Green Mobility Technology Roadmap

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DLR – Overview

DLR’s mission:

- exploration of the Earth and the solar system
- research aimed at protecting the environment
- development of environmentally-friendly technologies to promote mobility, communication and security.

8,000 employees are working at 33 research institutes and facilities in 9 locations and 7 branch offices.

SPACE  AERONAUTICS  TRANSPORT  ENERGY

SECURITY
DLM Transport – Goals and strategies

Superior Goals
- Assurance of mobility
- Protection of environment and resources
- Improvement of safety

Strategic basis elements
- Independent transport strategy
- Extension of the transport-specific range of skills
- Use of DLR internal synergies
- Intensified focus on applications
- Complex systems research
- Design and use of large-scale plant
- Cooperation with excellent partners from industry and science on a strategic basis
Transport – Portfolio

Transport Program

Terrestrial Vehicles
- Road Vehicles
- Rail Vehicles

Traffic Management
- Road Traffic Management
- Rail Traffic Management
- Airport Management
- Sea Traffic Management
- Traffic Management for Public Mass Events and Disasters

Transport System
- Transport Development and the Environment

Mobility
Environment
Safety and Security
Transport – Portfolio

Transport Program

Terrestrial Vehicles

- Improvement of modeling for vehicle energy systems
- Reduction of driving resistance and vehicle weight
- Improvement of navigation support and driver Assistance
- Novel train concepts covering aerodynamics, material sciences and lightweight construction, optimized energy management
DLR’s Research Network – “One DLR!”
Institutes orientation and Researchfields

System and concept research for road and rail vehicles

Leading-edge research in selected technology

Ability to synthesize with research institutes and DLR network
Institute of Vehicle Concepts

- Vehicle systems and technology assessment
  - TBS
- Vehicle energy concepts
  - FEK
- Alternative energy conversion
  - AEW
- Lightweight and hybrid design methods
  - LHB
- Next Generation Train
  - NGT
- Next Generation Car
  - NGC
Novel Vehicle Structures

Challenges

- Reducing energy consumption and/or CO₂ emissions
- Improving passive safety

Solutions

- New vehicle concepts for urban mobility
- Lightweight design
- Reduced vehicle mass
- Improved crash safety through structural integrity and new materials
- Usage of cost-attractive technologies
- Increased flexibility and modularity
Front Structure

Challenges
- Increase of passive safety

Solutions
- Energy absorption in frontal crash load cases

Crash of peeling tube front structure

Crash of sandwich front structure
Vehicle Energy Systems

Challenges

• Reducing energy consumption and/or CO₂ emissions
• Lowering of geo-political dependency

Solutions

• Range-Extenders
• Efficient energy converters (i.a. free-piston linear generator, micro gas turbine)
• Aggregates for use of waste energy (i.a. thermoelectric generator)
• Optimized energy management
• Fuel cell systems for in-vehicle application
• Powerful hydrogen tanks
Hydrogen range extender

Challenges

- Doubling the range of battery electric vehicle, which has extreme low available space

Solutions

- Integration of a high temperature fuel cell as on-board charger
- Innovative thermo-management for HVAC and range extension
CO₂-targets lead to efficiency increase in ICE and increasing share of electrified powertrains

Conventional powertrains are substituted by electrified ones (2040: 85% with ICE, 80% with battery)

In the long run, no powertrain is expected to dominate the market
Alternative scenario: Best hydrogen availability

Changes compared to base scenario: $\rightarrow$ 100% H$_2$ availability (no restrictions for infrastructure)

Impact on the new vehicle fleet:
- Cumulative about 2.3 million more fuel cell vehicles between 2010 and 2040 compared to base scenario
What may be important for the future?

Question to be addressed

- What chance has e-mobility?
- Options for hydrogen?
- Is there a potential for e-gas?
- …

Some answers

- Differentiation of fuels and vehicle concepts
- Hydrogen and electricity
- Urban vehicle concepts for urban mobility
- Assisted and autonomous driving
- Alternative vehicle concepts, e.g. new people mover, SkyTrains
- …
“Future mobility has to be energy efficient, sustainable and economically attractive”
Thank you for your attention!