HorizonUAM Project Overview

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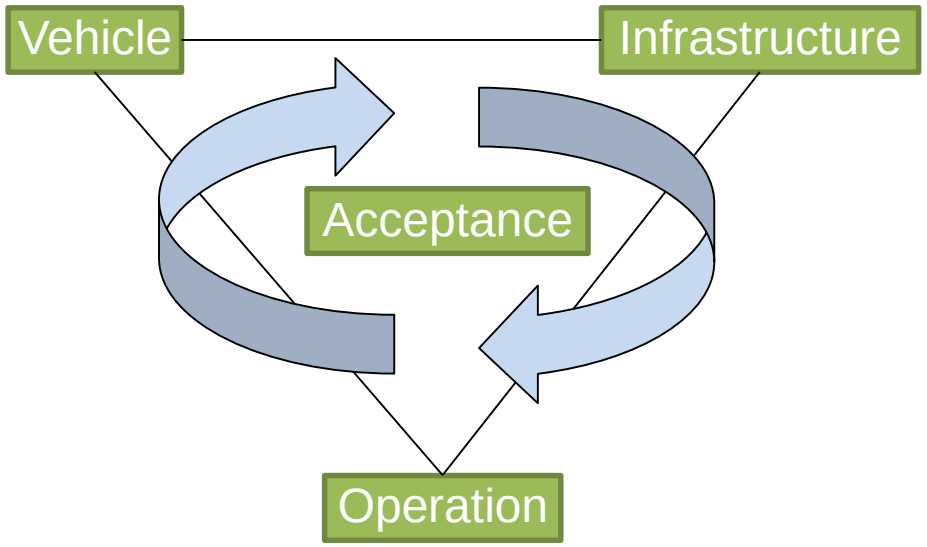
HorizonUAM
Project Framework

- Urban Air Mobility (UAM) research, focus on urban air taxi services
- DLR internal research project, initiated by DLR executive board
- 07/2020 – 06/2023
- 10 DLR institutes and facilities involved
  - Flight Guidance
  - Combustion Technology
  - Flight Systems
  - Air Transport and Airport Research
  - Communications and Navigation
  - Air Transportation Systems
  - Aerospace Medicine
  - System Architectures in Aeronautics
  - Atmospheric Physics
  - Unmanned Aircraft Systems
- Project budget 9.0 M€

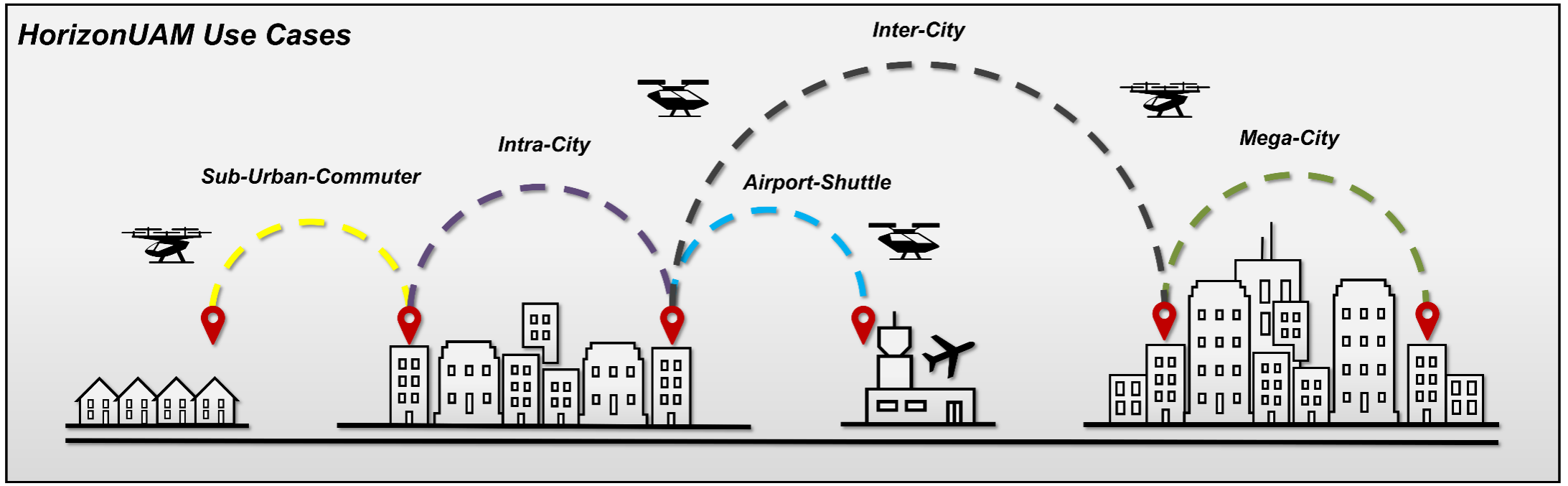
– HorizonUAM –



Project Content

- UAM system simulation
  - Scenarios, demand forecast, economy
- Vehicle
  - Vehicle family concepts, system technology, cabin
- Safety/Security
  - Autonomy, multi sensor navigation and communication, risk assessment, U-space concept
- Vertidrome
  - Infrastructure, flight guidance, UAM network management, airport integration
- Acceptance
  - Acceptance of civil drones and air taxis, citizen participation
- Demonstration/Assessment
  - UAM cabin simulator, tower simulator, scaled flight guidance/ navigation demonstrations

UAM as a System



Further reading:

- Schuchardt et al., Urban Air Mobility Research at the DLR German Aerospace Center – Getting the HorizonUAM Project Started, AIAA Aviation 2021, 08.2021
- L. Asmer et al., Urban Air Mobility Use Cases, Missions and Technology Scenarios for the HorizonUAM Project, AIAA Aviation 2021, 08.2021

➢ Session: UAM Roadmap and Use Cases

Vehicle Family Concepts

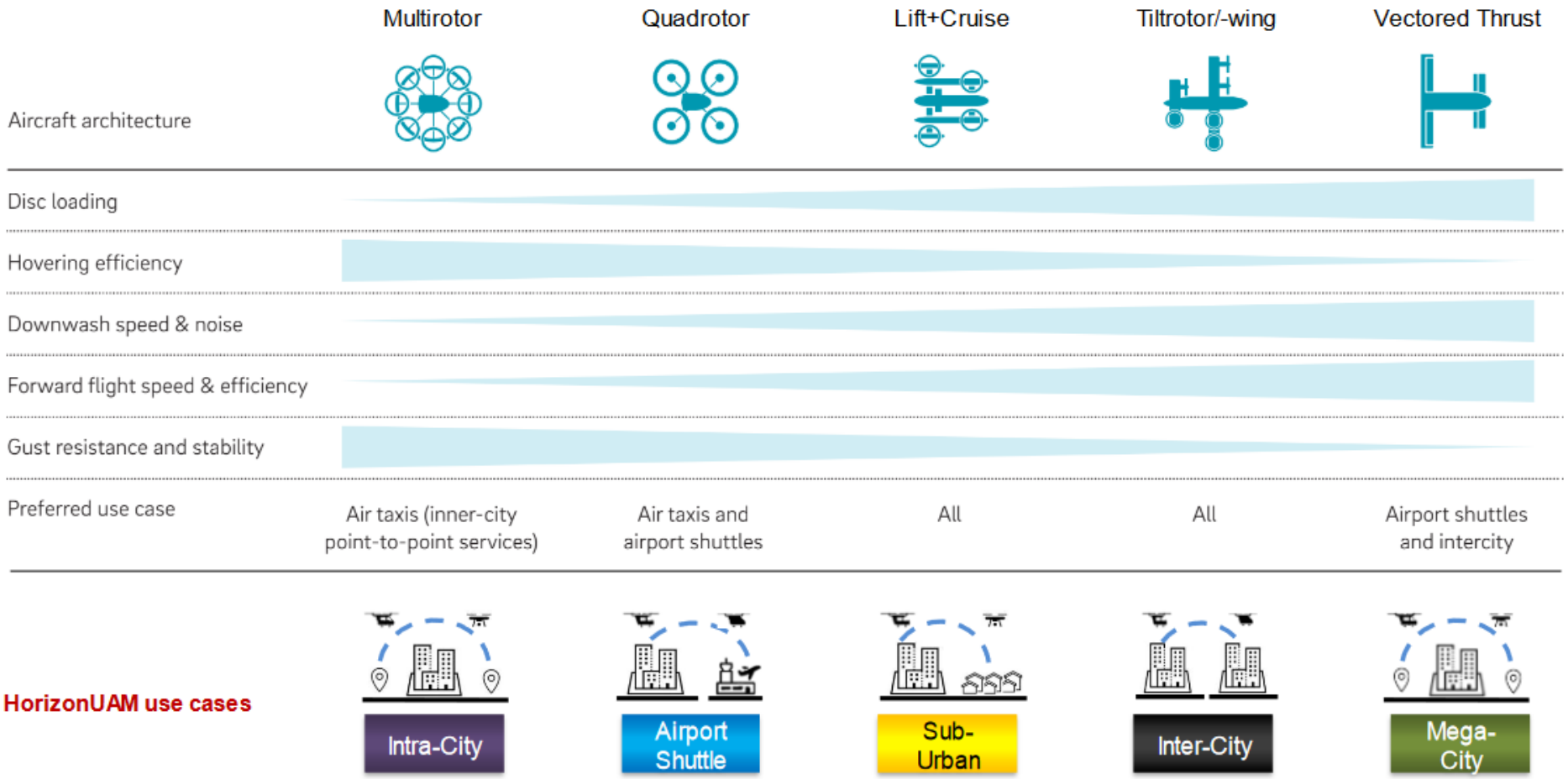


Figure based on: Roland Berger GmbH, “Urban Air Mobility the Rise of a New Mode of Transportation,” Nov. 2018.

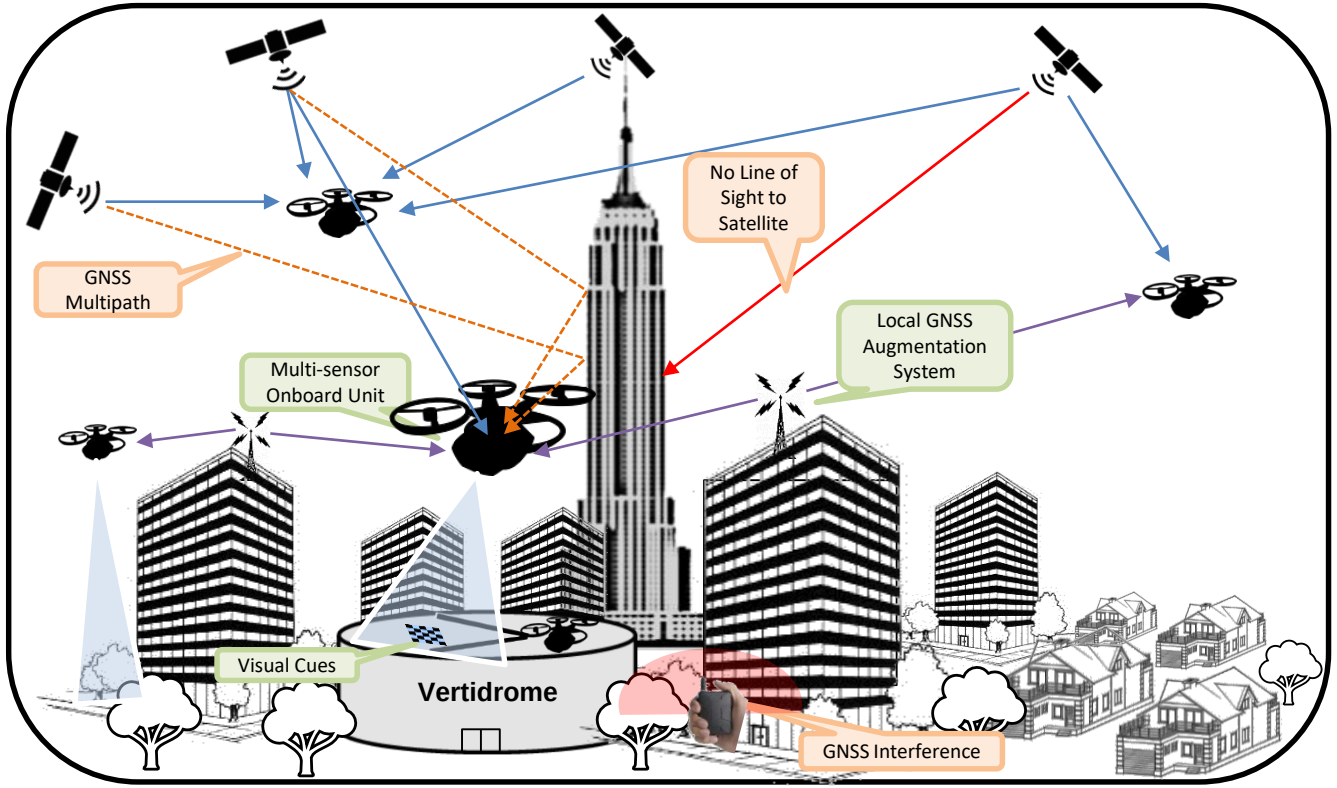
- Session: Simulation
- Session: Vehicle Design

Further reading:

- P.S. Prakasha, et al., Towards System of Systems driven Urban Air Mobility Aircraft Design, DICUAM, 03.2021
- P.S. Prakasha et al., System of Systems Simulation driven Urban Air Mobility Vehicle Design, AIAA Aviation 2021, 08.2021
- P.S. Prakasha et al., Urban Air Mobility Vehicle- and Fleet-level Life-Cycle Assessment Using a System-of-Systems Approach, AIAA Aviation 2021, 08.2021

Safety and Security

- Safe and secure autonomy
- System architecture for multi sensor navigation and communication
- Airspace integration through U-space services
- Risk assessment and collision detection in urban environments
- Cyber-physical security aspects



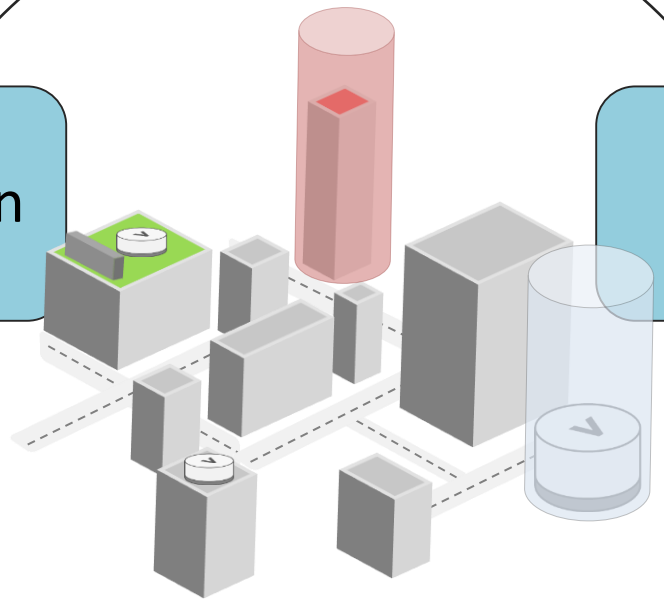
UAM navigation elements and challenges

Further reading:

- P. Nagarajan et al., ASTM F3269 - An Industry Standard on Run Time Assurance for Aircraft Systems, AIAA Scitech 2021, 01.2021
- S. Schopferer, et al., ML Applications in Unmanned Aviation: Operational Risks and Certification Considerations, Machine Learning in Certified Systems - DEEL Workshop, 01.2021
- Becker et al., Approach for Localizing Scatterers in Urban Drone-To-Drone Propagation Environments, EuCAP European Conference on Antennas and Propagation, 03.2021
- C. Torens et al., HorizonUAM: Safety and Security Considerations for Urban Air Mobility, AIAA Aviation 2021, 08.2021

➢ Session: Communication and Autonomy

Vertidrome



Demand

Environmental Integration

Physical Integration

Power System Integration

Airspace Integration

Location

Vehicle

Critical Dimension

Approach/Departure/Taxi Performance

Charging Characteristic

Vertidrome Operation

Approach/ Departure Path

Flow, Delay

Layout (Pads, Gates, Safety Margins)

Scheduling/ Sequencing

Aerodrome2 Aerodrome Connection

Non-nominal environment

Regulation

Requirement Proposals: UAM Aerodrome/ Vehicle

NASA - DLR collaboration on UAM air traffic management / network design

Bauhaus Luftfahrt - DLR collaboration on UAM vertidromes

Further reading:

- K. Schweiger et al., UAM Vertidrome Airside Operation: What needs to be considered?, DICUAM, 03.2021
- K. Schweiger et al., Urban Air Mobility: Vertidrome Airside Level of Service Concept, AIAA Aviation 2021, 08.2021
- F. Naser et al., Air Taxis vs. Taxicabs: A Simulation Study on the Efficiency of UAM, AIAA Aviation 2021, 08.2021

➢ Sessions: Vertidrome 1/2

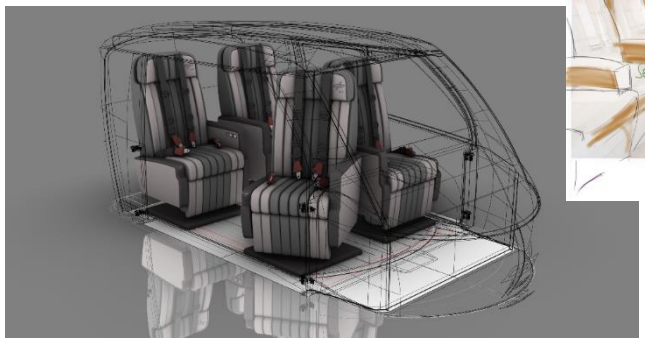
Social Acceptance

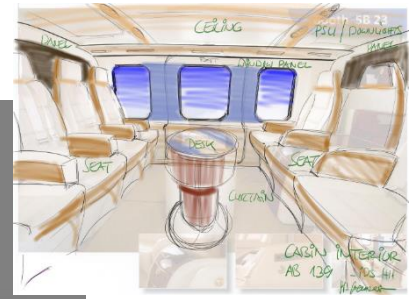
- Analysis of public acceptance towards civil drones and air taxis
- Participatory noise measurements
- Perception of drones and air taxis by pedestrians
- Air taxi passenger interaction and comfort

Virtual-reality assessment of urban mobility scenario including drones and air taxis

Further reading:

- A. End et al., Gender differences in noise concerns about civil drones, ICBEN Congress on Noise as a Public Health Problem, 06.2021
- I. Moerland-Masic, et al., Urban Mobility: Airtaxi Cabin from a Passengers Point of View, Comfort Congress 2021, 9.2021
- M. Stolz, et al., A User-Centered Cabin Design Approach to Investigate Peoples Preferences on the Interior Design of Future Air Taxis, to be presented at DASC 2021, 09.2021





Cabin design and hardware for mixed-reality passenger acceptance studies

➢ Session: Social Acceptance

Demonstration and Assessment

- Tower simulation for integration of UAM at airports
- Scaled flight demonstrations for showing communication, navigation and flight guidance concepts with drones in model city
- Final assessment of chances and risks associated with UAM
- Annual HorizonUAM Symposium

DLR tower simulator

Visualization of the National Experimental Test Center for Unmanned Aircraft Systems in Cochstedt, Germany

Modular model city to be erected on a scale of 4:1 at test center

Conclusion

- HorizonUAM is DLR‘s most recent collaborative research project on urban air mobility
- Project runtime: 07/2020 – 06/2023
- 10 DLR institutes are bringing in a variety of expertise
- Main focus of the project lies on urban air taxi services, including
  - Vehicle design
  - Vertidrome infrastructure
  - Airspace integration and operation
  - Public acceptance
- NASA-DLR collaboration on UAM air traffic management is integrated in HorizonUAM
- Annual HorizonUAM Symposia planned for scientific exchange beyond project boundaries

Thank you for your attention!