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AffordabLe LIghtweight Automobiles AlliaNCE

Future of Automotive Lightweighting Day

September 19, 2019

Aachen

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723839

Agenda

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Introduction & Overview

Thilo Bein, Fraunhofer LBF

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Why automotive lightweighting?

Lightweight materials can reduce the mass of a vehicle. Reducing a vehicle's mass reduces its **energy consumption**

Reducing the energy consumption enables a **lower fuel bill** for the driver, as well as **reduced emissions**

Additionally, lightweight materials allow the possibility to achieve a better vehicle **mass distribution**, which enables **better driving behaviour**

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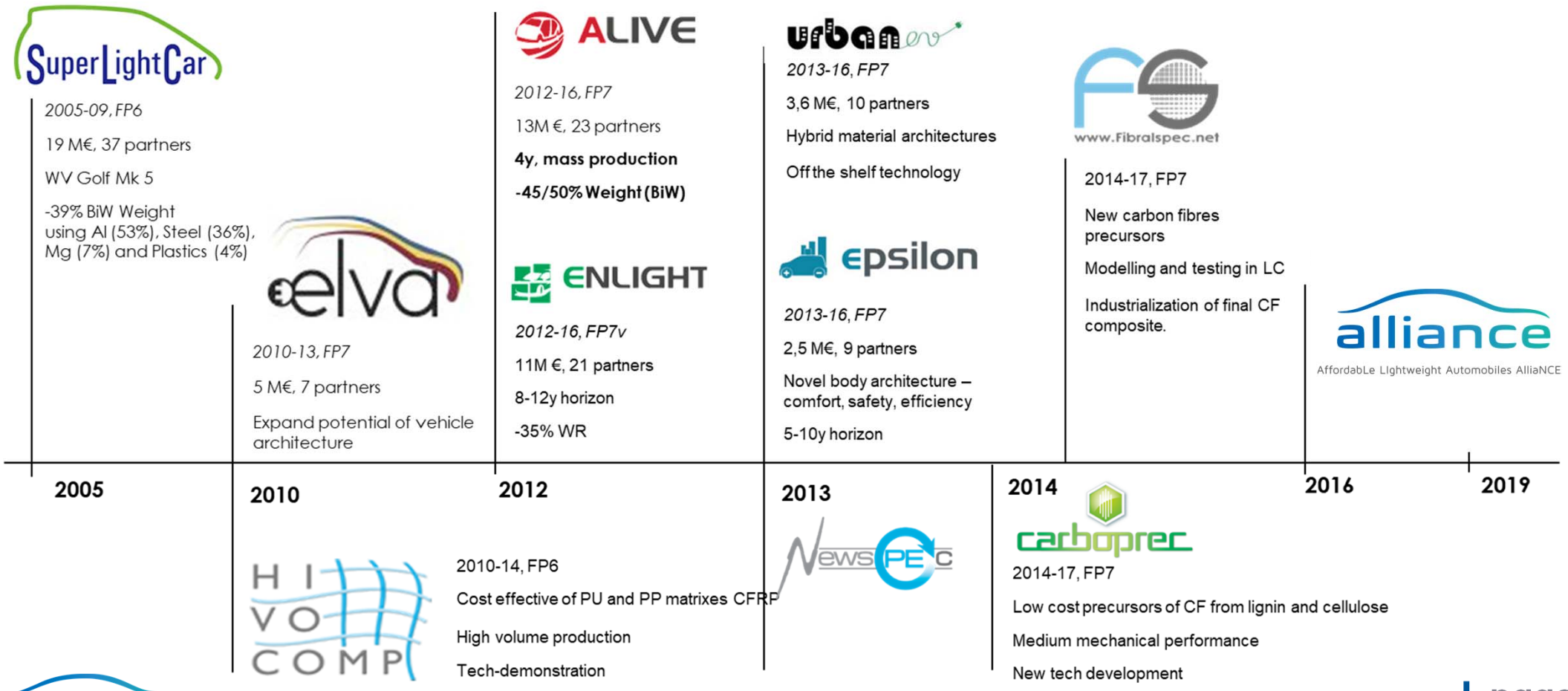
Lightweighting initiatives in Europe go way back...



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Funded Past Leightweighting Initiatives

Although they have resulted in several innovative solutions, the majority of these efforts have failed to reach widespread adoption.

This is due to the high costs, which is a result of several factors, including

- **the cost of materials (e.g. carbon fibre reinforced plastics),**
- **long cycle times and**
- **investments in new machinery**.

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An ALLIANCE of automobile leaders within EUCAR – European Car Automotive R&D

6	**European carmakers**	Daimler, Volkswagen, Fiat-Chrysler Research Centre, Volvo, Opel, Toyota
4	**Suppliers**	Thyssenkrupp, Novelis, Batz, Benteler
8	**Knowledge partners**	Swerea, Inspire, Fraunhofer LBF, RWTH-IKA, KIT-IPEK, University of Florence, Bax & Company, Ricardo

Duration 10/2016 - 09/2019

9.019.277 € Funding

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Objectives of ALLIANCE

⬇ 21-33% Weight **⬇ 6 % GWP** **< 3€/Kg Saved**

both for
internal combustion engine vehicle (**ICEV**) and battery electric vehicle (**BEV**)

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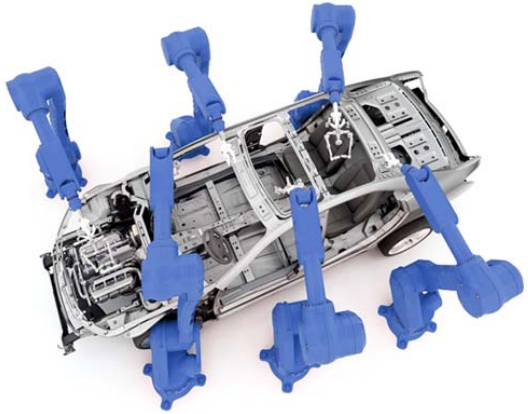
Addressing the concrete need for more efficient vehicles

Novel advanced materials

- High strength **steel** alloys
- New **aluminium** grades
- Fibre reinforced **polymers**
- Innovative **hybrid materials**

Focusing on:

- superior **performance**
- lower **cost**
- low **embedded footprint**



Manufacturing and joining technologies,

aiming at:

- reducing **energy consumption**
- increasing **automation**
- decreasing **cycle times**

Support tools

- **life-cycle** assessment
- **mass optimisation** software
- multi-parameter **design optimisation** methodology

Aiming at **pre-assessment of technologies**

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Making sure technologies find their way to the market

Implementing the new technologies on

- **eight different demonstrators of real vehicle models**, aiming at market application by OEMs
- **within six years** from project end (in 2025).

During the project,
the optimised modules are being **implemented into a virtual full-vehicle model**.

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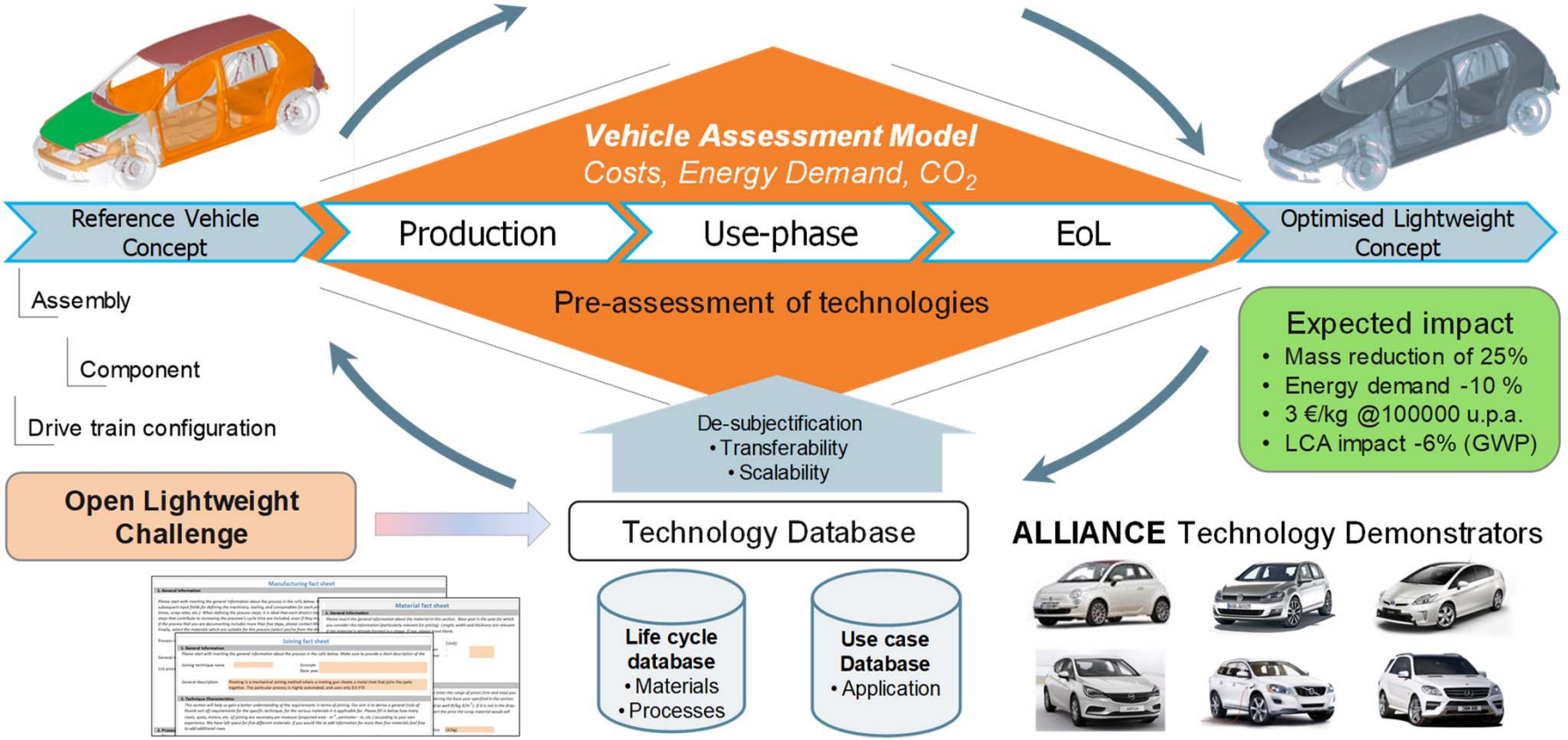
Holistic Development



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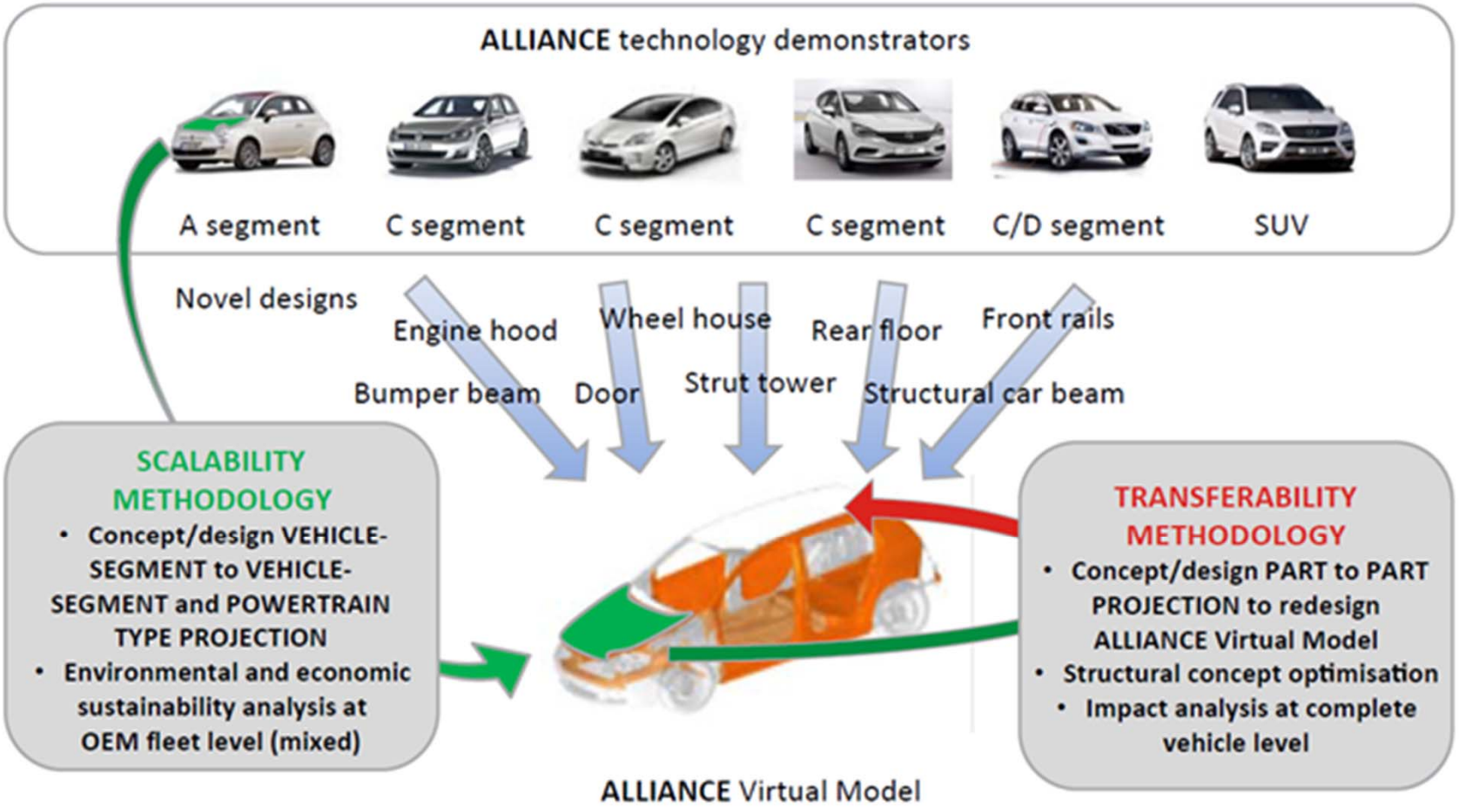
New methodologies for scalability and transferability



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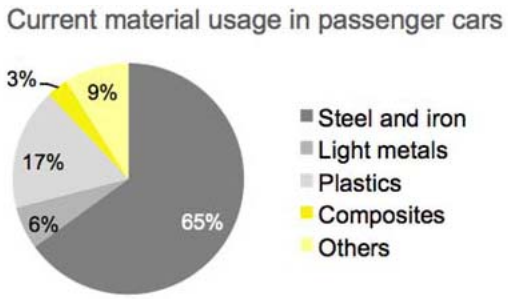
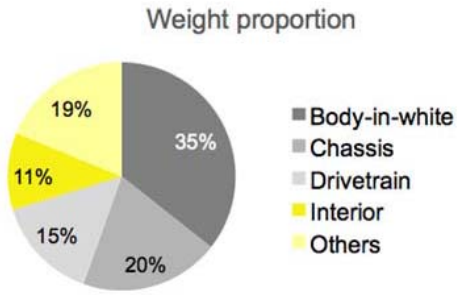
Approach – Material development

- Plastics, composites, steel & iron and light metals contributed to about 91% of the materials used → focus on **aluminium and steel**
- Advanced steel alloys development and characterisation
  - Optimize the manufacturing process to produce the best combination of properties
  - Weldability of the steel material: resistance spot, laser, MIG/MAG welding
- Advanced aluminium alloys development and characterisation
  - Development of high-strength 6xxx and 7xxx grade alloys
  - Mechanical characterisation of the alloys with process induced tailored properties, assessment of the manufacturing influences and measurement of forming properties for process simulation





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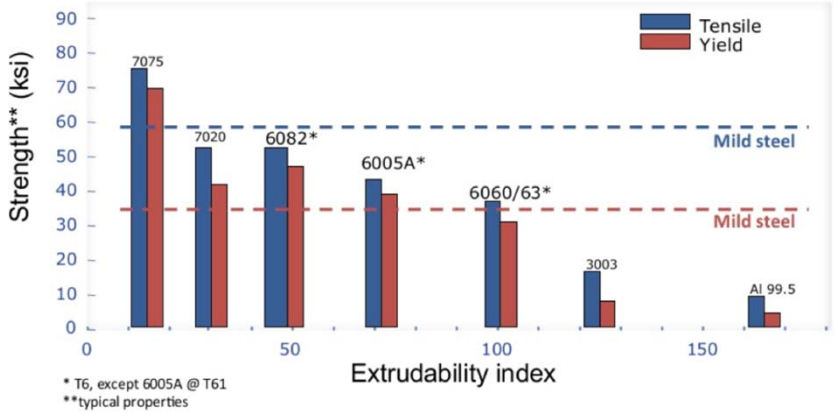
Approach – Efficient manufacturing

- Development of advanced metal forming technologies
- Development of manufacturing strategy for hybrid metal-FRP components
- Development of improved thermoplastic composite manufacturing process
- Joining technologies development (multi-material)
- Process compatibility assessment



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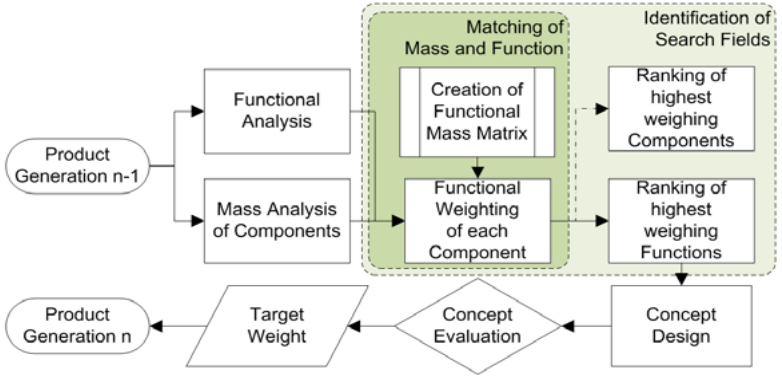
Approach – Design & Optimisation

- Multi-material and function integrated design concepts are required taking into account the full vehicle in a holistic way
- Lightweight orientated functional design concepts need to be introduced in very early stages of product development
- Preparation of generic methodology and training for holistic multi-material design and optimisation for light weighting
- Development and refining of the methodology, applied to a specific use case
- Analysis of benchmark and Functional concepts generation
- Multidisciplinary and multi-parametric Optimisation
- Validation of the methodology



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Expect Outcome

- **Advanced lightweight materials and related manufacturing technologies**
  - Advanced steel alloys and forming technologies
  - Advanced aluminium alloys and manufacturing process
  - Advanced plastics and manufacturing process
  - Novel developments in joining technologies
- **Advanced simulation tools and methodologies**
- **Multi-parameter design optimization methodology and process**
- **Mass optimizer software tool and LCC tools and database**
- **Environmental assessment (LCA) tools and database**
- **Design concepts of demonstrator components and subassemblies**
- **Test strategies for the novel design**
- **Economic business cases for specific technologies**

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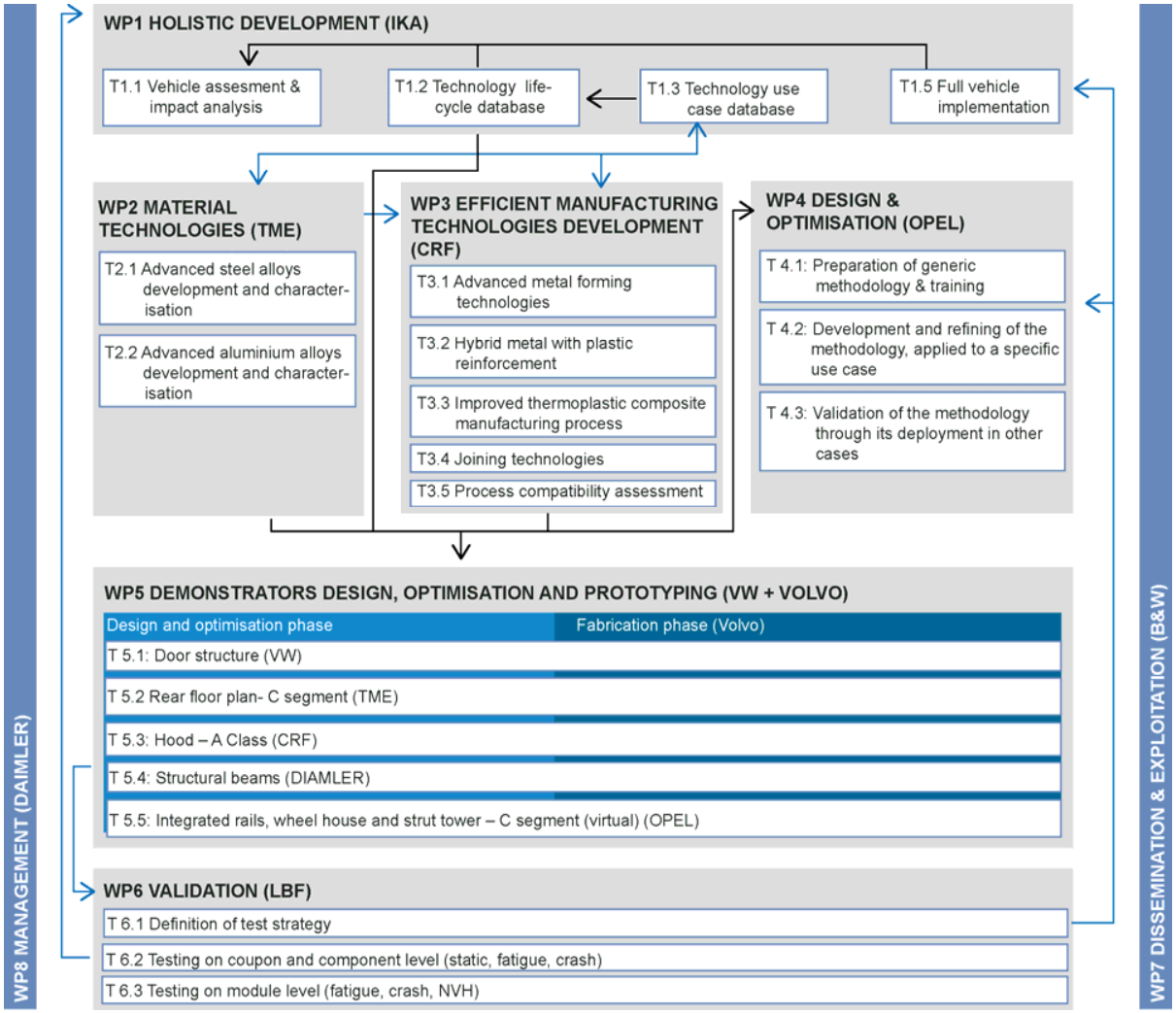
Project Structure



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