

# Automotive



**DLR German Aerospace Center  
Institute of Vehicle Concepts**



**Innovation:** Ribs and space frame unit for cars

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**Partner:**

ACE Advanced Composite Engineering GmbH 

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The rib and space frame unit is made up of three ribs (replacing the former A, B and C pillars) connected with metal longitudinal rails and castings. The simple geometry of the metal profiles compensates for the higher cost of the CFRP parts and allows a variable vehicle design (length). Within the new vehicle structure, the B rib is one of the most stressed parts in case of a side impact.

The DLR's goal was to create a structure combining outstanding performance and lightweight design for the B rib. The circular design itself offers the advantage of withstanding high radial loads (side impact). This geometry was combined with carbon fibres and the corresponding part design fulfilled both requirements.

Each segment of the B rib has to carry out different functions. The lateral part must be very stiff to form the passenger compartment. Topology optimizations were performed to find the best cross section. In case of an accident, the upper part of the B rib works as a hinge. The lateral part rotates around this hinge and the crash energy can be absorbed by the lowest section of the B rib. The greatest deformations occur under the passenger seat, at a place where they have fewer implications for the passengers' health or life. This guarantees a high level of safety within the passenger compartment.

The loads on alternative power systems can also be reduced. Hence, the possible indirect dangers caused by high-voltage batteries or hydrogen tanks below the passenger compartment are reduced.

The value created by the use of fibre-reinforced plastics, CFRP here, results in a high safety level while reducing the weight of the part and its adjacent components (about 35% compared to the reference structure).

The aim of the current development is to prepare the B rib for the American side-impact test according to IIHS, which is currently the most demanding one.

Because many car manufacturers currently face similar challenges (how to integrate CFRP into the body of the vehicle), the DLR Institute of Vehicle Concepts has a good chance of transferring this know-how into automotive applications.

