Caltrans, the FAA, or NASA?

- **VISION FOR KEY AREAS OF INTEREST**

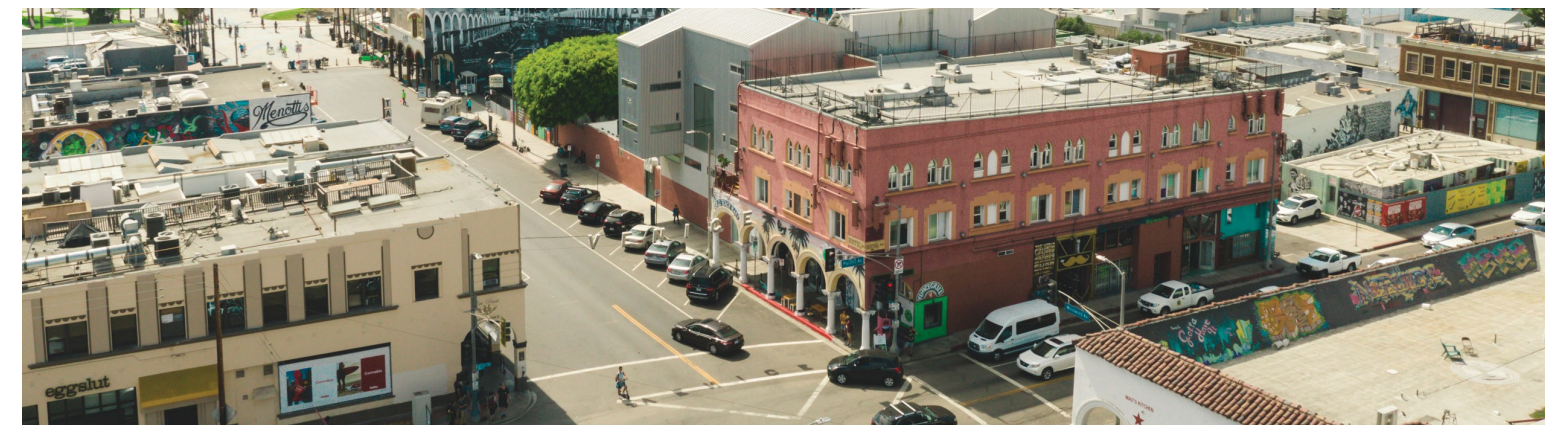
How do the City's strategic pillars of equity, health and safety, sustainability, economic growth, deidentified data, and multimodal connectivity translate into the UAM policy framework?

- **CONSIDERATIONS FOR LAND USE POLICY**

A guide for developing policies that establish the influence areas and safety zones for vertiports, as well as the associated land use and environmental regulations that should be considered in zoning regulations.

- **FUTURE POLICY AND IMPLEMENTATION OPTIONS**

A summary of permitting considerations for vertiport developers, UAM operators, UAM vehicles, and UAM service booking agencies.





# UAM Framework for LADOT

## 1.1 INTRODUCTION

As with any emerging transportation technology, there will be an evolutionary process whereby UAM vehicle technology will be developed and advanced. Vehicle propulsion is expected to evolve from hydrocarbon power to hybrid or fully electric power. Takeoff and landing characteristics are expected to evolve from traditional rotary to vertical takeoff and landing (“VTOL”, or “eVTOL” when electric powered, including transitional from rotary for lift to winged flight). Piloting is expected to evolve from traditional “piloted” with pilot in cockpit, to “Unpiloted”: initially remotely piloted, and eventually autonomous. New types of UAM aircraft will have a very different flight trajectory and noise profile than today’s helicopters. As such, the proposed framework incorporates the need for evolutionary flexibility, by considering three phases of UAM air operations:

- **INITIAL:**  
Operations are conceived considering current rules, regulations, and local agreements, initially aligning with current regulations around helicopters.
- **DEVELOPING:**  
An increase in operations will continue the incremental changes to the existing regulatory framework and procedures, including the establishment of a Provider of Services for UAM (PSU).
- **ESTABLISHED OPERATION:**  
Operations likely to evolve along the lines of key indicators such as structure, regulations, and automation levels. Additional regulations will be jointly identified and established by City, State, and Federal authorities.



During the initial phases of operations, LADOT and its partners should gather data on various characteristics of UAM flights specific to the final approach and takeoff to identify where disparities between UAM and typical helicopter operations exist in the areas of noise and safety.

These data points will serve to influence modifications to vertiport design and community planning standards which could be implemented in a “developing” UAM market in subsequent years.

Further refinement of these characteristics and technology developments will help guide policy as the UAM market enters an “established operation” or more mature stage.

## 1.2 ROLES AND RESPONSIBILITIES OF THE CITY

The role of the City is to ensure that Los Angeles has a safe, efficient, and modern transportation system that improves the quality of life for its communities and assures equitable and sustainable access to mobility and connectivity choices for all residents, businesses, and visitors.

The City is taking a comprehensive approach to the transportation network through consideration of how transportation needs impact the community's priorities, from public safety to economic and community development.

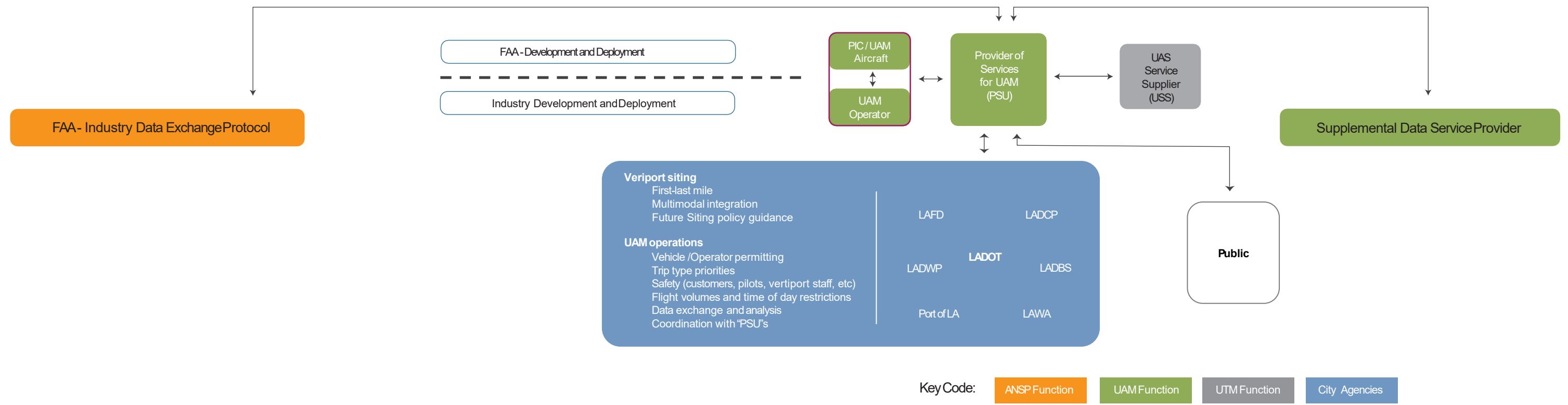
Given the unique nature of the operations of UAM aircraft, a major component of the City’s strategy will be the planning, regulation, and enforcement of an orderly development of a vertiport network, and how the vertiport network will be integrated into the City’s overall transportation network.

The building, operation, and maintenance of individual vertiports are anticipated to be supported through ever evolving forms of Private Public Partnerships with a focus on benefitting the local workforce and stakeholders.

The City’s primary goal of equitable and safe integration of UAM technology will inform all phases and therefore will best align all private and public interests along side policy objectives.

RESPONSIBILITIES SPLIT BETWEEN LADOT, OTHER CITY DEPARTMENTS, AND REGULATORY BODIES FOR THE IMPLEMENTATION OF UAM COULD INCLUDE:

1. Mapping expressed public needs and equity goals to city plans, policies, and permitting.
2. Integrating UAM services into existing and future transportation policies and plans.
3. Integrating UAM infrastructure into existing and future land use policies and plans.
4. Interfacing with NASA and the FAA to ensure aircraft and airspace safety.
5. Interfacing with various levels of government to ensure UAM operation security and safety for the community and environment.
6. Permitting operators or Providers of Services for UAM (PSUs) and setting local policies. (e.g. hours of operation, vertiport access, trip priorities, and trip or operator fees).
7. Participating in multi-directional data exchange for key areas such as real-time route shifting for planned or emergency events, increasing access to vertiports, or monitoring policy compliance.
8. Working with other municipalities and the county to ensure UAM policy consistency.
9. Working with transit and public transportation operators to operate UAM services independently or in coordination with existing transit services.



/ Localized Adaptation of FAA ConOps

1.2.1

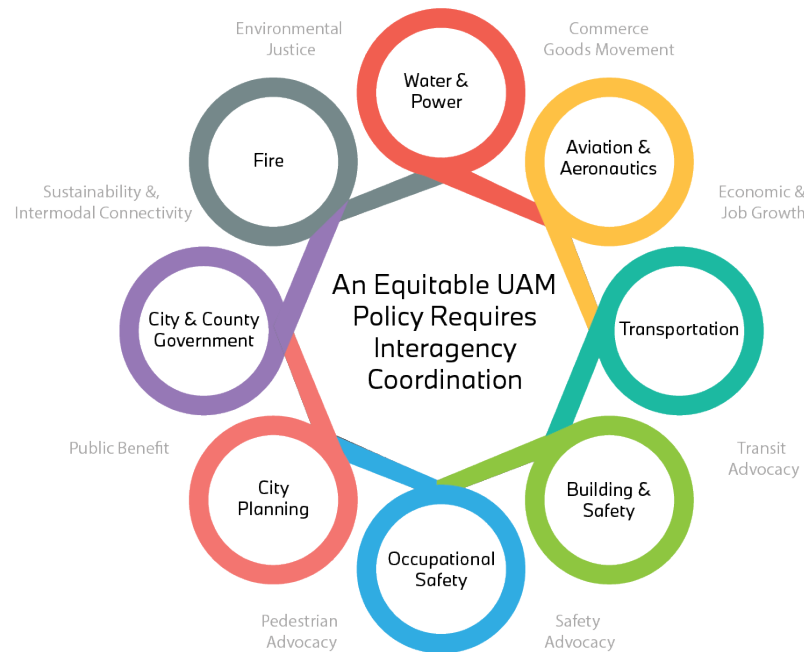
**INTERAGENCY COORDINATION**

In addition to the main actors of the UAM ecosystem, successfully implementing the UAM program will require coordination and cooperation between regulators and agencies at every level from national to local to define and resolve any conflicts that may arise within the essential roles and responsibilities of the UAM system. Even though civil aviation authorities are accustomed to dealing with all airspace issues, the integration of UAM will require city and regional stakeholders to take an active role in shaping some aspects of UAM policy development. These ecosystem stakeholders must work together to integrate UAM operations strategically and efficiently within the context of broader smart city planning efforts. They should also pay close attention to the wants and needs of the communities in which UAM will be implemented, working to get ahead of potential issues such as noise and visual pollution, while also identifying opportunities for UAM to help the community achieve its goals.

Working group with relevant stakeholders should convene regularly to ensure compliance with legal and safety standards. These working groups are a good opportunity to have stakeholders share knowledge, collaborate to solve any potential issues, identify operational improvements, and plan for future changes. The following agencies have been identified as potential stakeholders:

- Federal Aviation Administration (FAA)
- National Aeronautics and Space Administration (NASA)
- Los Angeles Department of City Planning (DCP)
- Los Angeles Department of Transportation (LADOT)

- Los Angeles Fire Department (LAFD)
- Los Angeles Department of Water and Power (LADWP)
- Los Angeles Department of Building and Safety (LADBS)
- City / County of Los Angeles
- CalTrans Division of Aeronautics
- Airport Authorities (e.g. LAWA, SMO, BGPAA, LGB, etc.)
- California Division of Occupational Safety and Health (CalOSHA)
- National Institute for Occupational Safety and Health (NIOSH)
- Port of LA
- SoCal Gas



*Diagram illustrating the interdependence of agency and stakeholder collaboration for equitable UAM policy*

1.2.2

**KEY STAKEHOLDERS**

In parallel to convening relevant stakeholder groups of national and local regulators and agencies, the City should create a platform for participation of relevant community groups. The creation of an Advocacy Advisory Committee (AAC) will provide a high-level community lens in the development of a new UAM policy. The intent is that the AAC will document the wants and needs of the communities in which UAM will be implemented.

Sessions of the AAC should aim on getting ahead of potential issues such as noise and visual pollution, while also identifying opportunities for UAM to help the community achieve its transportation and quality of life goals. The AAC can be one conduit by which local voices are heard and accounted for. Ideally, AAC participants should come from local community groups with varying special interests.

The AAC should align with the City of Los Angeles Transportation Commissioners specifically for UAM related topics and interface with other stakeholder advisory groups that the City partners with for a comprehensive dialogue.

The following types of interest groups should be considered:

- Environmental Justice
- Transit Advocacy
- Pedestrian Advocacy
- Safety Advocacy
- Civil Rights
- Economic
- LA Community Leaders

**Agencies**

- Airport Authorities (e.g. LAWA, SMO, BGPAA, LGB, etc.)
- California Division of Occupational Safety and Health (CA DOSH)
- CalTrans Division of Aeronautics
- City / County of Los Angeles
- Federal Aviation Administration (FAA)
- Los Angeles Department of Building and Safety (LADBS)
- Los Angeles Department of City Planning (DCP)
- Los Angeles Department of Transportation (LADOT)
- Los Angeles Department of Water and Power (LADWP)
- Los Angeles Fire Department (LAFD)
- Los Angeles International Airport
- National Institute for Occupational Safety and Health (NIOSH)
- National Aeronautics and Space Administration (NASA)
- Port of LA
- SoCal Gas

## 1.3 VISION FOR KEY AREAS OF INTEREST

### 1. EQUITY

As key priority areas, equity should be considered critical indicators of success for UAM in Los Angeles. The following equity considerations should be applied to all planning involved with deciding how and where the UAM ecosystem will operate.

#### COMMUNITY ENGAGEMENT

In addition to the operational stakeholders, interagency coordination, and the AAC, targeted community engagement with local stakeholders should be the primary focal point. This way DCP and LADOT can gauge where and how residents want vertiports integrated into their communities. Community engagement will be considered at every stage of the process, from framework development to approval of vertiport sites, frequency of operation, and multimodal integration. Engaging directly with established local community and advocacy groups is a pillar of the City's community engagement strategy.

#### ENVIRONMENTAL NOISE

DCP and LADOT should carefully consider the environmental noise impacts of UAM aircraft types and their operations, and facilitate mitigation of potentially damaging impacts through policies and regulations.

The introduction of UAM, with multiple new vehicle types and flight patterns, will require updates to noise abatement policies, which if done effectively, could improve the public's acceptance of UAM within the Los Angeles soundscape.

#### VERTIPOINT ACCESSIBILITY

Accessibility should consider all users including people with disabilities and seniors, and underserved communities, particularly communities of color. The network of vertiport sites should ultimately be equitably distributed throughout the City and connect to existing transportation networks. In addition to including them in all areas where they would be welcome (based on community stakeholder input), the City and LADOT should ensure that they are planned with equitable access by all users in mind.

Incentivizing placement of vertiports in underserved communities may be an option to ensure equitable access, but such a policy would need to be based on clear community desire, connectivity to existing transportation networks, and considerations for negative impacts to surrounding community.

#### CORRIDOR SATURATION & FLIGHT PRIORITY

While determining the configuration of UAM corridors, DCP and LADOT may want to consider paths that minimize flights over residential areas; and largely constrain paths to noise generating transportation paths – freeways, rail lines, and main arterials – as the established and publicly chartered helicopter routes do today. Furthermore, varying noise regulations should be considered for differing types of aircraft used for emergency services, passenger movement and goods movement. While these paths will not fully mitigate environmental noise to surrounding properties as there is a direct line of sight to the UAM flight path, the flight paths would align with other noise producing pathways that have some impact on the surrounding land-use. First responder vehicles shall take priority similar to terrestrial transportation.

#### ECONOMIC DEVELOPMENT

The integration of UAM in the urban fabric has the potential to benefit a community at every level, from local businesses to citizens in search of employment opportunities, both directly and indirectly. Local and regional stakeholders must take active measures to ensure that these benefits are realized to their full potential however. For example, UAM can help cities and regions attract new forms of investment, but stakeholders must make strategic choices in the process of infrastructure development to ensure that investment is funneled to the areas that need it most. Additionally, job training programs to attract, encourage, and invest in communities of color that are underrepresented in aviation and aeronautical skilled positions will also bring an equity aspect into the economic development that the UAM opportunity brings Los Angeles. As such, cities and regions should work closely with the business community to ensure that UAM is thoughtfully implemented and positioned to become a long-lasting component in local and regional transportation systems.

#### PAYMENT SYSTEMS AND FARES

While fare pricing may depend on UAM operators, DCP and LADOT as governing agencies might consider implementing policies or incentives for operators to provide lower fares and more accessible payment options to low-income users.

#### FLIGHT PRIORITIZATION

In the scenario where there are a limited number of UAM Corridors and the UAM network has not been developed sufficiently to allow for additional capacity, there will likely be cases where demand for UAM flights exceeds capacity, known as system saturation. When this is the case, a system of prioritization will be required. Prioritization criteria may include, but would not be limited to, the following types of flights (not necessarily in priority order):

- Distress: Serious and/or imminent danger, requiring immediate assistance.
- Urgency: Condition requiring immediate attention to maintain safety (emergency, etc.)
- Direction Finding: Situation where piloted or unpiloted navigation requires assistance
- Flight Safety: Condition concerning the safety of an aircraft or passenger (mechanical, medical, fire, etc.)
- Meteorological: Environmental changes or weather related situation affecting safety
- Flight Regularity: Consistency of operations to prevent delays or passenger complaints
- Higher Occupancy Aircraft: Greater payload requiring specific operational needs

Looking ahead to a future environment where the UAM system has been implemented for a significant amount of operational time, and continues to mature and expand, the anticipated high volume of flights (e.g. peak hour demand) in a thriving system will require many designated flight corridors to accommodate such demand (termed "UAM Corridors" in the FAA UAM ConOps document).

2. SUSTAINABILITY

The UAM framework should set clear guidelines surrounding vertiport implementation policies, permitting, and technology that protect the environment through adaptability to the evolving industry. As UAM aircraft promise quieter and greater efficiency over time, a flexible UAM policy should establish clear criteria to incentivize operators and riders to choose zero emissions vehicles that help to decarbonize the City's transportation network.

EMISSIONS

While the City and LADOT does not have jurisdiction to directly regulate the emissions of UAM aircraft given state and federal regulations in place, there are several strategies the City could use to effectively regulate the level of emissions that the public is exposed to from UAM aircraft. Such strategies, as described in the permitting framework section of this document, include:

- Regulating the types of vehicles that can land on city-permitted vertiports (incorporating a Vehicle Classification System)
- Limiting fleet size according to fuel type: all fossil-fuel, hybrid, and zero emission
- Limiting the provision of fossil-fuel refueling capabilities at city-permitted vertiports (through fire code or other ordinance limiting the presence of fossil fuel storage on-site)
- Incentivizing electric and renewable electric recharging capabilities and non fossil fuel vehicles at city-permitted vertiports

INCENTIVIZING ZERO EMISSION TRIPS

UAM policy should further incentivize the use of zero emission transit and the use of zero emissions multi-modal systems (transit, walk, cycle). Such incentives that align with the Mayor's Green New Deal and Executive Directive 25 will help UAM replace existing forms of transit that aren't zero emissions.

LEVERAGING DATA AND TECHNOLOGY

The existing National airspace is managed through a network of radar stations and manned air traffic control centers that monitor and manage the position of aircraft in the skies. This system will be even more important in order to successfully separate aircraft in a highly concentrated and dynamic environment of aircraft, micro-climates, and various obstructions. Los Angeles plans on integrating with these systems to both provide information on the availability of vehicle charging infrastructure, ground-based incidents, and to communicate digitally acceptable use for vertiport infrastructure. Data from these systems can be leveraged to inform the need for future investments in vertiport infrastructure and measure socio-economic, sustainability, and environmental outcomes.

In conjunction with collaborations with NASA and other members of the Open Mobility Foundation, LADOT's digital policy platform will be enhanced to accommodate UAM use cases and data structures while also preserving privacy outcomes according to the principles developed by the department in 2018-2020 to protect user privacy for micromobility.

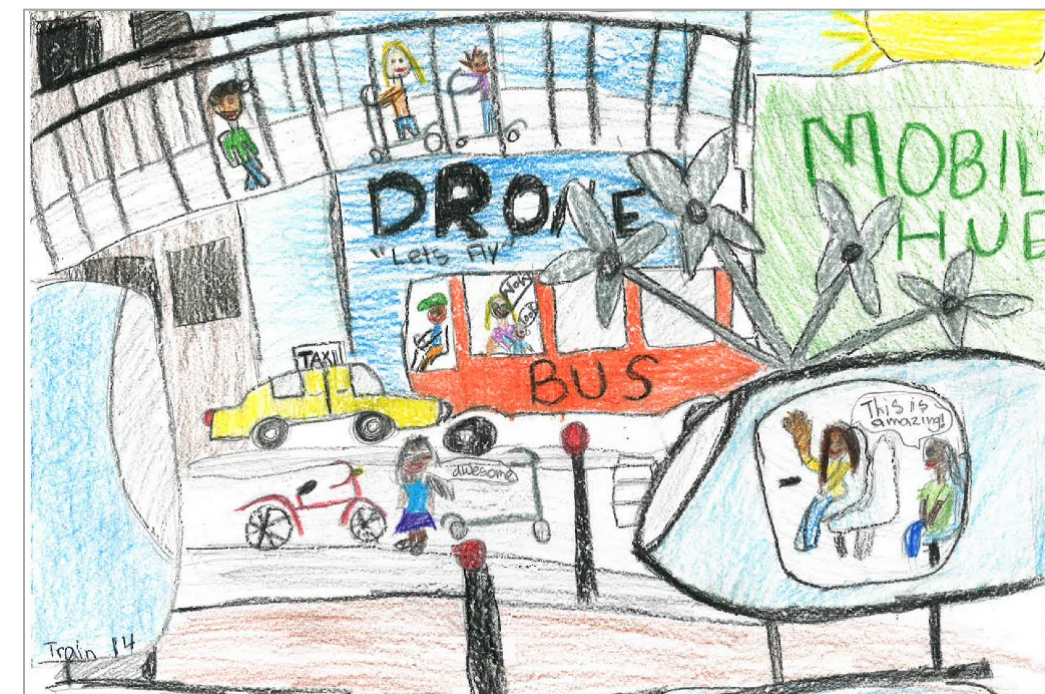
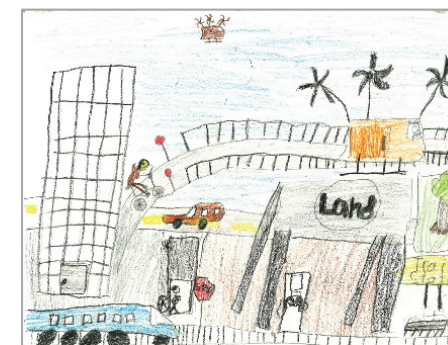
INTEGRATION INTO THE TRANSPORTATION NETWORK

The promise of UAM aligns with the City's goal of harnessing future transportation technology to optimize sustainable mobility across all modes of transportation.

Vertiports will be one aspect of the multimodal vision that LADOT has for Los Angeles. Trips made on UAM will serve passengers across many distances in a quick manner, but we must recognize that many trips will not begin or end in the immediate vicinity of the vertiport. To ensure UAM is fully integrated into the safe, healthy, livable and sustainable transportation network of the future, vertiports will need to be well integrated with other modes to ensure the first/last mile connections provide options for all users and trip types.

To achieve this, a focus on ground transportation integration should be a requirement for vertiports. Siting vertiports along existing transit routes, such as Metro Rail and Bus lines, will provide equitable access to these facilities. Additionally, an emphasis on shared mobility at the vertiport should be made to further emissions reduction. LADOT's mobility hubs may be expanded to these sites to provide BlueLA carshare, Metro Bikeshare, and other private shared mobility services including scooters and dockless bikeshare. Incentives for UAM could further discourage Single Occupancy Vehicle users/connectors.

Through this multimodal integration, UAM will have the opportunity to become an accessible and integral part of LA's multimodal and sustainable transportation network.



/ LAUSD elementary student depictions of "getting around town in the future"

### 3.

#### HEALTH AND SAFETY

Safety should include the protection of people, animals, and property on the ground and in the air from vertiport-related hazards.

Categories of safety include safety at the vertiport, safety around the vertiport (including height restriction areas and vertiport safety areas), aircraft safety, and personal safety for passengers and staff.

##### SAFETY AT THE VERTIPORT

It is important to issue a baseline set of physical security requirements for vertiport operators as typically seen at airports. Such an approach should include multi-layered protection with local physical security risks being assessed as part of the permitting and regulatory review on a case-by-case basis. (See Section 3.2.1 for details).

##### SAFETY AROUND THE VERTIPORT

Vertiport safety regulations can be integrated into zoning to minimize the number of people exposed to potential UAM aircraft accidents in the vicinity of the vertiport by considering density and use limitations within these zones

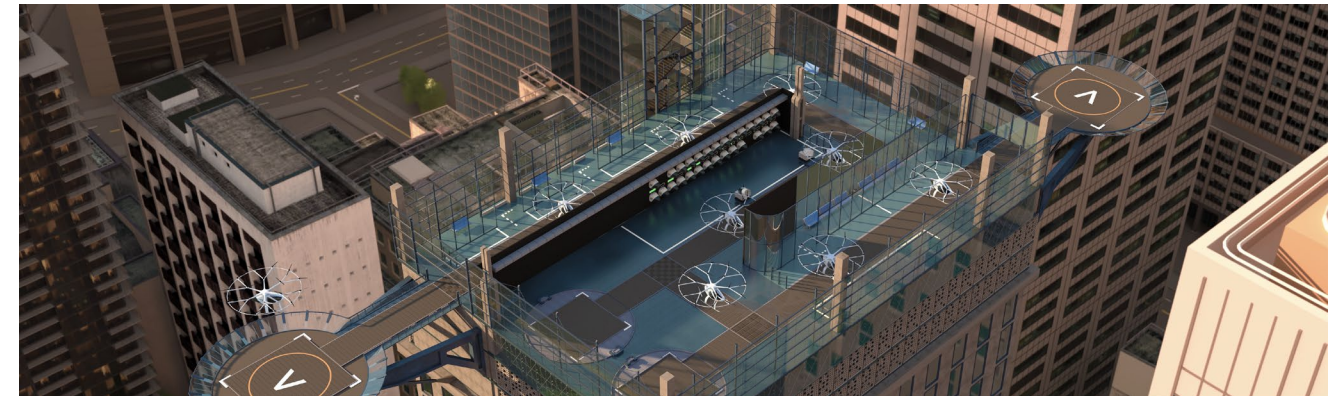
##### SAFETY OF SURROUNDING BIOLOGY

In addition to specifying safety requirements for persons and property, the UAM policy will include means of protecting the surrounding wildlife and natural environment..

(See Section 2.3.1 for details).

##### AIRCRAFT SAFETY

Since its inception, the Federal Aviation Administration has made its mission to establish safe practices for designing, building, and operating aircraft. In 2017 it achieved its goal of zero commercial passenger fatalities. Operating in low-level airspace increases the importance of existing and new regulations that address safety systems in UAM aircraft designs and operations. Cities like Los Angeles will complement shared safety outcomes with Federal Regulators through thoughtful vertiport placement, assessment of flight corridors, and public provisioning for weather sensor networks.



*/ Volocopter's vertiport landing concept for integrating air taxi infrastructure into Megacities, 2019*

##### PERSONAL SAFETY OF PASSENGERS AND STAFF

Safety at vertiports will be required to protect passengers, staff, aircraft, and vertiport property from accidental or malicious harm, crime, terrorism, and other threats. Such an approach should include multi-layered protection, combining restrictive user policies, security monitoring, and consideration of how to protect those directly under UAM flight paths.

# 2 Land Use Policy Considerations

## 2.1 PURPOSE

Consideration for establishing approaches for regulating land use around vertiports designed to help the City promote a safe, healthy, livable, and sustainable transportation network of the future through policy and regulation.

Some factors to consider for establishing possible land use policy around UAM may include the following::

- Review existing land use plan and zoning codes

- Assess how equity goals are being achieved

- Consider vertiport safety and influence zones

- Consider height and land use impacts within each zone

- Consider criteria for vertiport level of utilization (volume) and time of day (curfew) restrictions

- Identify transportation network implications and integration into a multimodal network for criteria requirements

- Establish criteria for general vertiport location approval process

## 2.2 BACKGROUND: CURRENT HELIPORT DESIGN

Per the “Urban Air Mobility Concept of Operations v1.0” issued on June 26, 2020 by the FAA, initial vertiport design criteria can coincide and incorporate current heliport and helipad design criteria, until sufficient flight performance data for UAM and VTOL aircraft can justify refinements to these standards and/or creation of new standards for UAM aircraft. Issues related to community planning (primarily noise, safety, and airspace clearance) are covered in the FAA Advisory Circular (AC) and are expanded in more detail in the California Airport Land Use Planning Handbook.

The FAA is developing interim guidance for vertiports based on UAM performance compared to traditional helicopters. Differences or gaps will be filled by performance standards and vehicle performance categorization.

DCP would lead the effort on creating the policies and codifying a regulatory permitting process with the input and collaboration of LADOT's technical expertise.

## 2.3 DEVELOPING A LAND USE POLICY

### 2.3.1 CEQA CONSIDERATIONS

The California Environmental Quality Act Guidelines (CEQA) requires that new development must be environmentally assessed for any impacts that may result from new development. A key consideration for the City will be to decide how to incorporate UAM vertiport siting into the City's land use and zoning codes. Environmental assessment will be done for all aspects of policy development and any implementation considerations

**2.3.2  
REVIEW EXISTING LAND USE  
PLAN AND ZONING CODES**

When considering where vertiports could or should be located, many factors need to be considered. These factors can be broadly categorized into connectivity – how well the vertiport is connected to both the urban air system as well as ground transportation systems; land use compatibility – whether the surrounding land uses can generate or benefit from demand for urban air travel; and community impact – the effects of both positive and negative externalities from the vertiport.

**MULTIMODAL CONNECTIVITY**

Developing and Establishing UAM Corridors: Vertiport locations on or near established flight paths should be prioritized to minimize overflight of non-designated flight paths. As UAM evolves, new UAM corridors will need to be identified and established. LADOT and DCP should work with the FAA and other partners to ensure that these corridors do not negatively impact or favor one community over another, while still creating a safe and efficient network for urban air travel. Community engagement will be key to developing equitable and accessible corridors.

**Connections with Ground Transportation:**

Vertiport locations should be well-connected with existing and future ground transportation, medical centers, and fulfillment locations. Locations within close proximity to high capacity transit systems, such as Metro Rail and Bus, Metrolink, and Amtrak, should be prioritized.

**LAND USE COMPATIBILITY**

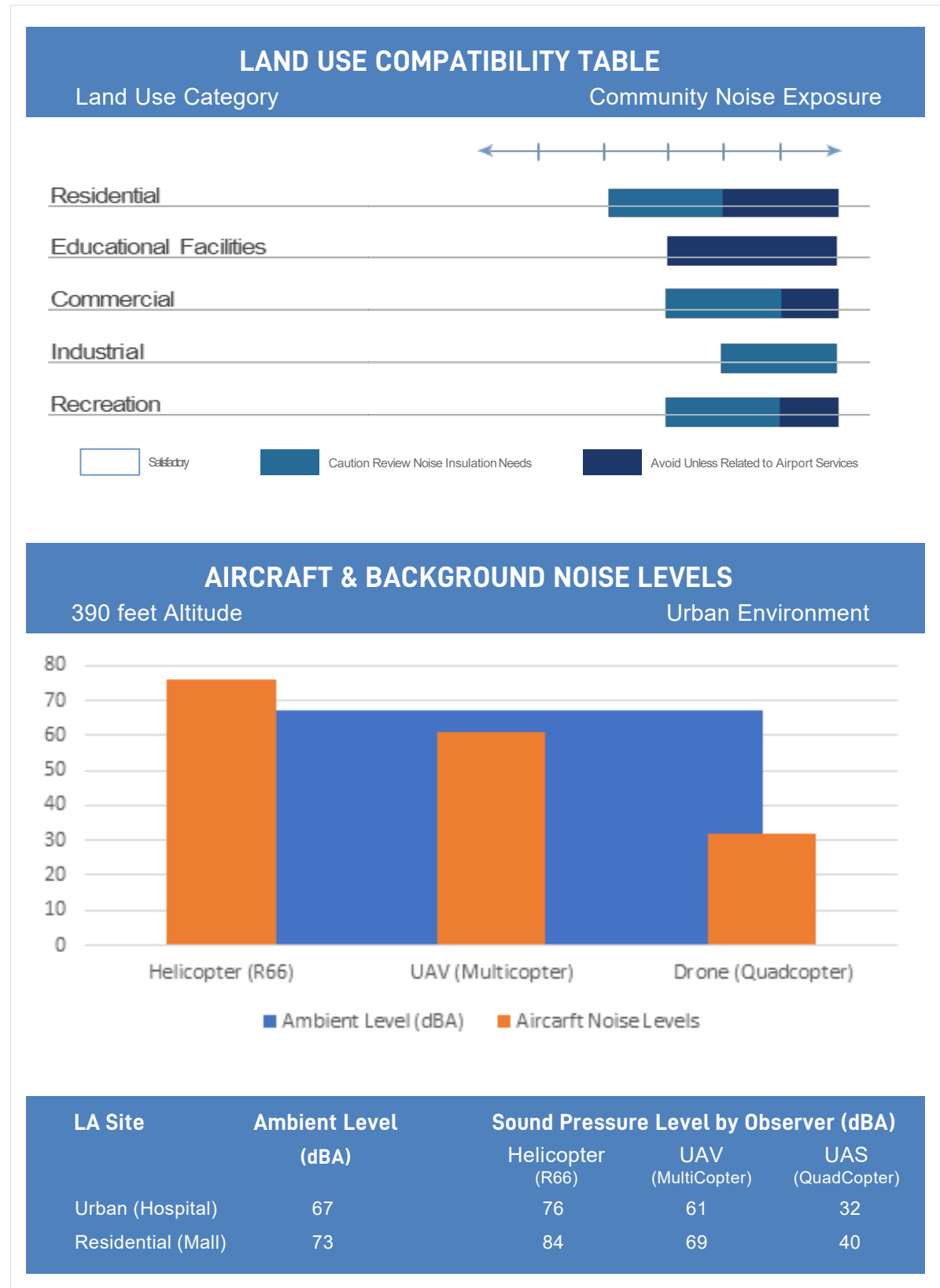
Current and Potential Land Uses: Vertiport locations should consider what types of land uses may support UAM demand, such as major retail centers, stadiums and arenas, major tourist attractions, higher education campuses, offices, and major transportation facilities. Certain types of land use may be more incompatible with vertiports, such as K-12 schools, and other sensitive uses.

Zoning: DCP can consider which current zoning or new zoning may be needed to allow for vertiport development.

**COMMUNITY IMPACT**

Socioeconomic and Demographic Characteristics: The distribution of vertiports in the City should carefully consider balancing both access and exposure to UAM operations. Closely linked to UAM corridors above, LADOT should work with DCP to ensure that vertiport locations do not negatively impact or favor one community over another. Strong community engagement will be an on-going necessity while considering where to allow future vertiport development.

Noise: Certain land uses that may be sensitive to noise should be carefully considered. Acceptable community noise levels for UAM aircraft are still unknown as there are limited studies and manufacturer data available at this time. However, we anticipate future policy will reflect today's in that acceptable noise levels will vary for different land uses, as shown in the Land Use Compatibility Table above, from the Los Angeles County Airport Land Use Plan (2004). The Table to the right shows sound level comparisons by vehicle type compared to ambient noise at hypothetical vertiport locations.



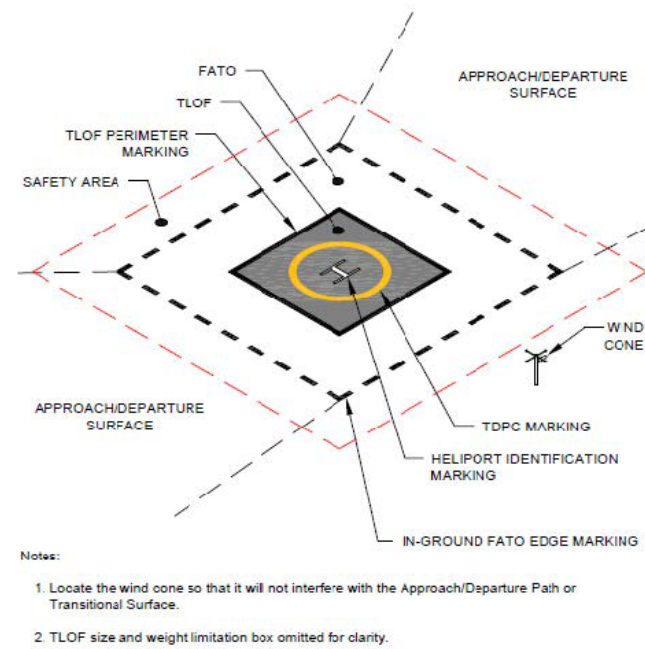
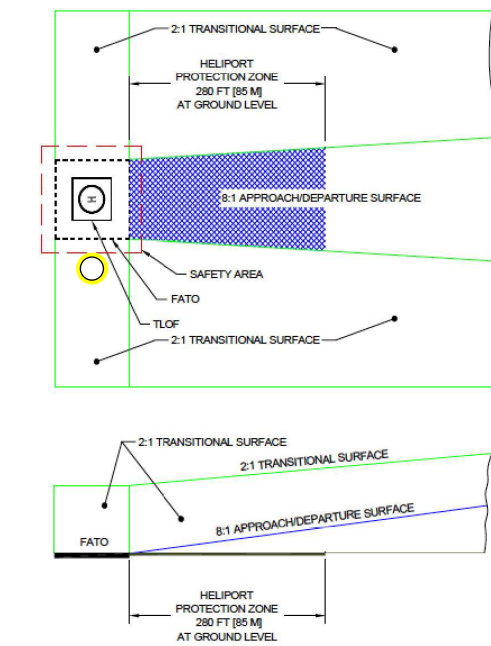
/ Data from Los Angeles location recordings and Land Use Compatibility Table



**2.3.3  
CONSIDERATIONS FOR DEVELOPING GENERAL  
VERTIPORT LOCATION APPROVAL PROCESS**

While specific location approval will need to be more rigorous and take into account the specific vertiport design for the site, as discussed in the following sections, the City can take a first step by considering generalized areas where a potential vertiport might be located. The considerations discussed in the previous section should provide a starting point for the approval process of general vertiport locations, and should align with LADOT's Strategic Work:

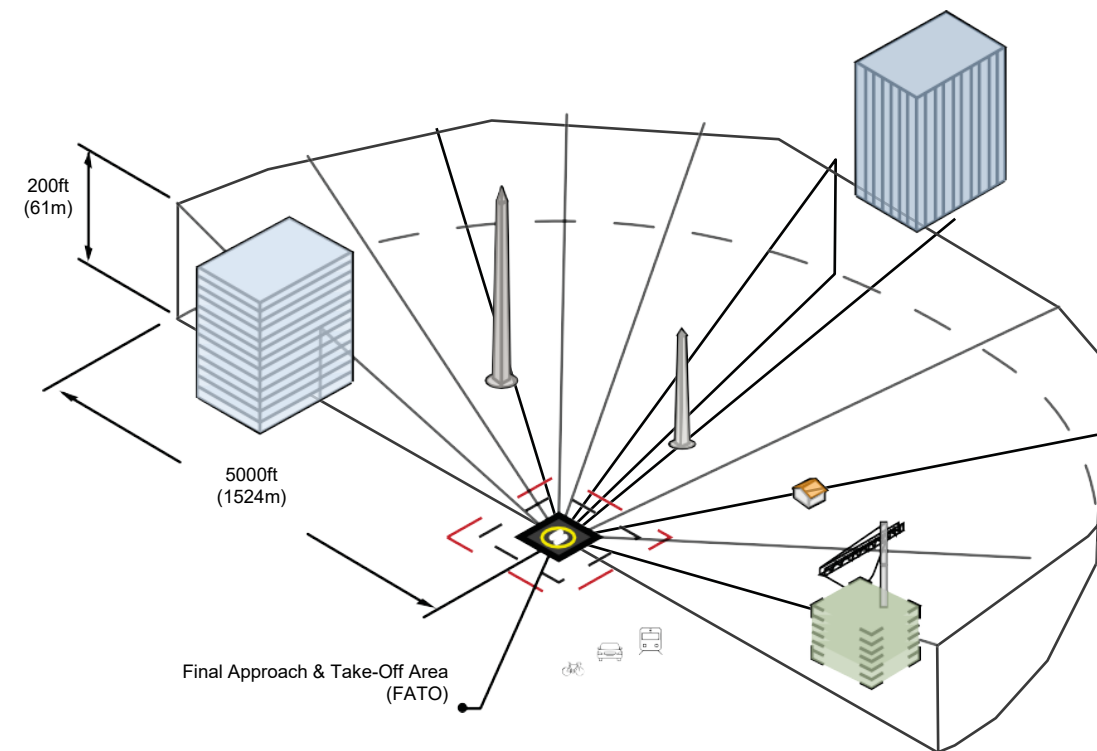
- Equity
- Sustainability
- Deidentified Data
- Health and Safety
- Economic Growth
- Multimodal Connectivity



**2.3.4  
CONSIDERATIONS FOR POSSIBLE VERTIPORT SAFETY  
AND INFLUENCE ZONES**

Initial considerations for the framework is to consider vertiport safety zones to protect the safety and noise impacts in the vicinity of the vertiport by imposing land use limitations. The safety zones to the dimensions of the “design aircraft”, which is the largest type of aircraft the vertiport is designed to accommodate. Vertiport safety zones in the future will likely differ from heliport safety zones with appropriate modifications for new types of UAM aircraft.

The graphics below show the various zones around a heliport that could be used in initial stages of UAM operations. These zones will evolve once more is known about UAM vehicle flight paths and noise contours.



*Illustrations depicting initial Vertiport Safety and Influence Factors*

When developing the extents of a Vertiport Influence Area (VIA), LADOT could reference guidelines for heliports and Heliport Influence Areas (HIA) provided by the California Airport Land Use Planning Handbook and the FAA Advisory Circular 150/5390-2C.

Three key factors should be considered:

#### 1. VERTIPORT SAFETY AREA AND PROTECTION ZONES

As more data becomes available for typical UAM operations, DCP, LADOT and its partners could work with the FAA to re-evaluate the risk level that is actually present within zones and determine if additional land uses and densities may be permitted within them.

#### 2. NOISE CONTOURS FOR TYPICAL AIRCRAFT ON FINAL APPROACH AND TAKE OFF

Noise contours for typical aircraft need to be established on a site by site basis and may follow the guidance in the California Airport Land Use Planning Handbook or the FAA's integrated Noise Model.

DCP and LADOT can reference the guidance provided in the Los Angeles County Airport Land Use Plan (2004) when measuring noise levels near a vertiport:

#### 3. AIRSPACE CLEARANCE SURFACES

While national airspace is regulated by the FAA, it is the local government's responsibility to ensure that the airspace surrounding airports (including heliports and future vertiports) and the designated air routes into and out of an airport are maintained.

As more data becomes available for typical UAM operations, DCP and LADOT (and its partners) may work with the FAA to re-evaluate the typical configurations of these surfaces to determine if revisions could be made for vertiports serving only UAM aircraft types.

### 2.3.5 EXISTING LAND USE REGULATION CONSIDERATIONS

The City can consider all of the various factors that need to be part of the land use, environmental, and community visions for Angelenos to enable a safe, equitable, and sustainable integration of UAM.



/ Pedestrian view of DTLA mobility

2.3.5.1

**HEIGHT LIMIT CONSIDERATIONS**

Height limitations in the vicinity of a vertiport are required to protect the public safety, health, and welfare by ensuring that UAM aircraft can safely navigate the airspace around the vertiport in the critical takeoff and final approach phases of flight. This protects both those in the UAM aircraft and those on the surface who could be injured in the event of an accident. In addition, height limitations are required to protect the operational capability of vertiports to accommodate a variety of UAM aircraft types in a variety of weather conditions.

As mentioned earlier, while national airspace is regulated by the FAA, it is the local government's responsibility to ensure that the airspace surrounding a vertiport and the designated air routes into and out of a vertiport are clear of vertical encroachment via zoning and individual building height permits.

It is conceivable that there may be cases where vertiport height limits contradict allowable zoning. The policy framework should address community need for balance between airspace versus focusing on development rights when such cases arise.

2.3.5.2

**VERTIPORT LAND USE COMPATIBILITY**

When considering where new vertiports should be located, the City can reference existing resources such as the California Airport Land Use Planning Handbook and The California State Aeronautics Act requiring all public-use heliport's need to obtain a Heliport Permit.

If a public-use heliport is considered a public airport it then requires an Airport Land Use Compatibility Plan (ALUCP) developed by a local Airport Land Use Commission (ALUC). The City could consider similar provisions for vertiport permitting and development of a land use compatibility plan for vertiports intended to be used by eVTOL aircrafts and operators.

**NOISE AND OVERFLIGHT**

In many ways, 2021 is much like 1958 where the existential question is if the public will accept aerial travel as safe and sustainable transportation. Low noise technologies can help earn public acceptance of UAM as a net benefit to society.

The City has invested in research to further understand how these new types of aircraft are experienced by those at vertiports and those living, working, and playing near them. The findings reinforce the importance noise has on public acceptance and supports to a tiered regulatory framework based on a new Vehicle Classification System (VCS). Operators using low-noise aircraft could be rewarded with take off and landings in more places than high noise aircraft use. Such an approach could simultaneously help the City garner public support for UAM operations and also manage those services through integration policies served by the City's Digital Policy Platform.

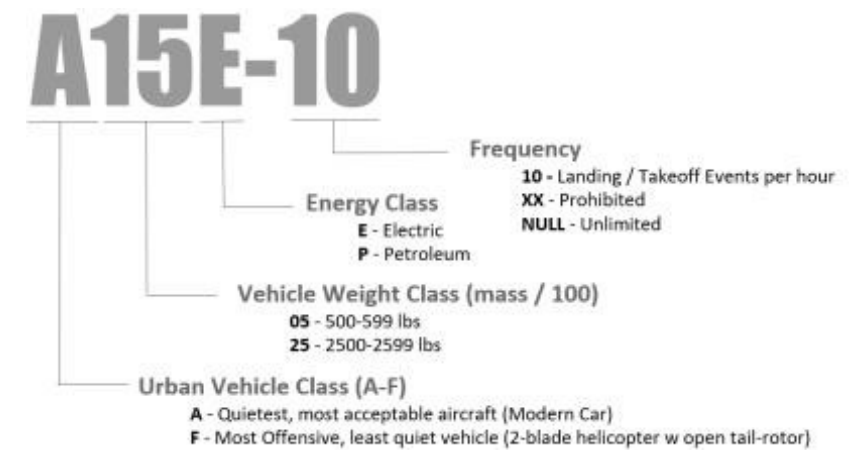
While the noisiest part of flight is typically experienced during takeoff and landing, overflight of sensitive areas is also a concern and an important factor in public acceptance. Los Angeles can work closely with the FAA and aircraft operators to define flight corridors that maximize safety and minimize any negative impacts on Angelenos.



Gensler's CitySpace concept for Uber's Skyport Mobility Hub, Uber Elevate summit 2019

**SAFETY AND AIRSPACE PROTECTION**

- Establish the extent to which aircraft safety concerns on final approach, take-off and landing may affect surrounding land uses (a Vertiport Influence Area, or VIA).
- Establish acceptable levels of risk related to specific land uses and densities, considering the surrounding urban form and context (urban, suburban, open space, etc.)



Example of Vehicle Classification System (Ellis and Associates)

The four key topics addressed in an ALUCP are:



**1 Noise:**  
Minimize the number of people exposed to frequent and/or high levels of aircraft noise capable of disrupting noise-sensitive activities.

**2 Overflight:**  
Notify people near airports of the presence of overflights to minimize or avoid annoyance associated with these conditions.

**3 Safety:**  
Minimize the risks associated with potential aircraft accidents by providing for the safety of people and property on the ground and enhancing the chances of survival of the occupants of aircraft involved in an accident.

**4 Airspace Protection:**  
Avoid the development of land use conditions which, by posing hazards to flight, can increase the risk of an accident occurring.

2.3.6

POSSIBLE COMPATIBLE LAND USES

The City should examine what existing land uses are complementary to each other as well as examine what land uses are not compatible or may cause negative or unwanted impacts. Generally, sensitive uses are prioritized in order to identify and avoid locating incompatible land uses near sensitive uses.

As sensitive uses include a broad range of uses such as schools or single family residences, the City can do a full land use analysis to evaluate the opportunities that best identify possible vertiport locations.

VERTIPORT PROTECTION ZONE

One option for helping to develop opportunities with land use compatibility is to create Vertiport Protection Zones.

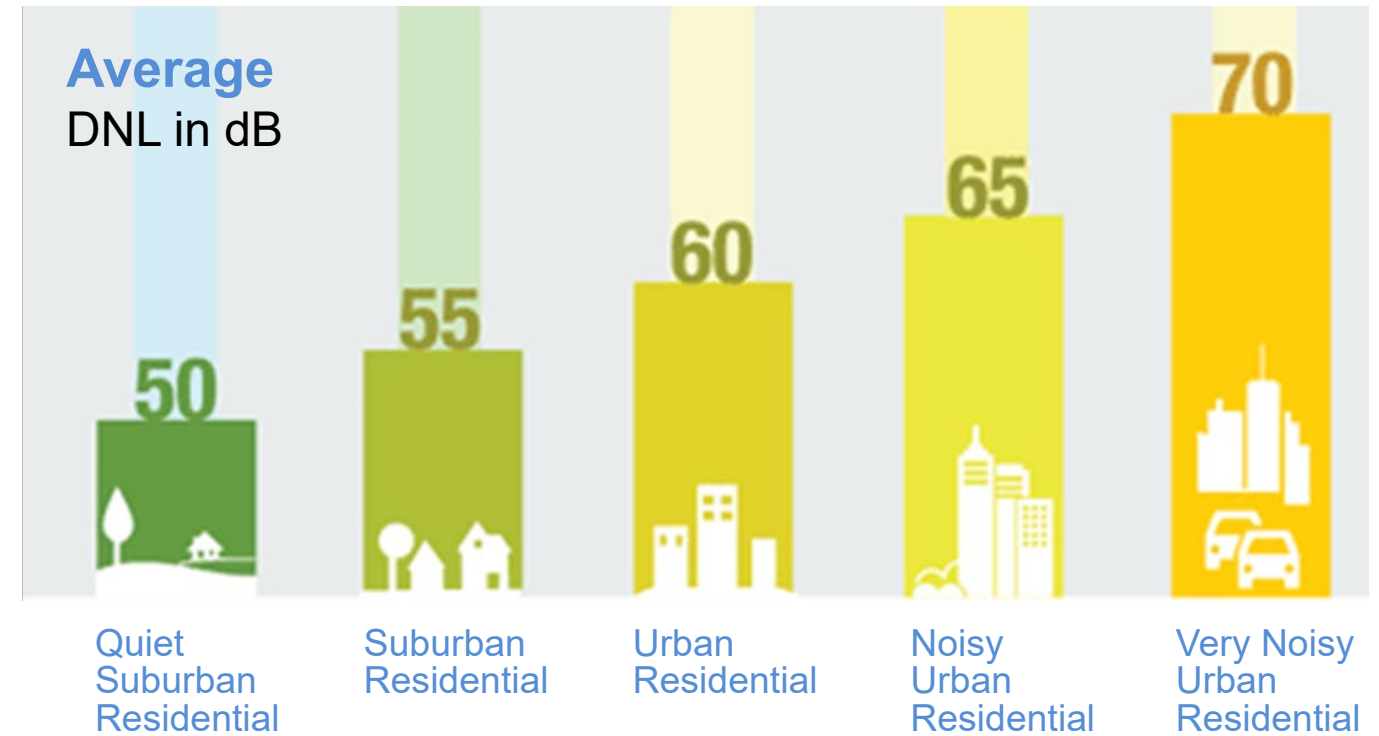
These zones can be developed to both protect sensitive uses from negative impacts and to co-locate compatible land uses near each other. The creation of these zones can include noise impact considerations to ensure that land uses do not create ambient noise levels resulting in negative impacts to the surrounding areas.

2.3.7

CONSIDERATIONS FOR ESTABLISHING VERTIPORT UTILIZATION AND OPERATIONS

The City's responsibility is to regulate the utilization of vertiports in order to limit noise nuisance and mitigate safety concerns for the surrounding community. A number of factors can contribute to the functional capacity of a vertiport.

These factors can include the following: Capacity of the adjacent UAM air corridor, the number of landing pads and aircraft parking spaces available, the passenger processing capacity of the facility (including ground-level passenger pick-up/drop-off....landing pad), other local ground transportation, number of daily operations, hours of daily operations, and trip type/purpose (emergency trips for medical services, goods movement, passenger movement, etc.).



/ DNL Values in Residential Areas; Federal Agency Review of Selected Airport Noise Analysis Issues. Federal Agency Committee on Noise August 1992

Note:

Studies have shown that low community acceptance of transportation increases in areas having low background noise. National Parks Service has partnered with certain entities to conduct long-term background noise level studies in Los Angeles and other cities, and further study is necessary to quantify this impact on the public.

The City's commitment to understanding UAM noise relative to community benefit and its impact on the surrounding built and natural environment can help inform local, state, and federal agencies.

**2.3.8  
INTEGRATING VERTIPOINTS INTO A  
MULTIMODAL NETWORK**

Vertiports will be one aspect of the multimodal vision that the City has for Los Angeles.

Every effort should be made to encourage vertiports to be sited near existing transportation facilities, including transit lines, major arterials roads, and roads with bike lanes.

Emphasis on a suite of comprehensive modal options made available at vertiport sites, such as Mobility Hubs, will help ensure integration of UAM into the multimodal network of Los Angeles.

Data protocols between UAM operators and ground transportation operators through a common data platform may also be developed to help better align supply of ground transportation with the demand generated by vertiport passengers.

Finally, adequate passenger loading space from private vehicles, taxis or rideshare vehicles (TNCs) will also need to be integrated into vertiport design.

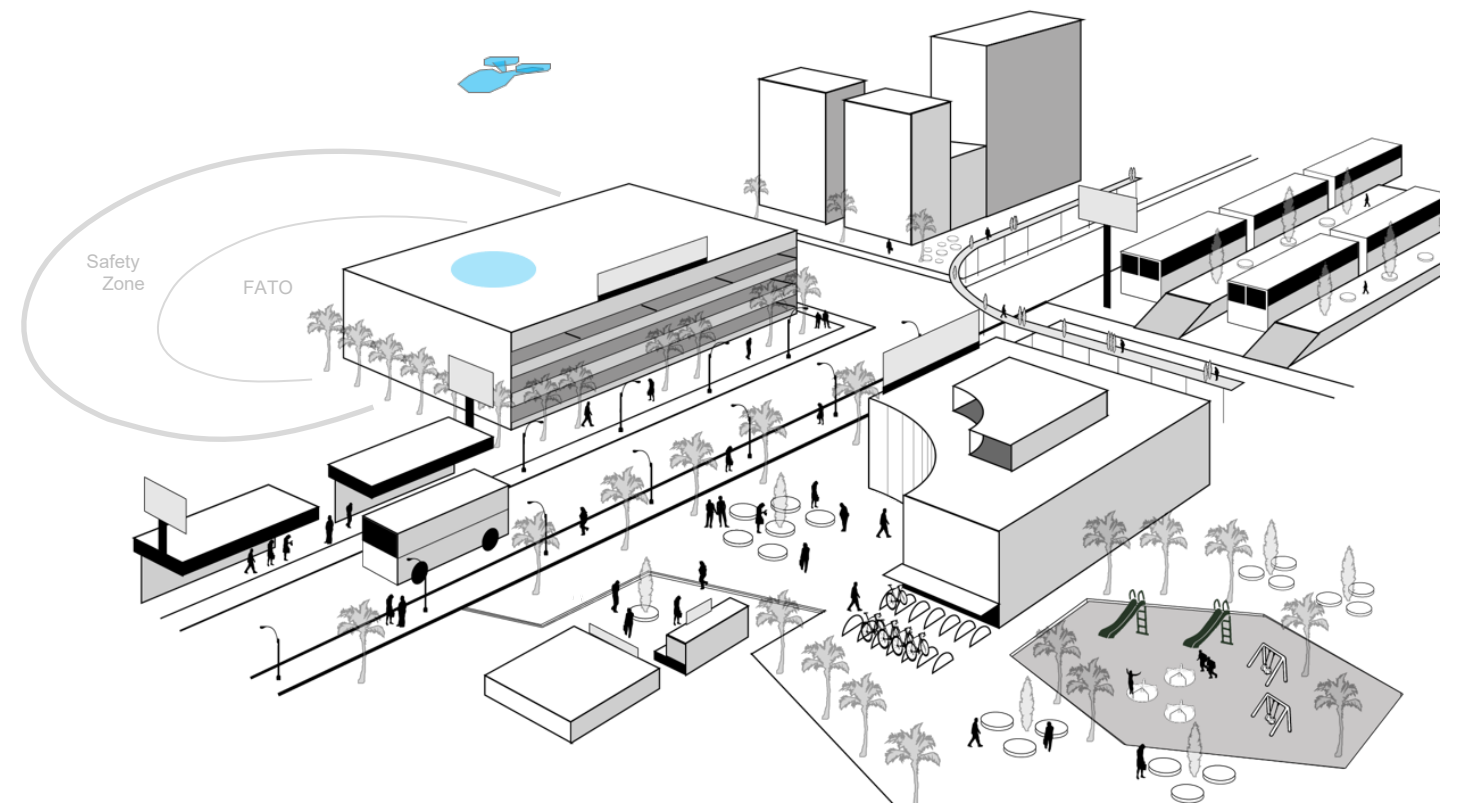
Potential vertiport sites can reference the existing LADOT Transportation Assessment Guidelines (2019) and prepare the required assessment. The assessment should pay close attention to:

- Pedestrian, bicycle, and transit facilities assessment (Section 3.2)
- Focus on the sections where “a project [may] intensify use of existing pedestrian, bicycle, or transit facilities” and/or if the project will be located on the City’s Vision Zero High Injury Network.
- Operational evaluation, including a quantitative evaluation of the project’s expected access and circulation operations and passenger loading evaluation (Section 3.3.3)
- Due to the nature of a vertiport as a transfer point between modes of transportation, an extra focus on passenger loading (especially from TNCs) should be included.
- Delay Analysis and Safety Evaluation for transportation projects (Section 3.3.4.2)

The geographic distribution of vertiports will increase as the market matures, therefore this should be taken into consideration when envisioning what multimodal connections will best serve passengers utilizing UAM.

In the initial phase a greater emphasis on transit and TNC / passenger vehicles may be more appropriate

. As the market develops, the catchment areas for vertiports may decrease, prompting a shift to shorter first/last mile connections and more flexibility to emphasize active modes and micro-mobility.



*Depiction of Multimodal Public Transportation Network*



**2.3.9  
EQUITY AUDIT FOR  
COMMUNITY ENGAGEMENT**

When deciding where to place vertiports as well as the overall vertiport network and flight paths, achieving equity for under-represented communities must be part of all the considerations.

Equity is both a process and an outcome and should be considered in development of a UAM land use policy as well as for each subsequent vertiport project. The first step is to establish a baseline - define and identify the Angeleno quality of life standards and minimum expectations.

In California, there are several tools that can be leveraged to understand baseline conditions, including the Cal EnviroScreen (<https://oehha.ca.gov/calenviroscreen>) and the Healthy Places Index (<https://healthyplacesindex.org/>).

Additionally, look for options for public benefits such as priority/expressed emergency services benefits, digital policy opportunities, job creation, job training opportunities, etc.

Areas of opportunity to consider for expanding public benefits may include exploring:

- Does a vertiport project disproportionately burden one demographic group over another?
- Is childcare provided for job trainees?
- Are community members being paid to assist with engagement topics?
- Are informative materials translated into multiple languages?
- Can the project help reconcile the legacy of historical inequities?
- Does the location or design of vertiports make it likely that certain demographic groups will have greater access and accrue more of its benefits?
- Are community members being engaged at times and locations that are convenient and culturally specific?
- Does the vertiport project align with and support community priorities?
- Does the vertiport project have accountability to the community to ensure equitable benefit?
- Who has power in this process?
- How can a UAM policy or vertiport project share power with communities?
- What is the history of the location where a vertiport is being considered?
- Are there past injustices that have occurred in that community or to the particular demographic that lives there?
- Has the community identified current or ongoing problems that stem from past injustices?

## 2.4 UAM Land Use Policy Elements

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### Zoning Considerations

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Understand current or new zoning considerations / Existing guidelines for heliports (FATO)  
Evolve UAM flight path boundaries and characteristics (e.g. shorten safety zones)  
Analysis of emerging navigation technology affects on safety (e.g. autonomous vehicles)

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### Safety Regulations

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Consider existing heliport risk levels (Vertiport Protection Zone - VPZ)  
Data analysis to better determine the risk level present within a VPZ  
Based on new technology, further refine the risk levels present within a VPZ

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### Compatible Land Uses

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Consider existing acceptable risk and noise levels (Heliports and CEL )  
Criteria for geographic location and configuration evaluation ( Including Heliport Influence Area - HIA)  
Alignment with LADOT's Strategic Work and City Goals

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### Sensitive Land Uses

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Baseline existing sensitive land uses (e.g. schools, protected habitat, land marks, hazardous materials)  
Align with the City's vision for preserving the environmental and community benefits  
Consideration of a Vehicle Classification System (Vehicle type relative to noise levels)

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### Noise Contour Areas

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Benchmark Heliport Influence Area (HIA) / LA County Airport Land Use Plan - (2004)  
Noise level evaluation against initial projections (Possible noise monitoring station data comparison)  
Compare noise effects and influence on land uses (Empirical data from more sophisticated noise models)

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### Number of Operations

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Consider background noise levels and acceptability based on community feedback (Urban, Suburban, Industrial Areas)  
Corridor capacity integration with public transportation (Align with multimodal network criteria)  
Density and acceptance analysis (Added corridors and/or access)

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### Time of Day Restrictions

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Consider daytime and evening limits (Determine when trip purpose best meet demand; balance with noise considerations)  
Evaluate effectiveness of any time of day operation limits against community benefit  
Consideration of a Vehicle Classification System (Vehicle type relative to time of day restrictions)

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### First / Last Mile Connections

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Prioritize locations for equitable access and integration with the City's existing transportation network  
Further integration with shared active mobility (e.g. bikeshare, scooters)  
Integration with Mobility Hubs for evolving trip types, higher trip density, and higher pedestrian activity

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### Traffic Impacts

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Prioritize the safety of pedestrians (Pick-up / drop-off activity)  
Evaluation of decreased single occupancy trips (Integration with existing transportation network)  
Considerations for improving active connections and access (proximity to high capacity transit systems)

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### Digital Policy

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Used to implement the City's tiered regulatory framework potential  
Complements Land-use policymaking to govern aircraft noise, propulsion type, time of day, day of week operations  
Served by LADOT's Digital Policy Platform and integrated with flight planning and airspace management systems  
Prioritizes deidentified data  
Useable for updates and compliance monitoring  
Utilized for flexible and adaptable integration with existing transportation network

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# 3 Future Policy Consideration and Implementation Options

## 3.1 PURPOSE

This chapter outlines possible options for implementing vertiports in the City of Los Angeles.

This early cross departmental collaboration helps all departments align on defining the City's long-term goal of a future UAM policy as well as ensuring that permitted operators meet the City's predetermined sustainability, equity, and safety goals.

### EXPLORATION OF A REGULATORY PERMITTING PROCESS

In the course of developing policies and site location opportunities for vertiports, the City can consider creating a regulatory permitting process.

This regulatory permitting process can include requirements such as: standards and regulations for passenger movement, standards and regulations for goods movement, existing heliport conversion requirements, operation frequency and schedule information, federal and state safety compliance, fleet information, operational data exchange, flight route information, permit processing fees, insurance and indemnification.



*/ Uber Elevate Summit 2019: The Beck Group's Dallas Skyport retrofit concept*

## 3.2 PERMITTING CONSIDERATIONS FOR VERTIPOINT DEVELOPERS

### SAFETY

DCP and LADOT are to establish safety guidelines for vertiports to reduce risks to passengers and staff. The City's responsibility to mitigate safety concerns will consider noise nuisance for the surrounding community and will likely extend to the permitting of vertiport developers and UAM operators.

#### Best Practices may include, but are not limited to:

- Working with the FAA and other Federal Regulators to ensure alignment on vehicle and operational safety.
- Air operations area (flight deck) are to be for authorized personnel only (trained vertiport staff) with passengers escorted to/from UAM aircraft on the flight deck.
- Building is constructed to helipad / heliport standards (or new vertiport standards) concerning occupancy separations, fire suppression, fall protection, etc.
- Security checkpoints to screen for weapons, prevent hijacking, or other malfeasance.
- In UAM aircraft and at vertiports, provide cameras, voice communications, and "panic button" for operator notification of unsafe conditions or unruly passengers.
- Sound monitoring for analysis of compliance with agreed noise levels for a specific location or type of vertiport.

### SAFETY AT THE VERTIPOINT

To ensure structural and emergency safety of the vertiport building, the building shall follow the State Heliport (CalTrans Division of Aeronautics) and local building permitting processes (Los Angeles Department of Building and Safety, and Los Angeles Fire Department). It is unlawful to operate a heliport in the State of California without a State Heliport Permit. In the future, a vertiport will most likely fall under a similar or the same category of heliport permitting.

### SAFETY FOR PASSENGER AND STAFF

Safety at vertiports will be required to protect passengers, staff, aircraft, and vertiport property from accidental or malicious harm, crime, terrorism, and other threats. Unlawful interference could be acts of terrorism, sabotage, threat to life and property, or communication of a false threat, bombing, etc. Depending on the operations of the vertiport, these security measures may include, but not limited to:

- Security screening intended to deter and prevent hijackings and the transport of explosive, incendiary, or unauthorized weapons aboard UAM aircraft. Staff background checks may be conducted through DOJ or other if determined necessary or beneficial.
- Cybersecurity is intended to protect the information of UAM operators' business and passengers as well as prevent potential aircraft sabotage. Such an approach should include multi-layered protection, combined with restrictive user policies and constant security monitoring.

### DESIGN CONSIDERATIONS MAY INCLUDE, BUT ARE NOT LIMITED TO:

- Size: Touchdown and Lift Off (TLOF) area shall be sized to accommodate the TLOF requirements of the aircraft.
- Weight Capacity: In a circle in the middle of the TLOF, identify the maximum weight of the UAM, in units of thousands of pounds. This number should align with any Vehicle Classification Systems (VCS).
- Charging or refueling of electric powered UAM aircraft.
- Markings: Define the limits of the Touchdown and Lift-off area with a solid red line.
- Safety Net: If the TLOF is elevated above the adjacent roof surface, it shall be outfitted with fall protection. (Load capabilities based on the State Heliport permitting process)
- Fire Protection: Fire Hose Cabinets shall be provided with specified residual pressure and gallons per minute flow as provided by the fire department.
- Lighting: Shield any ambient lighting to avoid affecting the pilot's vision with unwanted glare.
- Wind Cone: Locate a lighted wind cone assembly that complies with the requirements of FAA Advisory Circular 150/5345-27 (within the line of sight from the vertiport but outside the safety area and below the flight paths)
- Means of Egress: Each vertiport shall have not less than two exits from the TLOF in accordance with the latest California Building Code.
- Separation of Exits: Such egress points shall be separated a minimum of 75 ft. along the perimeter of the TLOF.
- Drainage: Provisions shall be made to drain flammable liquid spillage away from any exit or stairway serving the landing area. (outside certain circumstances to be defined)
- Pavement: Type and strength of pavement material for the TLOF area to handle a long lifecycle and should have a non-slippery surface for people

### 3.3 PERMITTING CONSIDERATIONS FOR UAM OPERATORS

The UAM ecosystem may benefit from a flexible framework that allows the City to manage market entry and aircraft supply through the permitting of companies, vehicles, and pilots, including certain basic requirements such as a minimum number of aircraft in a permitted fleet.

The City, by way of the Department of City Planning, and in conjunction with the LADOT can consider limitations on number of operators and frequency of flights if the market reaches a saturation of congestion.

Similar to LADOT's regulations for Taxi and For-Hire vehicles, any new ordinance governing Part 135 air carriers for UAM may consider specifying that all aircraft in service must be part of a managed fleet and will be required to have a FAA approved hazardous materials (dangerous goods) certificate.

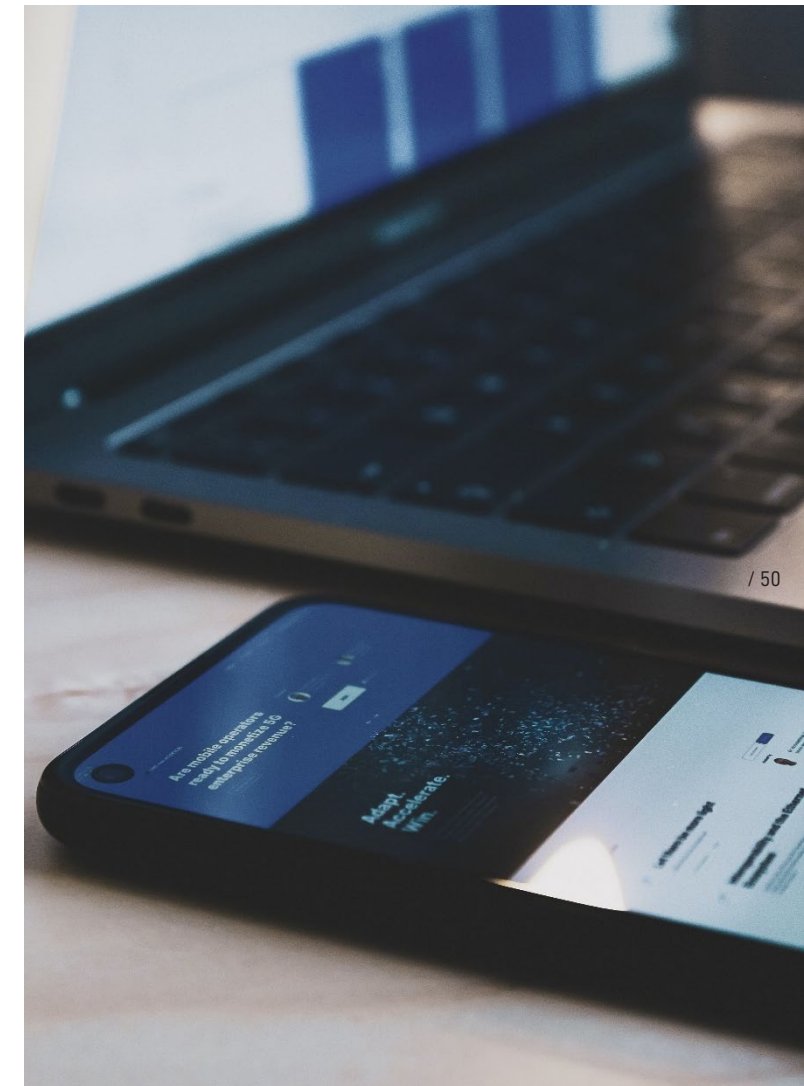
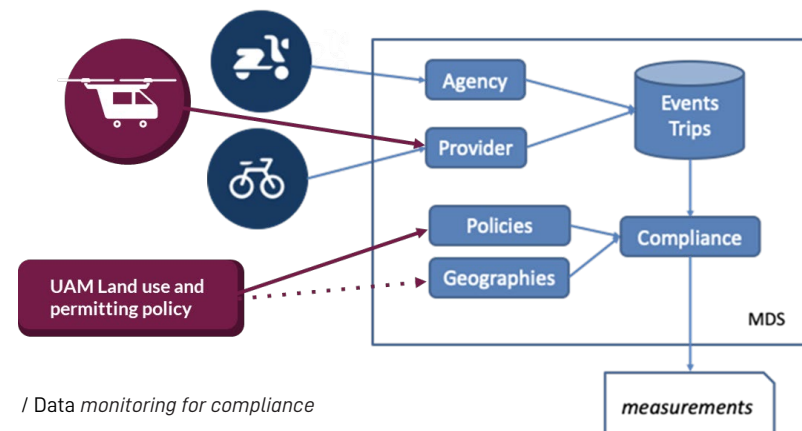
Best practices include requirements for UAM operator companies to perform inspections as well as provide pilots with training on aircraft safety and maintenance/inspection checks.

It is possible that certain type of vertiport permitting such as emergency, air ambulances, search and rescue, or other types of first responders may have differing evaluation than other types of UAM operations.

Additionally, the UAM operator companies must maintain records of all inspections, preventative maintenance, and maintenance repair records for each aircraft, and provide detailed descriptions of aircraft maintenance and inspection in their annual business / management plans that are submitted to LADOT.

The City will maintain its ideals of sustainability, equity, and connectivity as this new mode of transportation becomes introduced to the Los Angeles landscape.

As such, these values will be reflected in policy considerations and the regulatory permitting requirements that the City will set for these new type of urban aircrafts.



**3.3.1  
FLIGHT PATHS**

It is expected that the earliest UAM operations traversing between two vertiports will fly along defined helicopter routes. The FAA has published helicopter route charts for eight metropolitan areas in the United States, including Los Angeles.

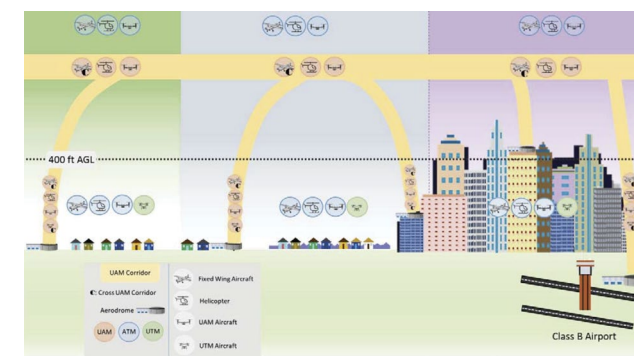
These helicopter routes tend to overlay highways, freeways, arterial roads, and railways on the ground as a visual reference for pilots while in the air. As the system continues to evolve, these helicopter routes for UAM operations will need to also evolve as they become more complex due to advancement and higher demands of future UAM operations.

To ensure continuous, safe UAM flights, it is within the City's interest to assist new UAM operators and service providers by delivering and requiring defined systems operating standards. Such systems operating standards should include, but be not limited to, considerations for:

- Equitable distribution of air traffic between vertiports, especially when operating in areas where communities of concern are present.
- Flight path restrictions and/or mitigation measures that ensure a continuous, efficient, and safe environment for UAM aircraft in intended areas of operations (e.g. avoiding determined incompatible land uses and obstacles affecting navigable airspace).
- Required data and information exchange between UAM operators, PSUs, and city agencies.
- Measurement considerations for noise abatement in areas where higher-tempo and higher density of future UAM operations will occur, especially when operating in areas where communities of concern are present.
- Establishment of a tiered noise violation process where the UAM operator of any aircraft operating contrary to the provisions of a created noise ordinance shall be given a written notice that a violation has occurred. Further violation notices are likely to include fines and eventual UAM operating license termination.



*/ Existing Helicopter Routes in the Los Angeles Metropolitan Area*



*/ FAA's Preliminary Understanding of UAM, UTM, and ATM Operating Environments*

**3.3.2  
AIRCRAFT OPERATING /  
PERFORMANCE STANDARDS**

Airworthiness safety and risk management are critical to the integration of UAM into the U.S. National Airspace System (NAS). The aviation safety process, which is well established, includes the design and operation of UAM per FAA rules and regulations. Safety is based on acceptable risks and appropriate mitigations as they pertain to people and property damage. Aircraft must be operated within the environmental and performance parameters defined by the manufacturer and must be maintained in accordance with established instructions for continued airworthiness.

The requirements for aircraft/airworthiness certifications demonstrate that the aircraft design complies with FAA regulations. This would be an expansion of FAR Part 107 in which the FAA will issue waivers/authorizations to certain requirements of Part 107 if an applicant demonstrates they can fly safely under the waiver without endangering people or property on the ground or in the air.

### 3.3.4 EMISSIONS STANDARDS

Section 233 of the Clean Air Act (CAA) states: No State or political subdivision thereof may adopt or attempt to enforce any standard respecting emissions of any air pollutant from any aircraft or engine thereof unless such standard is identical to a standard applicable to such aircraft under this part.

Therefore, LADOT does not have jurisdiction to directly regulate the emissions of UAM aircraft. However, there are several strategies that LADOT and its partners can use to effectively regulate the level of emissions that the public is exposed to from UAM aircraft. Such strategies include but are not limited to:

- Limiting fleet size according to fuel type: all fossil-fuel, hybrid, and all-electric.
- Regulating the types of vehicles that can land on city-permitted vertiports.
- Limiting the provision of fossil-fuel refueling capabilities at city-permitted vertiports (through fire code or other ordinance limiting the presence of fossil fuel storage on-site).
- Providing incentives for eVTOL charging capabilities at city-permitted vertiports.

The California Clean Miles Standard and Incentive Program is a program stipulating that by 2021 there should be an established baseline for GHG emissions by TNCs.

In 2021 annual reduction targets should be defined, and in 2022 each TNC company needs to develop reduction plans to meet a specified target level of greenhouse gases emissions. This process of setting targets is to be repeated every 2 years. The City can lobby the State Legislature to extend this to UAM aircraft fleets or work with the legislature to determine if the law can be applied to UAM operators in the future.

Outside of that, DCP and LADOT can determine the best strategy to effectively manage emissions exposure from UAM as the market matures.

## 3.4 PERMITTING CONSIDERATIONS FOR UAM SERVICE BOOKING AGENCIES

It is important that UAM service booking agencies follow a set of digital guidelines set forth by DCP and LADOT. This is likely whether they will be integrated with UAM operators, vertiport developers, or are independent.

The section on the following pages describes in detail the data guidelines that UAM service booking agencies most likely will need to abide by.



To satisfy the LADOT Mobility Data Specification (MDS) Requirements, UAM service booking agencies seeking to operate within the Los Angeles jurisdiction must comply with the Open Mobility Foundation MDS.

3.4.1

DATA COLLECTION, DATA REPORTING, AND DATA PRIVACY



GUIDING PRINCIPLES

- **Open-Source:** allows any city or company to run MDS and related products as a service within their city free from any royalties or license fees.
- **Competition:** fosters a competitive market for companies to develop products as a service in cities by creating a single platform where everyone is invited to participate and build.
- **Data and Privacy:** adheres to best practices for privacy standards, commits to data collection transparency, and above all else, protects citizen privacy.
- **Harmony:** encourages consistent regulation so that providers can offer low cost, predictable services across municipal borders.
- **Sustainability:** prepares cities for regulating transportation services that are low-emission, resilient, and ultimately better for the environment.



DATA COLLECTION

Required data collection will be consistent with many other Mobility-as-a-Service (MaaS) programs in the United States, including Uber, Lyft, Bird, Lime, and Ford GoBike. Data requirements will be listed in the permit regulations. Required data may likely include:

- Data in the MDS which includes deidentified information on trips, rides, number of vehicles, as well as other system usage statistics to be used in planning efforts;
- A new data feed specification system, similar to General Bikeshare Feed Specification (GBFS) or General Transit Feed Specification (GTFS), which will allow system availability and status information to be shared with the public and third-party operators; and
- Deidentified reporting on system use, memberships, low-income programs, and other pertinent data.



DATA REPORTING

Data reporting will be required for all Operators as it will assist the City in observing changing trends in the industry and inform decisions made by the affected government agencies and by City Council. To operate UAM aircraft within the Los Angeles jurisdiction, Operators will abide by the following data reporting regulations:

- Operators shall make deidentified real-time data in MDS format available to the City, and/or a City-designated, third party transportation data analysis platform, for purposes of aggregating this data, evaluating vehicle usage, or enforcing the requirements in a permit. The precise origin and destination points will be obscured to a one-block (or equivalent) radius to protect user privacy. Vehicle IDs must be unique vehicle identifiers that are consistent over time. Operator data may be publicly reported in an aggregated form(s).

Any MDS compatible application programming interface (API) must expose data where:

- The trip starts in or out of the City of Los Angeles,
- The trip ends in the City of Los Angeles or not,
- GPS telemetry data shows the trip passing through the City of Los Angeles.

• Operators shall make deidentified real-time data available via a public API endpoint in the data standard similar to General Bikeshare Feed Specification (GBFS) or General Transit Feed Specification (GTFS), with reasonable modifications to this specification to account for the unique nature of Operator's UAM aircraft. A smartphone-based application used to hail a UAM aircraft does not qualify as a publicly accessible application program interface. Public UAM feeds may omit aircraft IDs to protect user privacy.

• The public API need not be available without authentication; however, any member of the public, including commercial entities, can gain access to the data provided by the API by requesting access through a web interface. Moreover, the provider should provide access on an average of at least 50 requests an hour.

More information about MDS can be found online at <https://github.com/openmobilityfoundation/mobility-data-specification>

LADOT reserves the right to share data collected with third parties to process and analyze data and to use it for program planning and operations purposes.

 DATA REPORTING

•Operators must provide reports on key performance indicators, including, but not limited to, the following:

- Utilization rates;
- Total downloads, active users, and repeat user information;
- Total trips by day of week and time of day;
- Origins and destinations;
- Trips per UAM aircraft by day of the week, time of day;
- Average trip distance;
- UAM aircraft maintenance reports (including but not limited to UAM aircraft identification number and maintenance performed);
- Incidents of theft and vandalism;
- Number of complaints;
- Number of crashes or collisions, including the date and time of the incident, UAM aircraft ID, location of the incident (geo coordinates), traveling path of the aircraft, the severity of the incident (fatality, injury, or property damage only), and if Police report was filed;
- Payment method information;
- Rebalancing to designated service areas;
- Number of customers participating in the low-income discount program; and
- Number of discounted rides taken.

•Operators must provide reports on a quarterly basis.

•Operators must agree to distribute an opt-in user survey, developed by LADOT or a designated third party, to all Users annually and to provide input on survey questions.

•The Operator agrees not to engage in anti-competitive behavior with other UAM aircraft Operators, including falsifying data.

•Operators shall provide real-time access to data showing the location of all their UAM aircraft.

 DATA PRIVACY

Data collection poses risks to personal privacy and threats to innovation and competition. Therefore, data should be collected in a quantity and at a level of detail that is reasonably necessary to implement and ensure compliance with new regulations or to deliver legitimate public policy outcomes. Personal privacy rights of passengers and pilots and should be protected and not result in the disclosure of confidential business information.

The rules and regulations should require trip data to be deidentified and specify that it will be used only for the stewardship of the public right of way including areas involving public safety, congestion management, and transportation planning, including curbside management, traffic management, multimodal service planning, and the allocation of public funding for those purposes.

Operators will be responsible for protecting any personally identifiable information from unauthorized use by implementing the following standards:

- The Operator must employ an electronic payment system that is compliant with the Payment Card Industry Data Security Standards (PCI DSS), and provide proof of compliance.
- The Operator must provide a Privacy Policy that safeguards Customers' personal, financial, travel information, and usage
- The Operator should clearly communicate to the public and the City what personal information is being collected about Users, how it is being used, and for how long.
- The Operator should produce a Privacy Policy that complies with the California Online Privacy Protection Act (CalOPPA) and any data protection laws applicable to minors, and further, expressly limits the collection, storage, or usage of any personally identifiable information to the extent required to accomplish the provision of the Urban Air Mobility system.

### 3.5 COORDINATION / CONSIDERATIONS FOR CARGO UAS

Like UAM, Unpiloted aircraft system (UAS) cargo delivery is a subset of the NASA's and FAA's Advanced Air Mobility (AAM), an industry initiative to develop an air transportation system that moves people and cargo between local, regional, intraregional, and urban places previously not served or underserved by aviation using revolutionary new aircraft. The commercial applications and opportunities for UAS operations, particularly at low altitudes, across a myriad of sectors from inspection, to survey, to monitoring, to package delivery, present enormously enticing incentives and business cases. While all of these applications for UAS operations are useful for Los Angeles, the largest interest to the City would likely be cargo UAS delivery.

Cargo delivery drones may be much smaller than person-carrying UAM aircraft, therefore they may have different landing sites, different designated airspace, and different air traffic management rules, as developed in parallel with UAM, in a system designated by NASA and FAA as UAS Traffic Management or "UTM", with UTM operations managed by UAS Service Suppliers (USS).

UTM has been under development for several years, with an FAA ConOps V2.0 that is a few years ahead of the recently issued UAM ConOps.



/ Data monitoring for drone operations, 2019



# Future Considerations

## SOCIALIZATION AND COMMUNITY ENGAGEMENT

The Mayor's Office recently announced a new partnership to introduce Urban Air Mobility, becoming one of the first US cities to provide government support to this emerging industry. The Urban Air Mobility Partnership is a public-private collaboration between the Mayor's office, the Los Angeles Department of Transportation, and Urban Movement Labs, a public entity created to test new mobility ideas. Private sector participants include Designworks, Arup, Ellis and Associates, and is financially sponsored by the UAM Division of Hyundai Motor Group. This one year project will map out challenges to UAM in the city, implement solutions to challenges, visualize a vertiport, hire a UAM fellow to advance public engagement around UAM, and create a policy toolkit for UAM that may be adopted by local governments across the United States.

## INTERAGENCY POLICY DEVELOPMENT COORDINATION

The City should identify key stakeholders to be involved from each city agency and a committee lead to take on development of a UAM policy. Policy should articulate the City's desired role relative to Federal agencies and regional partner governments. In addition to operational stakeholders and interagency coordination, community engagement should be the primary focal point.

An advisory committee should be created to involve local communities for meaningful policy development, including equity policies related to cost of service, geographic distribution of vertiports, geographic distribution of UAS drops, frequency and density of service to underserved areas, etc.

## EQUITY

Equity and inclusion shall remain key priorities for UAM long term success in Los Angeles. UAM Policy considerations, supported by a dynamic Digital Policy, can be used to ensure equitable access to take off and landing sites and to increase community benefits overall from UAM in Los Angeles.

## FUTURE UAM SERVICE PLANNING

City agencies should consider a land use and permitting policy for vertiports that includes an approach to California Environmental Quality Act Guidelines (CEQA) compliance. This may entail a decision on site-by-site or system-wide CEQA clearance. The City, State, and Federal agencies shall continue collaborative dialogue around defining governance over vertiport deployment.

## JOB CREATION

The City can begin evaluating the type and number of jobs Operators will require to support UAM services. Investigation into these jobs can inform the type of training necessary for new employment opportunities created through UAM.

## DIGITAL POLICY

Deidentified data collected through the MDS can be used to continually improve UAM operations and to support a flexible approach to an evolving technological landscape. Voluntary options to use personal data may help evaluate new or enhanced services or assist the City improve rider experience.

## INTERMODAL CONNECTIVITY

The City can begin to include UAM services as consideration in new or on-going research and development projects. Consideration of UAM services in projects today can help define the criteria that will be necessary for successful integration of UAM into Los Angeles' transportation network.

## SUSTAINABILITY

The City can incentivize UAM operators and reward riders for choosing UAM vehicles that help decarbonize the City's transportation network. The infrastructure needed to support UAM would ideally be the same as other forms of shared mobility to ease adoption of zero emission modes of travel and reduce single occupancy trips.

# TECHNICAL APPENDIX

## MAIN ACTORS OF THE UAM ECOSYSTEM

While the City has a large role in how the UAM ecosystem will be implemented within the Los Angeles jurisdiction, it is also important to recognize the other governing agencies (federal / state / local), public interest stakeholders, and other airspace users that will also influence the overall ecosystem for UAM. These actors and others that emerge will need to collaborate and integrate with the City's and LADOT's UAM goals and objectives to achieve a cohesive, functioning UAM ecosystem.

### Federal Aviation Administration (FAA)

The FAA performs regulatory and policymaking, Air Traffic Control (ATC), Air Traffic Management (ATM), and National Airspace System (NAS) data exchange roles for UAM. The FAA published its Concept of Operations (ConOps UAM) on June 26, 2020. The FAA's NextGen Office also published its UTM CONOPS version 2.0, which addresses increasingly complex operations within both controlled and uncontrolled air environments. Much of the framework and terminology on UAM operations are described below, and referenced elsewhere in this report, is based on the guidance outlined in the FAA UAM ConOps v1.0 document.

### FAA – Regulatory and Policymaking

The FAA is the federal authority over aircraft operations in all US airspace, and the regulatory and oversight authority for civilian operations in the NAS. The FAA maintains an operating environment that ensures airspace users have access to the resources

needed to meet specific operational objectives and that shared use of the airspace can be achieved safely and equitably. The FAA develops or modifies regulations to support UAM operations. The FAA may also provide guidelines for Community-Based Rules (CBRs) and will approve CBRs to ensure that the FAA authority is maintained (e.g., NAS safety, equal access to airspace, and security). The FAA will define, maintain, and make publicly available UAM Corridor definitions and will manage the performance requirements of UAM Corridors.

### FAA – Air Traffic Control (ATC)

As the Air Navigation Service Provider (ANSP) for the United States, the primary purpose of FAA ATC is to maintain separations and prevent collisions between aircraft operating within the NAS; however, for UAM operations, tactical separations within designated "UAM Corridors" is allocated to the UAM community with no tactical ATC services provided by the FAA. ATC may provide advisories regarding UAM operations to other aircraft on a workload-permitting basis. As such, ATC must have on-demand access to UAM operational data to ensure safety for aircraft receiving ATC services. ATC may request information as needed from participating actors and may receive automated notifications in accordance with applicable requirements.

The ATC responsibilities that enable UAM operations are:

1. Set UAM Corridor availability (e.g., open or closed) based on the operational design (e.g., time of day, air traffic flow direction of a nearby airport).

2. Provide advisories about UAM operations to other aircraft on a workload-permitting basis.
3. Respond to UAM off-nominal operations as needed as part of fulfilling its responsibilities, ATC may review any pertinent information from UAM operations.

### FAA – NAS Data Exchange

FAA NAS data sources are available to UAM operations via FAA-industry exchange protocols. This allows for authorized data flow between the UAM community and FAA operational systems. This interface between the FAA and UAM stakeholders is a gateway such that external entities do not have direct access to FAA systems and data. FAA data sources available via the FAA-industry data exchange include, but are not limited to, flight data, restrictions, charted routes, active Special Activity Airspaces (SAAs).

### Urban Air Mobility Operator

UAM operators may conduct operations as scheduled service or on-demand service via a request from an individual customer or an intermodal operator. UAM operators are responsible for regulatory compliance and all aspects of UAM operation execution.

The use of the term 'Operator' in this document indicates airspace users electing to conduct operations via cooperative management within the UAM environment.

The UAM operator obtains current conditions from a Provider of Services for UAM (PSU) and Supplemental Data Service Provider (SDSP) services (e.g., environment, situational awareness, strategic operational demand, UAM vertiport availability, supplemental data) to determine the desired UAM Operational Intent information such as location of flight (e.g. vertiport locations), route (e.g. specific UAM Corridors), and desired flight time.

UAM operators must provide flight intent and operational data to a PSU to operate within, or cross, UAM Corridors. UAM Operational Intent data serves the following primary functions:

1. Informs other Operators of nearby operations within the UAM Corridor to promote safety and shared awareness.
2. Enables strategic deconfliction.
3. Enables the identification and distribution of known air space constraints and restrictions for the intended area of operation.
4. Enables distribution of spatially and temporally relevant advisories, weather, and supplemental data.
5. Supports cooperative separation management services (e.g. conformance monitoring, advisory services).

The UAM operator also plans for off-nominal events. This includes an understanding of alternative landing sites and the airspace classes that border the UAM Corridor(s) for the specified operation.

Upon completion of the operation, the UAM operator notifies the PSU.

# TECHNICAL APPENDIX

## Provider of Services for UAM (PSU)

A PSU is an entity that supports UAM operators with meeting UAM operational requirements that enable safe, efficient, and secure use of the airspace. A PSU:

1. Provides a communication bridge between federated UAM actors – PSU to PSU via the PSU Network – to support the UAM operator’s ability to meet the regulatory and operational requirements for UAM operations.

2. Provides the UAM operator with information gathered from the PSU Network (e.g. about planned UAM operations in a UAM Corridor) so that UAM operators can ascertain the ability to conduct safe and efficient missions.

3. Analyzes and confirms that a UAM operator’s Operational Intent is complete, consistent with current advisories and restrictions, and considers the planned flights of other UAM operators, the capacity of the UAM Corridor, all airspace restrictions, UAM vertiport availability and its landing surface quality (CBR), as well as any adverse environmental conditions.

4. Provides the confirmed flight intent to the PSU network.

5. Distributes notifications (e.g. constraints, restrictions) for the intended area of operation.

6. Distributes FAA operational data and advisories, weather, and supplemental data.

7. Supports cooperative separation management services (e.g., conformance monitoring, advisory services).

8. Determines UAM Corridor use status.

- a. UAM Corridor use status (e.g. active, inactive) is an indication that one or more UAM operations are occurring in the UAM Corridor.

9. Archives operational data in historical databases for analytics, regulatory, and UAM operator accountability purposes.

These key functions allow a PSU to provide safe and cooperative UAM operations without direct FAA involvement on a per-flight basis. The data exchanged between the FAA and PSUs would occur when the FAA has created constraints for a specific airspace, when there are requests for information (RFI) from the PSU or when FAA information is sent to the PSU, and when the PSU sends responses to RFIs to the FAA. Integration with LADOT’s successful Mobility Data Specification (MDS) could be used for efficient interaction with the PSUs and could be used for accurate and timely collection of deidentified data for LADOT’s purposes (e.g. permit, operate, monitor, or enforce, as well as informing the City for continuous policy updates based on performance and compliance learnings).

PSU services support operations planning, flight intent sharing, strategic and tactical deconfliction, airspace management, and support to abnormal or problematic operations. PSUs may provide value-added services to subscribers that can optimize operations or provide access to supplemental data that further support safe UAM operations. PSUs exchange of information with other PSUs via the PSU Network enable safe and reliable UAM services (e.g. exchange of flight intent information, notification of UAM Corridor status, information queries).

PSUs also support local municipalities and communities, as needed, to gather, incorporate, and maintain airspace reservations that may be accessed by UAM operators.

## Supplemental Data Service Providers

UAM operators and PSUs use Supplemental Data Service Providers (SDSPs) to access supporting data including, but not limited to, terrain, obstacle, vertiport availability, and specialized weather. SDSPs may be accessed via the PSU network or directly by UAM operators.

## Unpiloted Aerial System Service Supplier (USS)

USSs are entities that support Unpiloted Aerial System (UAS) operations under the UAS Traffic Management (UTM) system, generally operating below 400 feet above ground level (AGL).

Examples of UAS Service Suppliers are delivery drone companies and recreational drone users. From a UAM operational perspective, USSs will interact with PSUs as follows:

1. Enable UTM operations to use PSU network services to cross a UAM Corridor.
2. Support UAM off-nominal operations as needed.
3. Support UTM off-nominal operations as needed.

## Other National Airspace System (NAS) Airspace Users

Other NAS Airspace Users are any non-UAM aircraft operation within the NAS.

Other NAS Airspace Users have the responsibility to know about and meet the relevant performance and participation requirements to operate in, or cross, active UAM Corridors; or avoid the active UAM Corridors. UAM Corridor definitions and availability will be publicly available. Examples of Other National Airspace System (NAS) Airspace Users include commercial jets, general aviation aircraft, law enforcement and emergency services helicopters, and military aircraft.

## Public Interest Stakeholders

Public interest stakeholders are entities declared by governing processes (e.g., FAA, CBR) to be able to access UAM operational information. This access may support activities including, but not limited to, public right-to-know, government regulatory, government assured safety and security, and public safety.

Examples of public interest stakeholders are local law enforcement, emergency services, U.S. federal agencies, community interest groups, and other local advocacy groups.

## City Policy Makers

UAM’s unique relationship to the built and natural environment requires clear policy to guide UAM and UAS implementation within the existing transportation network and across multiple communities.

Policy makers will need to be deeply integrated to answer the how, why, who, and what questions UAM creates. This is especially true if those decisions involve tradeoffs for other public goods.

## TECHNICAL APPENDIX

### VERTIPOINT INFLUENCE AREA (VIA)

Reference guidelines for heliports and Heliport Influence Areas (HIA) provided by the California Airport Land Use Planning Handbook and the FAA Advisory Circular 150/5390-2C.

Three key factors should be considered:

#### 1. VERTIPOINT SAFETY AREA AND PROTECTION ZONES

Due to its limited size, the FAA safety zone is likely to be located fully within vertiport property.

Within the protection zones, no land uses should be permitted that allow for a public assembly of people, and no residential land uses should be permitted. (See FAA Advisory Circular 150/5390-2C, Section 211). Flight paths into and out of vertiport are hazard zone, therefore no public gatherings should occur.

As more data becomes available for typical UAM operations, partners should work with the FAA to re-evaluate the risk level that is actually present within these zones and determine if additional land uses and densities may be permitted within them. Specifically, safety zones should not overlap.

#### 2. NOISE CONTOURS FOR TYPICAL AIRCRAFT ON FINAL APPROACH AND TAKE OFF

Noise contour mapping for UAM operations needs to be established on a site by site basis. The development of such contours should consider the height (elevation) of the Touchdown and Lift Off (TLOF) surface, approach/departure flight paths, expected aircraft types and frequencies, and hours of operation. UAM aircraft noise profiles and operations are still in development. Thus, today's methods for aircraft noise contour calculations and predictions are likely to be modified to better represent UAM technologies as well as sensitivities of the environments they serve.

New metrics and parameters should be developed to align with the UAM aircraft technologies and UAM operations. As a starting point and for historical comparison to past studies, an approach to noise contour mapping process for vertiports could use the guidance provided in the Los Angeles County Airport Land Use Plan (2004) summarized below:

Calculate the Community Noise Equivalent Level (CNEL) is an average made up of numerous single noise events. CNEL readings are used to establish noise impact contours around airports. The contours take into account such things as aircraft fleet mix, number of flights, and time of day. Noise readings taken in a 24-hour period are weighted depending on when during the day the noise occurs. Evening and nighttime events are given greater weight than those occurring during the day. (Noise occurrences between 7:00pm and 10:00pm are given a weight of 5 additional decibels while those occurrences between 10:00pm and 7:00am are given an additional 10 decibels.)

Noise contours should be calculated by following the guidance in the California Airport Land Use Planning Handbook, Appendix D: Measuring Aircraft Noise. If the FAA's Integrated Noise Model (or its replacement, Aviation Environmental Design Tool) method is used, user-provided data on noise from the types of aircraft that will operate at a vertiport, potentially obtained directly from aircraft manufacturers, will be critical for determining the extent of the noise contours.

#### 3. AIRSPACE CLEARANCE SURFACES

The FAA defines airspace clearance surfaces for airports and heliports in FAR Part 77 and AC 150-5390-2C. While national airspace is regulated by the FAA, it is the local government's responsibility to ensure that the airspace surrounding airports (including heliports and future vertiports) and the designated air routes into and out of an airport are maintained.

**Touchdown and Lift Off Area (TLOF)** – The paved surface where an aerial vehicle can land.

**Final Approach and Take-Off Area (FATO)** – The area over which the pilot completes the final phase of the approach to a hover or a landing and from which the pilot initiates takeoff.

**FAA Safety Area** – The heliport safety area is a defined perimeter area immediately extending beyond the FATO area around a landing surface. AC 150/5390-2C defines the width of a safety area relative to the maximum size of the design aircraft.

**Heliport Protection Zone** – The HPZ has the highest level of exposure to potential helicopter accidents and should be clear of all structures and activities. For heliports it is a trapezoidal area that extends 280 feet from the edge of the FATO along the defined approach/departure paths. Heliports are required to have a minimum of two (2) approach/departure paths, separated by at least 135°, so that they can accommodate operations in a variety of wind directions.

**Approach Safety Zone** – The Approach Safety Zone (ASZ) has the second highest level of exposure to potential helicopter accidents. The Approach Safety zone(s) (APZ) are 1000 feet long extending from the outer edge of the HPZ, with the same dimensions as the surface projection of the Approach Surface.

**Approach Surface:** For heliports, this extends 4,000 feet along the approach/departure paths from the FATO, at an 8:1 slope. No structures should penetrate this surface.

**FAA Notification Surface:** For heliports, this extends 5,000 feet 360° around the FATO, at a 25:1 slope. Structures may penetrate this surface upon notification to the FAA, and FAA review.

**Heliport Influence Area (HIA)** – The geographic area around a heliport that is subject to a Land Use Compatibility Plan. The HIA is based on the location and configuration of the vertiport and the extent of noise and safety impacts associated with the vertiport. It generally includes the HPZ, SSZ and noise contours.

**Sideline Safety Zone** – The Sideline Safety Zone (SSZ) is an area extending 250 feet from the FATO edge. Helicopters do not normally fly over this area, except by the helicopter losing directional control on take-off. Excludes the area of the HPZ and the ASZ.

## TECHNICAL APPENDIX

### POSSIBLE COMPATIBLE LAND USES

Once the extent of a potential Vertiport Influence Area (VIA) is established, any existing land uses must be evaluated for compatibility. There are two key areas of the VIA that require different evaluation metrics: the Vertiport Protection Zone (VPZ) and the noise contour area. Guidance on how to evaluate land uses within each of these areas is detailed below based on current codes and regulations. However, new processes should be developed to align with the characteristics of UAM aircraft technologies and UAM operations.

#### VERTIPORT PROTECTION ZONE

According to the FAA AC 150/5390-2C, “The FAA discourages residences and places of public assembly in a Heliport Protection Zone.” This would include such places as churches, schools, hospitals, office buildings, shopping centers, and other uses with similar concentrations of people. Additionally, hazardous materials such as fuel (including gas stations) should not be located in the HPZ. DCP and LADOT and other City Departments and agencies can consider similar guidelines when determining compatible land uses within a VPZ and while developing Land Use land use policies and plans.

#### NOISE CONTOUR AREA

As a starting point, land uses that fall within the Vertiport’s noise contour area should be evaluated based on the table provided in the Los Angeles County Airport Land Use Plan (2004):

Historically, the metric for assessing aircraft noise is the A-weighted DNL, or day night level. This quantifies the noise exposure from multiple flights over a 24-hour period with a greater penalty at night. Typically this is averaged over a year’s time for land surrounding airports. The FAA has designated a 65 DNL level as a maximum acceptable level. This number is simple on paper but has propagated complex issues since its introduction in the 1970s.

Using the CNEL, future studies/metrics, and community engagement measures (e.g. immersive simulations in Arup SoundLab®), DCP and LADOT can consider which value (conventionally 65 dBA or 55 dBA) is the maximum level acceptable for each land use.

Studies using existing aircraft noise (not UAM aircraft) show that the percentage of highly annoyed individuals drops considerably with a maximum value in the range of 50-55 dBA CNEL, versus 65dBA CNEL.

If there is a 1.5 dBA DNL (or 1.5 dBA CNEL) increase predicted in noise sensitive areas as a result of a change, it should prompt further examination per FAA Order 5050.4B, National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions.

Once the safety zones and vertiport influence area has been established, the appropriate densities, height restrictions and uses can be determined by consulting the guidelines provided in the Los Angeles County Airport Land Use Plan (2004).

# TECHNICAL APPENDIX

## ESTABLISH LEVEL OF VERTIPOINT UTILIZATION AND TIME OF DAY RESTRICTIONS

### LEVEL OF INTENSITY / USAGE

A number of factors can contribute to the functional capacity of a vertiport, including the capacity of the adjacent UAM air corridor, the number of landing pads and aircraft parking spaces available, the passenger processing capacity of the facility (including ground-level passenger pick-up/drop-off, vertical circulation to reach the landing pad, and passenger screening at the landing pad), and other local ground transportation. These factors may limit the total possible number of operations at a vertiport.

Acceptable noise levels and a safety risk factor for the communities surrounding vertiports should be developed. Key considerations could include acceptable noise levels for nearby land uses, acceptable safety factors for nearby densities of people, and ground transportation capacity to handle the flow of passengers. Additionally, time of day restrictions may also be linked to both acceptable noise levels and safety risk factors.

### NUMBER OF DAILY OPERATIONS

The number of aircraft takeoffs and landings is anticipated to be low in the initial UAM market, and then increase as the market evolves. The FAA has recently released guidance on an initial concept of operations for UAM (Urban Air Mobility Concept of Operations v1.0, issued June 26, 2020), which LADOT will consider during its impact assessment stages. In this document, the FAA envisions three initial phases of operations:

- Initial UAM Operations
- Developing ( ConOps 1.0) Operations
- Mature State Operations

While this is what the FAA predicts will happen, caps (maximums) on the number of daily or hourly operations (based on noise levels, time of day, and safety factors) that may be more restrictive than the expected capacity of future technology and systems may be created.

For further descriptions and more information, see Urban Air Mobility Concept of Operations v1.0, issued June 26, 2020.

### PHASE POLICY DEVELOPMENT

It is envisioned that the policy development will evolve as the industry continues to advance and evolve. As such operations will need to also evolve with this policy development.

It is likely that initial policy development will reflect FAA minimum performance and safety requirements. This will evolve into a fully codified, regulatory structure with adopted policies, goals, performance standards and permitting requirements that regulate time, place and manner of operation and development for varying types of uses such as emergency services, passenger movement and goods movement.

### TRIP TYPE OR PURPOSE

Emergency trips, such as air ambulances, could be given priority or be exempt from the maximum daily operations and/or time of day restrictions.

Cargo trips, which may have significant impact on ground transportation and traffic operations, may be redirected to only operate at certain times or at certain vertiports with compatible surrounding land uses.

Vehicle and trip types will vary by number of passengers or payload and desired destinations. Having vehicles specified by a Vehicle Classification System (VCS) would provide more tools to regulate vertiport locations and the specific vehicles which are permitted for take off and landing.

# TECHNICAL APPENDIX

## AIRCRAFT NOISE

UAM and eVTOL aircraft configurations and development have conventionally grown around the following three architectures:

- Multi-Rotor - Use of multiple fixed rotors to generate flight.
- Tiltrotor - Multiple propellers that rotate about a fixed axis during different modes of flight.
- Lift-and-Cruise - Vehicles with separate sets of propellers fixed for horizontal and vertical flight.

Every configuration has the same basic noise components:

- Powertrain Noise – typically noise from internal or continuous combustion engine. eVTOLs have electric motors that do not generate traditional engine noise.
- Thickness Noise – created by the shape of a blade passing through the air while moving forward. eVTOLs generally have lower tip speeds and generate less noise.
- Loading Noise – any loading forces on the blades. Multi-directional rotors/different rotor uses in different stages of flight avoid the traditional quantity of loading noise; any substantial broadband noise is typically absorbed by the atmosphere.
- Volume Noise – noise from fluid shear from jet engines or when a shock is generated at forward-advancing blade tips. eVTOLs with propellers may not generate significant volume noise.

While these components are shared by most aerial vehicles, eVTOLs have specific qualities that generally abate noise.

## SINGLE / MULTI-EVENT NOISE CRITERIA

Criteria could consist of a body of targets that meet the criteria and more. Not all metrics apply to all purposes however. Many metrics depend on audibility and the temporal variation of sound; missing is any variation in loudness, tonality, response to time-varying factors, or the dosage of sound per event. For instance, it is shown that DNL does not correlate directly to percent highly annoyed, one metric used in community acceptance.

The novelty of UAM noise in the soundscape that the public currently experiences is expected to lead to a lower community annoyance threshold. Many metrics averaged over long periods assume that among aircraft, their sound energy signatures are similar. This will not be the case for future UAM and UAS vehicles, especially those having evolved or completely new forms of propulsion which promise to significantly lower noise levels during take off and landing.

Some studies have shown, unsurprisingly, that respondents prefer that the UAM aircraft have no noticeable noise. It will be important to understand actual noise level impact through monitoring during the early stages of implementation

Currently, psychoacoustic researchers are working to determine the annoyance, acceptance, and perceptibility of UAM aircraft.

There are many existing aircraft/transportation noise metrics, and encompass the entire flight process over varying time periods:

- Lmax – The maximum sound level of a noise “event,” although this number does not account for the duration of the event
- SEL – Sound exposure level that is the sound energy of an event within a one second period
- Leq – Equivalent sound level over a period of time whose energy would be equal to the SEL in one second of time; takes advantage of multiple sound events
- DNL – Day Night average sound level that aggregates exposure over a 24-hour period; expressed as the noise level for the average day of the year on the basis of annual aircraft operations
- SENEL – A metric used by regulatory agencies to determine airworthiness and type certifications for aircraft
- CNEL - Community Noise Equivalent Level is the average sound level that aggregates exposure over a 24-hour period. While similar to DNL, CNEL implements a penalty for both evening and nighttime exposure.

Recent studies show that there has been a substantial change in the public perception of aviation noise – there is a higher level of annoyance across all noise levels than there was in past studies (e.g. FAA Neighborhood Environmental Survey).

Currently, psychoacoustic researchers are working to determine the annoyance, acceptance, and perceptibility of UAM aircraft and understand if existing aircraft/transportation noise metrics are appropriate or new noise metrics are required to better characterize human response.

# TECHNICAL APPENDIX

## CONSIDERATIONS FOR PERMITTING

State Heliport Permit requirements are stated in the California Public Utilities Code (PUC), Section 21001 et seq., otherwise known as the State Aeronautics Act, and the California Code of Regulations (CCR), Title 21, Sections 3525-3560, Airports and Heliports. Note that unless specified in the law otherwise, an airport is equal in definition to a vertiport. PUC 21013 says that aircraft use airports; UAM aircraft will meet the PUC 21012 definition of aircraft, so vertiports can be seen as airports for UAM aircraft. CCR 3525 specifically states the term "airport" shall apply equally to vertiports unless specified as "airports only" or "vertiports only".

**•Permitting Considerations**— A set of separate requirements / criteria that vertiport developers, UAM operators, and UAM service booking agencies would need to abide may also be unique to their applications. Performance standards and regulations will be outlined for varying uses such as passenger movement or goods movement, as well conversion requirements from existing heliport infrastructure.

**•Indemnification Clause**— Provide an indemnification provision to shift potential costs from one party to the other.

**•Insurance**— Require insurance for the duration of the agreement to protect against claims for injuries to persons or damages to property that may arise from or in connection with the performance of the work hereunder by the operator, its agents, representatives, employees, or subcontractors.

**•Permit Fees**— Fees for the application of the permit and each aircraft that will be in operation.

**•Fleet Information**— Form that includes the proposed fleet size of the operator. Specifications should include the vehicle type and quantity of each aircraft.

**•Service Model and Vehicle Summary**— A summary of their service model and qualifications, including FAA aircraft certifications, images of the vehicles, and their mobile application's API affordance. Maintenance and service records for the aircraft vehicles may be required. Aircraft vehicles may be required to be equipped with noise measurement monitors that record noise levels at all times aircrafts are operational to ensure noise requirements are maintained and enforced.

**•Implementation Plan**— Operators shall provide a plan for service implementation including timeline(s) and service area map(s). These implementation maps should include the distribution of the fleet by geographic areas.

**•Data and Privacy** - UAM operators and UAM service booking agencies seeking operational permits likely must comply with the Open Mobility Foundation MDS, which shall be updated and published by LADOT.

**•Duration**— Vertiport and Operational permits Will have a prescribed period of time regardless of being an initial or renewal permit (possibly annual or whatever the final determined duration).

To ensure the safety of both the users and the communities impacted, administrative regulations, penalties for noncompliance, insurance requirements, and a permitted operator fee structure to monitor operator behavior and finance program expenses may need to be created.

Possible need to create administrative regulations to ensure safe and responsible use of the aircraft and compliance with local, state, and federal laws.

The permitting system could also require monitoring of operators for compliance with safety regulations and establish penalties for noncompliance. The permit will set penalties levels based on the severity and number of violations. Operators that do not comply with requirements established by the permit policies will be at risk of having their permit suspended or revoked, fleet size reduced, receiving administrative fines, or having aircraft removed.

Potential fees may include an annual operating fee, deposit fee, and a per aircraft fee. These fees would cover program monitoring software to administer the permit program, permit application review and issuance, ongoing program monitoring for compliance with permit requirements, reporting on program implementation, and development of recommendations for improvement of the system.



# Acknowledgments

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## Support provided by:

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Conni Pallini, Los Angeles Department of City Planning  
Ken Bernstein, Los Angeles Department of City Planning  
Julia Thayne DeMordaunt, Office of Los Angeles Mayor Eric Garcetti  
Karina Macias, Office of Los Angeles Mayor Eric Garcetti  
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# LOS ANGELES DEPARTMENT OF TRANSPORTATION

URBAN AIR MOBILITY

Policy Framework Considerations

September 13, 2021

20

21

