

HorizonUAM - Forschung zum urbanen Luftverkehr am Deutschen Zentrum für Luft- und Raumfahrt

Bianca I. Schuchardt
DLR Institut für Flugführung
Deutsches Zentrum für Luft- und Raumfahrt

Deutscher Luft- und Raumfahrtkongress 2021
Dialogtag
1. September 2021
online



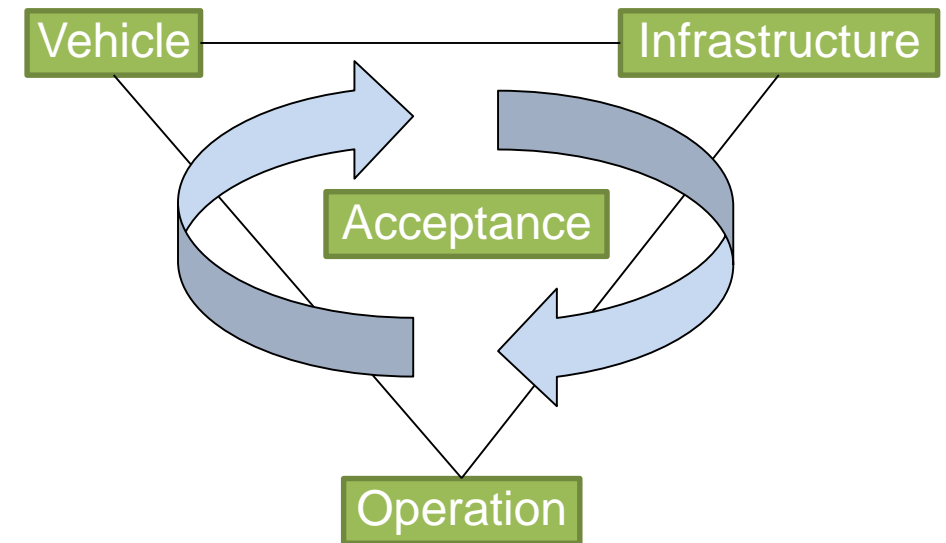
Knowledge for Tomorrow



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€

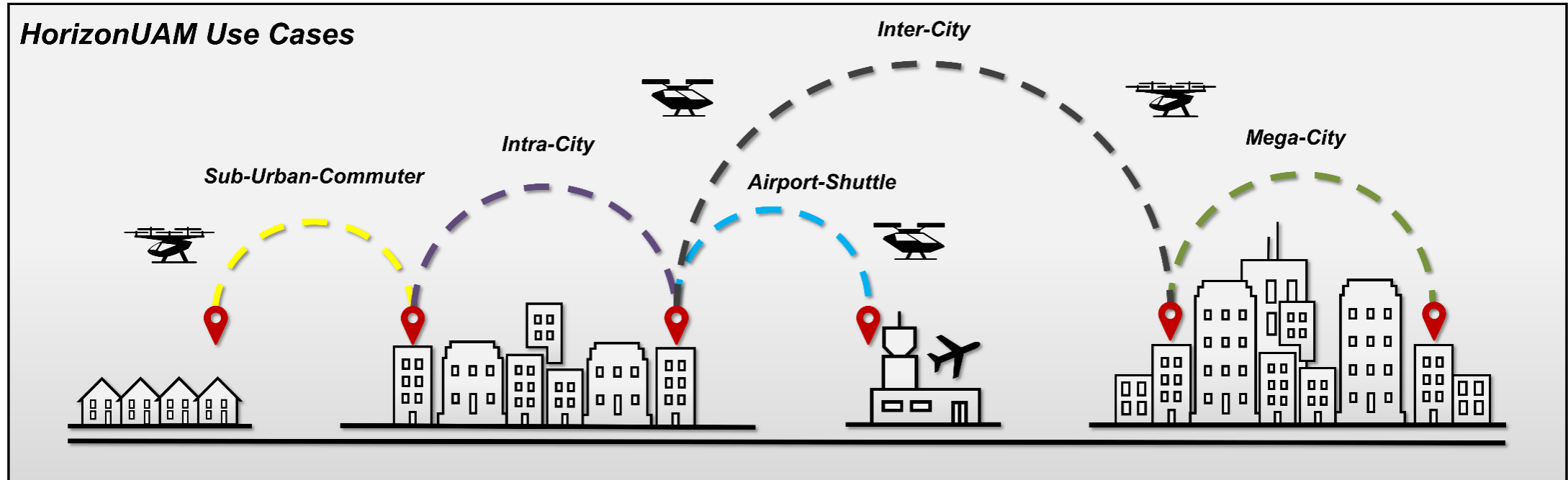


Project Content

- 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

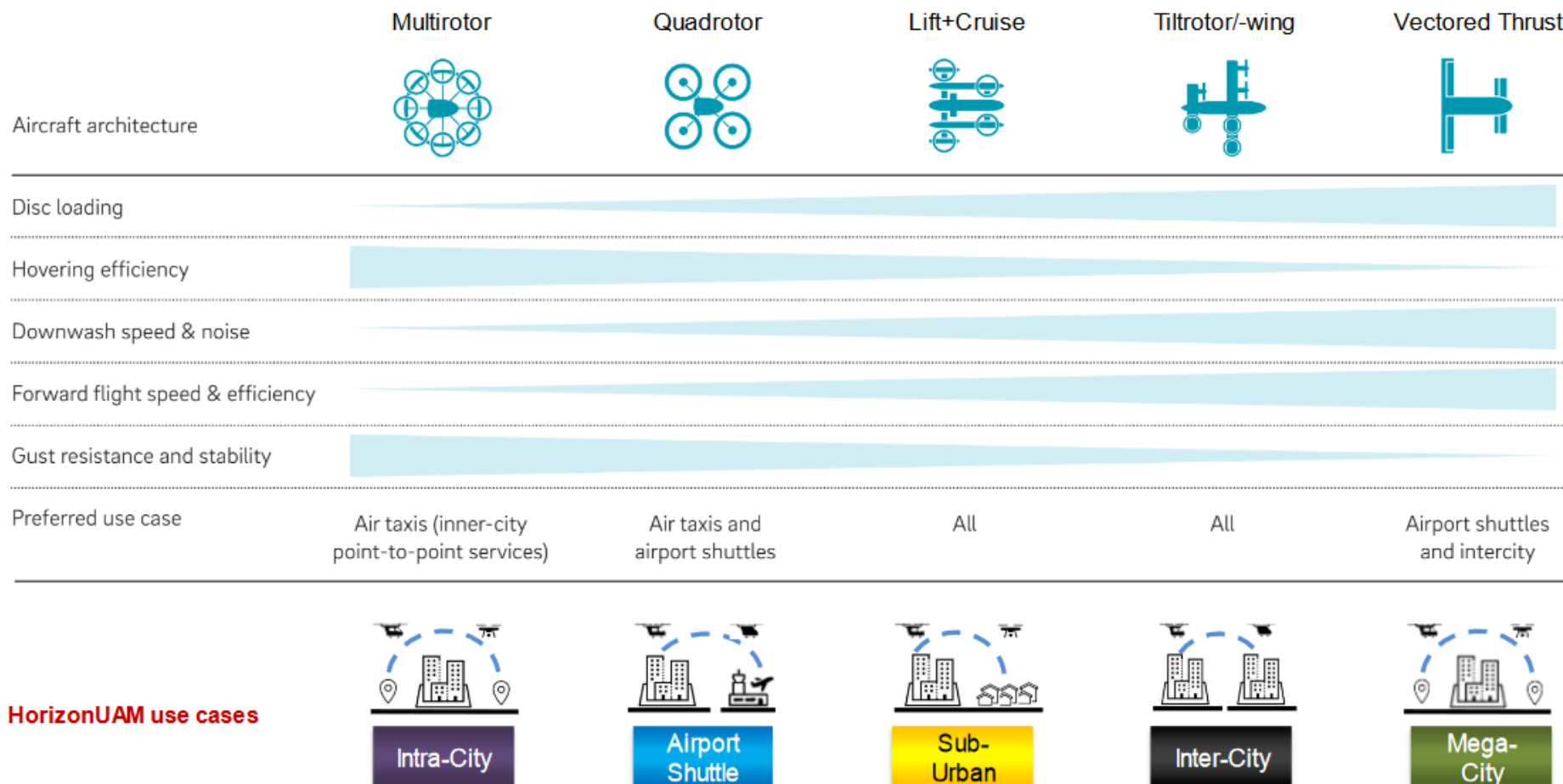


Further reading:

- 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



Vehicle Family Concepts



Further reading:

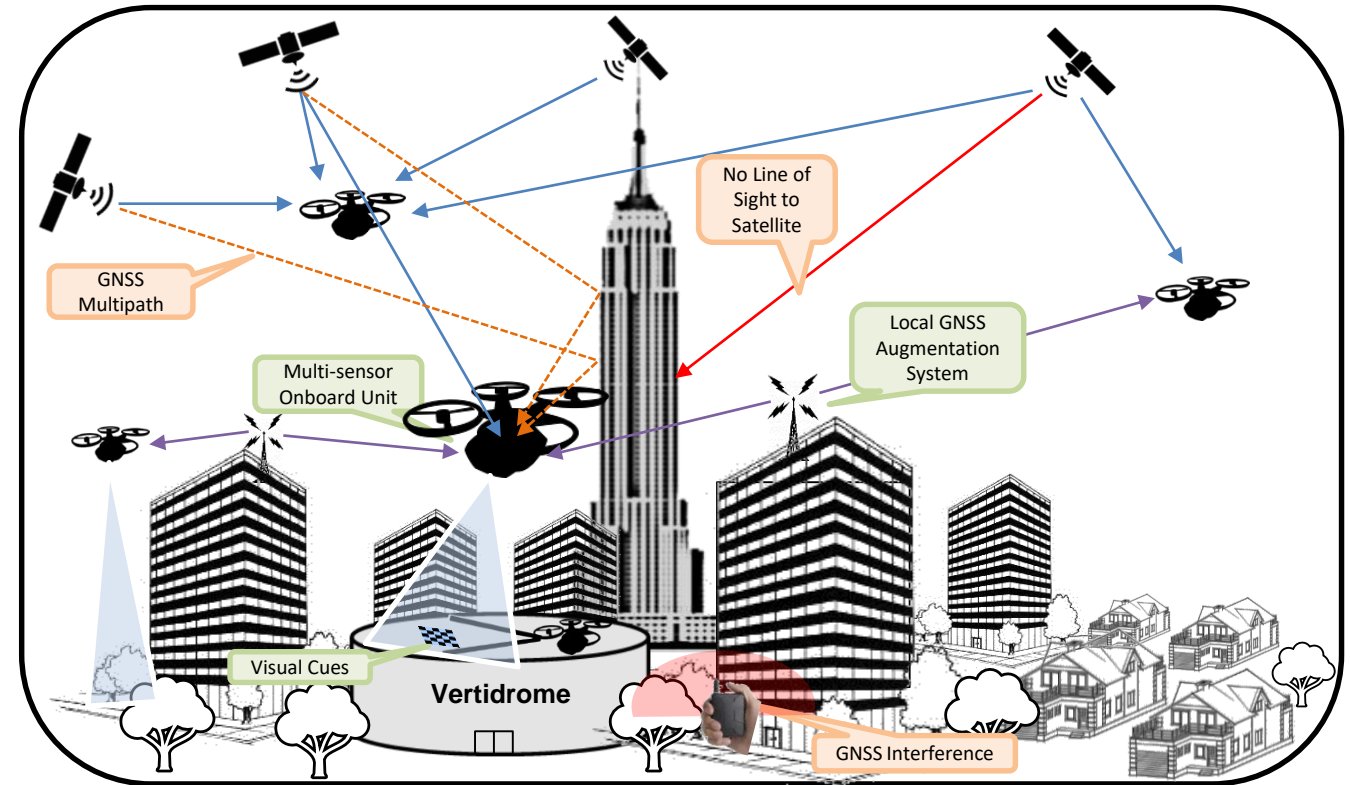
- P.S. Prakasha, et al., Towards System of Systems driven Urban Air Mobility Aircraft Design, DICUAM, 03.2021
- P.S. Prakasha et al., System of Systems Simulation driven Urban Air Mobility Vehicle Design, AIAA Aviation 2021, 08.2021
- P.S. Prakasha et al., Urban Air Mobility Vehicle- and Fleet-level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

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



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



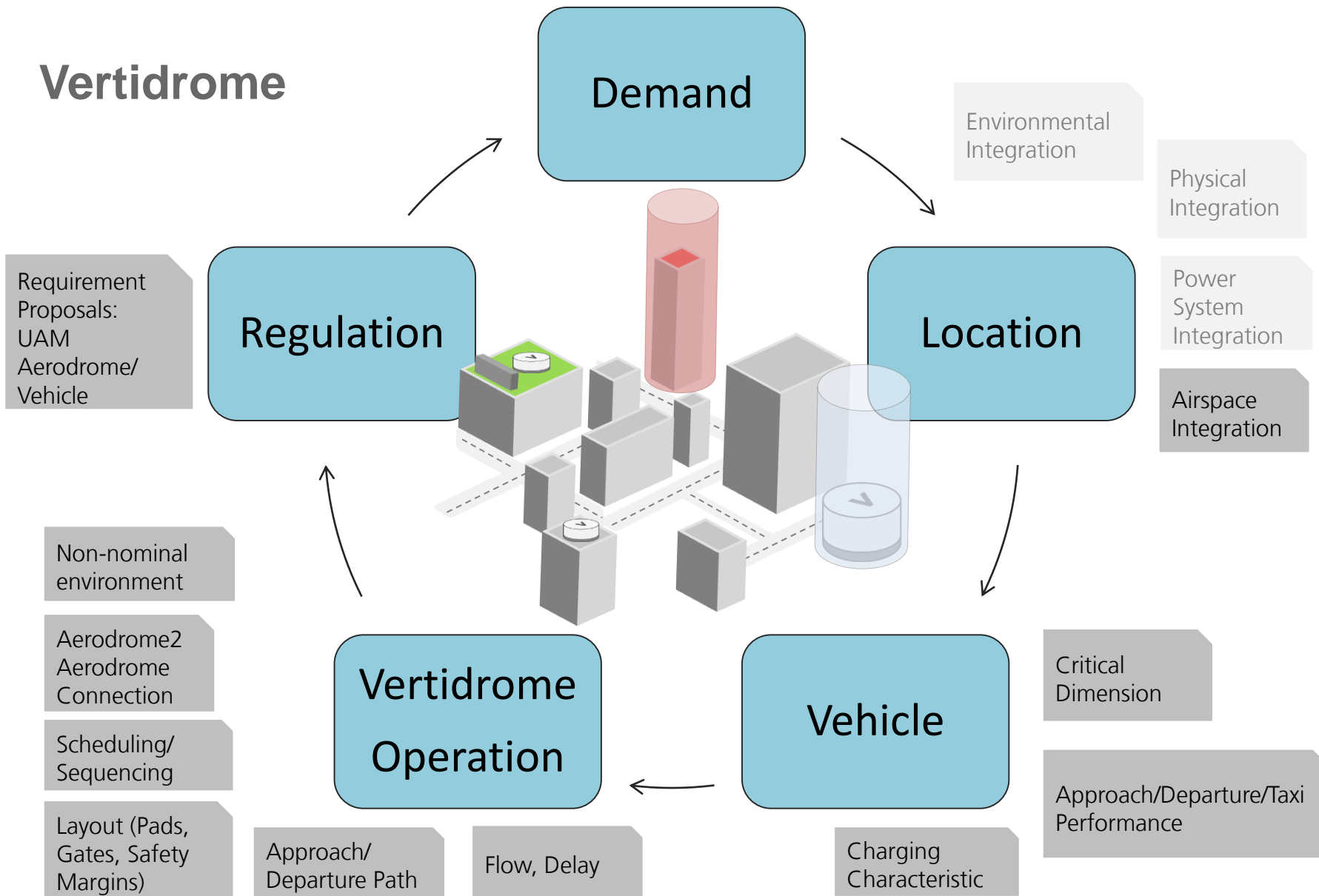
UAM navigation elements and challenges

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

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

Vertidrome



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
- K. Schweiger, UAM Vertidrom Operationen - Vision als Treiber der aktuellen Forschung, to be presented at DLRK 2021, 09.2021



Public Acceptance

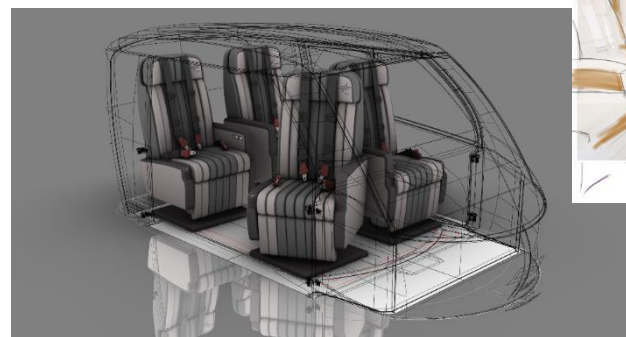
- Analysis of public acceptance towards civil drones and air taxis
- Participatory noise measurements
- Perception of drones and air taxis by pedestrians
- Air taxi passenger interaction and comfort

Further reading:

- A. End et al., Gender differences in noise concerns about civil drones, IC BEN 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



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



Cabin design and hardware for mixed-reality passenger acceptance studies

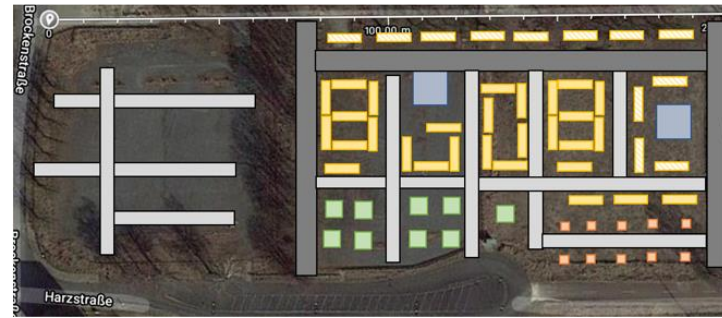
Demonstration and Assessment

- 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





Join us at <https://dlr.expert/horizonuam2021>

Virtual symposium

Free to register before 12 September

Thank you for your attention!

Corresponding author:

Dr. Bianca I. Schuchardt
DLR Institute of Flight Guidance
German Aerospace Center
bianca.schuchardt@dlr.de

