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SuperLIGHT-CAR: lightly towards the car of the future

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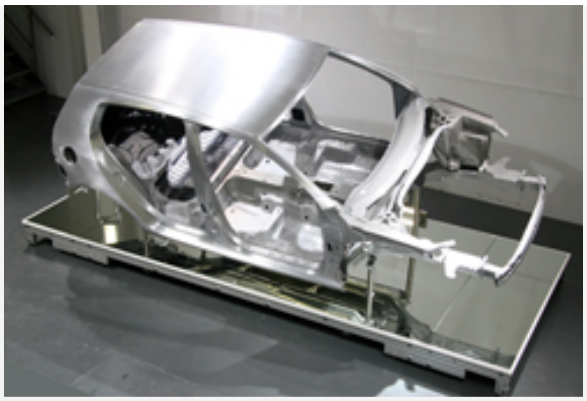


The SLC prototype

DLR front-end concept enables 32% weight saving

For four years, 37 leading partners in research and in the vehicle and component supply industries – from nine European countries – have been working on lightweight car frames for the clean cars of the future in the EU 'SuperLIGHT-CAR' (SLC) project. Recently, the participants presented their results at the concluding conference and, at the same time, unveiled a prototype of the new lightweight frame. With the front-end structure, which achieves a weight saving of more than 30%, the German Aerospace Centre (Deutsches Zentrum für Luft- und Raumfahrt; DLR) made a significant contribution to the overall concept.

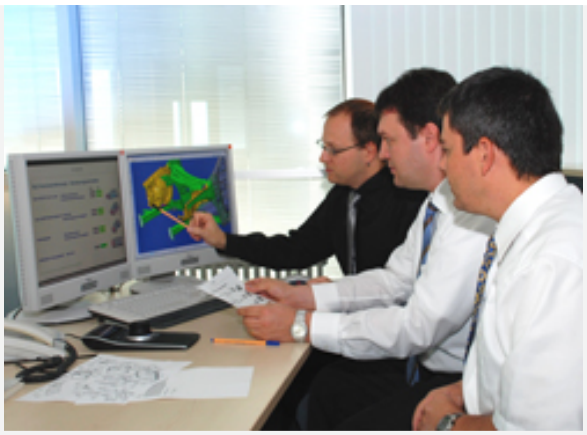
Lower fuel consumption, reduced carbon dioxide emissions

Video: SuperLIGHT-CAR

In order to make a contribution to fuel consumption and carbon dioxide reductions in the future, the European project partners, led by Volkswagen AG, had set themselves the target in 2005 of achieving a weight saving of at least 30% in the body shell – related to the VW Golf V as the reference structure. This was to be done without any reduction in safety while maintaining the various vehicle-specific requirements, such as a high level of crash safety and stiffness, as well as keeping the additional costs for production volumes of 1000 vehicles per day to a reasonable level.

The focus was on what is referred to as multi-material design: the challenge was to use the correct lightweight building material – magnesium, aluminium, steel, fibre reinforced composites – in the right place. With a weight saving of 35%, – that is, 180 kilograms related to the reference structure – the SLC team has managed to surpass its ambitious target at the end of four years' work.

DLR Institute of Vehicle Concepts develops front-end concept

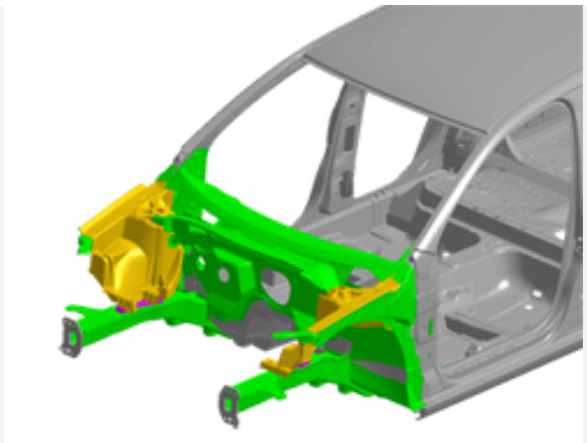


Development of the SLC front-end model

The DLR Institute of Vehicle Concepts (Institut für Fahrzeugkonzepte; FK) in Stuttgart developed the front-end structure from magnesium and aluminium as part of the EU SLC project, saving 32% (24 kilograms) of the original weight. This result was made possible by the intelligent use of different materials in a composite design.

Lightweight through magnesium

A key part in reducing the weight of the front-end was played by a highly-integrated magnesium cast component: more than 60% of the original weight was saved in the magnesium strut tower, while at the same time integrating about 12 steel components in a single cast component. Here, the great weight saving arose first from the 'conceptual lightweight construction', in which a highly-integrated cast component combines several functions and parts; second, from the 'lightweight material construction' through the use of magnesium; and, third, from the 'design for lightweight construction' and the resulting geometrical optimisation. This methodical procedure provided the basis for the great reduction in weight. Furthermore, the aluminium longitudinal rails in the front-end have been fabricated with what are known as 'tailored welded blanks' – sheet metal profiles in various wall thicknesses from 2.6 to 3.8 millimetres – giving the advantage of improved mechanical characteristics with a lower component weight.



Deployment of magnesium and aluminium

The high demands with regard to the crash behaviour of the front-end required several rounds of optimisation in the design calculations. Despite the weight saving in the front-end, the DLR engineers were able to achieve excellent crash behaviour. The simulation results show that all the prescribed static and dynamic load conditions were met. Indeed, the crash behaviour improved in several respects. For example, the footwell intrusion in the DLR concept was 51 millimetres, in comparison to 100 millimetres in the reference design.

Potential for future electric vehicles

In line with the motto 'Let's get on the road', the SLC consortium did not present its forward-looking concept only on paper. The results are accessible to the public in a real prototype and provide authoritative inputs for future car body structures. Lightweight construction is a key technology for cars of the future, not just in regard to conventional means of propulsion but also for electric vehicles.

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