

Urban Air Mobility - Trends & Challenges

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Head of Visionary Aircraft Concepts

>> *Founded in November 2005 by*

- > The Bavarian Ministry of Economic Affairs, Infrastructure, Transport and Technology
- > Airbus
- > IABG
- > Liebherr Aerospace
- > MTU Aero Engines



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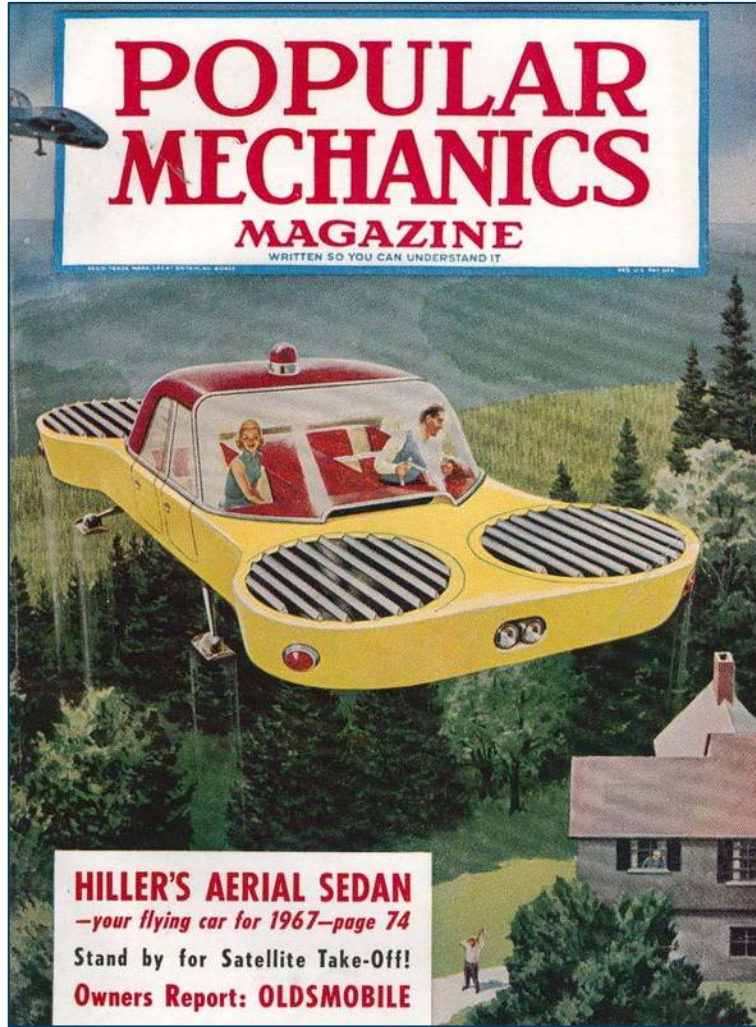
>> *A non-profit research institution with long-term time horizon*

- > Strengthening the cooperation between industry, science and politics
- > Developing new approaches for the future of aviation with a high level of technical creativity
- > Optimizing through a holistic approach in science, economics, engineering and design
- > Added value due to interdisciplinary teams
 - Aeronautical engineering
 - Economy & ecology
 - Geography
 - Informatics & knowledge management
 - Materials science
 - Physics & chemistry
 - Social sciences

>> *Going “New Ways“ for the mobility of tomorrow*

The Idea of Aviation in Urban Mobility is not new.....

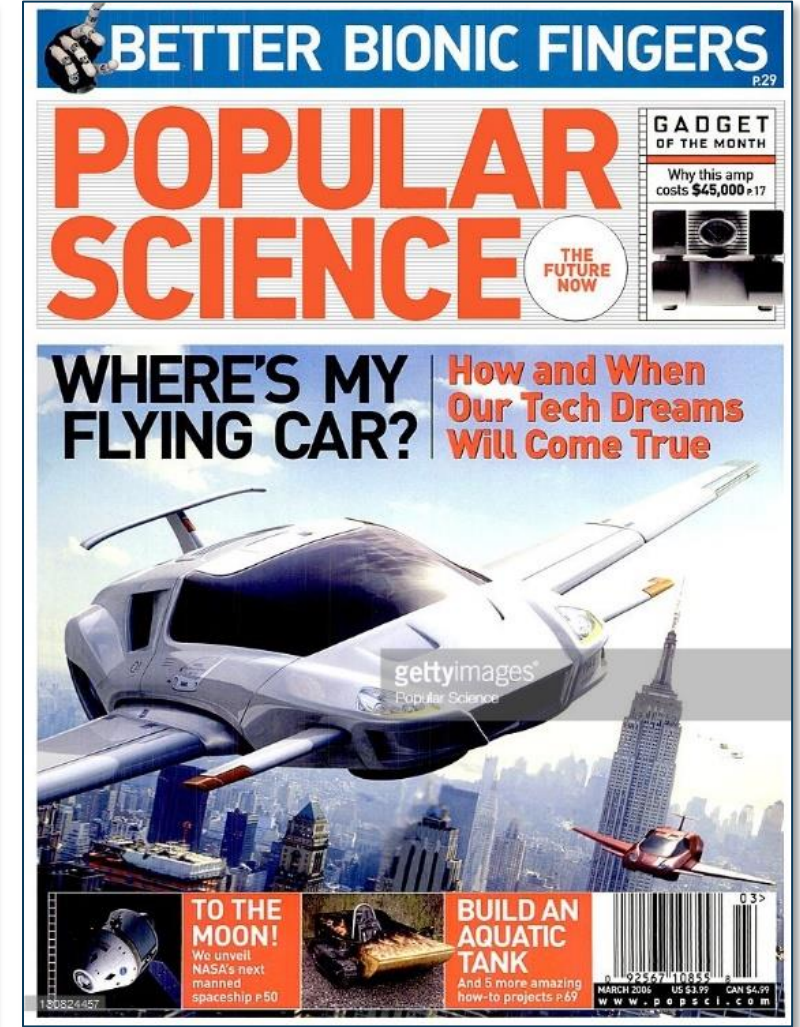
1967



1991



2006



...and existed and still exists....



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We'll fly you from JFK to midtown Manhattan in just ten minutes. Or to the World Trade Center in the Wall Street area in just eight minutes. Or to Newark Airport in seventeen minutes.

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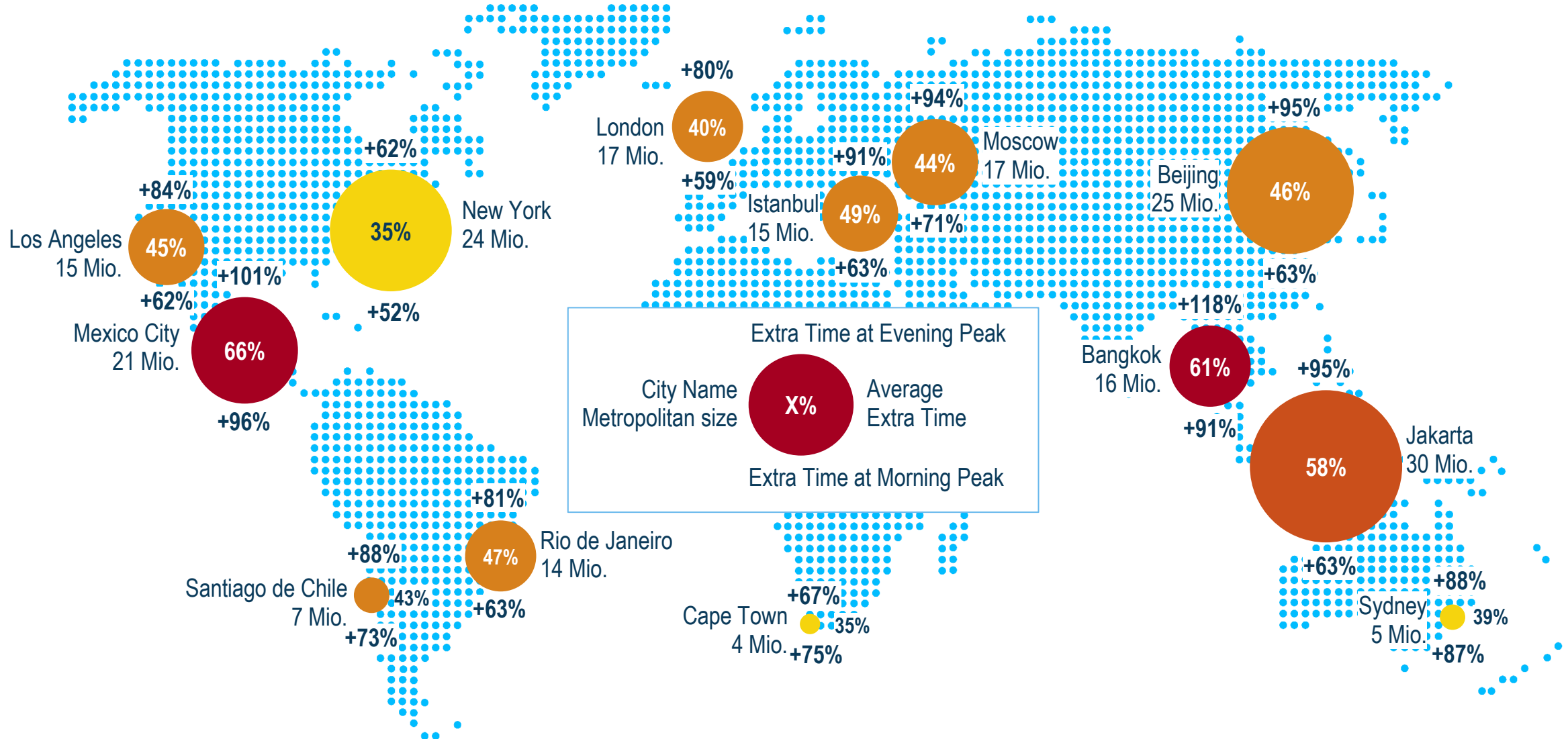
Mobility within and between cities



Source: ESA World Urbanization prospects 2014

Commuting Times in Large Metropolitan Areas

Data according to TomTom



Vehicle



Infrastructure

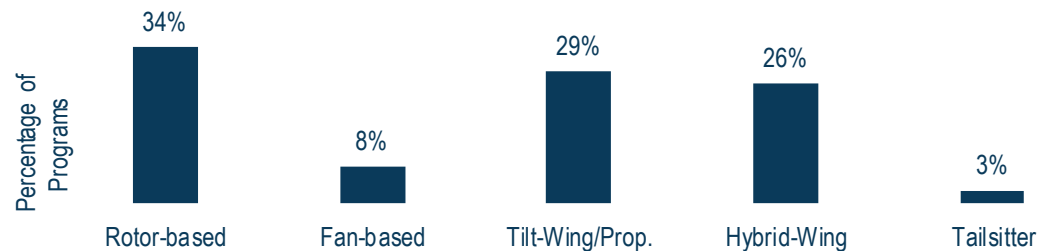
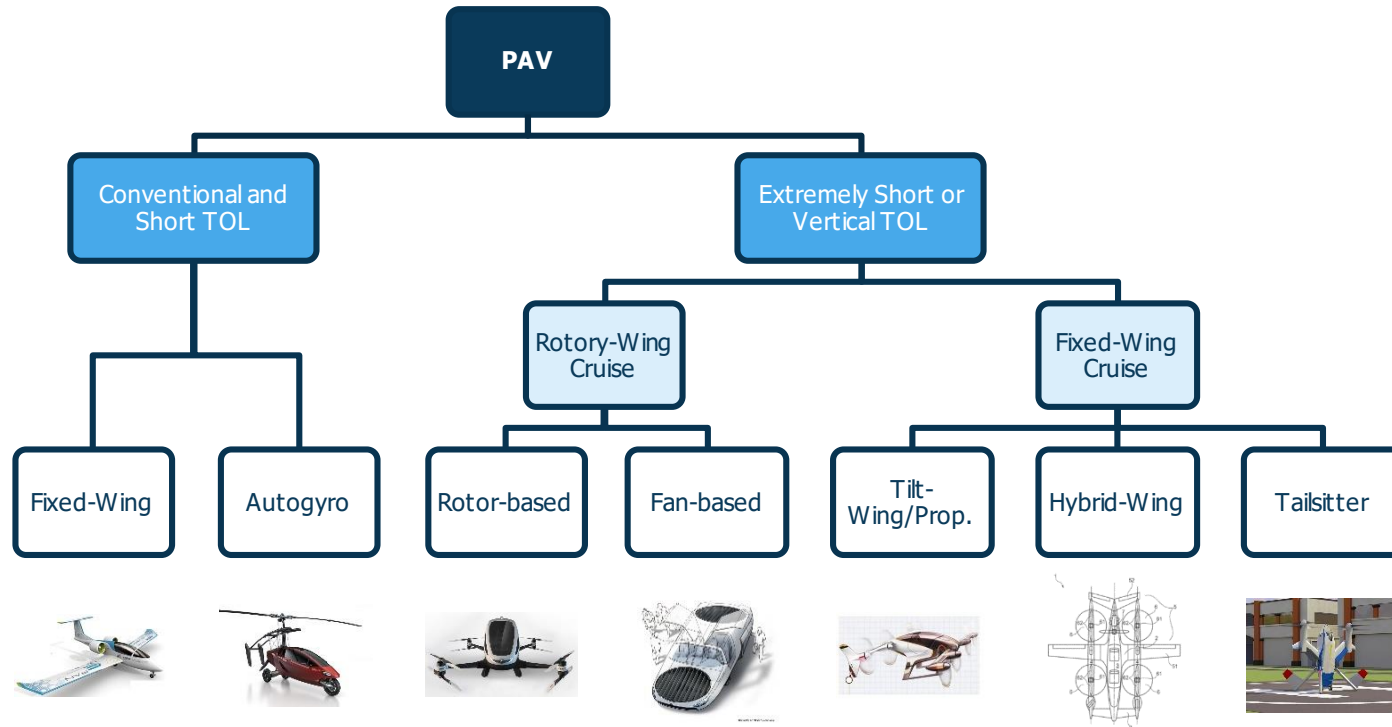


Airspace Integration & Operation

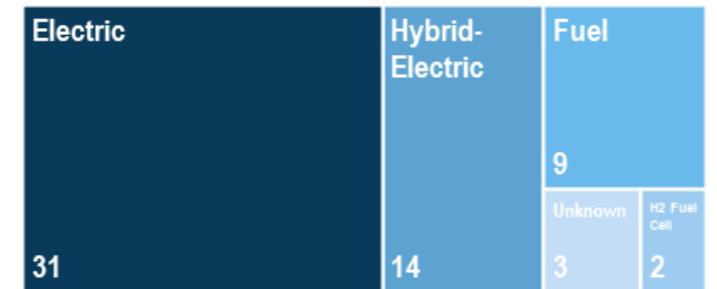


Community Acceptance

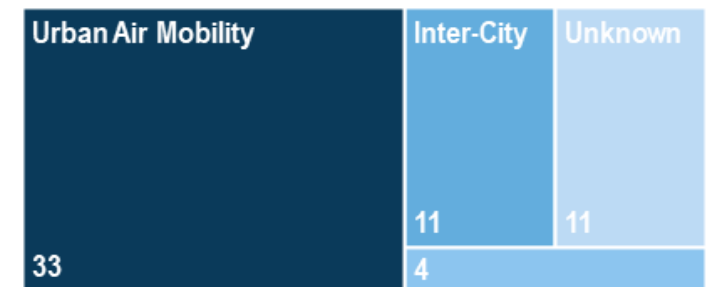


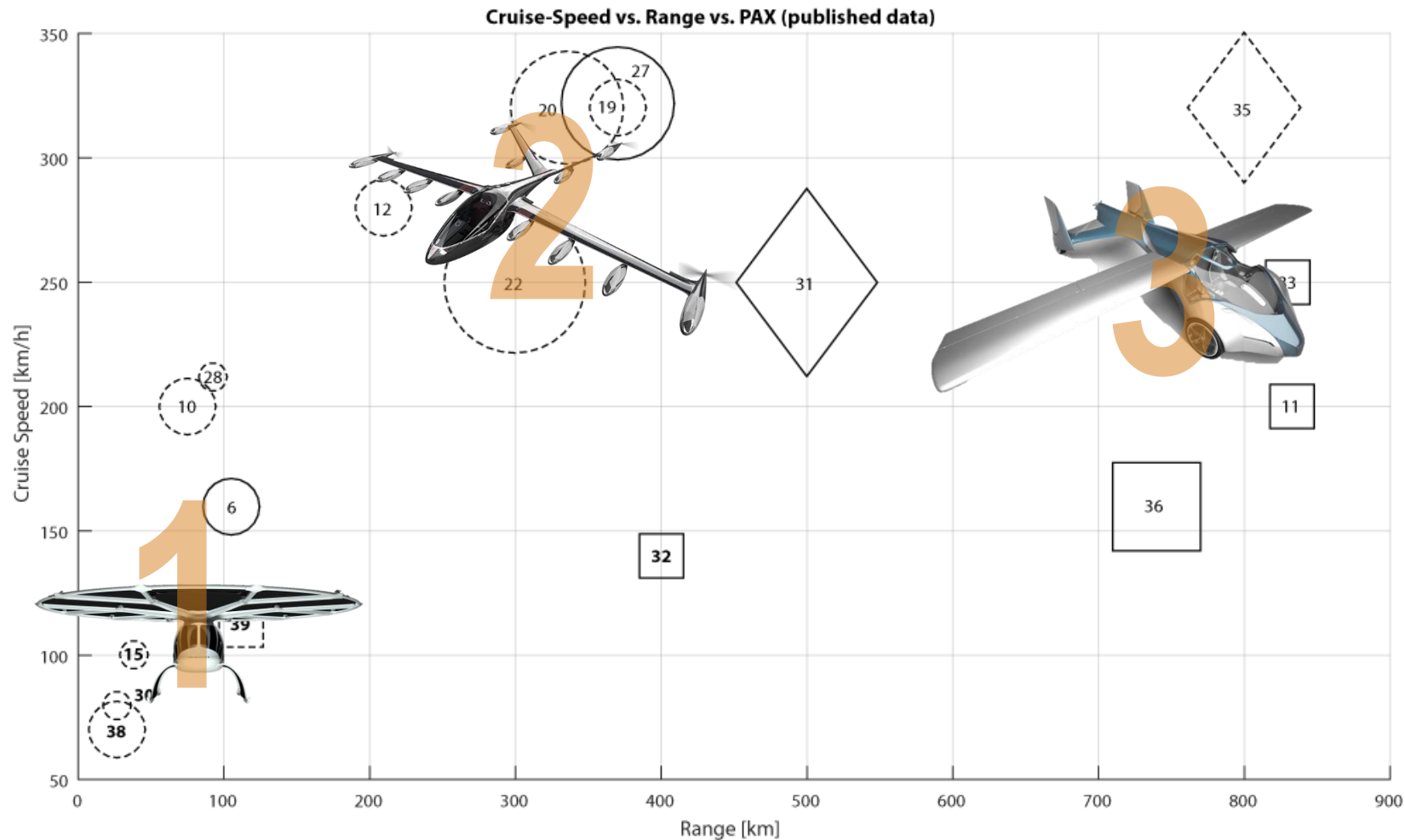


Energy Source



Concept Types/Purpose

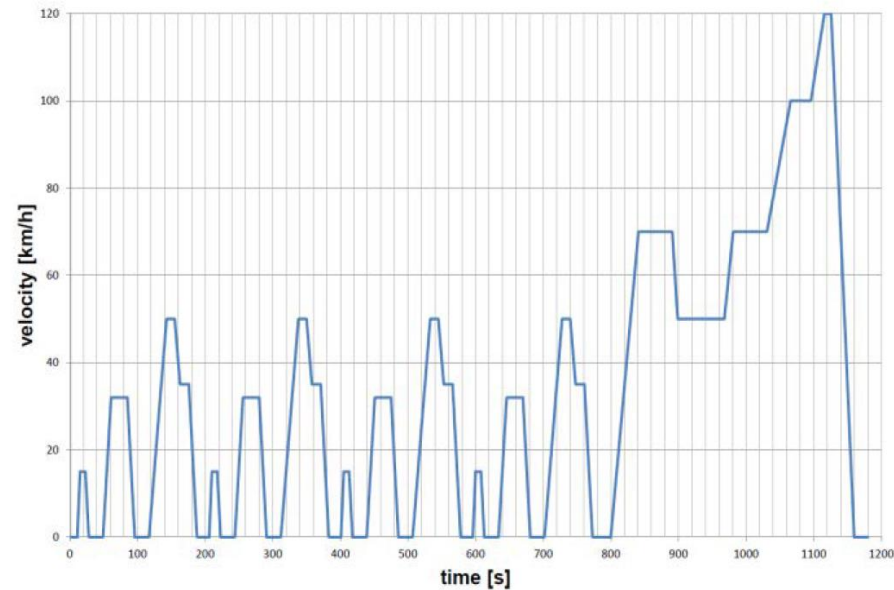




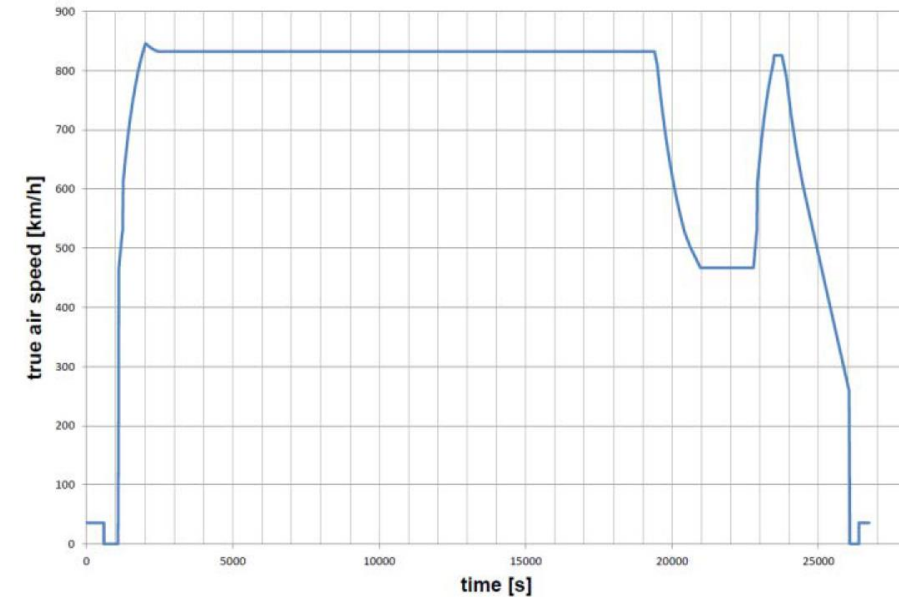
1. **Rotary-Wing & Fan-based Concepts**
2. **Tilt-/ Hybrid-Wing-Configurations**
3. **Fixed-Wing „Flying Cars“**

Main Differences between Automotive & Aviation Applications:

>> Mission Profile



> Recuperation is part of energy management



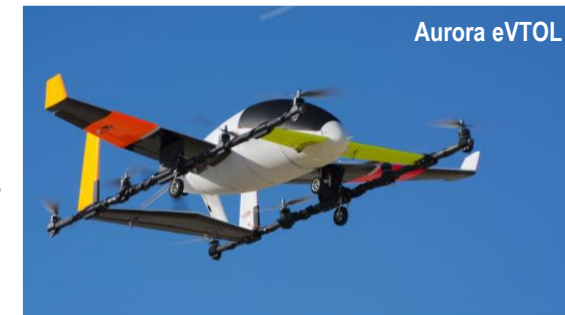
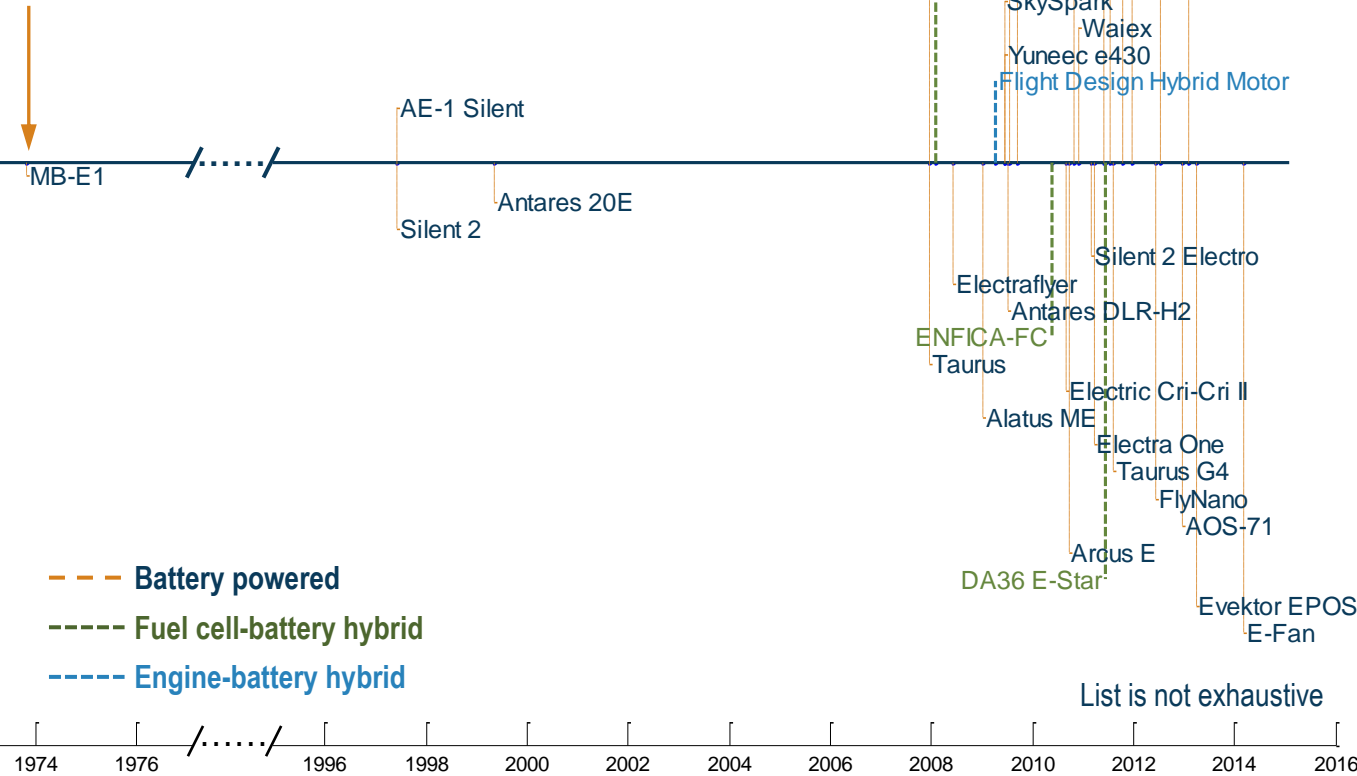
> Constant energy demand over a large part of the mission

Electric Aircraft History & Future Concepts



© Flight International

MB-E1 on October 21, 1973

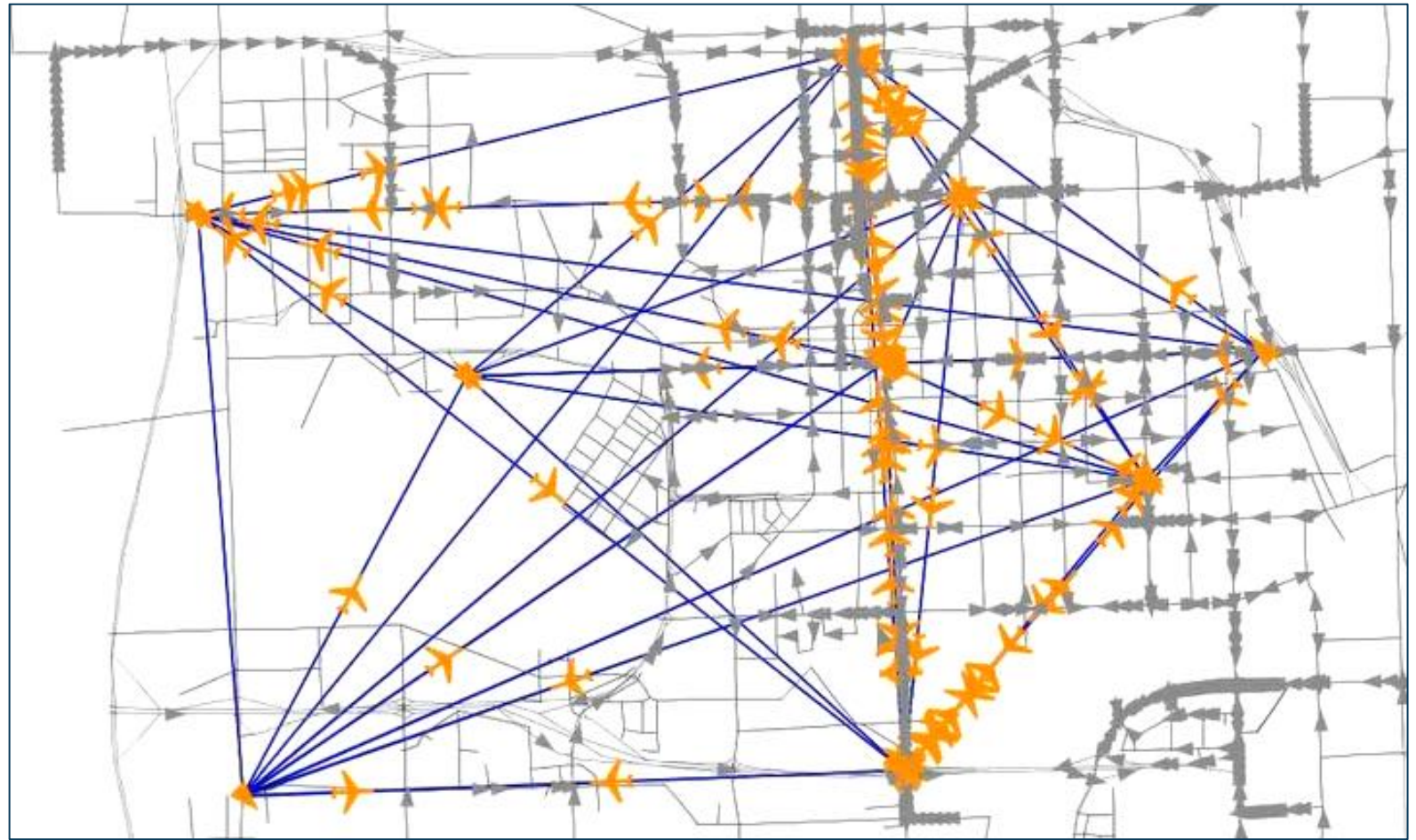
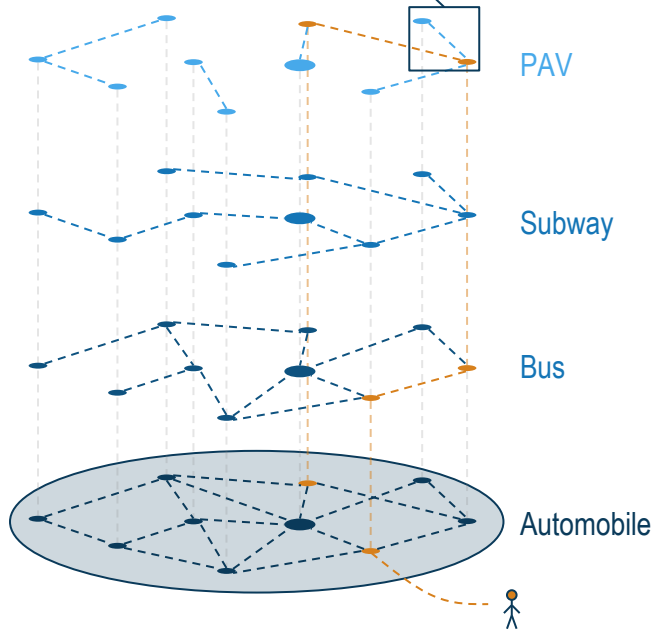
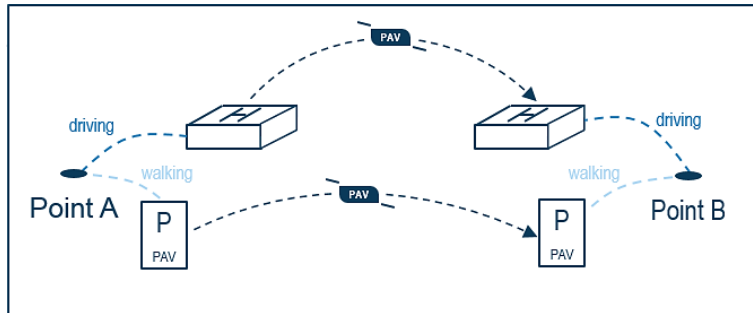


Urban Air Mobility Infrastructure Concepts

(Visualisations taken from NASA, Uber, Volocopter, Lilium)



Integration of UAM into urban mobility



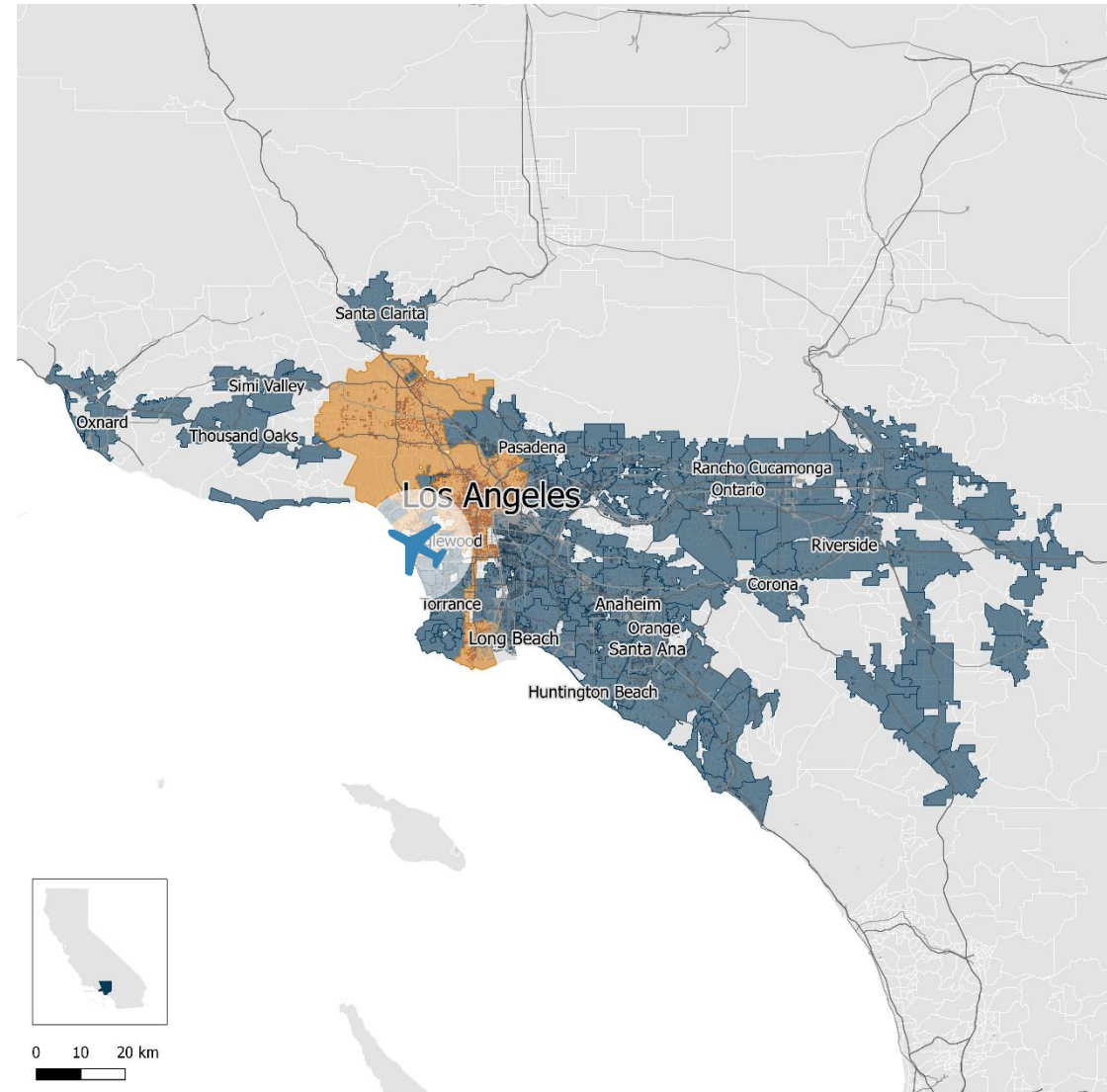
Sioux Falls MATSim Baseline Scenario: UAM covering 4% of trips

What are the implications on cities?

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>> Example: Los Angeles

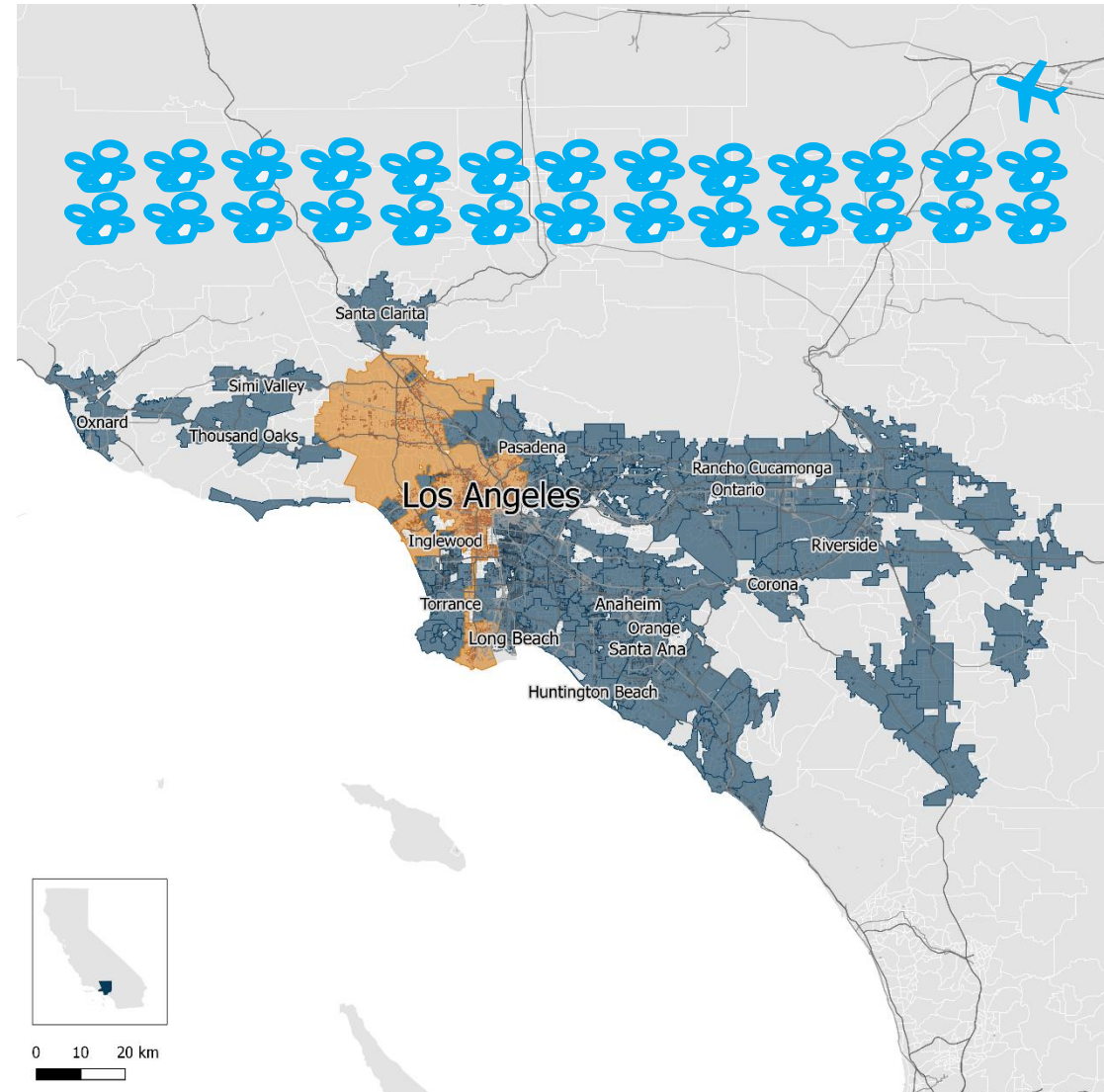
- **Population**
 - City: approx. 4 Million
 - Metropolitan Area: approx. 13 Million
- **LA International Airport**
 - Aircraft Operations per day: around 2000 A/C



What are the implications on cities?

>> Assumption:

- Average number of rides per day
 - 3 by every resident
- PAV share on transport capacity similar to taxi:
 - 1% of passenger traffic
- PAV flights / hour
 - 5.000 in LA city
 - 16.000 in LA metropolitan area



What are the implications on cities?

Automation / Autonomy

- Pilotless Operation
- Air Traffic Management
- Databases

Infrastructure

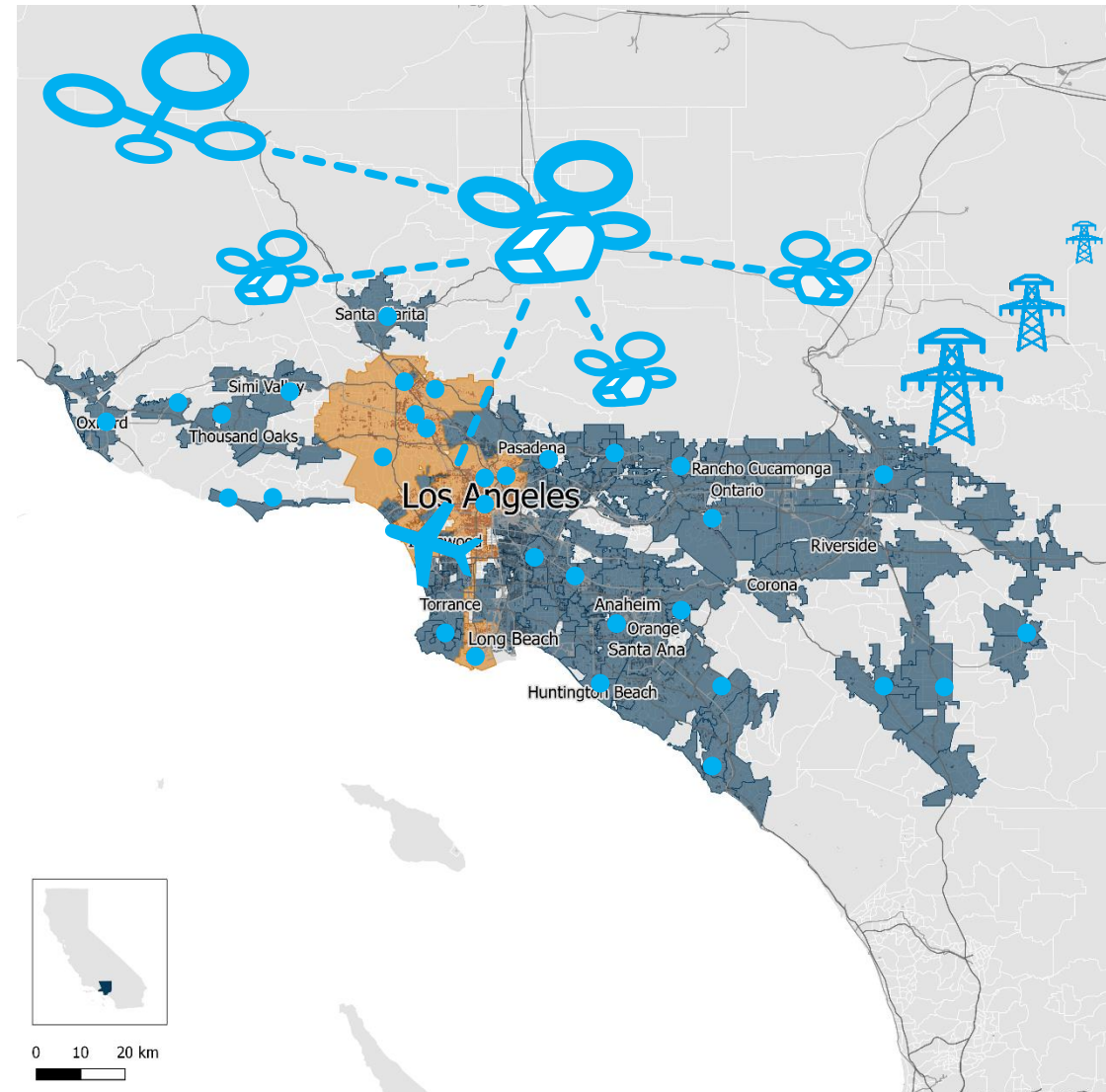
- PAV-Ports
- Power Supply
- Communication

Reliability of Service

- Capacity
- Time for Waiting & Travel
- Interoperability with other Modes of Transportation

Safety & Regulations

Acceptance



>> *Multiple aspects are still being discussed:*

- > Vehicle characteristics regarding take-off and landing capabilities, travel speed, capacity,...
- > Operational concepts as on-demand vs. scheduled, commercial vehicles vs. personal vehicles, inter- vs. intra-city,...
- > Possible market structures, ownership models and business models
- > Level of system costs
- > Infrastructure set-up
- > Air traffic management, routing and scheduling, UTM/ATM integration
- > Regulatory framework

>> *What we know today...*

- > High level of activities on research and industry side with focus on vehicle demonstrator and ATM/UTM concepts
- > Commercial, piloted operations targeted in 2023 onwards
- > Full-scale, autonomous operations decades away
- > Operation from (heli)pad type area
- > Various studies show an UAM market share of <10%, more around 4-6%

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