

Automotive technology in 2010 - potentials for passenger car applications

Univ.-Prof. Dr.-Ing. H. Wallentowitz

Dipl.-Ing. J. Leyers, Dipl.-Ing. P. Urban,
Institut für Kraftfahrwesen Aachen (ika)

Dr.-Ing. T. Parr,
Forschungsgesellschaft Kraftfahrwesen Aachen mbH

Conference:
European Alliance for Thermoplastic Composites,
Wolfsburg 1./2. July, 2003

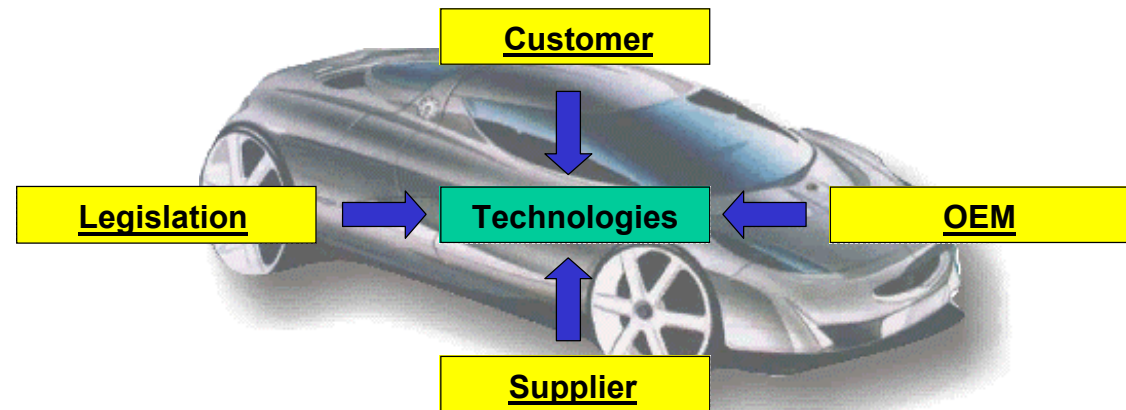
Contents

- **Introduction**
- **Analysis of future relevant technology trends**
- **Interaction and dependencies of future relevant technologies**
- **Material application in automotive engineering**
 - Development tendencies concerning application of alternative materials
 - Application potentials of fibre composite plastics
- **Summary**

Influences on technology development

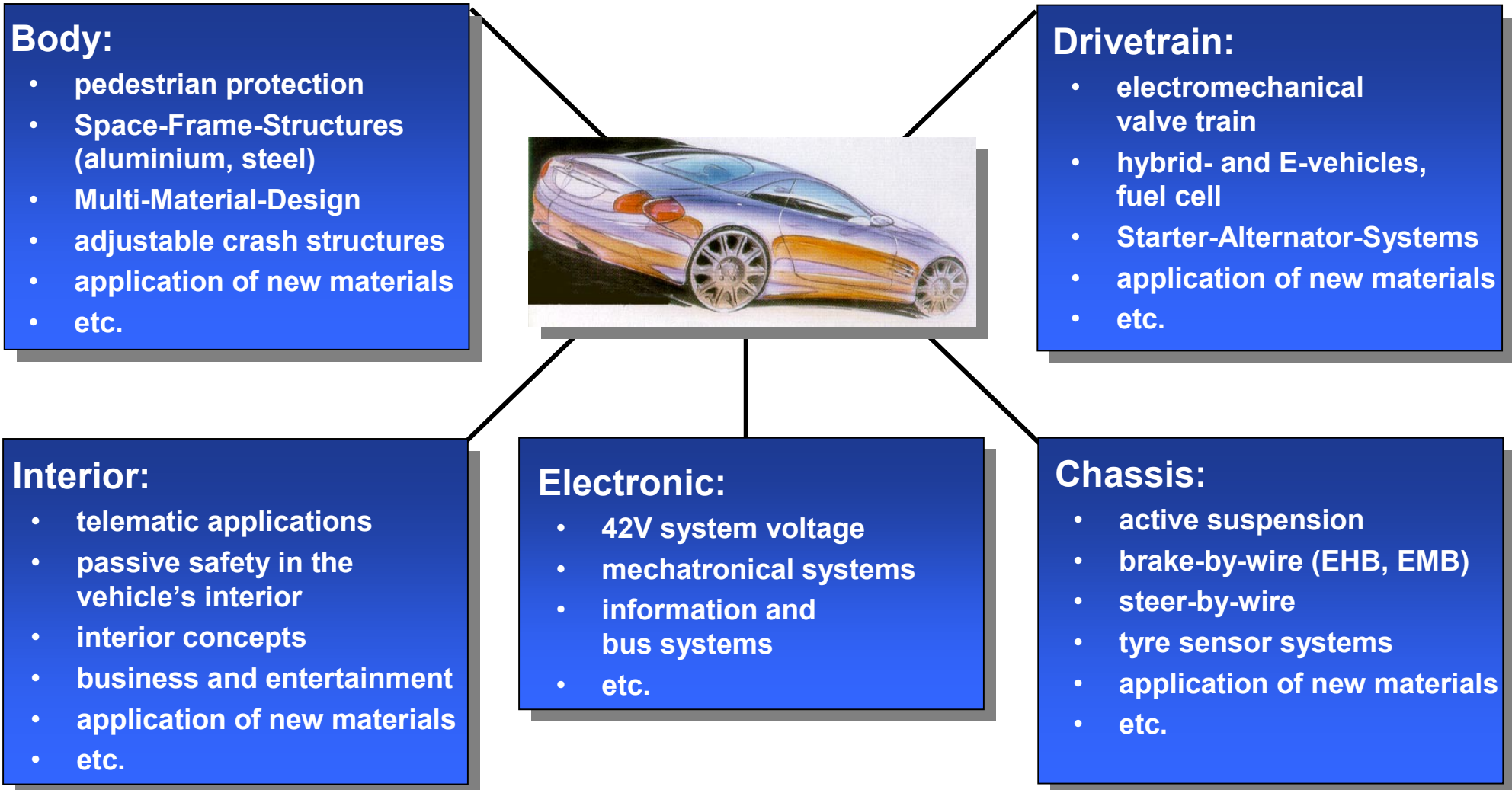
Technology developments are characterized by :

- customer requirements (e.g. emotion, image)
- legislation (e.g. environmental and safety demands)
- manufacturer and supplier (e.g. operational benefit, sales volume)



The fulfilment of demands concerning function, weight and economy is decisive for the success of new technologies under compliance of legal regulations.

Assortment of automotive specific product technology trends



Example of scenario analysis results

Technology results I

Technologies	Scenario 1: innovation and luxury“
Chassis:	Brake and steer by wire, electrical parking brake, global chassis management, collision avoidance
Body:	Innovative material design, partly aluminium- or steel-space-frame, pedestrian protection completely realised
Drivetrain:	Optimised engine technologies, CVT-transmission, starter-generator, drive train control system
Interieur:	Thermomanagement, intelligent passive safety systems, digital map and communication functions
Electronics:	42V-power supply, high-speed-data-bus systems, portable multimedia devices

Example of scenario analysis result

Technology results II

Attributes	Scenario 1: „innovation and luxury“
Driver for technologies:	Highest technology requirements of final customer regarding design, optics, image, high comfort, etc.
Segment:	e.g. Audi A8, S-Class, BMW 7-series, Maybach
Form of market entry:	Innovations with additional functionalities (market entry of the technologies as substitution or new entrance)
Market penetration:	Technologies possess production stage

Scenario analysis

Scenario overlapping results

Interaction and effects of the technologies:

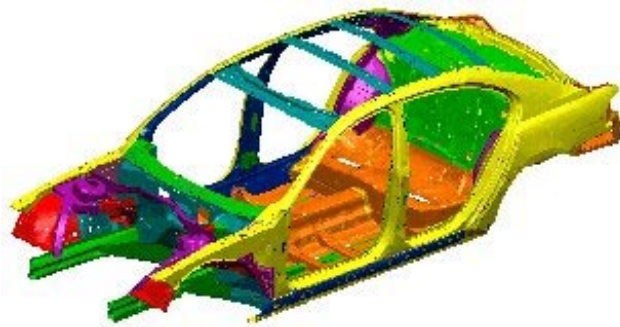
- Increased importance of the functional and system overlapping interaction of several technologies
- Very distinctive interdependence of the technologies with regard to market entry
- Serious need for cooperation due to increasing complexity of future technologies

Assortment of material specific results:

- Alternative body concepts like Multi-Material-Designs and Space-Frame-Structures gain more importance in comparison to steel shell construction
- Application of closures like doors in Multi-Material-Design
- Alternative light weight materials like high-strength steel, aluminium, magnesium as well as plastics (unreinforced and reinforced) will become more important in the future

Body structures

Steel unibody (BMW 7-series)



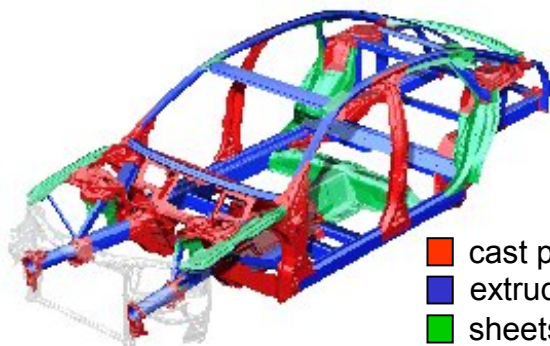
- DC06 (120 Mpa)
- DC04140
- ZStE180
- ZStE220
- ZStE260
- ZStE300
- ZStE380
- ZStE420
- CP800

Multi-Material-Design (Aston Martin V12 Vanquish)



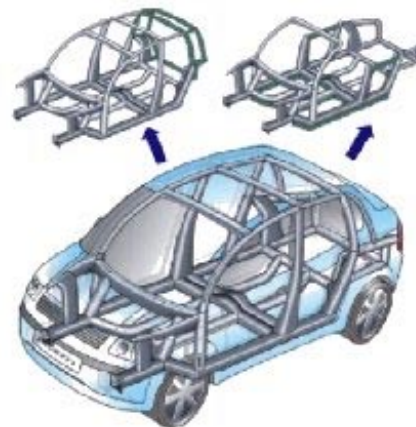
- outer skin: hot worked aluminium sheet
- body platform: bonded aluminium sections
- centre tunnel, A-pillar: carbon fibre reinforced plastic
- side sections, luggage compartment floor, crash structures: fibreglass reinforced plastic

Aluminium-Space-Frame (Audi A8)



- cast parts
- extruded profiles
- sheets

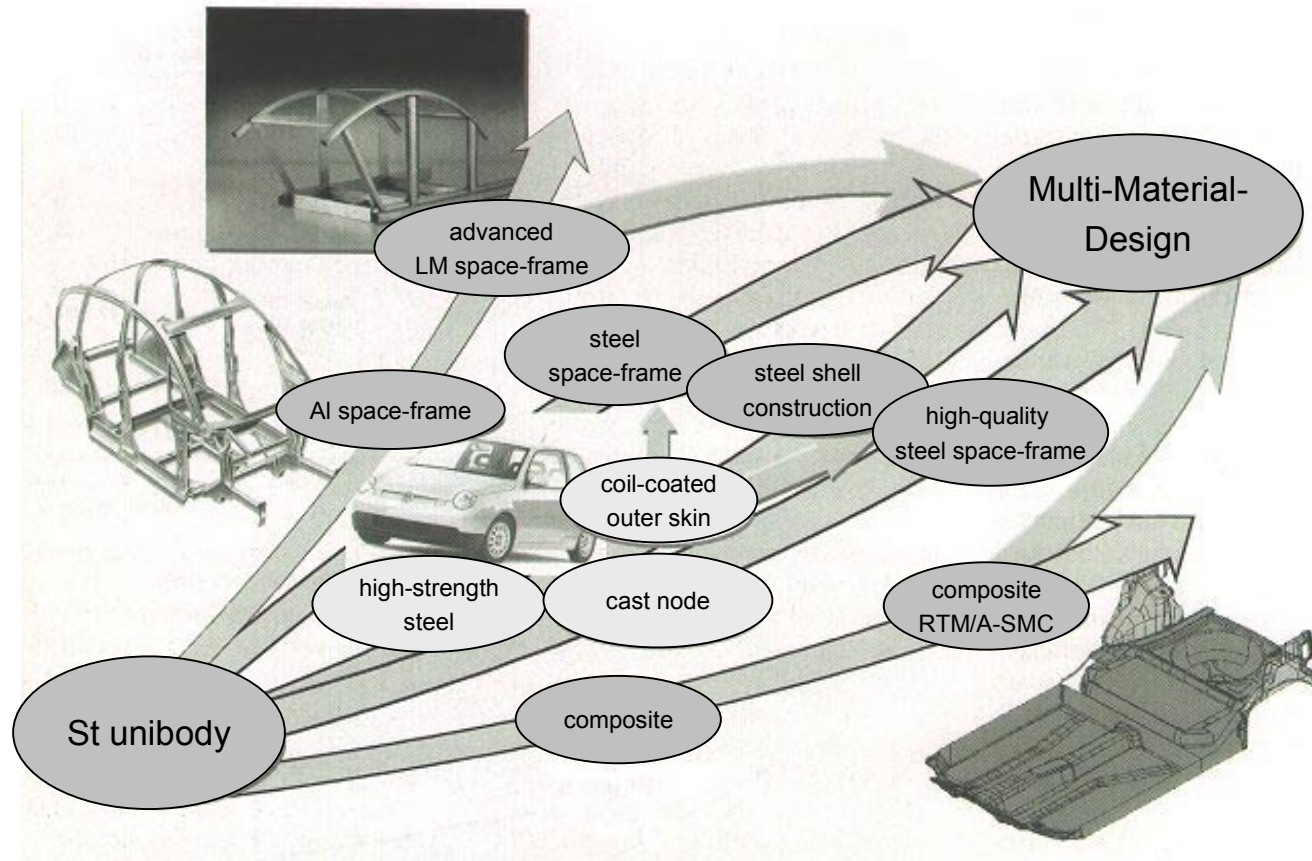
Steel-Space-Frame (TKS)



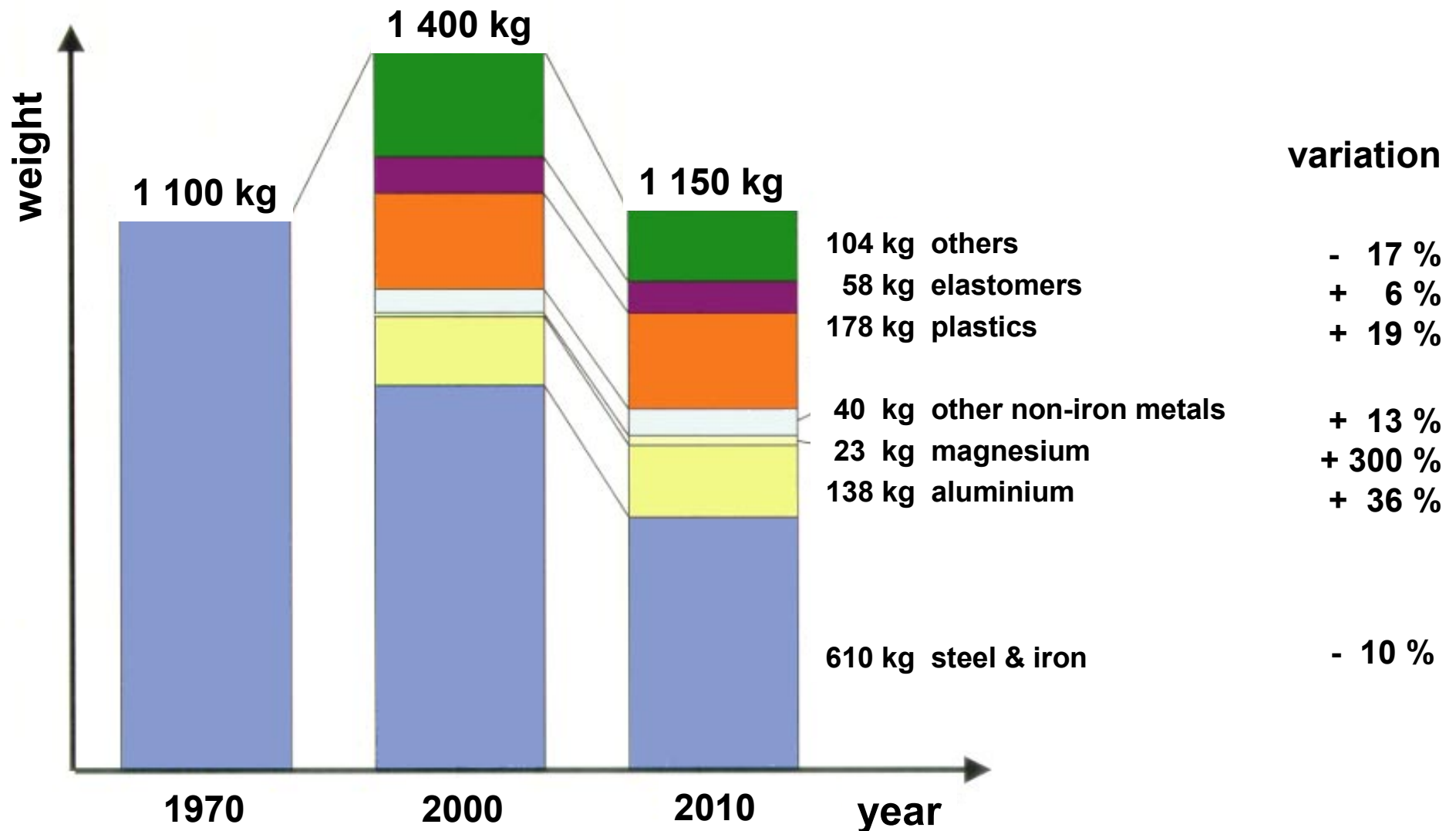
Magnesium-Space-Frame (VW)



Development tendencies towards the application of alternative materials



Development of materials in a mid-size car



Summary

- improvement of functional and system-overlapping interactions of automotive technologies
- strong dependence of technologies among each other
- gain of importance for alternative materials like aluminium, magnesium and reinforced/unreinforced plastics in comparison with steel
- reinforced plastics have found their way into the vehicle to an increasing extent
- structural components made of FRP will be engaged in niche products
- still substantial development demands for complete plastic body structures