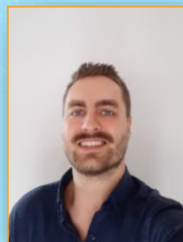# URBAN AIR MOBILITY

INSIGHTS INTO THE VIRTUAL AND USER CENTRIC DESIGN PROCESS FOR A FUTURE EVTOL CABIN CONCEPT

F. Reimer, I.-M. Masic, T.-M. Bock, L. Winkler, F. Meller, B. Nagel

Fabian Reimer
German Aerospace Center e.V (DLR)
+49 40 2489641 370
Fabian.Reimer@dlr.de

HorizonUAM
2nd URBAN AIR MOBILITY SYMPOSIUM

DLR

Presentation & Session Overview

Session 1:
"Social Acceptance Research: Surveys and Experiments"

Session 2 (11:15-13:15):
"Air Taxi Vehicle, Systems and Cabin Concepts"

Fabian Reimer, Thomas-M. Bock, Line Winkler, Frank Meller, Björn Nagel

"Urban Air Mobility – Insights into the Virtual and User Centric Design Process for a Future eVTOL Cabin Concept"
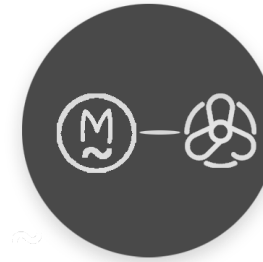
Patrick Ratei, Nabih Naeem, Prajwal Shiva Prakasha

"Fleet-Centric Vehicle Design Space Explorations of Urban Air Mobility by System of Systems Simulations"

Oliver Bertram, Florian Jäger

"System Design Results for an Air Taxi Concept in HorizonUAM"

Florian Jäger, Oliver Bertram

"Development of a Safe Powertrain System Architecture for the HorizonUAM Air Taxi Concept"

Patrick Sieb

"Maintenance Considerations for Urban Air Mobility Vehicles"

Boeing successfully completes test flight of air taxi prototype

Source: USA today

Flying cars could become reality by end of decade, top industry boss claims

Source: The Mirror

Volocopter Commits to Launch Air Taxi Services in Singapore

Source: Eco-aviation.org

Paris will use FLYING TAXIS to shuttle sports fans across the city during the 2024 Olympic Games, officials claim
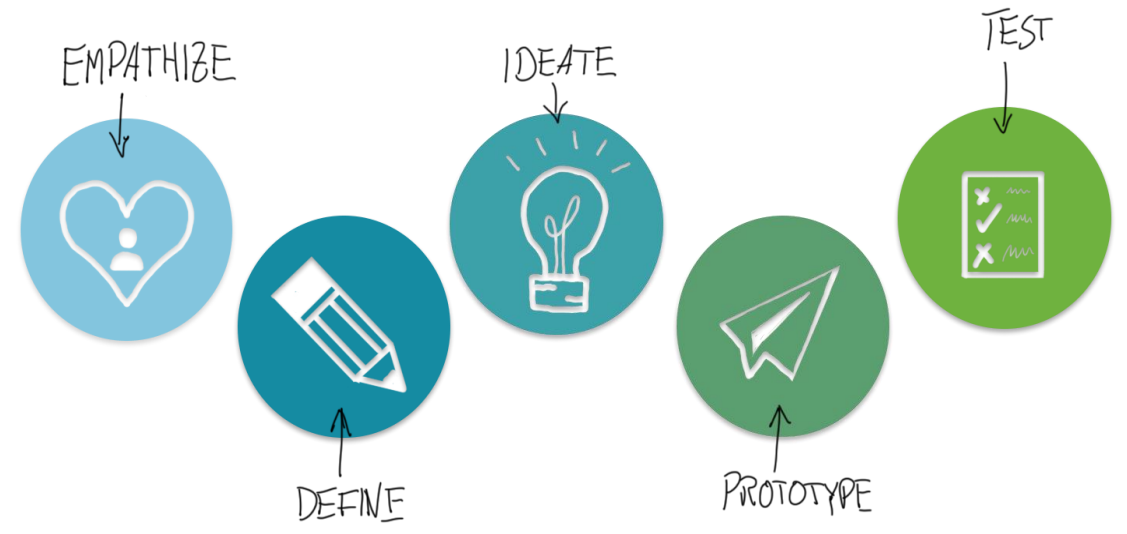
Source: Daily Mail

FUTURE OF TRANSPORTATION

The New York Times

Taxi! To the Airport — by Air, Please.

Several companies are betting they can bring electric urban air travel to the masses — perhaps within the next few years.

Source: The New York Times

Tokyo start-up shows off manned flight of its flying car

Source: The Asahi Shimbun

User Centered Design – Why?

Flexible User Needs

- Travel preferences highly **individual** and constantly changing
→ **User centric design** approach for flexible solutions

Design Thinking

- **Understanding** the users needs, fears and wishes
- **Involve** the user in the early design process

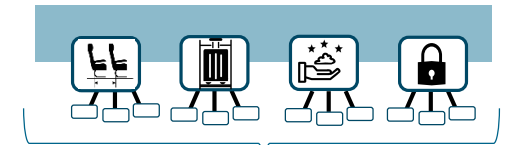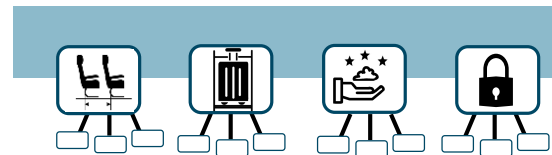# User Research – The Journey in Horizon UAM
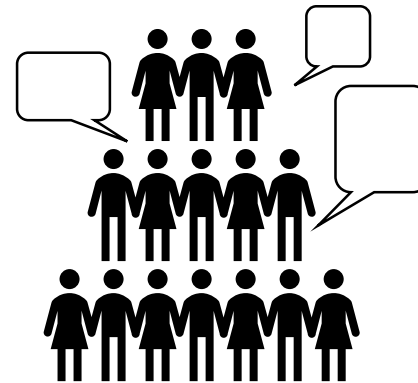

July 2020

Kickoff

December 2020

Focus Group Study

June 2021

Onlinesurvey

December 2022

UAM Symposium

A User-Centered Cabin Design Approach to Investigate Peoples Preferences on the Interior Design of Future Air Taxis, Maria Stolz et al. (2021), DASC Conference 2021, San Diego, USA
Safety & Privacy in Urban Air Mobility (UAM) – A User Centric Design Approach Providing Insights into People´s Preferences for UAM Cabin Designs, F.Reimer et. al (2021),AHFE 22, New York City, USA
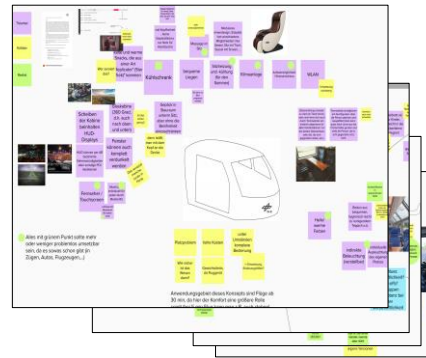
User & Mission Requirements

Personas

Clara Meyer

Gender: Female, 19 yrs.
Job: Student
Income: <10k/year
Residence: Berlin (City)

Tim Claussen

Gender: Male, 35 yrs.
Job: Consultant
Income: 90k/year
Residence: Trittau (Village)

Greta Hermann

Gender: Female, 62 yrs.
Job: Teacher
Income: 75k/year
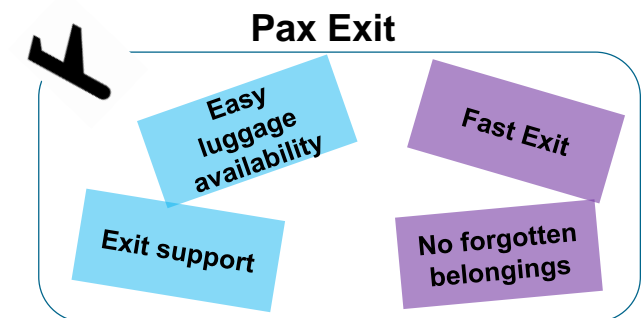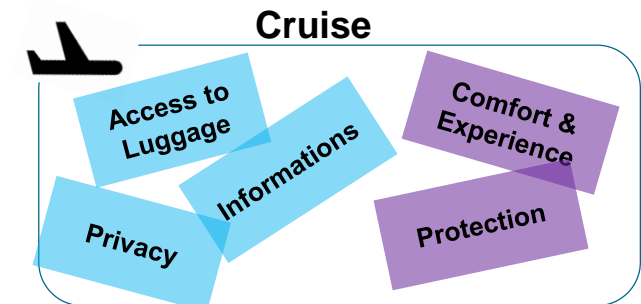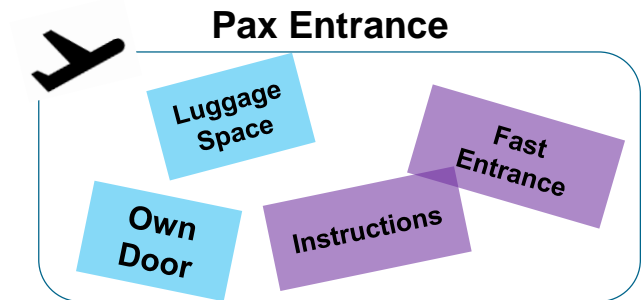**Residence:** Minden (Small town)

Use Cases

Airport Shuttle

- On-time service
- Middle distances 50 and 100 km
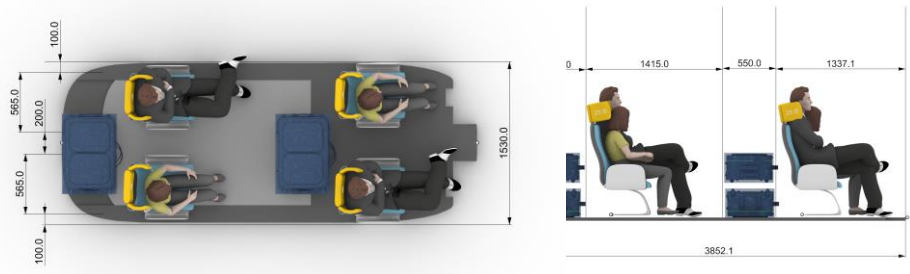- Flight between city center and airport

Intra-City

- On demand service
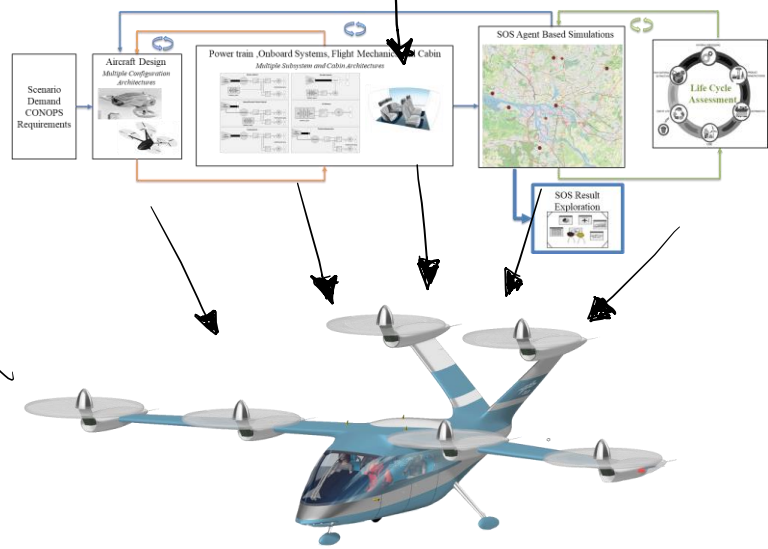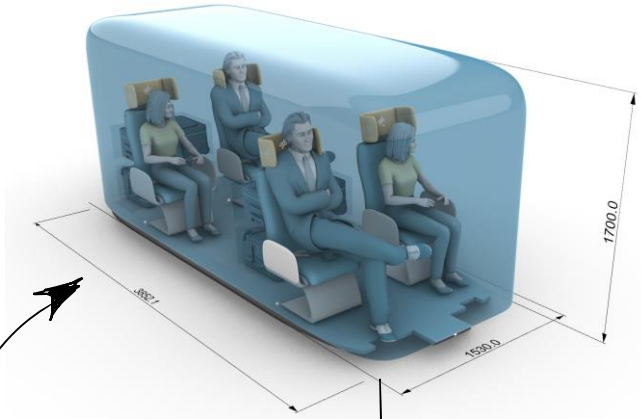- Small distances to 50 km
- Flight in central city area

User Journey

Pax Entrance

Luggage Space
Own Door
Instructions
Fast Entrance

Cruise

Access to Luggage
Informations
Privacy
Comfort & Experience
Protection

Pax Exit

Easy luggage availability
Exit support
Fast Exit
No forgotten belongings

Cabin Design Step 1: Layout Definition
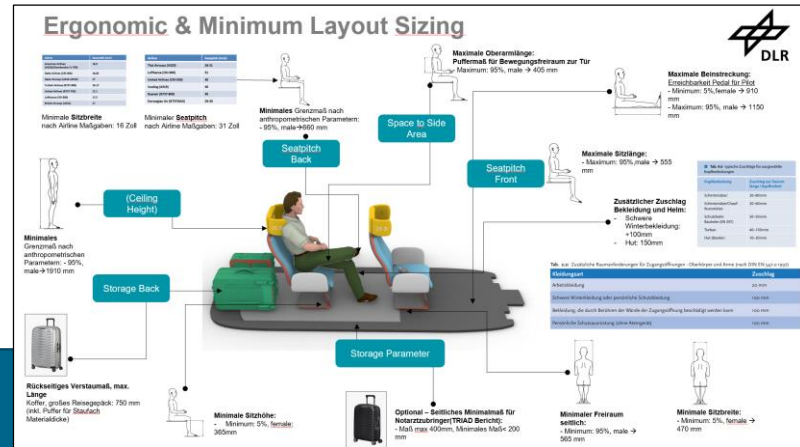
Layoutdefinition

Overall Cabin Geometry

- **Ergonomic** & **anthropometric** parameters
- First **positioning** of seats and luggage

- Integration of layout
- Input to **SoS** framework
- Multi use case vehicle **Airportshuttle/Intracity**
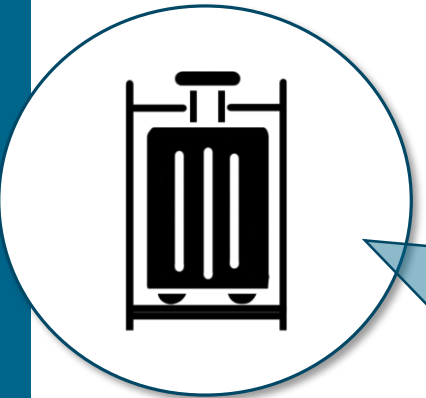
Detailed Cabin Design: Main Focus

Comfort & Experience

- Extended Outsideview
- Wheelchair accessability
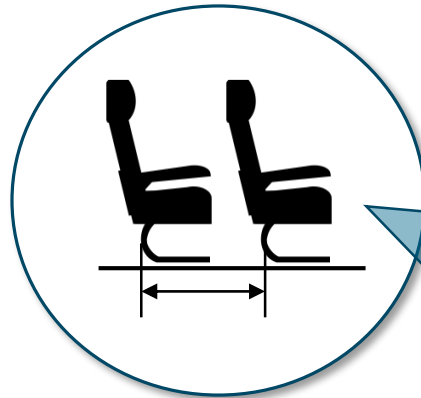- Seatcomfort **space** and individualized **privacy**

Safety & Security

- Balance between **closed compartment** and **open area**
- **Flexible** partition needed for personallized space
- Safety against **physical violence**

Luggage

- Storage **options**
- **Accessability** during flight
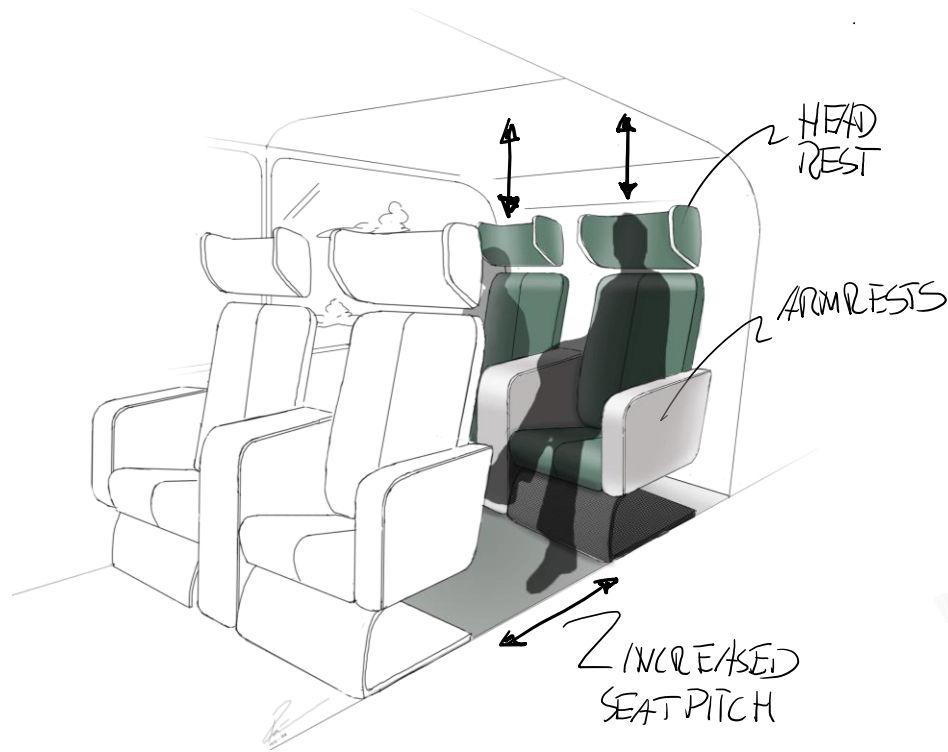- **Fast** and **easy** storage of luggage, handluggage <u>and a wheelchair</u>

Seating & Configuration

- **Legspace**, distance & privacy Lateral **communication**
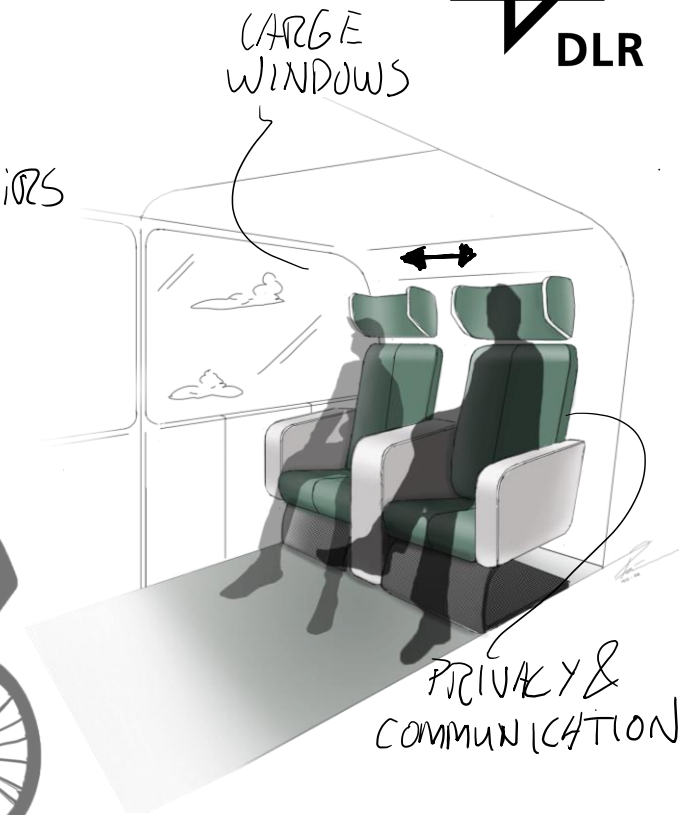- Positioning in **flight directon**

Comfort & Experience

Seat Comfort

PRM Seat

Flight Experience

- Min. **31"** seatpitch and **17"** seat width
- Comfortable seat height and **headspace**
- **Arm-** and **headrestes**

- Easy and fast storage for **wheelchairs**
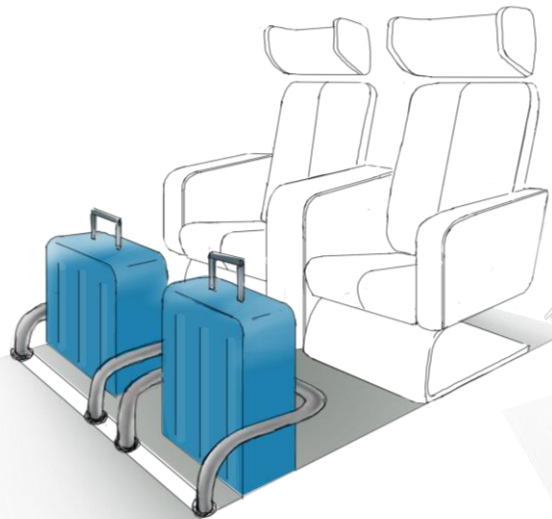- Easier **seating** process for PRM

- Large windows and **extended outside view**
- **Shared experience,** lateral communication + **privacy**

Luggage

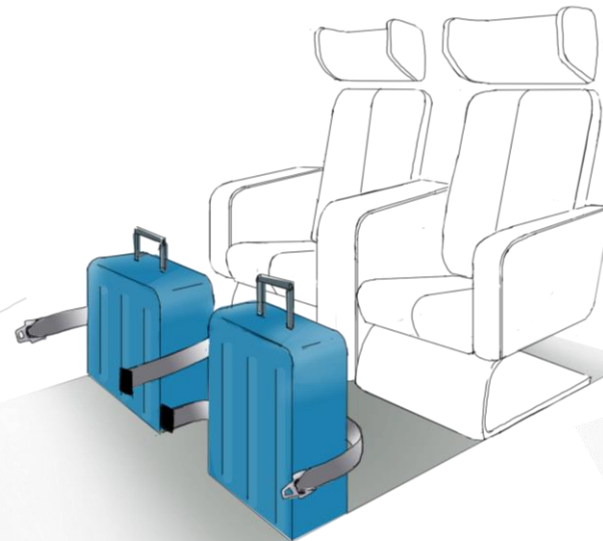## Sub Concept 1

Fixation Bars

- Full **reachability** of luggage pockets during flight
- **Easy** and **modular** integration of fixation bars

Sub Concept 2

Fixation Belt

- **Additional fixation** via belt
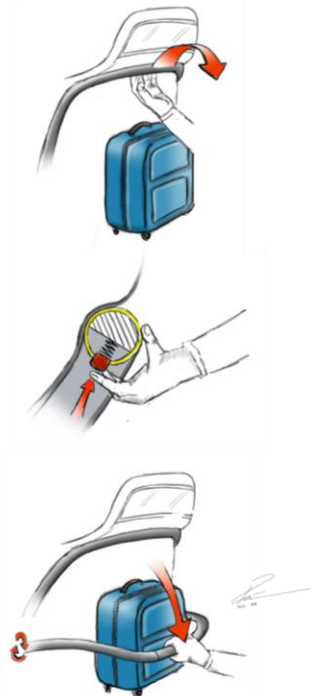- Easy and intuitiv **fixation of wheelchair**
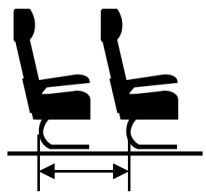
Sub Concept 3

Protection

- **Impact protection** for front seat via lightweight walls
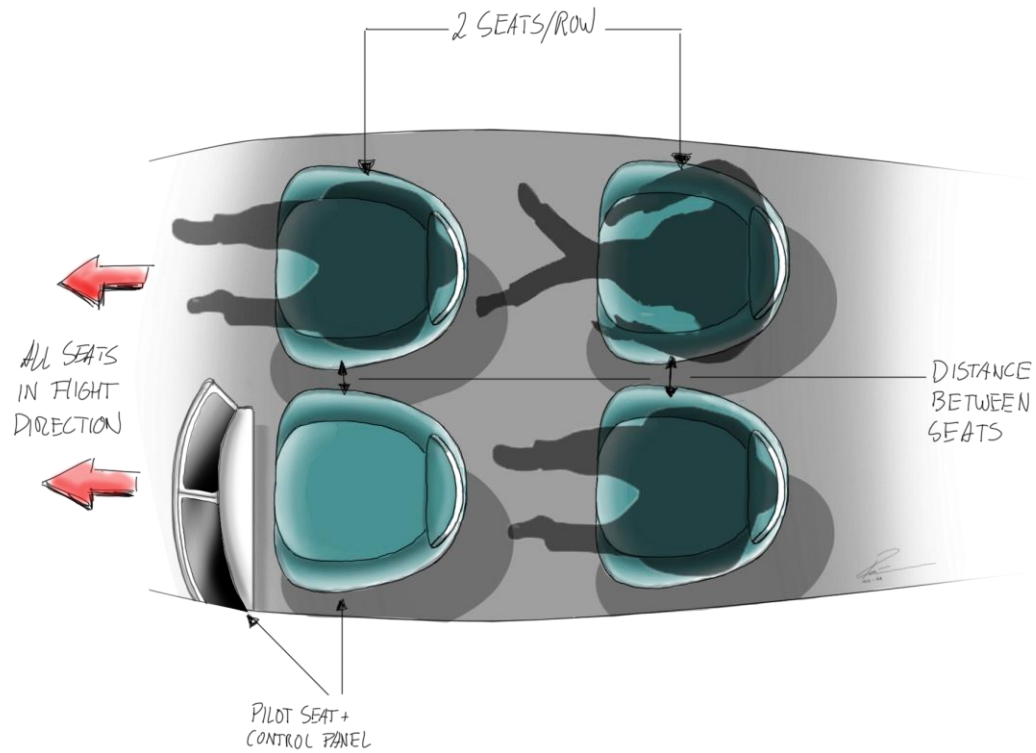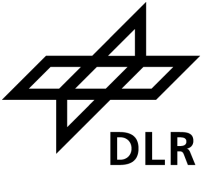
Sub Concept 4
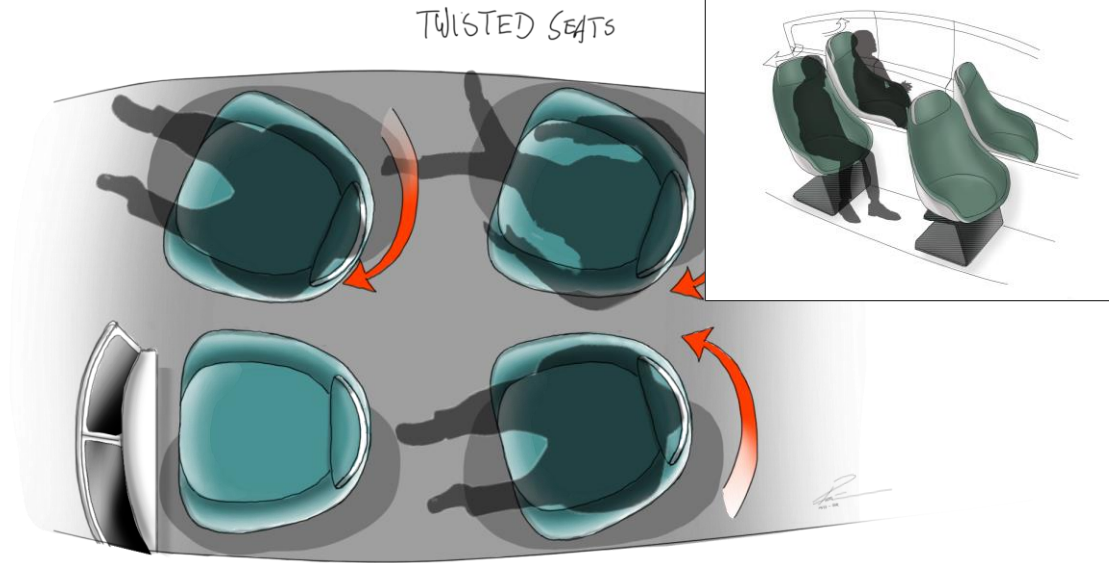
(Optional Storage Support)

- Fixation mechanism for **easy** luggage storage
- **Fast** and easy lock/unlock system

Seating and Positioning
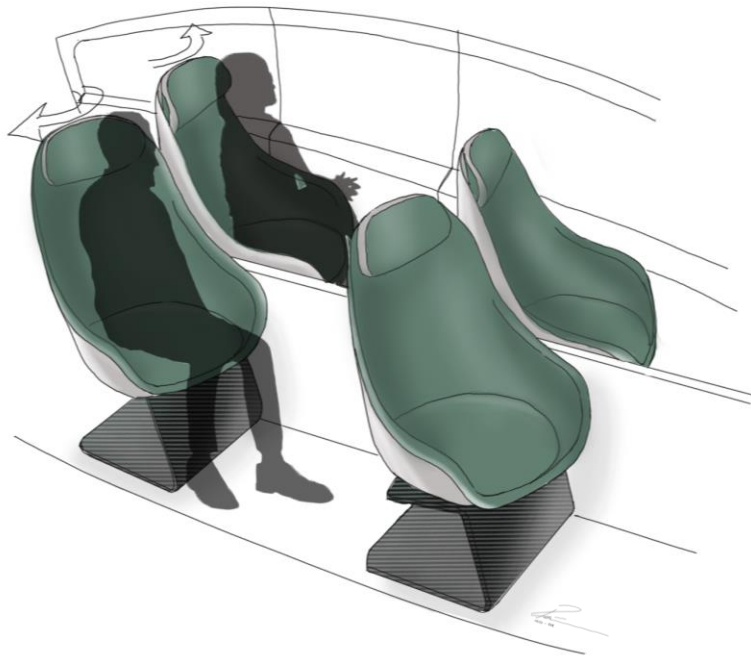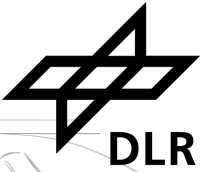

Basic Seating Arrangement

Twisted Seat

- Seat positions **in flight direction**

- 2 Seats/Seatrow, **distance** between Seats

- Pilot **visible**, optional passenger seat for future **autonomeous** approach

- Easy **entrance** and **seating** process
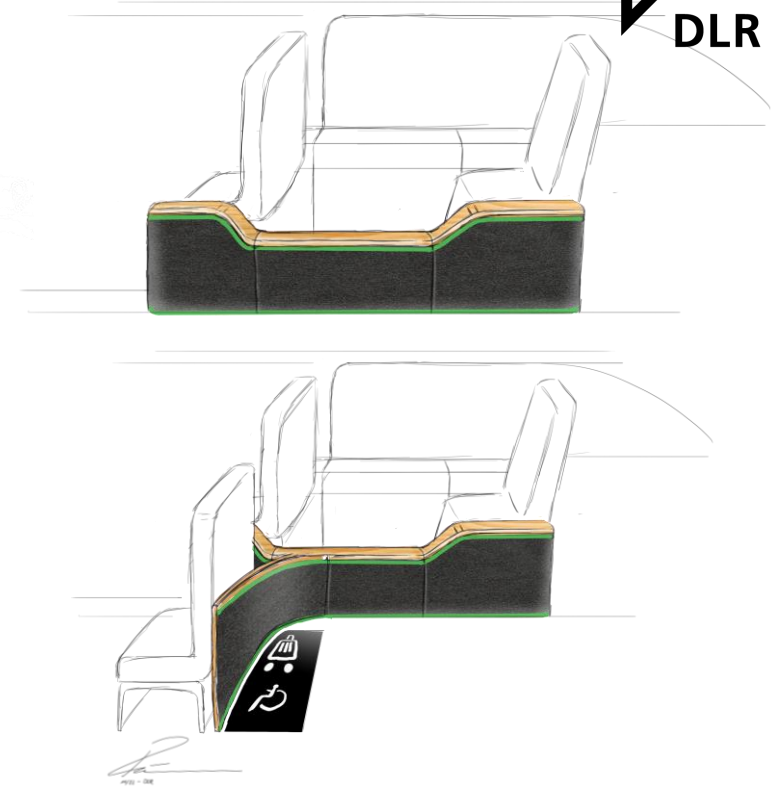
- Extended outside **view**

Safety & Security

Turned Seat

- Increased **privacy** without partition wall and full separation
- **Communication** optional possible in lateral direction

Headrest and Protection

- „U-Shaped" and **flexible** face **protection** via headrest in addition to turned seats
- Integrated noise cancelling optional
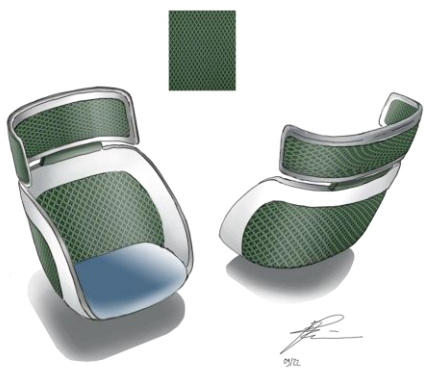
Separation Module

- Partially separated areas by using a **subtle separation** concept (comparable to automotive)
- Combination of **separation** module and seat **protection**

DLR

Airportshuttle/Intracity – Cabin Concept

Seat Concept - Details


HORIZON
UAM

HORIZON
UAM

DLR

© DLR 2022

Seat Concept - Perspective

Conclusion & Outlook

- Early involvement of user
→ Effective approach for UAM Cabin concepts
→ Positive feedback of user and high potential to raise the level of acceptance

- Digital and multifunctional cabin concept (two Use Cases) covering main user requirements

- **MS 2.4.3:** Detailed and finalized cabin concept ready
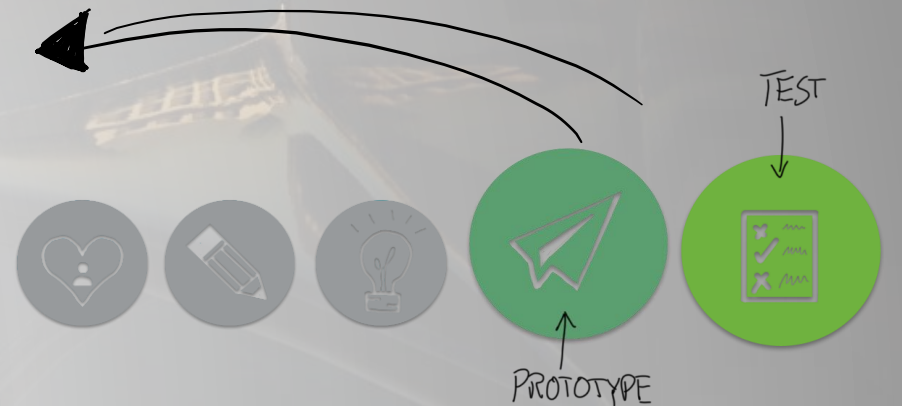
Air Taxi Vehicle, Systems and Cabin Concepts
Presentation Overview

Fabian Reimer, Thomas-M. Bock, Line Winkler, Frank Meller, Björn Nagel

"Urban Air Mobility – Insights into the Virtual and User Centric Design Process for a Future eVTOL Cabin Concept"
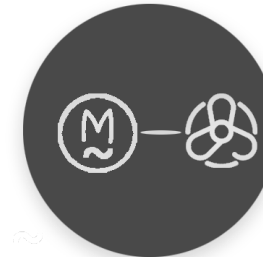
Patrick Ratei, Nabih Naeem, Prajwal Shiva Prakasha

"Fleet-Centric Vehicle Design Space Explorations of Urban Air Mobility by System of Systems Simulations"

Oliver Bertram, Florian Jäger

"System Design Results for an Air Taxi Concept in HorizonUAM"

Florian Jäger, Oliver Bertram

"Development of a Safe Powertrain System Architecture for the HorizonUAM Air Taxi Concept"

Patrick Sieb

"Maintenance Considerations for Urban Air Mobility Vehicles"

Thanks for your attention!

German Aerospace Center e.V. (DLR)

Cabin & Cargo Concept Design
+49 40 2489641 370
Fabian.Reimer@dlr.de

More Infos about HorizonUAM?

DLR