CARL VON OSSIETZKY universität OLDENBURG

OFFIS INSTITUT FÜR INFORMATIK

DLR Deutsches Zentrum für Luft- und Raumfahrt e.V. in der Helmholtz-Gemeinschaft

IMoST Integrated Modelling for Safe Transportation

Die IMoST2-Vision:
Stand und nächste Schritte

PD Dr. Frank Köster

Deutsches Zentrum für Luft- und Raumfahrt e.V.

Assistance and Automation

- Supporting the driver by advanced assistance and automation
  - raising safety
  - raising efficiency and conserve resources
  - facilitation of driving by taking over (sub-) tasks ...

- Characteristics
  - multi-layer
  - open / adaptive / cognitive / cooperative ...
  - distributed / interconnected (e.g. 802.11p and UMTS/LTE)
  - human-centered ...

Comfort/Infotainment-Layer

strategical layer (plan & navigate)

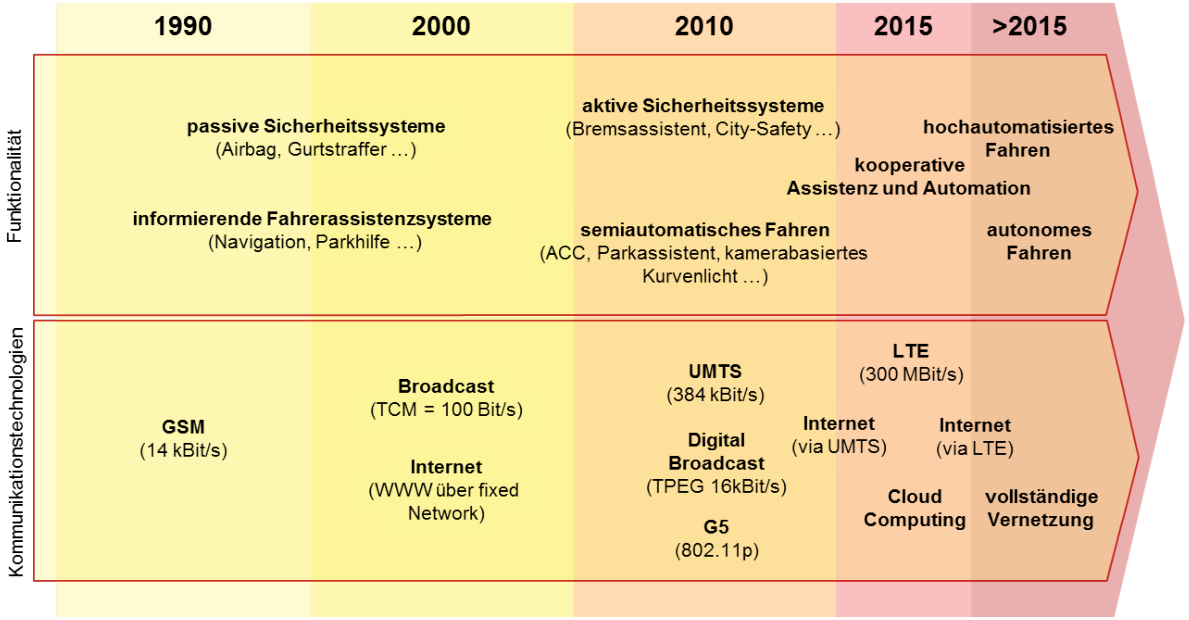
tactical layer (maneuver)

operational layer (stabilize vehicle)

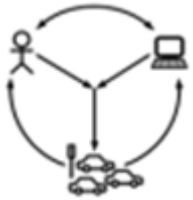
Assistance and Automation

IMoST
Integrated Modelling for Safe Transportation

- Timeline

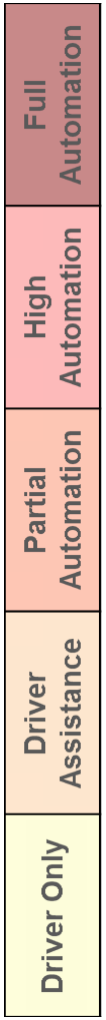


- Core-Challenges: Providing different levels of assistance and automation and transitions between these levels



Driver Only	Driver Assistance	Partial Automation	High Automation	Full Automation

Assistance and Automation



- The system takes over longitudinal and lateral control completely and permanently. In case of a take-over request that is not followed, the system will return to the minimal risk condition by itself.
- The system takes over longitudinal and lateral control; the driver must no longer permanently monitor the system. In case of a take-over request, the driver must take-over control with a certain time buffer.
- The system takes over longitudinal and lateral control, the driver shall permanently monitor the system and shall be prepared to take over control at any time.
- The driver permanently controls either longitudinal or lateral control. The other task can be automated to a certain extent by the assistance system.
- Human driver executes manual driving task.

IMoST – Core-Results

- Driver assistance system
  - Different levels of automation
  - Well-defined transitions between levels of automation
  - Interaction schema is based on different types and locations of stimuli – empirically validated (most advantageous) combinations.
  - Available in simulation environments and research-vehicles

IMoST – Core-Results

- Virtual test driver and virtual instance of a driver
  - Theoretical foundations completed
  - Technical integration still to be finished
- Virtual test track
  - Holistic real-time co-simulation of driver / assistance system / vehicle / traffic
- Analysis techniques
  - Simulation-based analysis methods: guided simulation to reach specific situations
  - Driver models (cognitive and stochastic) for efficient modelling of complex behaviours
  - Visual logic for description of traffic scenarios

ISi-PADAS / D3CoS

- ISi-PADAS provides an innovative methodology to support risk based design and approval of Partially Autonomous Driver Assistance Systems (PADAS)
  - raising safety
  - decreasing the level of human error

- D3CoS – Designing Dynamic Distributed Cooperative Human/Machine-Systems
  - Build cooperative driver assistance systems
  - Test them with human drivers

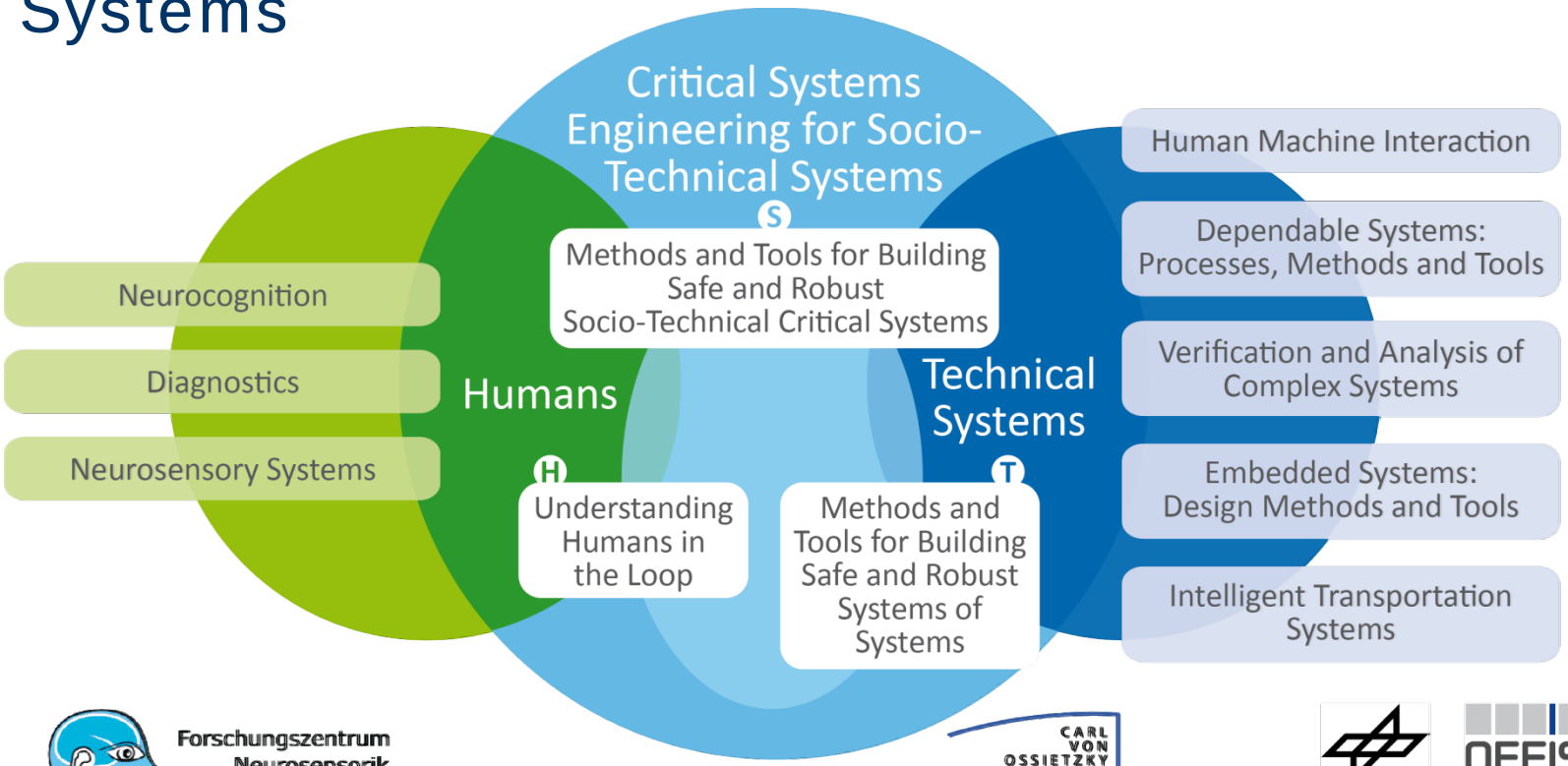
HoliDes

- HoliDes – Holistic Human Factors and System Design of Adaptive Cooperative Human-Machine Systems
  - Support the development of adaptive cooperative human/machine systems
  - Provide tool-set to qualify adaptive cooperative human/machine systems

CSE in Soc.-Tech. Systems

IMoST
Integrated Modelling for Safe Transportation

- CSE – Interdisciplinary Research Center on Critical Systems Engineering for Socio-Technical Systems



Forschungszentrum Neurosensorik
Universität Oldenburg

CARL VON OSSIETZKY universität OLDENBURG
Interdisziplinäres Forschungszentrum Sicherheitskritische Systeme

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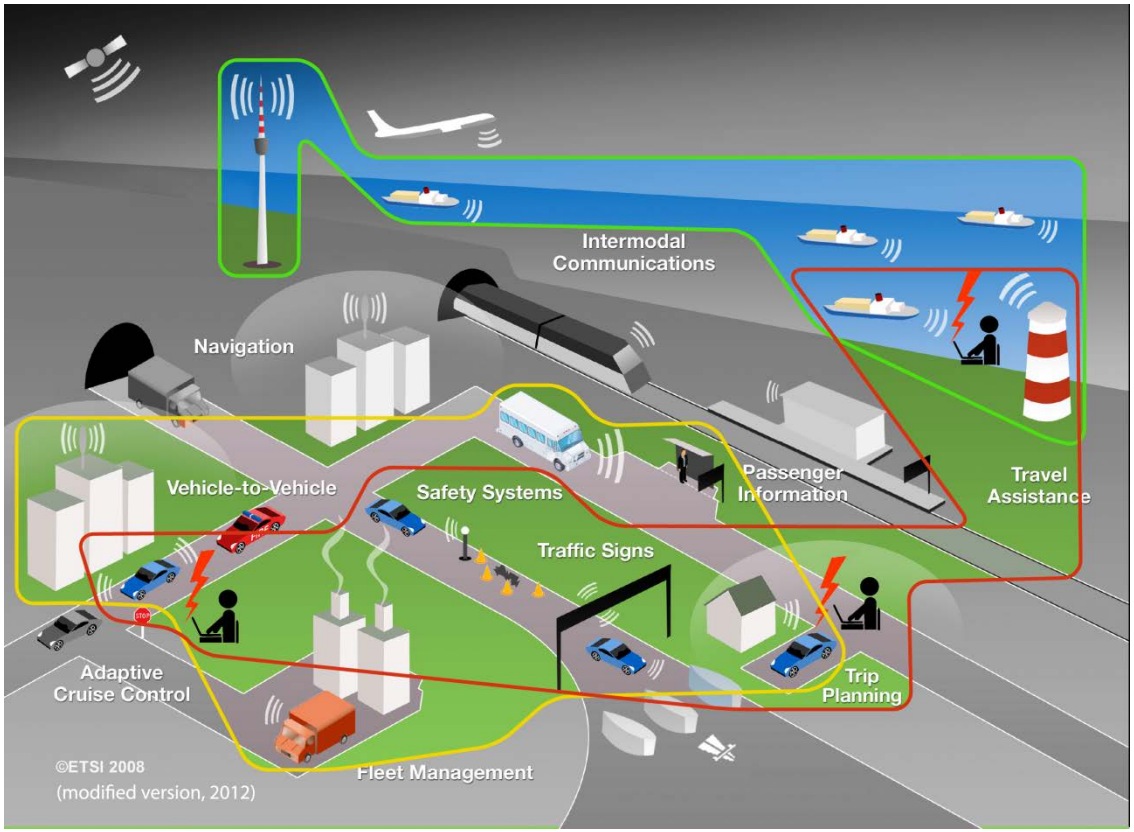
CSE in Soc.-Tech. Systems

IMoST
Integrated Modelling for Safe Transportation

- CSE – Interdisciplinary Research Center on Critical Systems Engineering for Socio-Technical Systems



Projects:

- The Car that Cares
- Cooperative eNavigation
- The Safety Impact of Security in Soc.-Technical Systems

CSE in Soc.-Tech. Systems

IMoST
Integrated Modelling for Safe Transportation

- The Car that Cares
  - Cooperative assistance and automation
  - Course of vehicle's action is part of a socio-technical system (consists e.g. of driver, car, and other traffic participants)
  - New human-machine interaction strategies will be proposed with special respect to
    - innovative sensor technologies
    - metrics to estimate e.g. stress, workload, and functional limitations derived from the health state of the driver
  - Validation and first practical demonstration within Living Lab

AIM – Anwendungsplattform für intelligente Mobilität

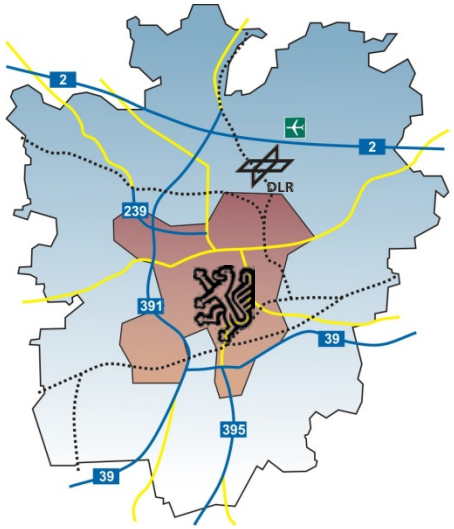
IMoST
Integrated Modelling for Safe Transportation

New large-scale research infrastructure in the city of Brunswick (Germany): An entire city serves as a platform for application-focused science, research, and development in the field of intelligent mobility services.

Major part of AIM consists of

- simulation toolboxes and simulators,
- dedicated test tracks,
- real urban areas, and
- selected parts of the surrounding regions.

Besides observation we can influence selected large-scale aspects (e.g. traffic flows) and microscopic aspects (e.g. traffic lights and ADAS) of traffic/mobility.



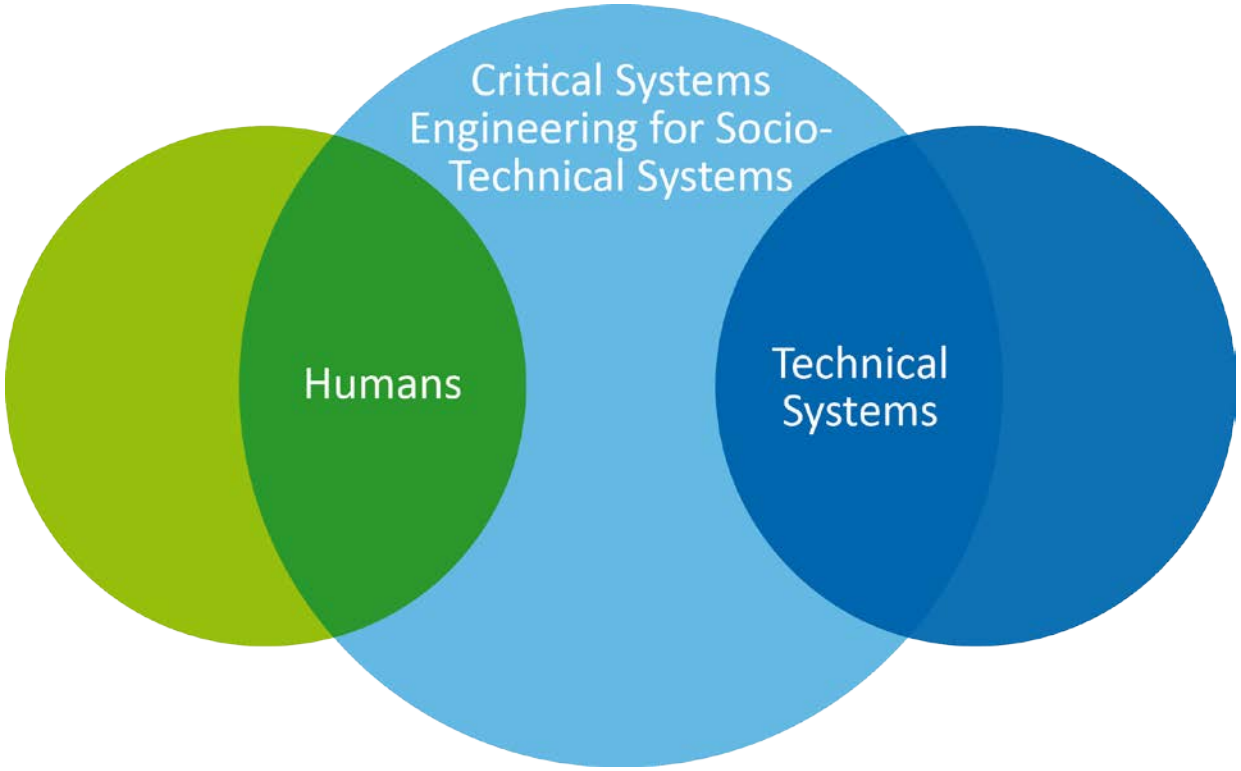
Legend:
- urban area
- sourroundings
- expressway
- highway
- railway

Long term cooperation:

DLR

Research infrastructure provided by AIM:

- Reference tracks in the BS region – virtual
- Rail reference tracks in the BS region – virtual
- Tram reference tracks in the BS region – virtual
- Simulation of traffic flow in the BS region
- Traffic flow data in the BS region
- Modular Mock-up
- Modular and Scalable Application Platform for ITS Components
- Test tracks
- Reference tracks in the BS region
- Intersection for research
- Level crossing for research
- iSharedSpace / iLane
- High-precision positioning in the BS urban area
- Virtual traffic management centre
- Vehicle fleet / Mobile services
- Traffic management / traffic data platform
- Driver Performance Database
- NDS platform
- Integration of public passenger (rail) transport data
- Mobility portal


Critical Systems Engineering for Socio-Technical Systems
Humans
Technical Systems

Thank you!