URBAN AIR MOBILITY RESEARCH AT THE GERMAN AEROSPACE CENTER (DLR)

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K-UAM Confex, 8-10 Nov. 2023, Incheon, South Korea

DLR

Deutsches Zentrum
für Luft- und Raumfahrt
German Aerospace Center





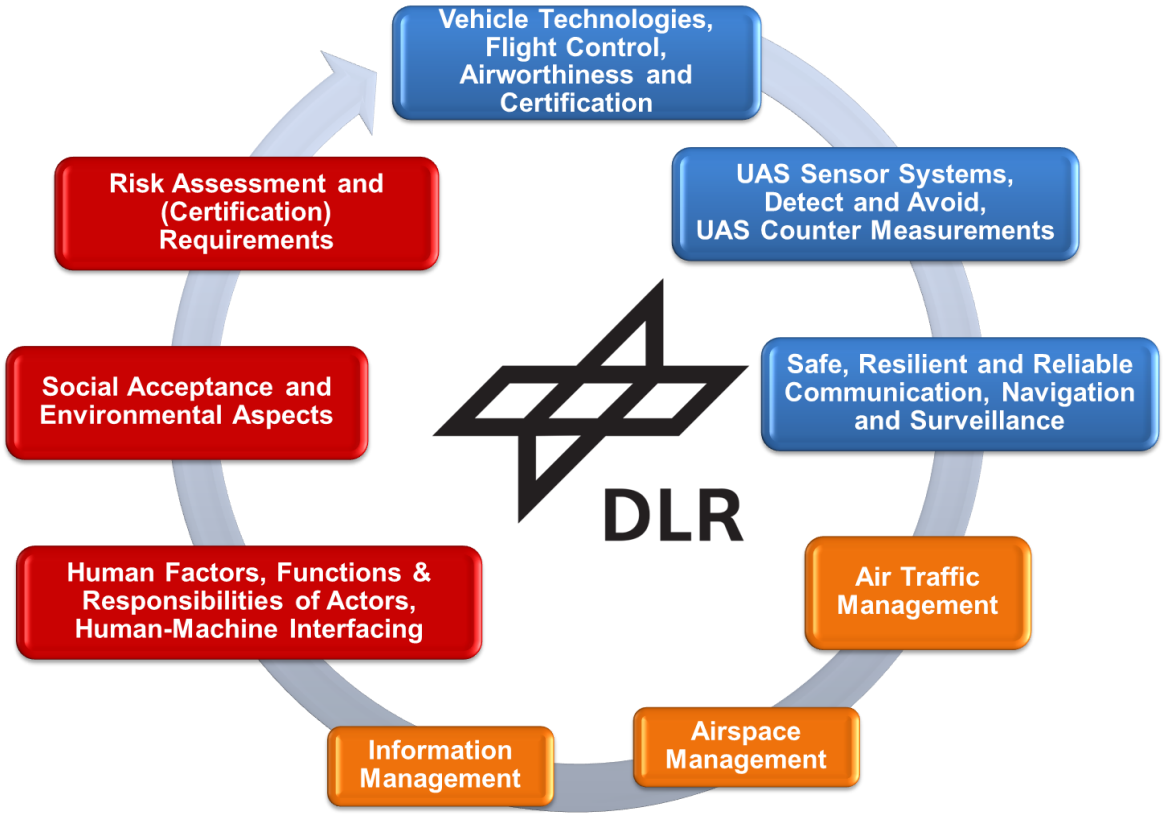
- Research Institution
- Space Agency
- Project Management Agency

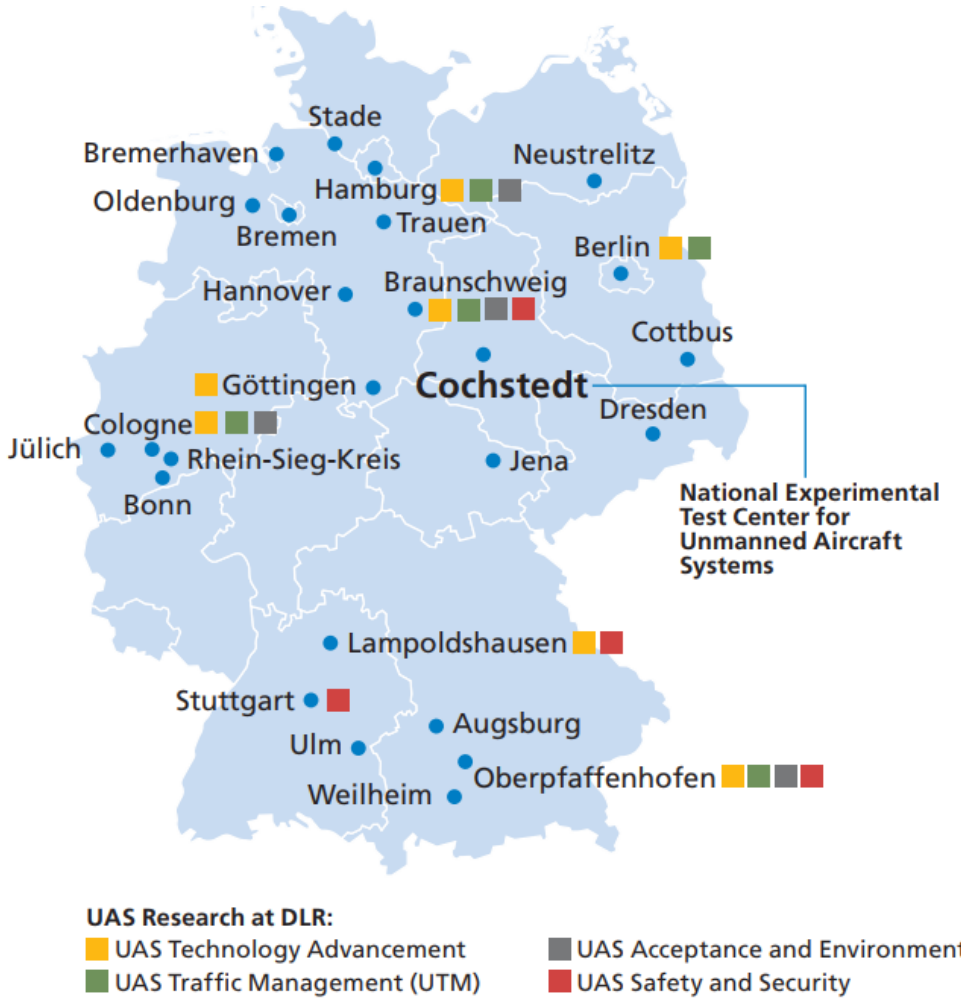
Research Fields

- Aeronautics
- Space Research and Technology
- Transportation
- Energy
- Security (cross-sectional field)
- Digitalisation (cross-sectional field)

DLR Sites and Institutes

Unmanned Aircraft Systems (UAS) Research

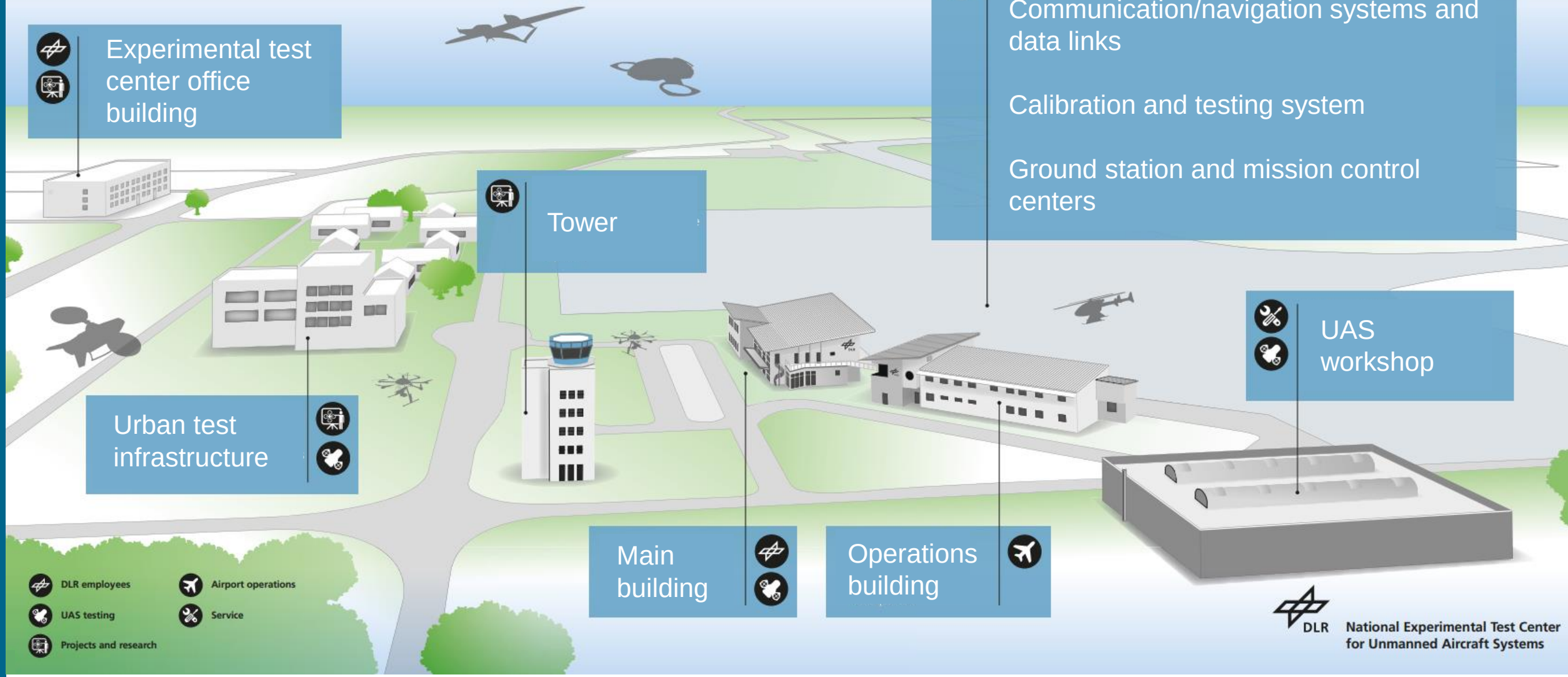




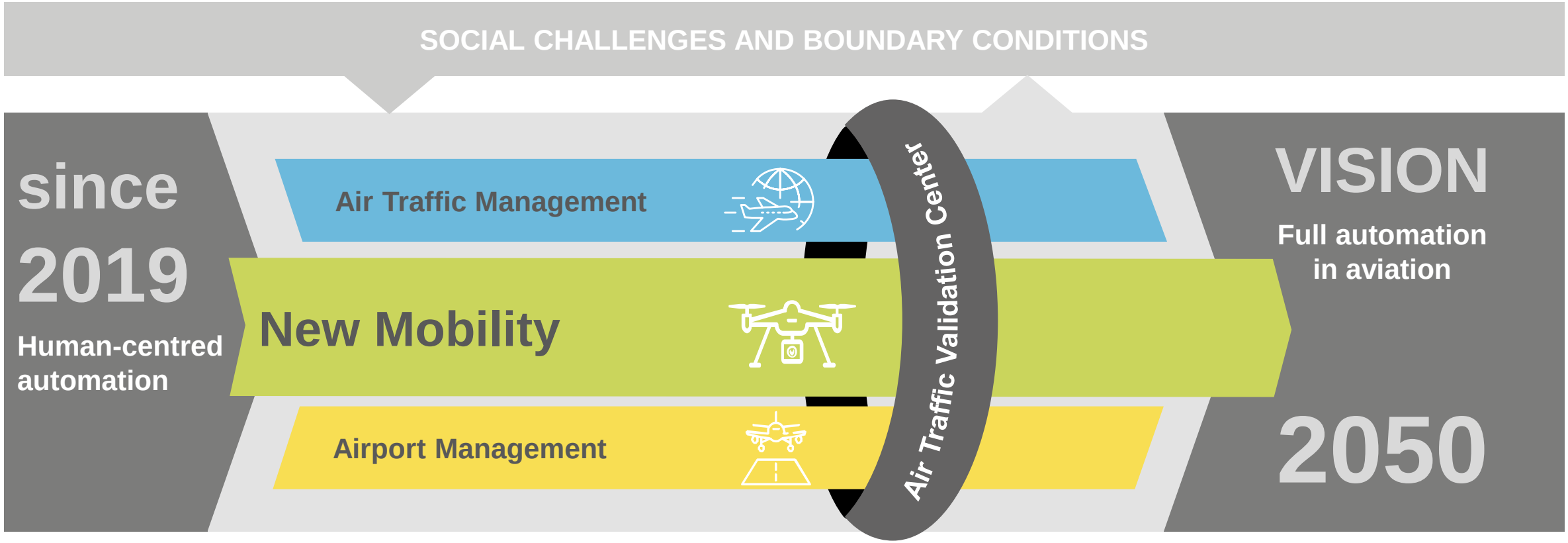
- In total, 10,000 employees work in 54 institutes and facilities.
- Offices in Brussels, Paris, Tokyo and Washington D.C.

National Experimental Test Center for UAS
Cochstedt, Germany

Experimental Test Center Site and Infrastructure



Research Focus of the Institute of Flight Guidance
The Vision of Full Automation in Aviation

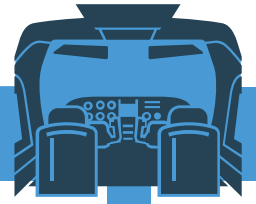


The Air Traffic Validation Center

Flexible and powerful for ATM concepts, technologies and procedures

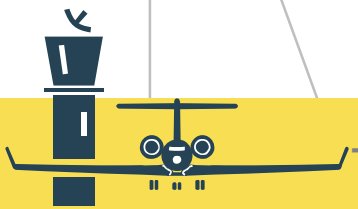
Model-based performance evaluation

- AirTOP
- TrafficSIM
- WW-ATM
- SIMMOD



Real-time simulation

- HMI Lab
- GECO
- ATS360
- TowerLab
- HubSim
- ATMOS
- Sectorless Lab
- ACCES
- UAS Lab
- Air Taxi



Test environments at Braunschweig and Magdeburg-Cochstedt airports

- MLAT WAM
- Datalink/ GBAS
- Remote Tower
- DLR Research Aircraft
- Drones

External test environments

- ARIF Hamburg
- External Airports
- ATC Tower/ Center
- External Aircraft

Unmanned Aircraft Systems and Urban Air Mobility

Airspace Integration

- Performance and density-based traffic management for a wide range of aircraft

Mission Management

- Coordinated planning and implementation for multiple UAS

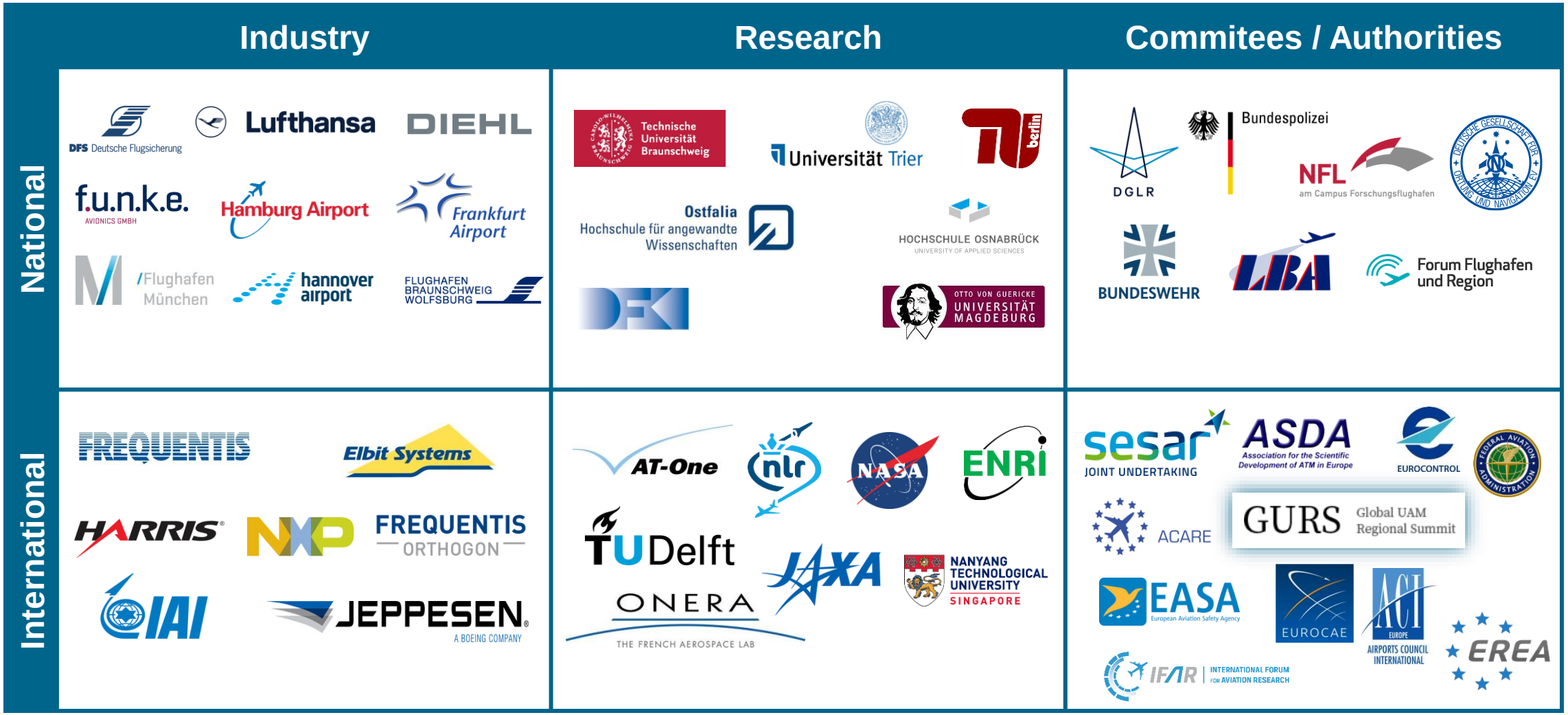
Technology

- Reliable navigation and 4D trajectories for the guidance of the UAS

Demonstrator DO 228 D-CODE

- National demonstrator for unmanned air vehicles in medium altitude and long endurance (MALE UAV)
- Integration of collision avoidance systems in cooperation with industry partners

Key Networks and Partners



Urban Air Mobility Research at the German Aerospace Center (DLR)

HorizonUAM

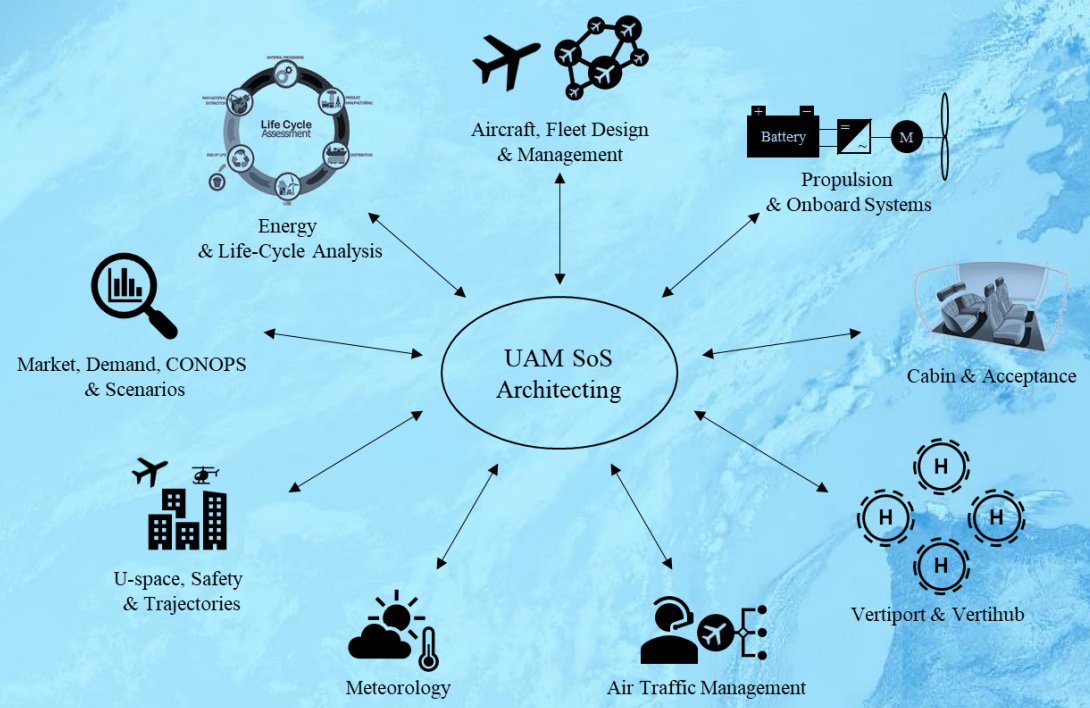
DLR

Objective:
Assessment of opportunities and challenges of air taxis and urban air mobility (UAM) concepts

Main content

- Forecast of UAM market share
- Model-based UAM system simulation
- Air taxi vehicle system development
- Flight guidance concepts for vertidromes
- Airport integration of UAM traffic
- Public acceptance
- Scaled flight demonstrations in model city

- Duration: 07/2020 – 08/2023 (38 months)
- Scope: 52.1 person-years (9.1 M€)
- Participants: 10 DLR institutes, cooperation partners NASA and Bauhaus Luftfahrt

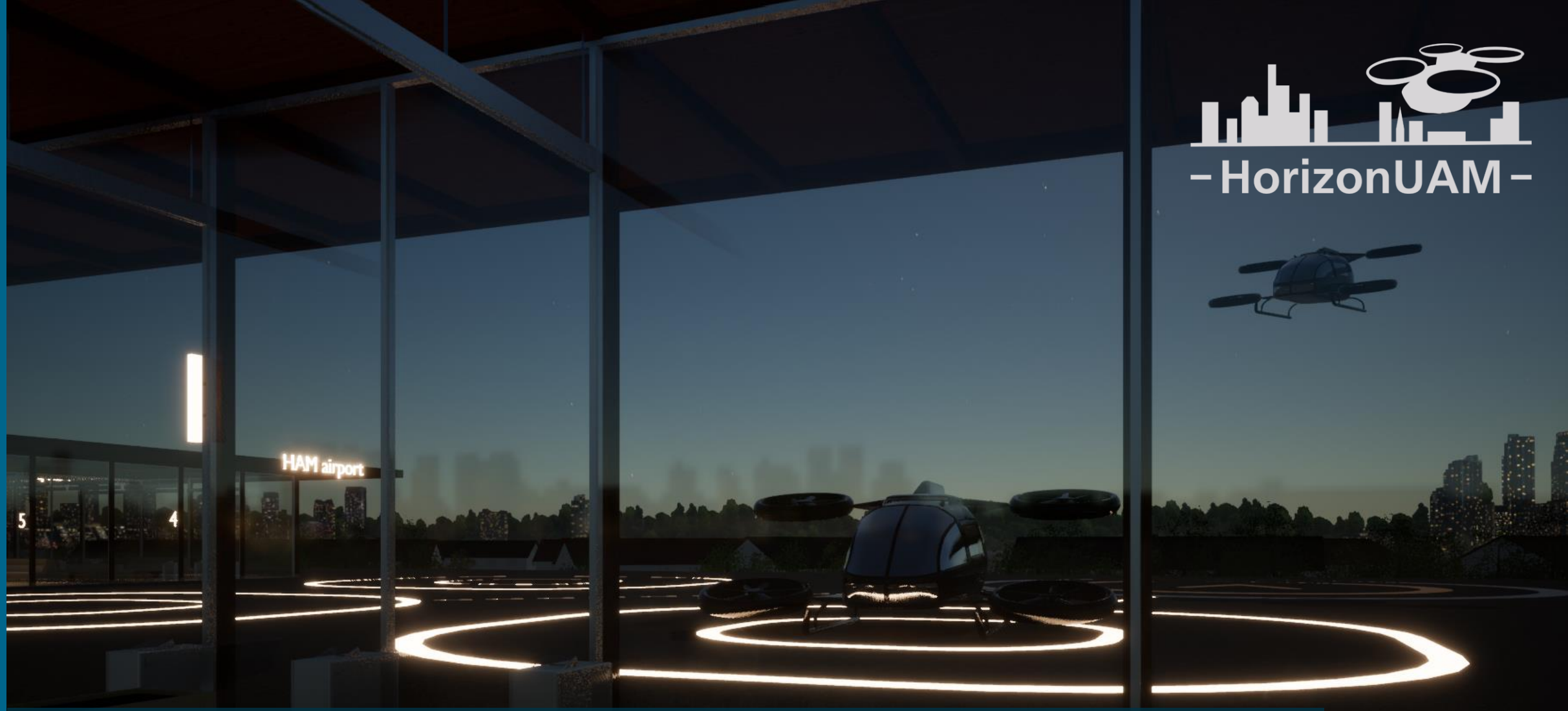


HorizonUAM

OVERALL SYSTEM SIMULATION

DLR


HorizonUAM
VEHICLE
DLR
Photo Urvence @ iStock 2091922059



HorizonUAM

VERTIDROME

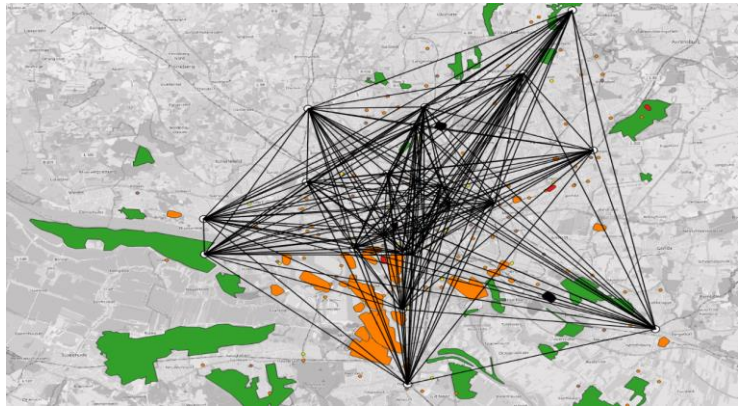
DLR

Vertidrome

Airside Level of Service

- Fast-time simulation of vertidrome operations.
- The method **Level of Service** was adapted for the assessment or vertidrome airside operations.

Network Management



- **Hamburg Case Study:** A network of 20 vertiports requires 422 parking positions, a maximum cumulated charging power of 11.05 MW and 275 vehicles to service **2800 missions per day**.
- A reduction of **battery charging time** can reduce the fleet size by 18%, causing a spatial footprint reduction of 24% regarding parking stands.

Airport Integration

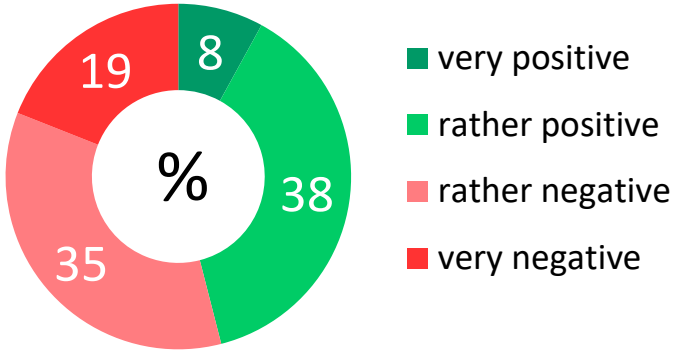
- Human-in-the-loop simulation: 44 conventional aircraft, 15 air taxis/hour and 10 air traffic controllers.
- Integration into conventional runway systems is only recommended for low-traffic hours.
- **Exclusive air taxi working position** in case of more traffic is suggested.


HorizonUAM
PUBLIC ACCEPTANCE
DLR

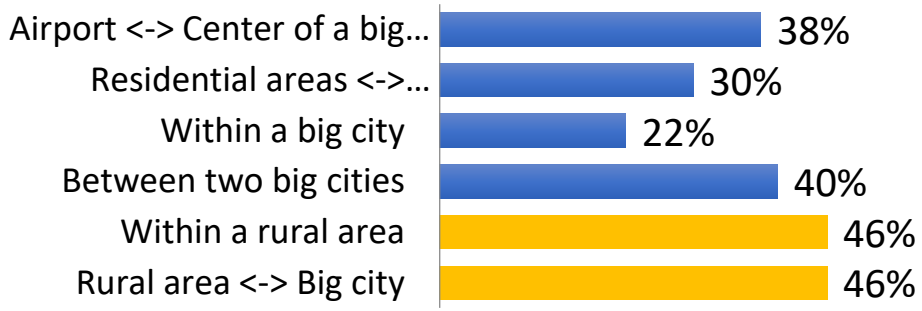
Large-scale Telephone Survey

- Attitude towards air taxis in general is mixed in the German population.
- Acceptance of using an air taxi is highest for use cases including rural areas.

Attitude towards air taxis



Willingness to use an air taxi



N = 1001 computer-assisted telephone interviews in 2022 (ø 21 Min.), representative for the German population

Mixed-Reality Simulation

- 30 participants experienced an airport shuttle flight in the city of Hamburg in a mixed reality air taxi simulator.
- Well-being tended to be higher when an air steward was on board during flights with re-routing.

DEMONSTRATION

Urban Air Mobility Flight Demonstration

at the National Experimental Test Center for Unmanned Aircraft Systems, Cochstedt, Germany

- Air taxi flight from vertidrome “Hamburg Airport” to “Hamburg Binnenalster”
- Scaled demonstration: multicopters representing passenger carrying air taxis
- Focus of demonstration:
  - Airspace integration through U-space (unmanned aircraft system traffic management)
  - Vertidrome management
  - Artificial intelligence (AI) for automatic detection of persons
  - Urban communication and navigation

HorizonUAM

THANK YOU FOR YOUR ATTENTION

DLR

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- Previous publications: https://www.dlr.de/fl/en/desktopdefault.aspx/tabid-18246/29007_read-76340/

Imprint

Topic:	**Urban Air Mobility Research at the German Aerospace Center (DLR)** K-UAM Confex, Incheon, South Korea
Date:	9 November 2023
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