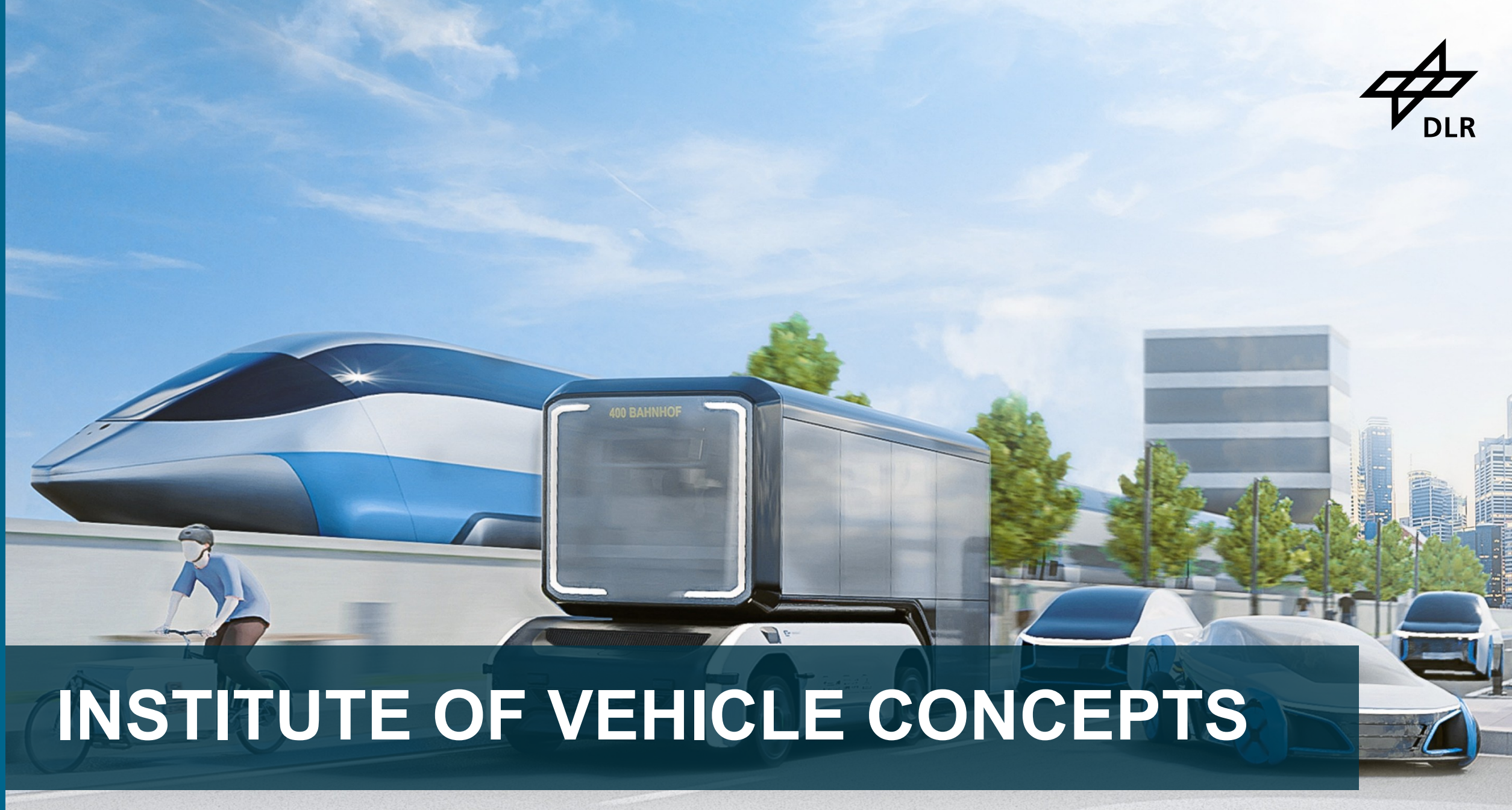
U-SHIFT: MODERN CHALLENGES OF A LEVEL 4 SELF-DRIVING MODULAR VEHICLE

Eric Pohl, German Aerospace Center, Institute of Vehicle Concepts, Stuttgart

ADAS & Autonomous Vehicle Technology Expo Europe

DLR



INSTITUTE OF VEHICLE CONCEPTS

Eric Pohl, German Aerospace Center, FK-FLK, 04/2025

We shape the mobility of the future – sustainable, cost-effective and user-oriented



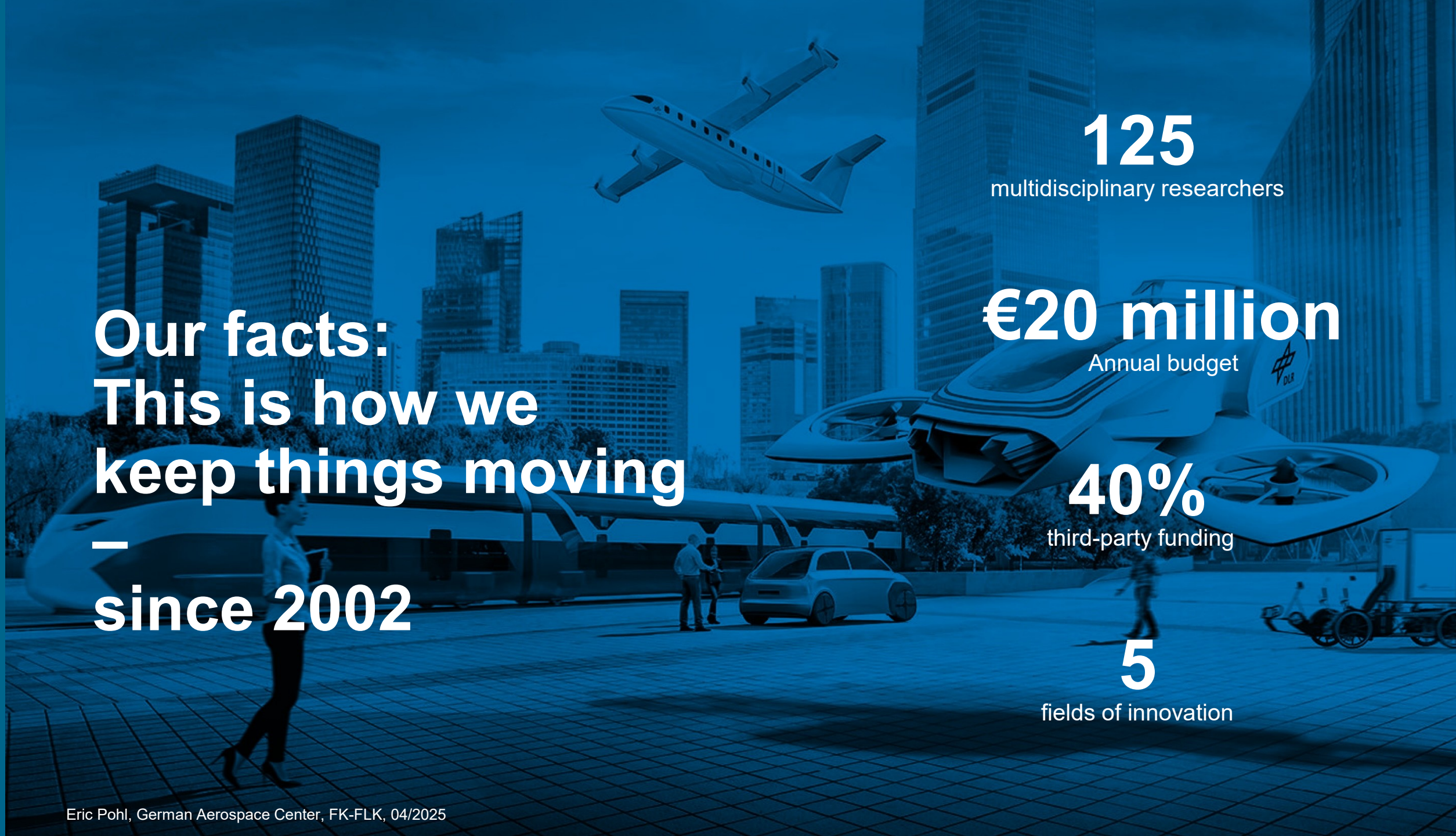
PROTECTING THE CLIMATE



SECURING MOBILITY



SHAPING TRANSFORMATION



Our facts: This is how we keep things moving – since 2002

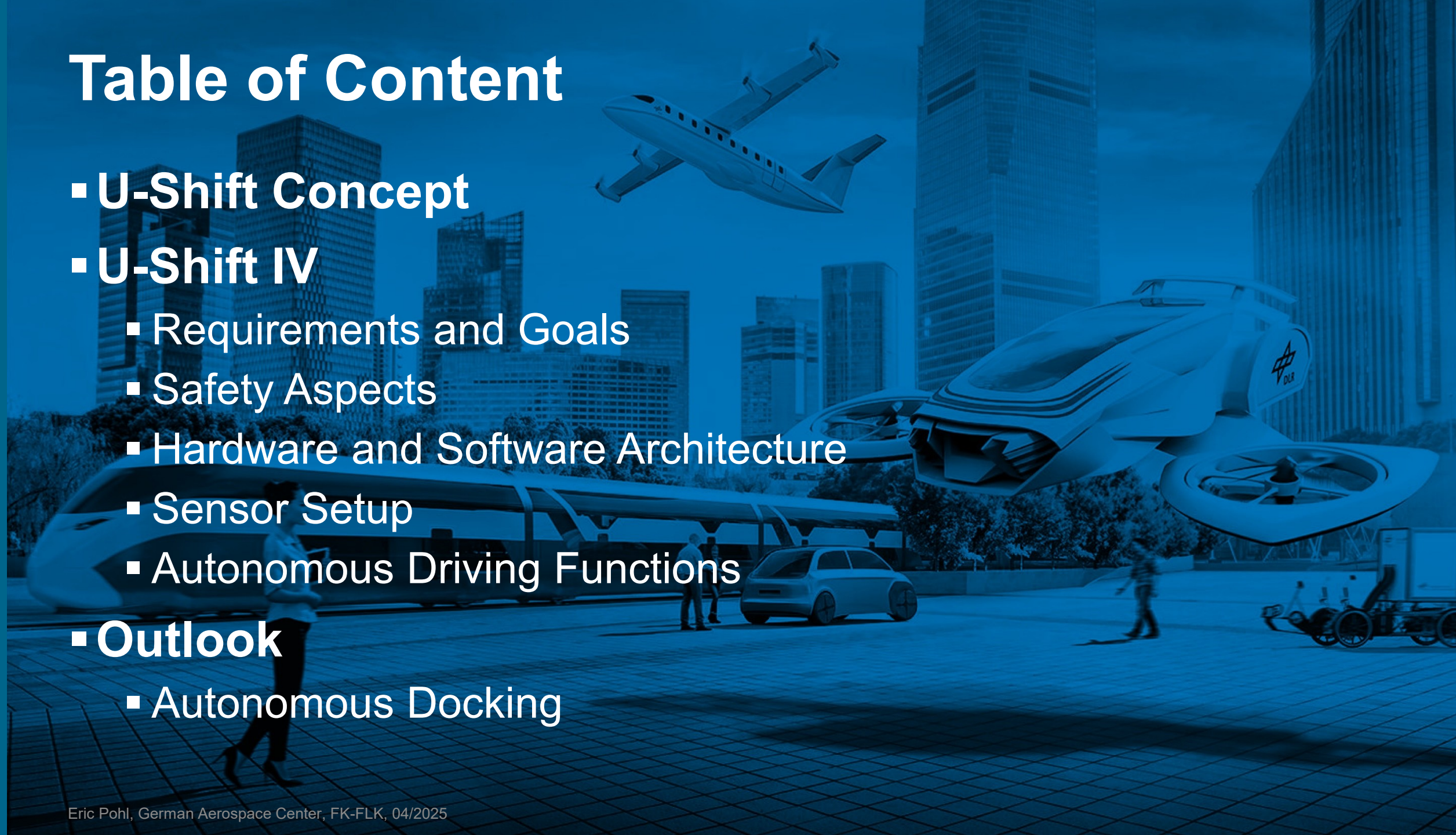
125
multidisciplinary researchers

€20 million
Annual budget

40%
third-party funding

5
fields of innovation

Table of Content



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  - Requirements and Goals
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- **Outlook**
  - Autonomous Docking

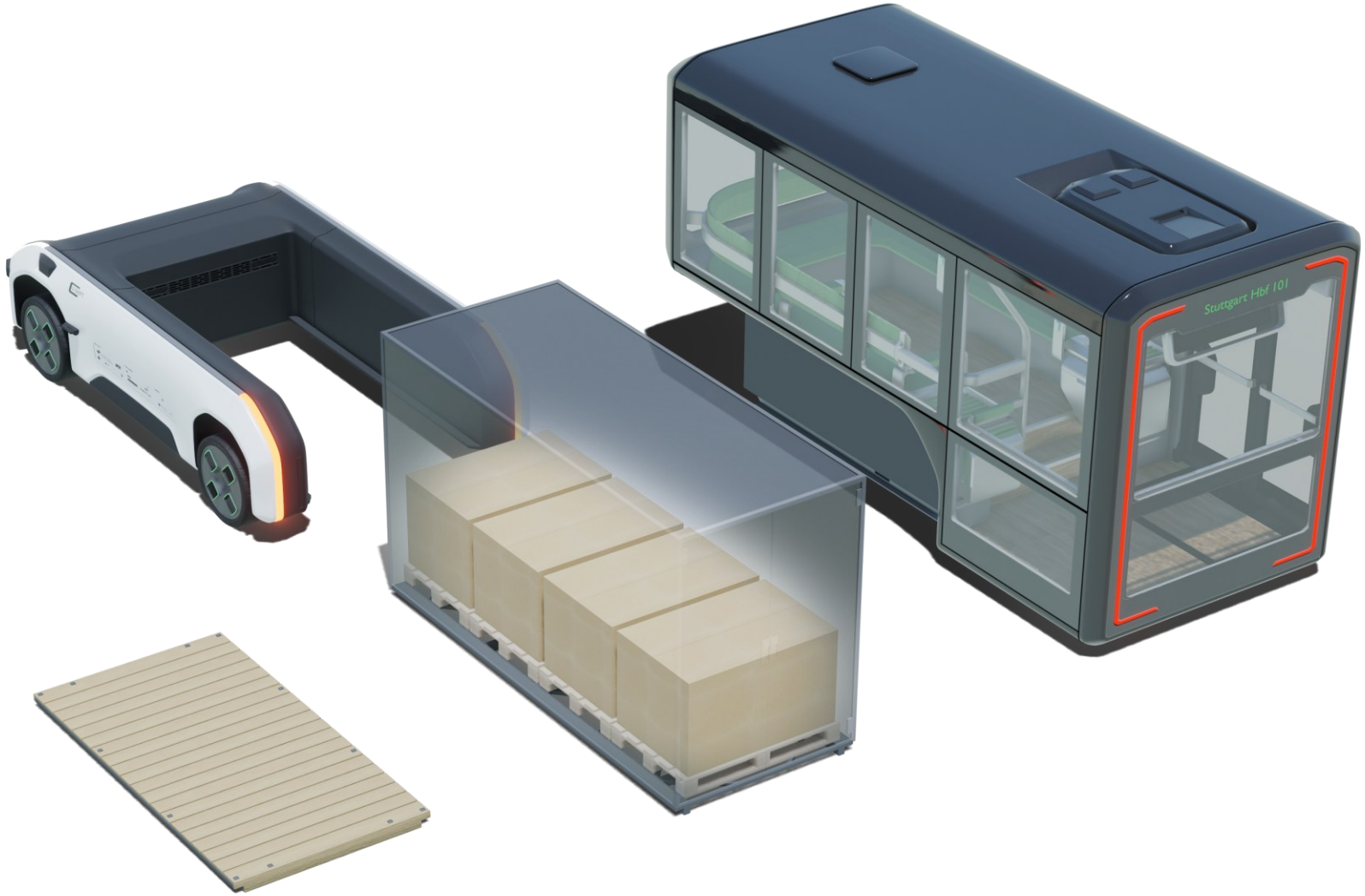


U-SHIFT – MODULAR ON-THE-ROAD

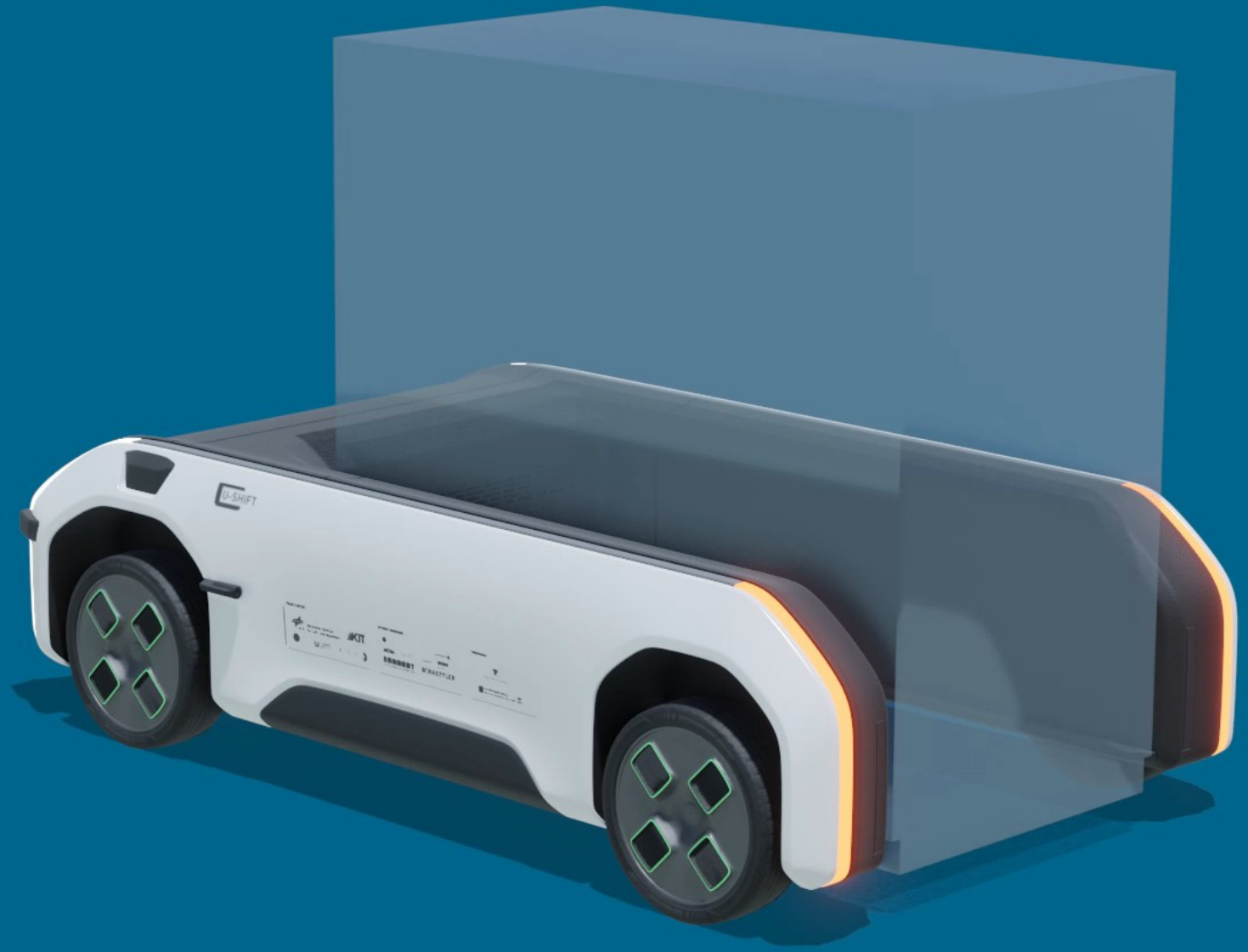
Eric Pohl, German Aerospace Center, FK-FLK, 04/2025

The U-Shift Concept

Urban
50-70 km/h
24/7 Service
Multiple Tasks
On-Demand



The U-Shift Concept



U-Shift Application











U-SHIFT IV – FIRST ON THE ROAD

Federal Garden Show 2023

Spinelli Area Plan



DLR U-Shift Pavillon

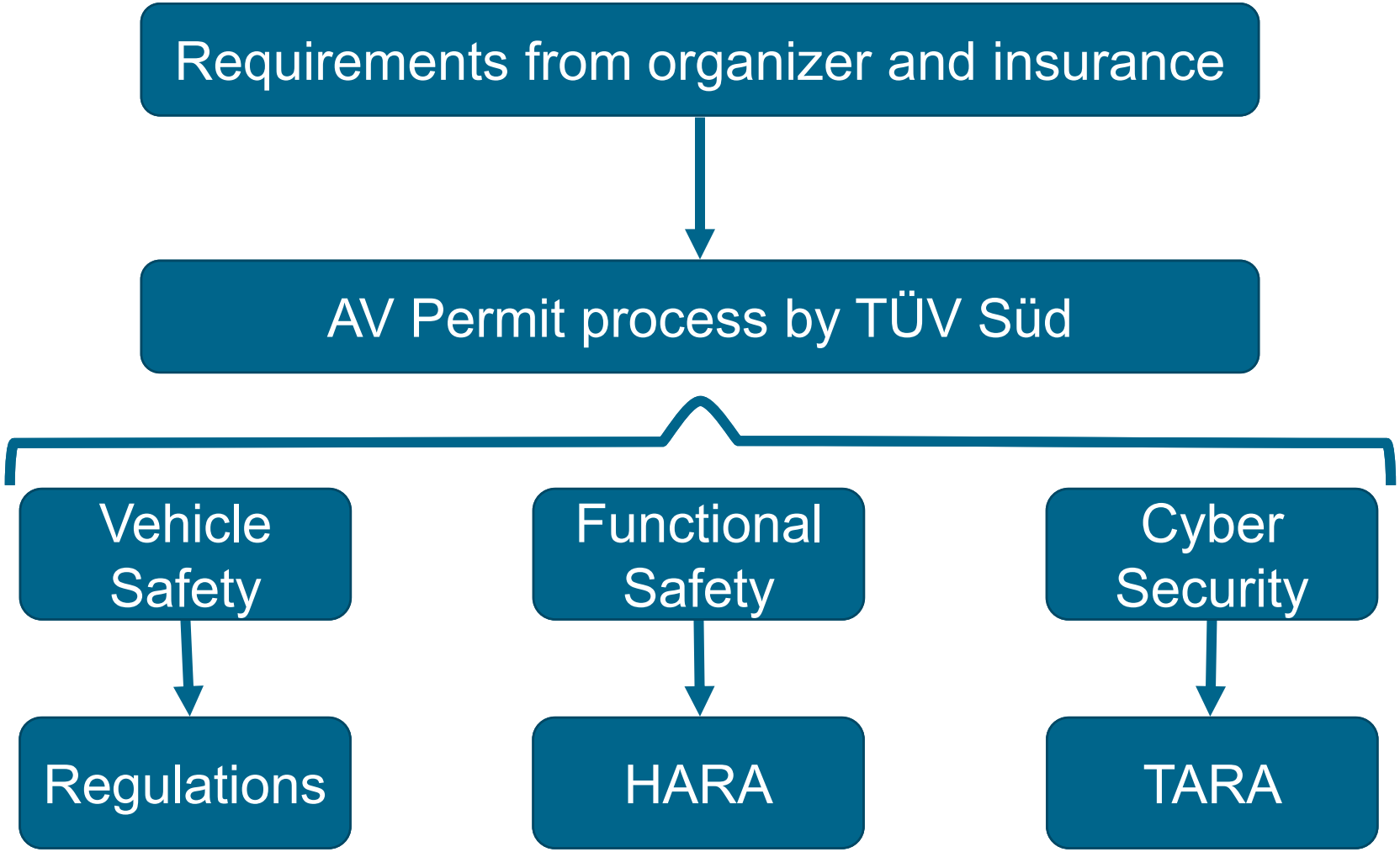


U-Shift Vehicles



BUGA23 Spinelli Area © Bundesgartenschau Mannheim 2023

Federal Garden Show 2023 – Requirements



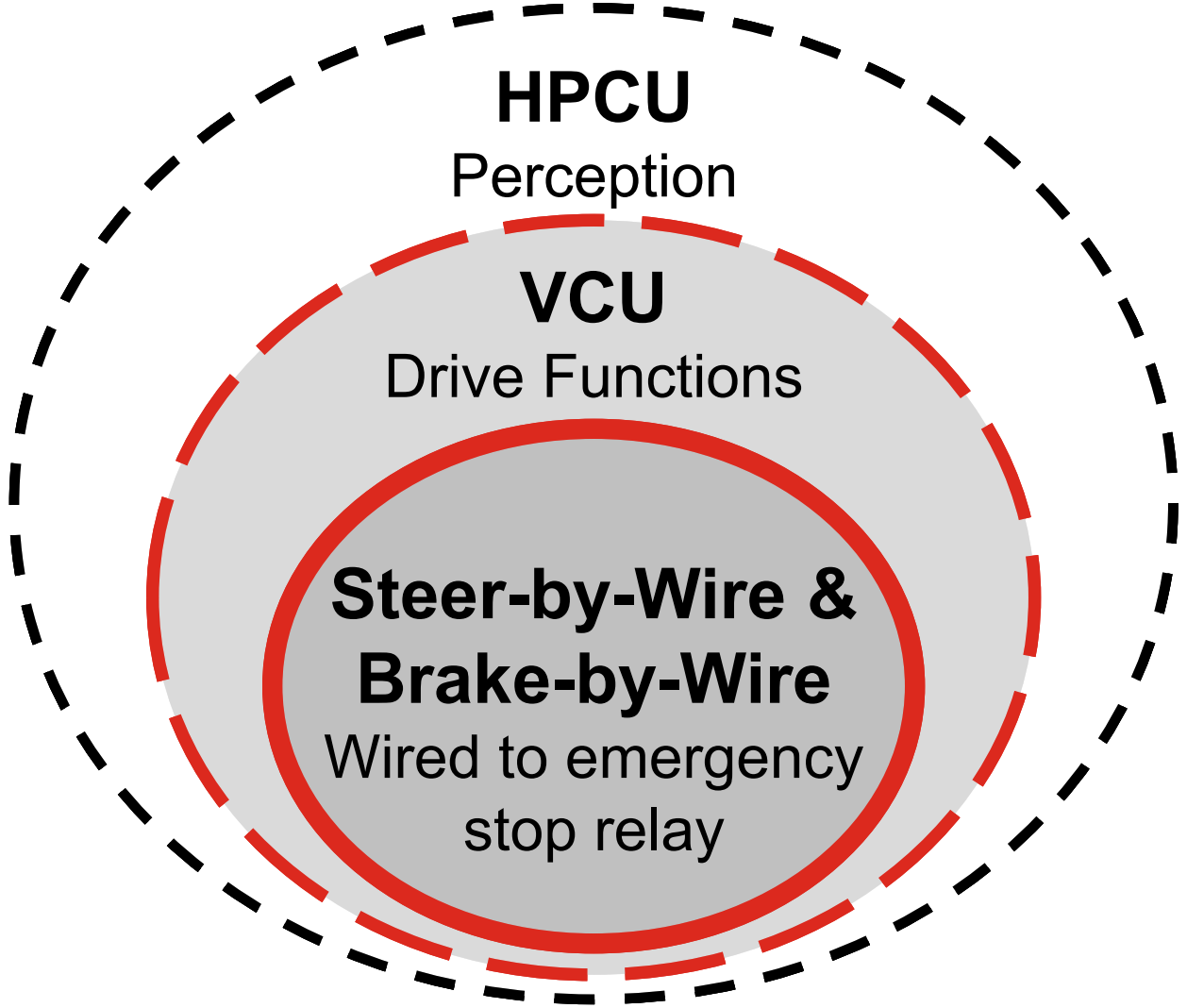
TÜV Süd AV-Permit framework (https://www.tuvsud.com, last accessed 2023/09/27)

Federal Garden Show 2023 – Safety Goal



U-Shift IV – Hardware & Software Architecture

- Automotive grade component selection
- Outer Layers
  - Low Safety Requirements
  - Limited vehicle control
- Inner Layer
  - High Safety Requirements
  - Direct vehicle control





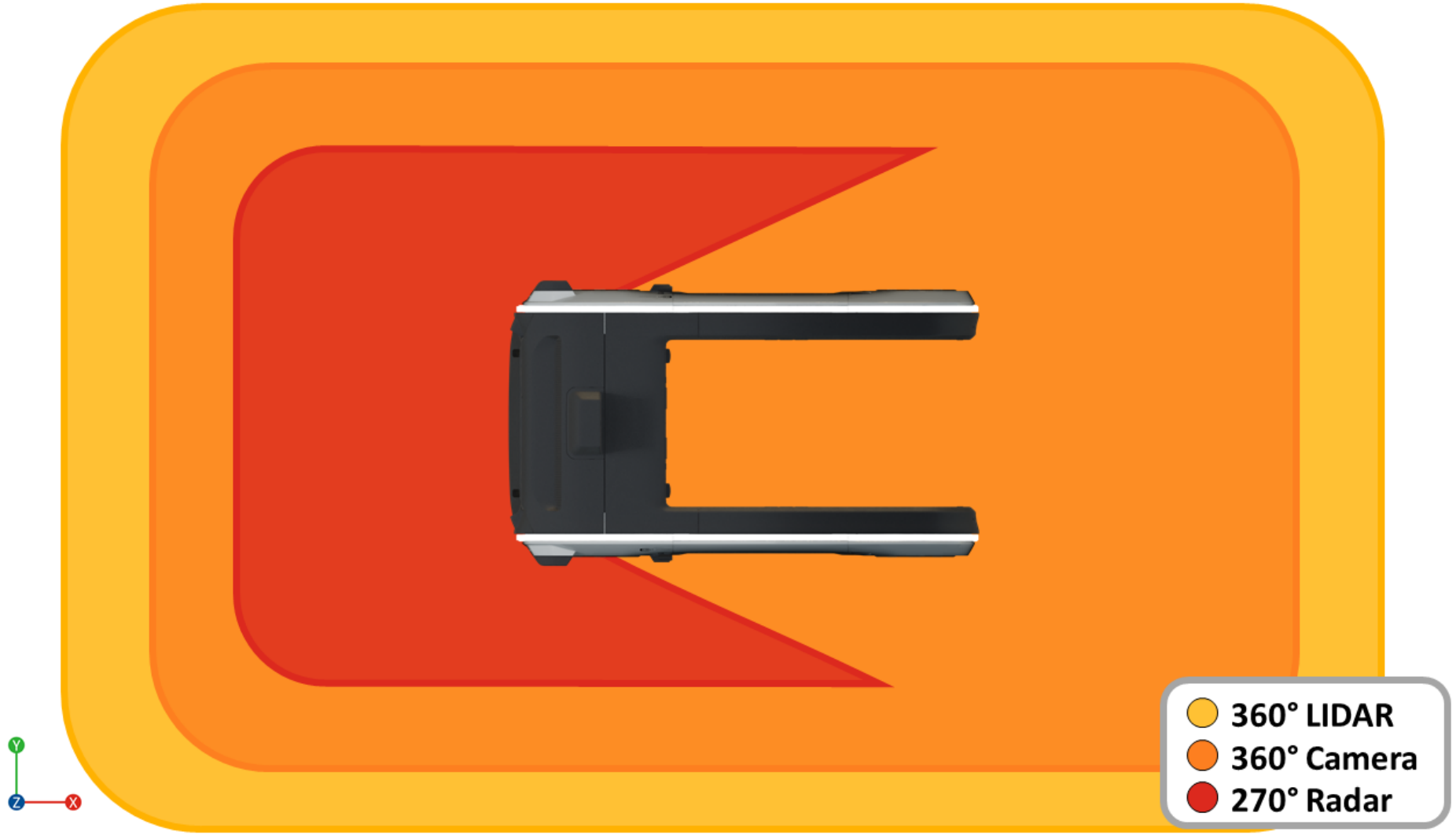
U-SHIFT IV – SENSOR CONFIGURATION

Eric Pohl, German Aerospace Center, FK-FLK, 04/2025

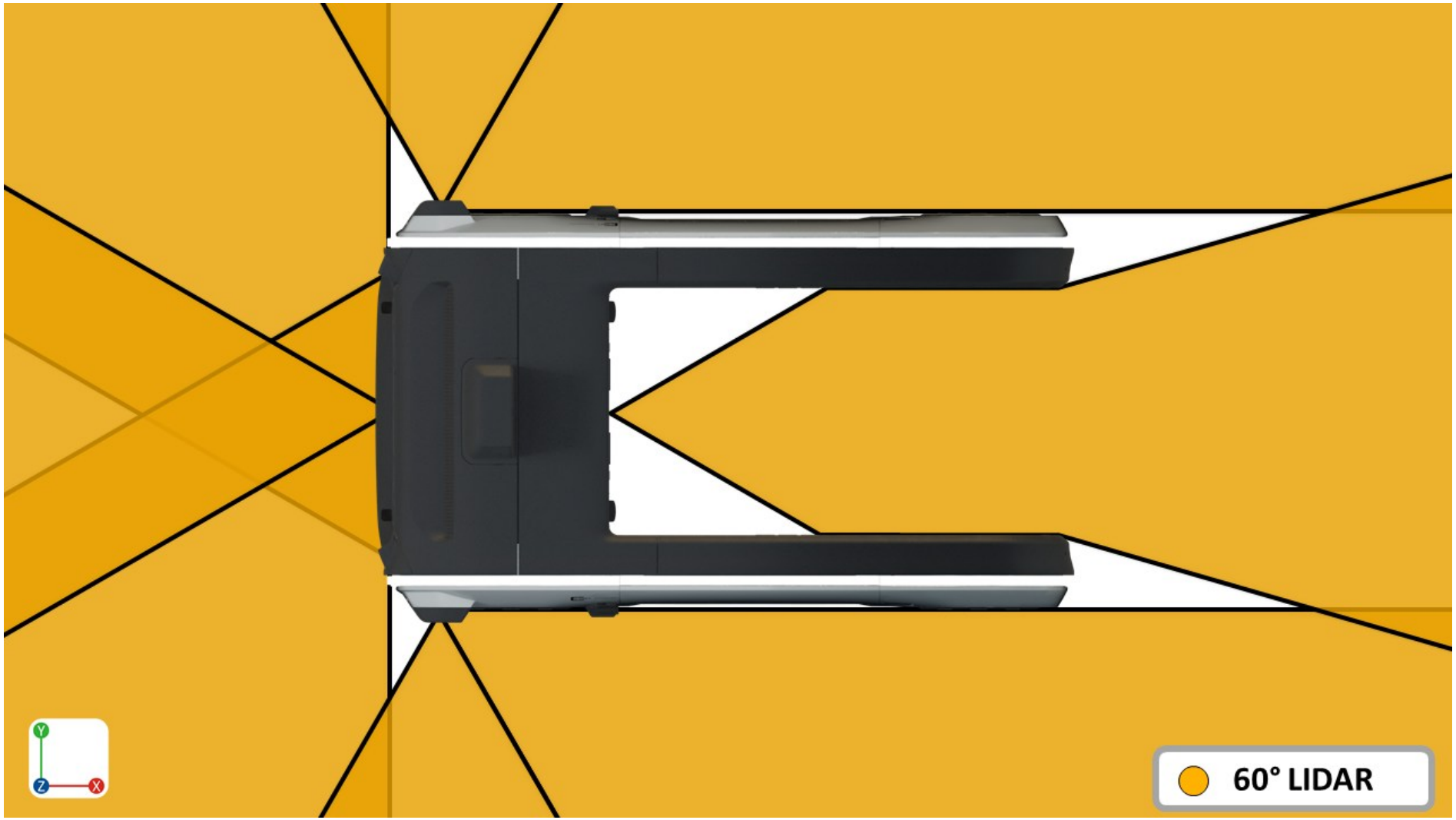
U-Shift IV – Multi-Modal Perception Configuration



U-Shift IV – Multi-Modal Perception Architecture



U-Shift IV – LIDAR Setup



U-Shift IV – Camera Setup



U-Shift IV – Radar Setup



130° Radar

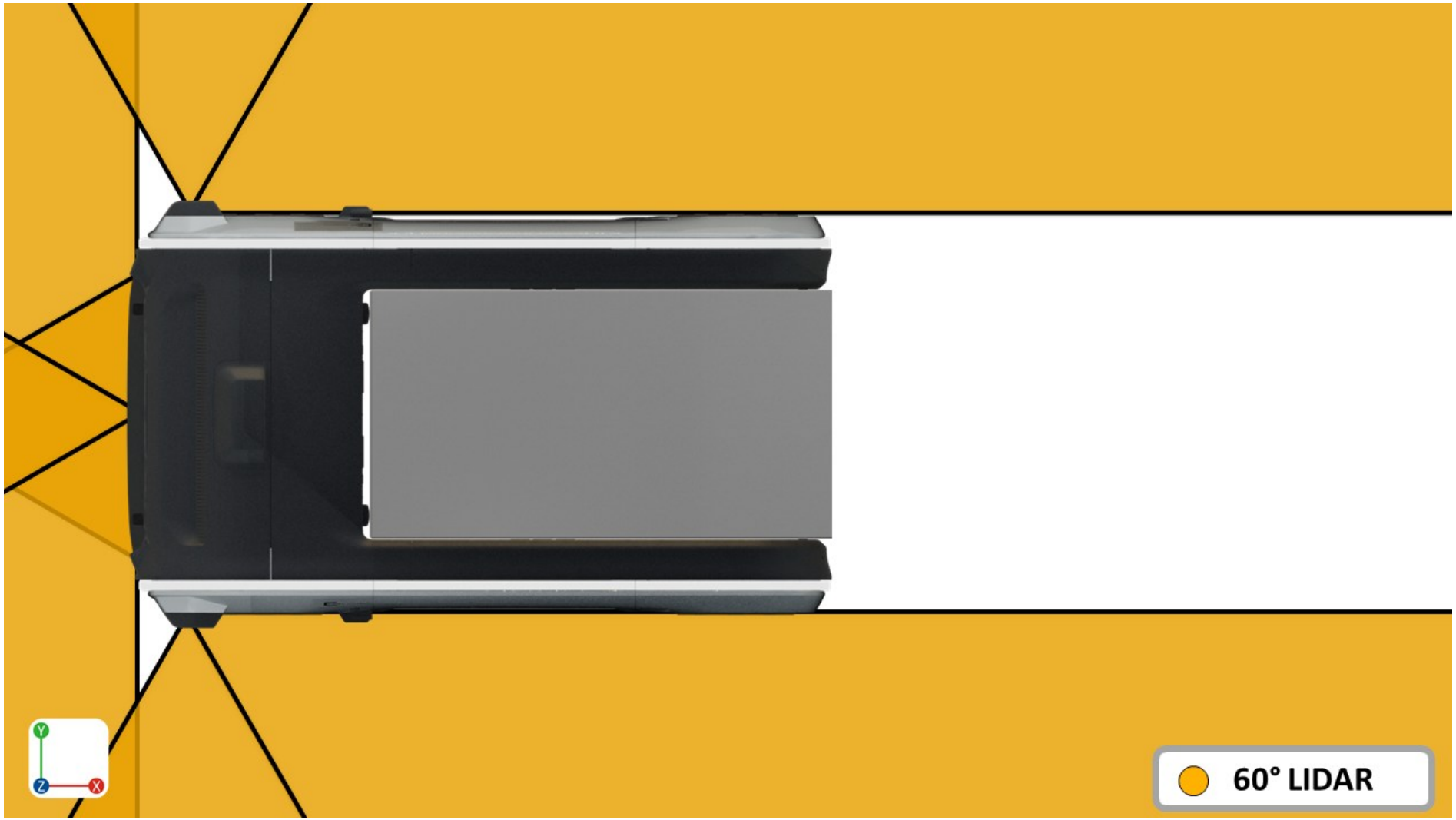
U-Shift IV – Sensor Occlusion



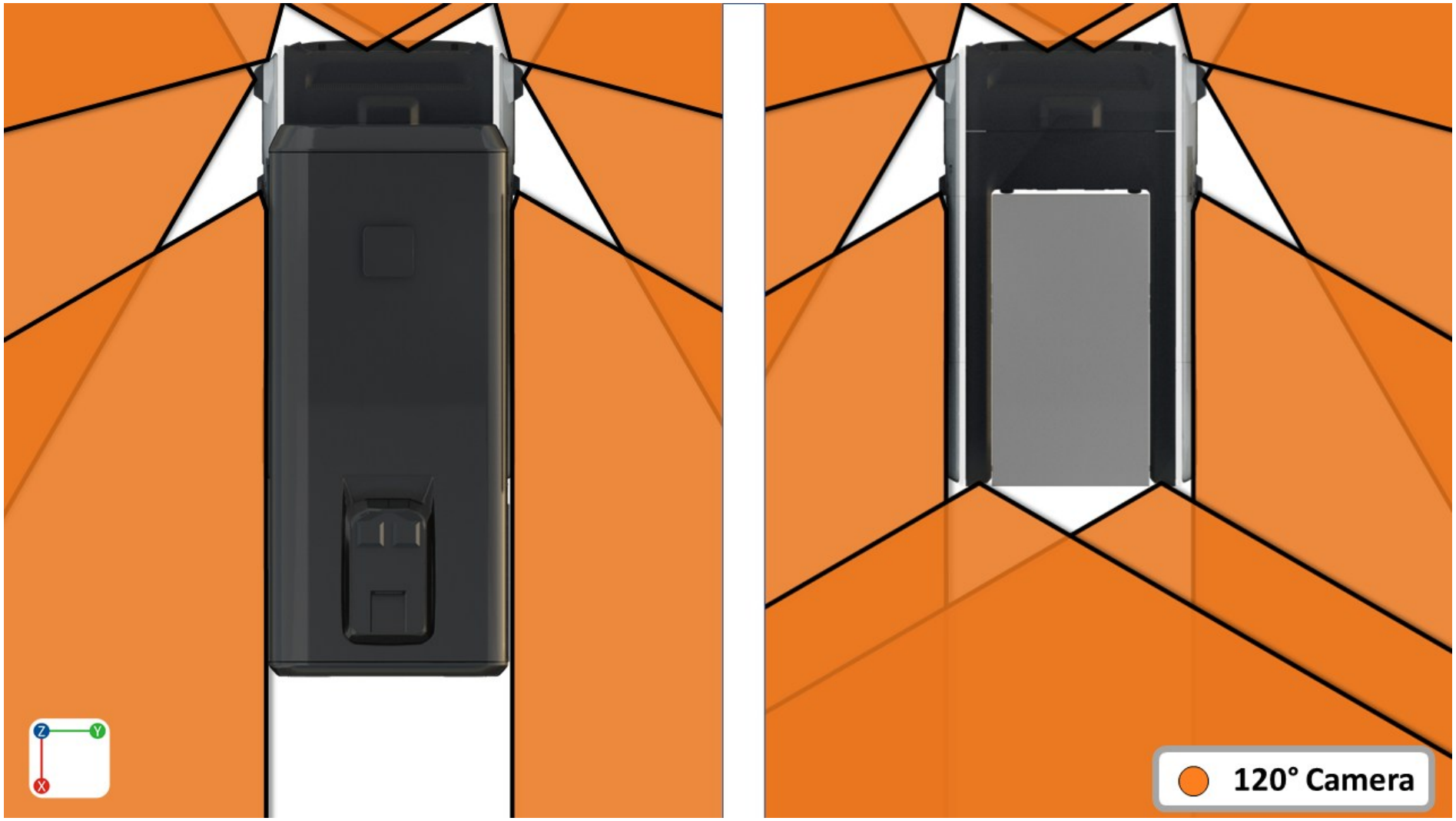
U-Shift IV – Sensor Occlusion



U-Shift IV – Sensor Occlusion



U-Shift IV – Sensor Occlusion



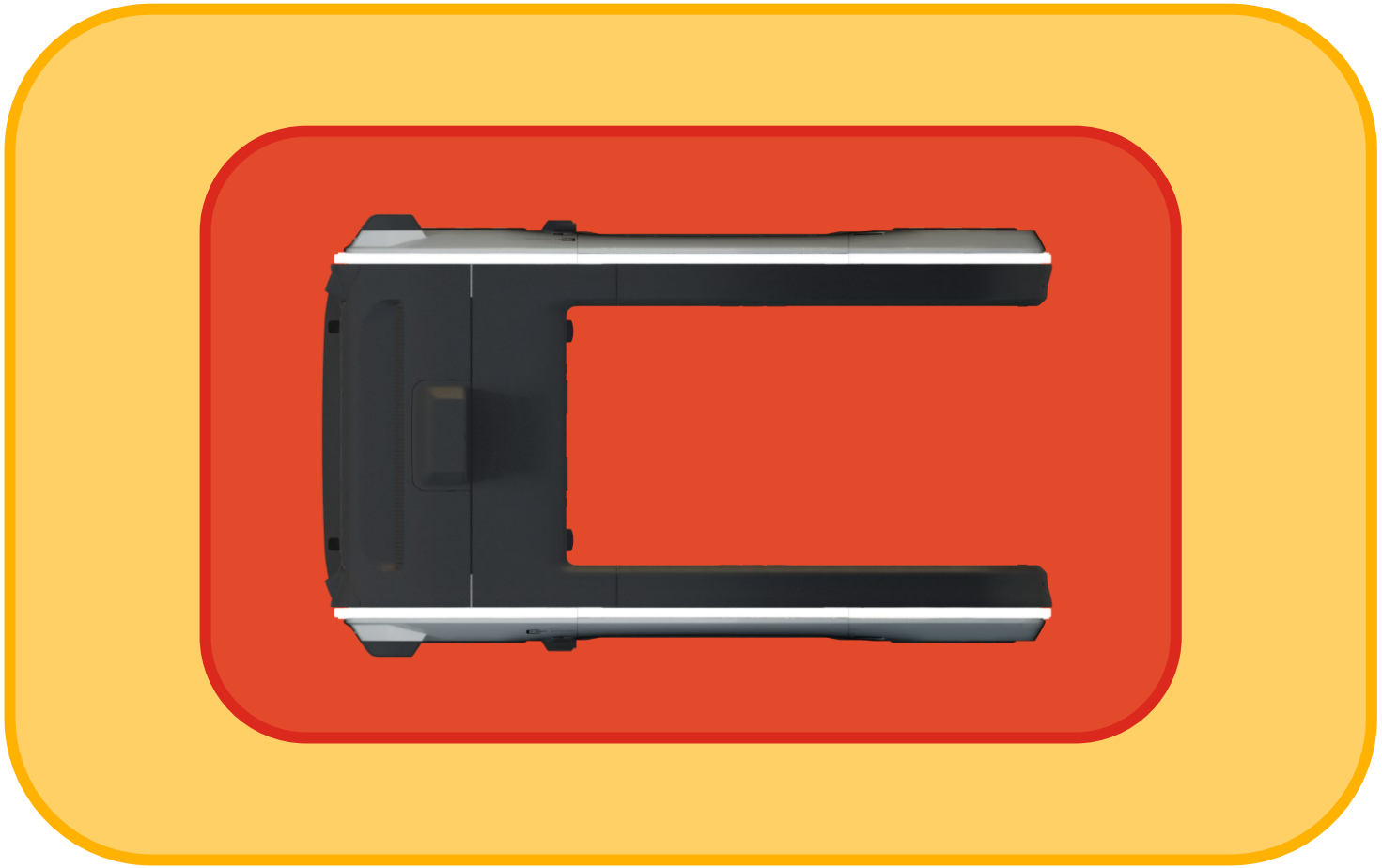


U-SHIFT IV – AD-STACK

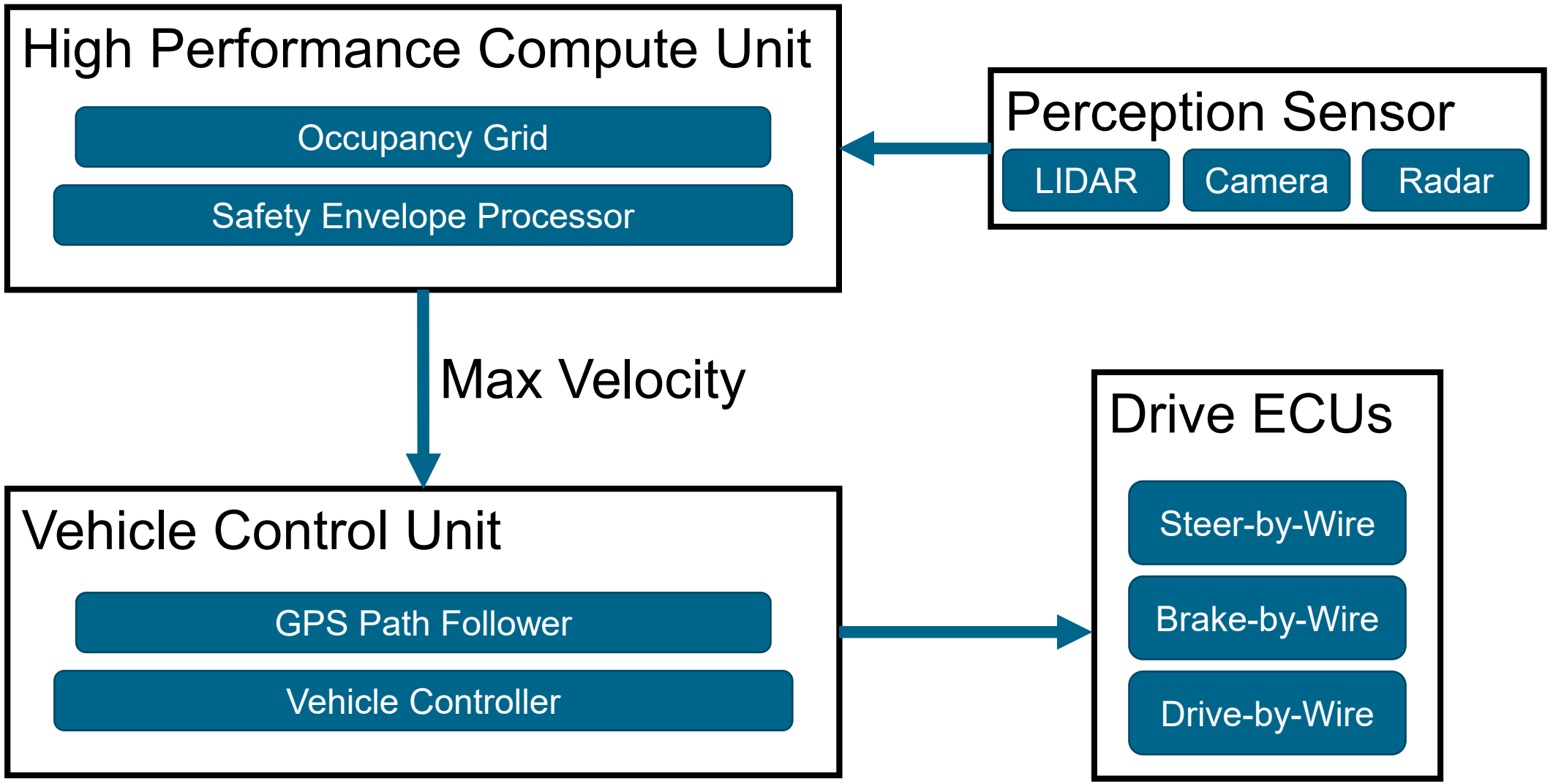
Eric Pohl, German Aerospace Center, FK-FLK, 04/2025

U-Shift IV – AD-Functions

- RTK-GPS Path Follower
- Occupancy Grid with Safety Envelope
- Max velocity interface



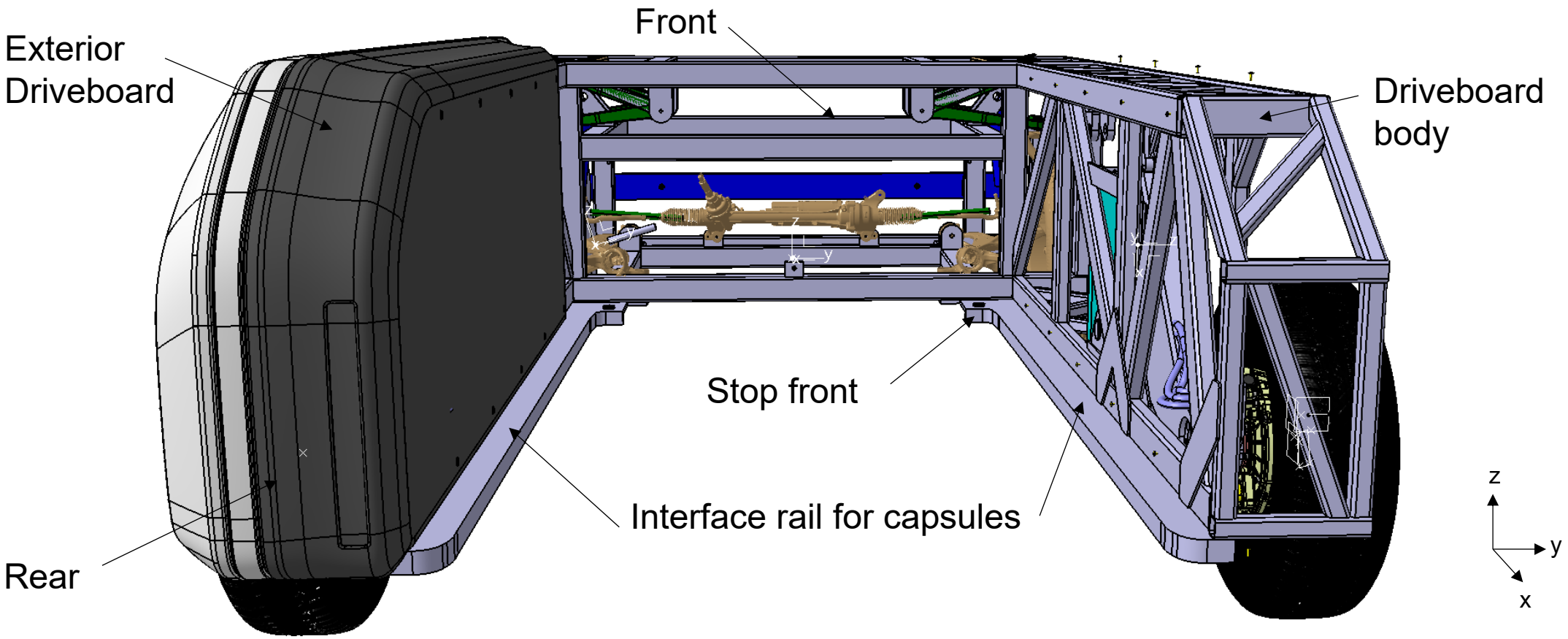
U-Shift IV – AD-Architecture





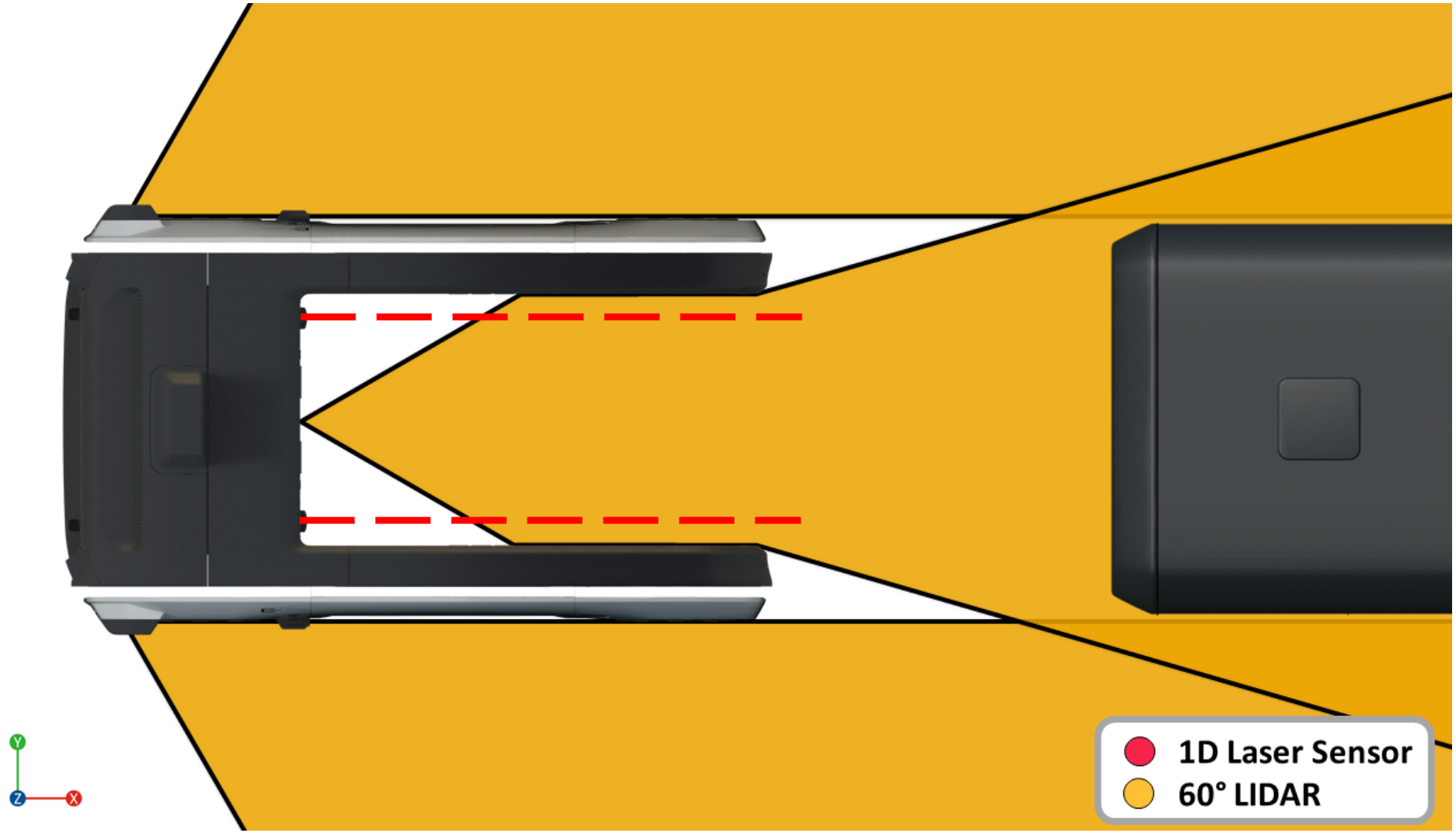
U-SHIFT IV - OUTLOOK

U-Shift IV – Automated Docking



Münster, Marco; Siefkes, Tjark; ... (2021) U-Shift vehicle concept: modular on the road. In: 21st Internationale Stuttgarter Symposium Automobil- und Motorentechnik, 30.-31. März 2021, Stuttgart.

U-Shift IV – Automated Docking



THANK YOU



Imprint

Topic:	U-Shift: modern challenges of a Level 4 self-driving modular vehicle ADAS & Autonomous Vehicle Technology Expo Europe May 20-22, 2025, Stuttgart, Germany
Date:	May 21, 2025
Author:	Eric Pohl
Institute:	Institute of Vehicle Concepts
Credits:	All pictures „DLR (CC BY-NC-ND 3.0)“ if not stated otherwise