HorizonUAM Project Overview
Bianca I. Schuchardt

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

Aircraft architecture

- Disc loading
- Hovering efficiency
- Downwash speed & noise
- Forward flight speed & efficiency
- Gust resistance and stability

Preferred use case

- Air taxis (inner-city point-to-point services)
- Air taxis and airport shuttles
- Lift+Cruise
- All
- All
- Tiltrotor/wing
- All
- Vectored Thrust
- Airport shuttles and intercity

HorizonUAM use cases

- Intra-City
- Airport Shuttle
- Sub-Urban
- Inter-City
- Mega-City

Further reading:

- P.S. Prakasha, et al., Towards System of Systems driven Urban Air Mobility Aircraft Design, DICUAM, 03.2021

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

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

Requirement Proposals:
UAM Aerodrome/Vehicle

Non-nominal environment
Aerodrome Connection
Scheduling/Sequencing
Layout (Pads, Gates, Safety Margins)

Demand

Environmental Integration

Physical Integration

Power System Integration
Airspace Integration

Regulation

Critical Dimension
Approach/Departure/Taxi Performance
Charging Characteristic
Flow, Delay

Location

Vertidrome Operation

Vertidrome

Vehicle

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

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

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

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

➢ 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
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!