

**RECARO**

## **Composite seat solutions in progress**



**Max Riedel - director engineering**

**18.05.2011**



## AGENDA

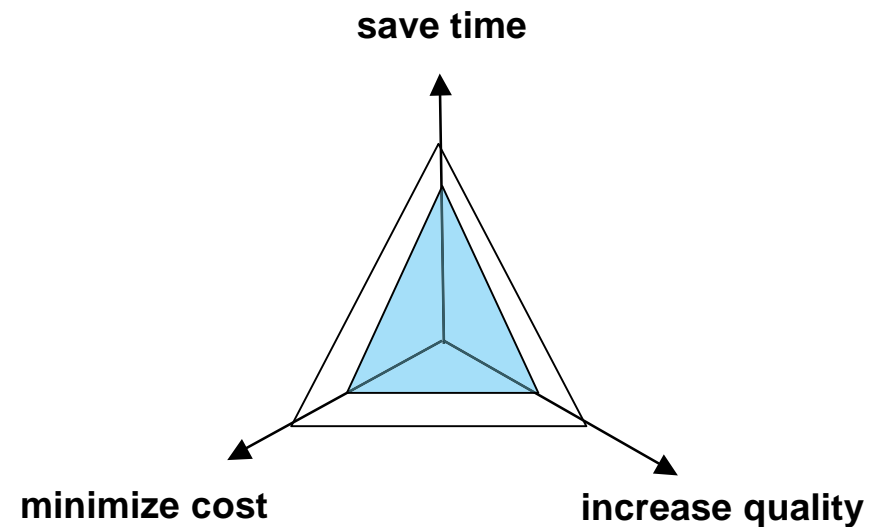
- THE RECARO COMPOSITE SEAT CONCEPT
- RECARO COMPOSITE SEAT HISTORY
- IMPACT TO OVERALL VEHICLE WEIGHT
- THE COMPOSITE SEAT IN A CROSS CARLINE STRATEGY
- ADVANTAGES AND SCOPES
- OPTIONS TO REDUCE ADDITIONAL WEIGHT
- COMPOSITE SEATS IN PROGRESS



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- Initial situation in the automotive industrie :
  - Increasing requirements for technologies and materials
    - rising customer demands for comfort and functions
    - higher legal requirements for safety
    - globalisation and price erosion
    - complexity and individualisation of products
    - flexible production
    - enviromental requirements
      - Recycling
      - CO<sub>2</sub> reduction



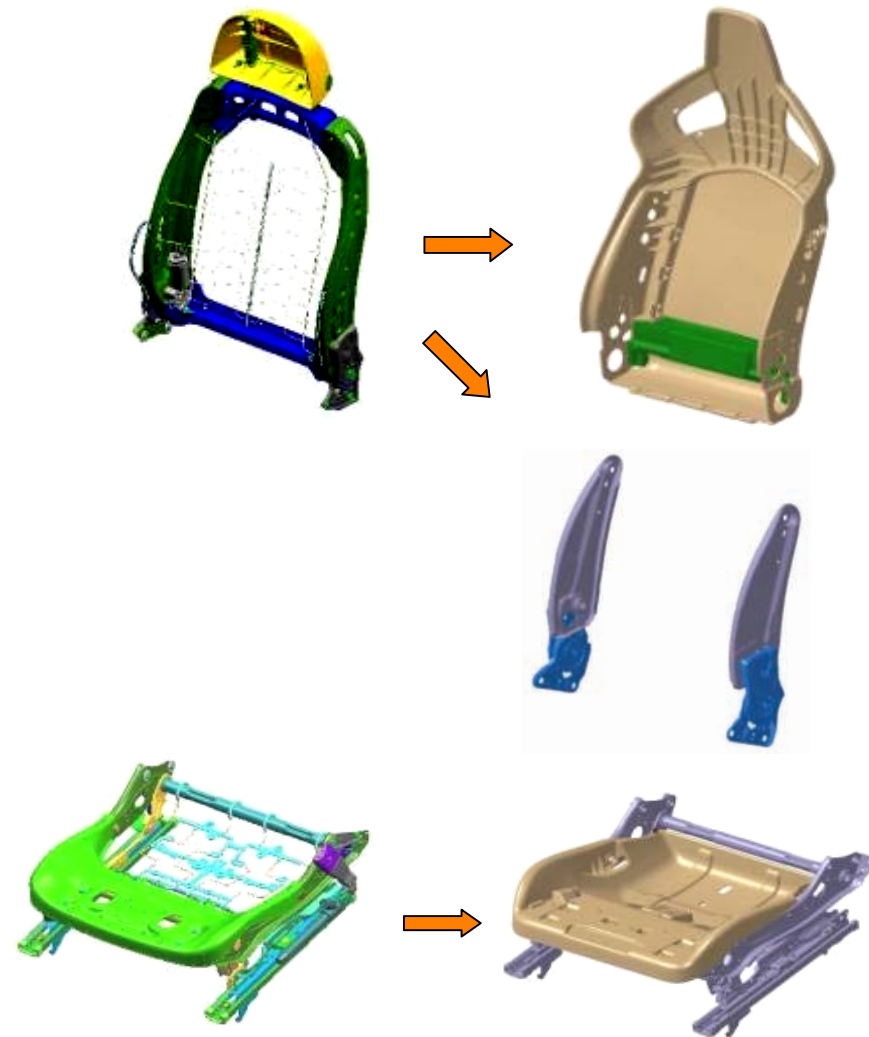


- Assignment :

- replacing a standard steel backrest frame by a composite backrest shell.
- engineering an optimized connection to the series recliners.
- implementing an injection moulded seatshell to the series substructure.

OEM Standard

RECARO



**What makes this  
concept so special?**



- Advantages / Features :



- Advantages / Ergonomics :





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### 1968 – First light weight seat for Porsche 356

- Material : In the beginnings steel plate, followed by thermoset with metallic reinforcement





### 1976 - RECARO Rallye

- Material : Thermoset
- Stiff, with tilt adjustment





### 1990 - RECARO A8

- Material : PA6 GF30
- Reclineable, with tilt adjustment



### 2003 – Porsche Carrera GT

- Material : carbon fibre
- Weight incl. adapter and leather-Trim = 10,8 Kg
- Lightest serial shell for OEM



### 2006 – RECARO Sportster CS

- Material : PA6 GF50
- First aftermarket seat with integrated sidebag
- Used in several OEM high end variants



### 2010 – RECARO project AE 249

- Material : GMTex
- reclinable with integrated sidebag
- Up to 6 way electric adjustment available



### 2010 – RECARO project AE 249

- Material : carbon fibre
- Inner and outer shell; pad- system
- Matches the latest FIA regulations 2011 for WRC and OEM motorsports





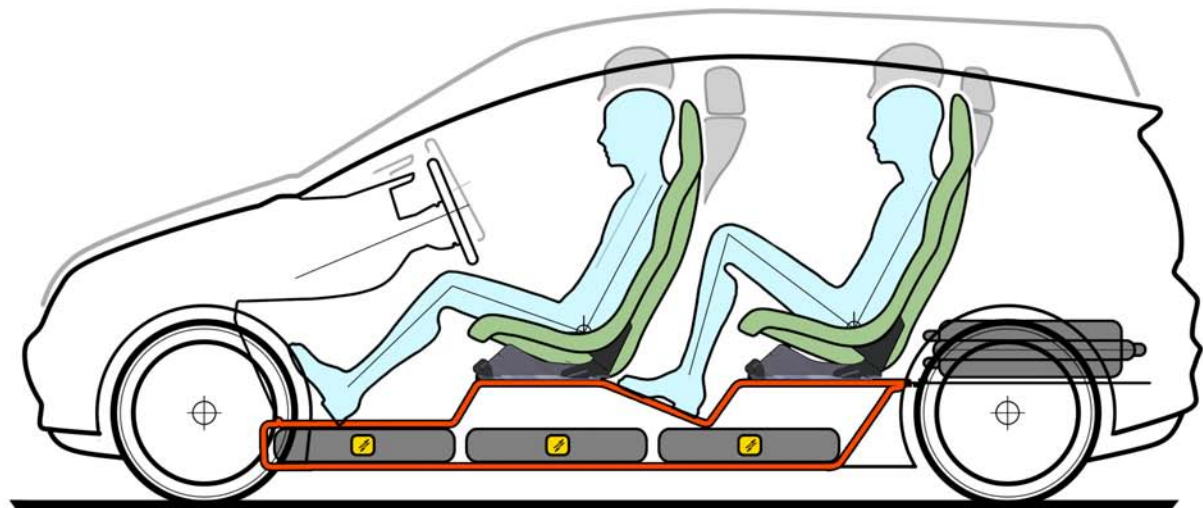
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### Size and composition of a seat can affect whole vehicle layout

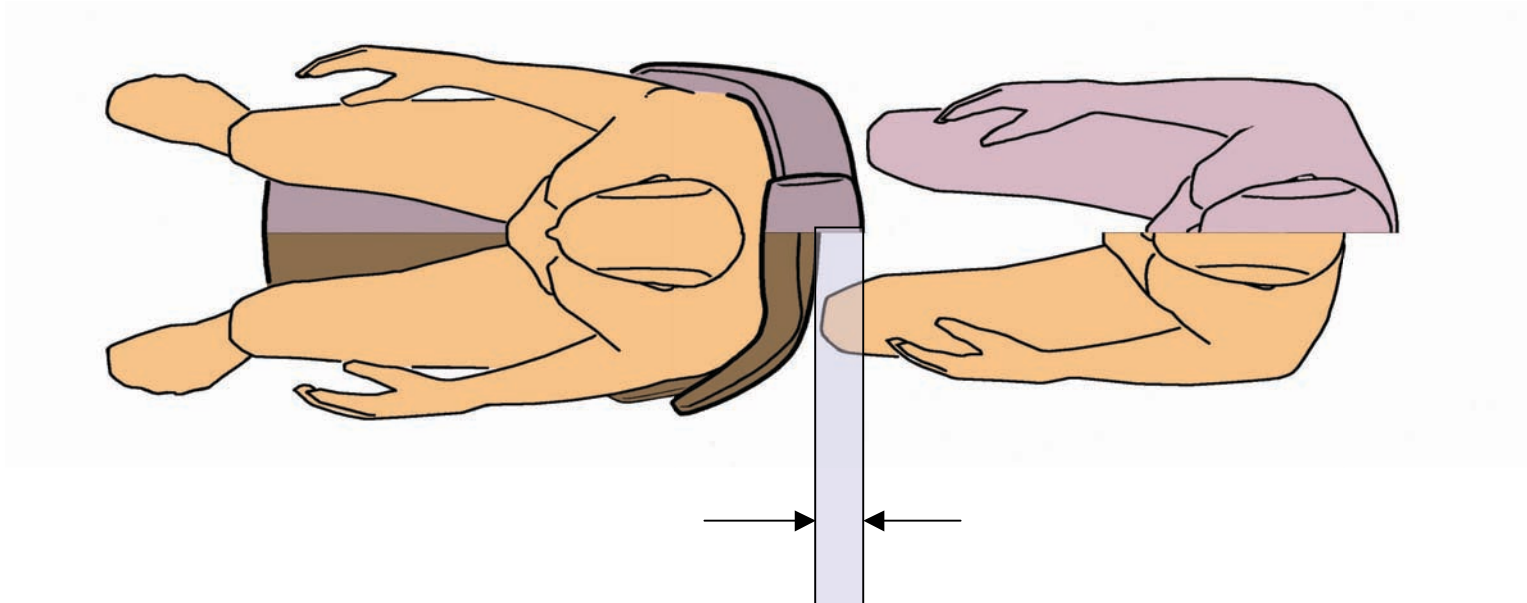
- A seat with a very low SRP can have a major influence to vehicle shape
- Reducing cross sectional area and aerodynamic resistance according to that
- Intelligent light weight design
- Scope for design





### Size and composition of a seat can affect whole vehicle layout

- Seat dimensions can have a major influence to vehicle package



➔ Room saving for

- Passengers in the fond
- Space for adjustment front seats
- Packaging

➔ Reduced car length

### – Saving weight:

- vehicle: 7,000 kg
- seats: 3,000 kg
- Total economy: 10,000 kg

### – Cost reduction:

- By saving material

### – Reducing cross sectional area:

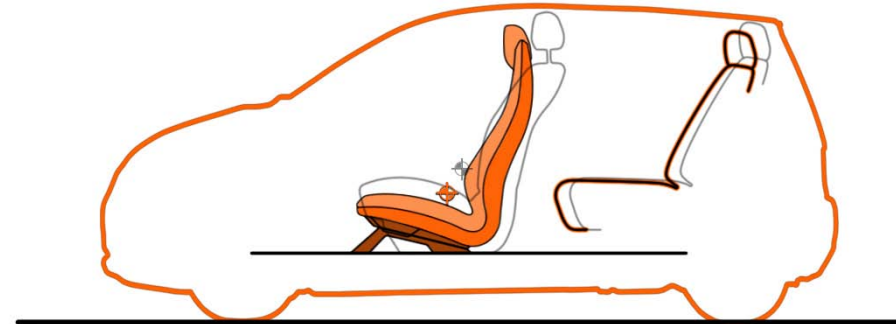
- -0,065 m<sup>2</sup>

### – Fuel saving:

- -0,05 Ltr./100 km

#### Szenario:

Volumemodell mit 1.000 cars/day,  
230 days/year, 6 years lifetime

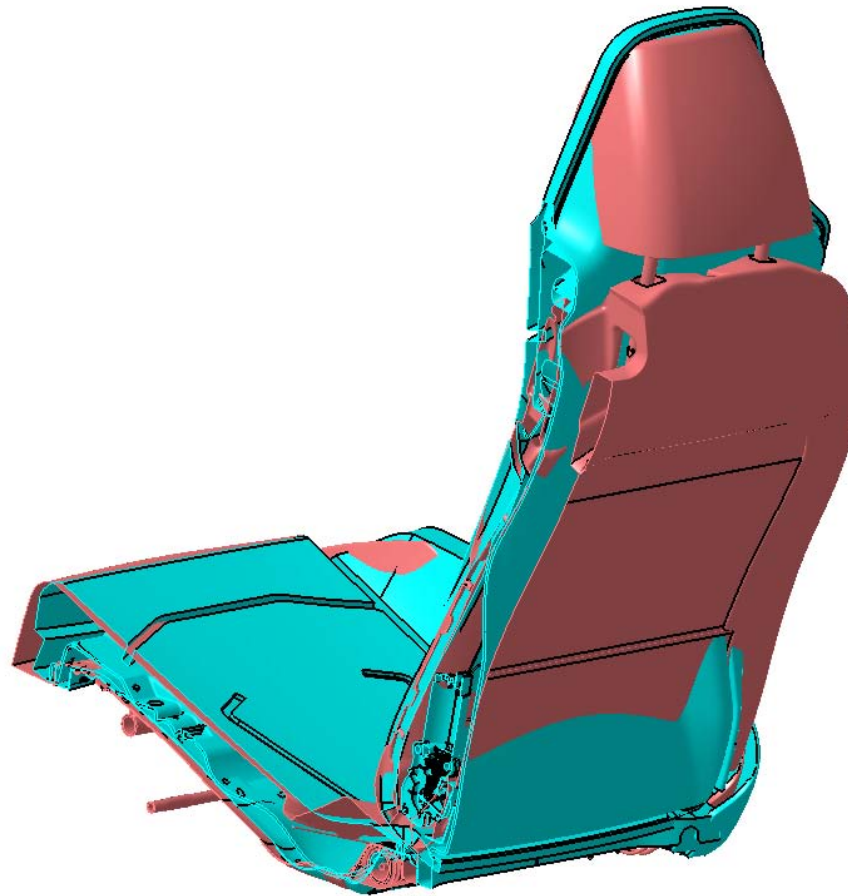


#### Economic figures in lifetime: (all vehicle of that type)

Preserving material and resources:	<b>13.800 to</b>
Saving fuel (150Tkm):	<b>103.500 m<sup>3</sup></b>
CO <sub>2</sub> -reduction:	<b>227.700 to</b>

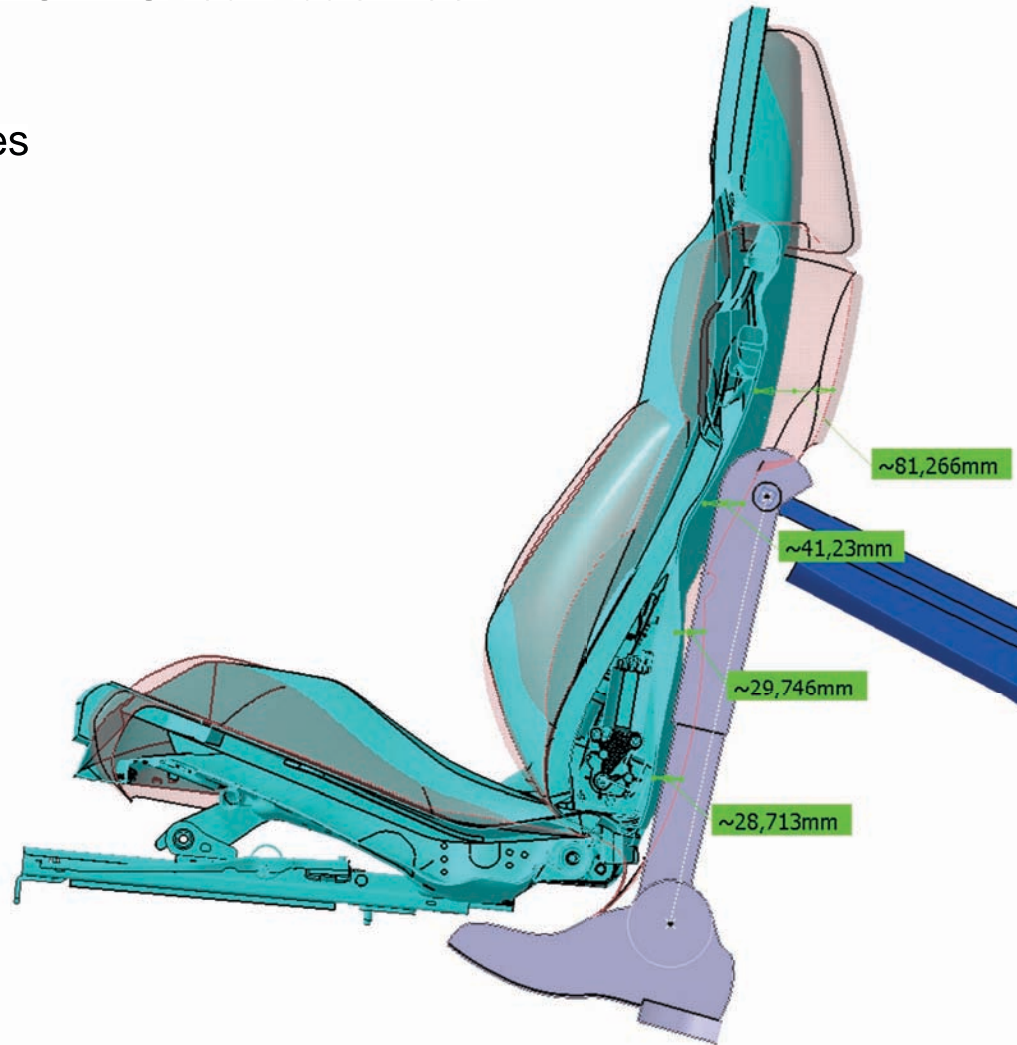
## Comparing a RECARO lean backrest with a standard seat

- Regarding up to date types



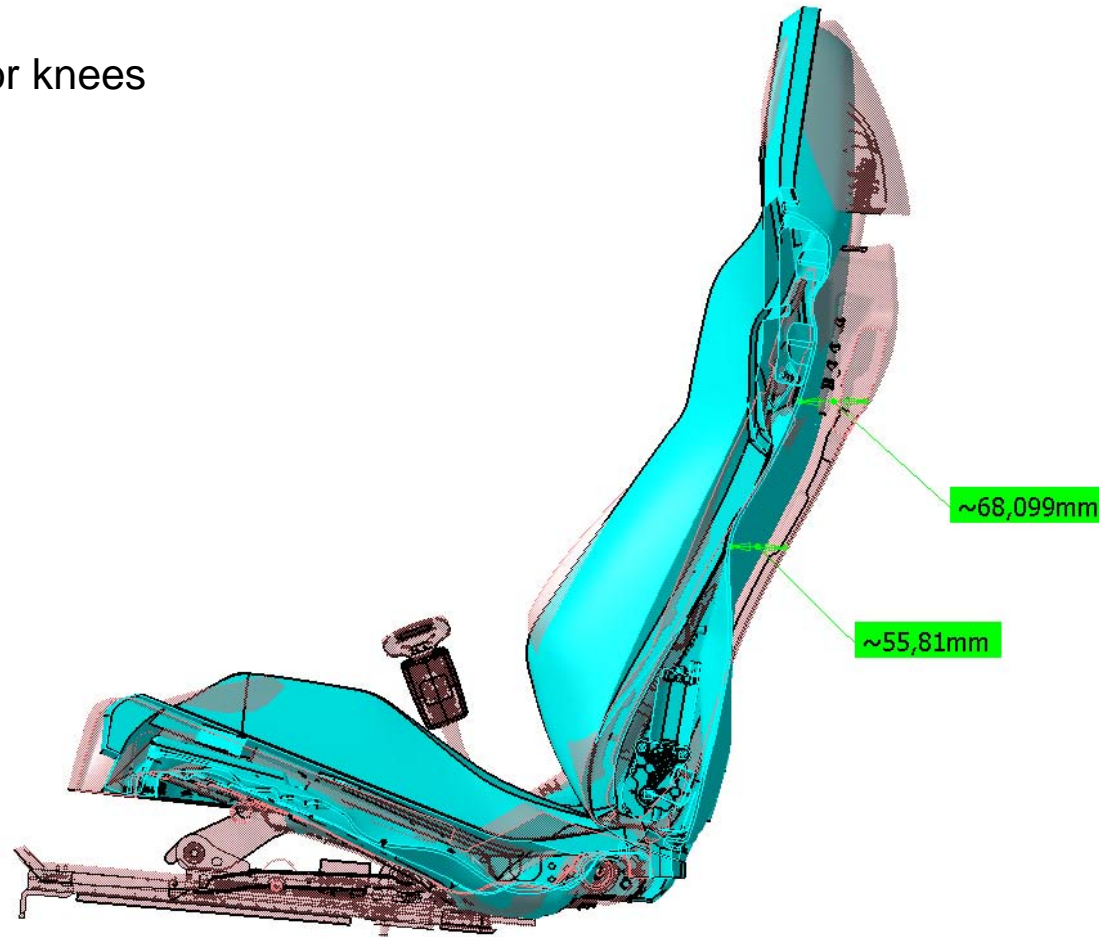
### More living space with a RECARO lean backrest

- Comparing C346:
- 81 mm more space for knees
- 28 mm more legroom



## More living space with a RECARO lean backrest

- Comparing A311:
- 68 mm more space for knees
- 55 mm more legroom



### Following same targets with the RECARO „pure seating“

- Saving weight and space:
- Using a slight and hollow seatshe
- Higher resisting torque
- Minimize package



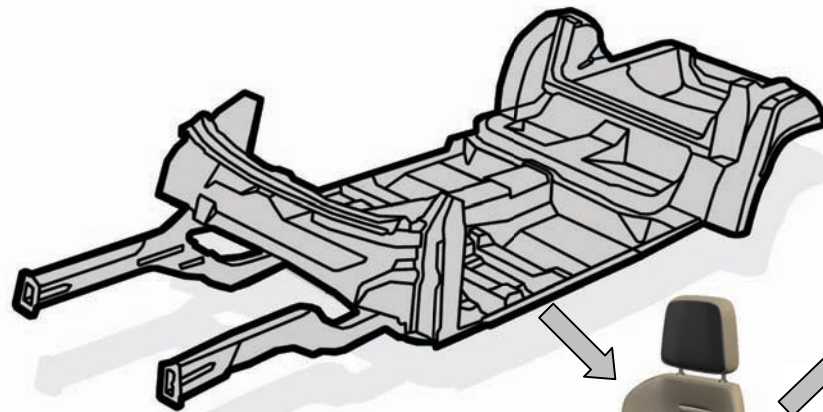




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### OEM Plattform „A“



RECARO Composite backrest  
RECARO Substructure



Basic Seat „Comfort“



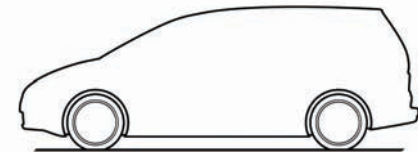
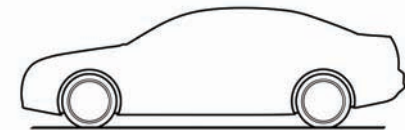
Sport Seat „Extra“



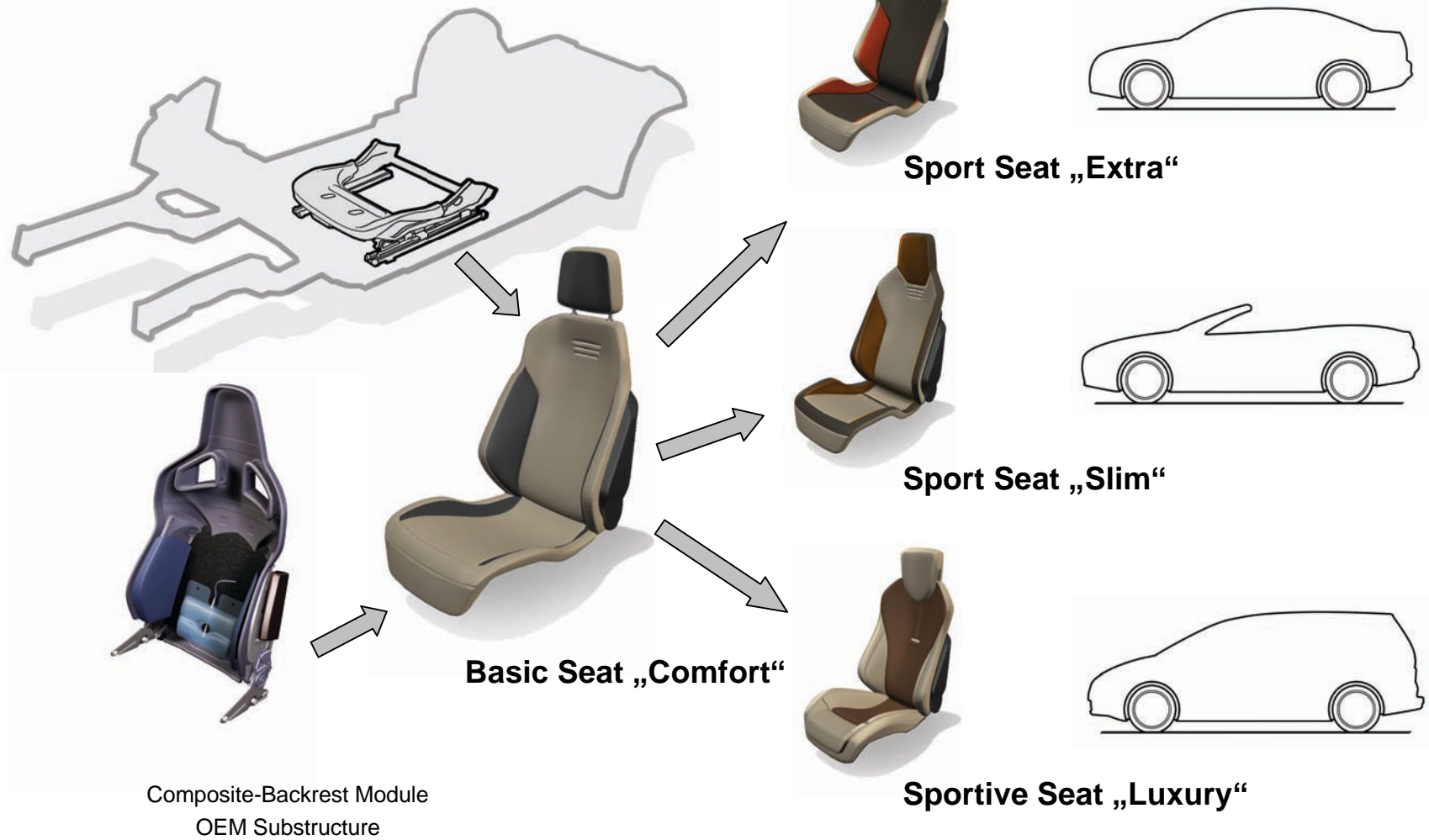
Sport Seat „Slim“



Sportive Seat „Luxury“



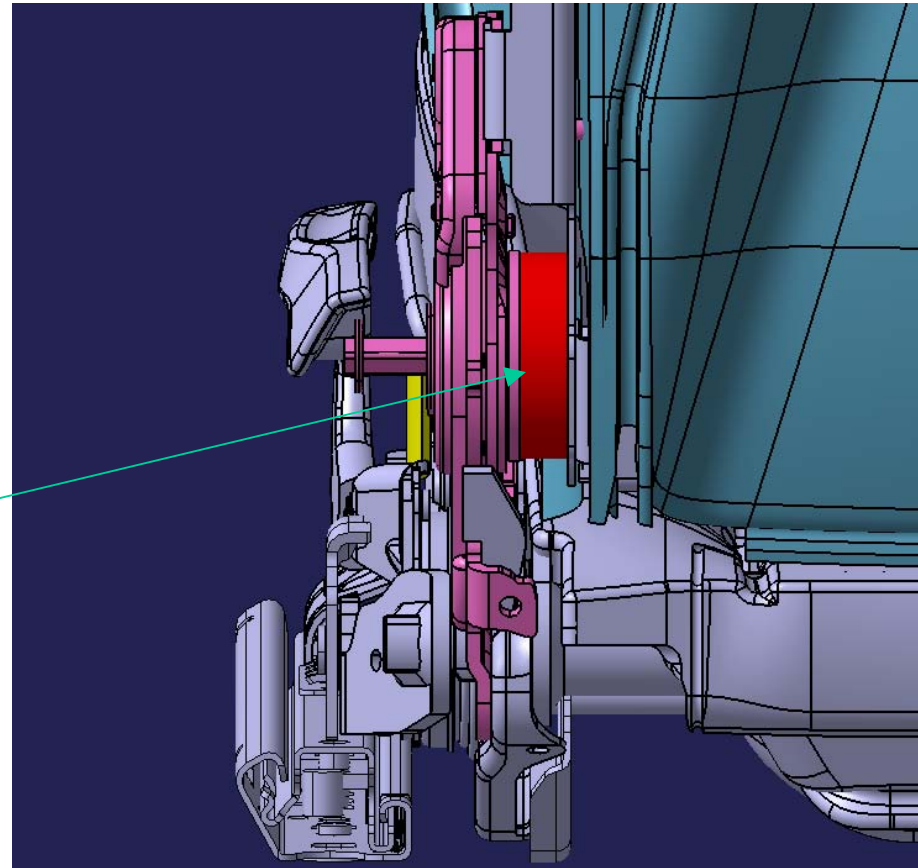
### OEM Seat Substructure



## joining concept

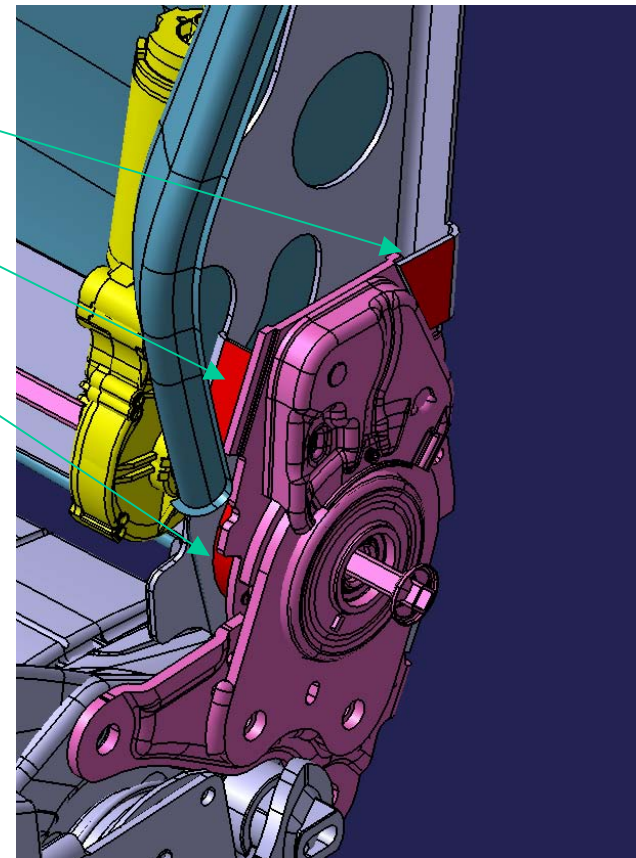
- Designing a modular sidemember
- Carry over existing recliners
- Bridge the gap with a spacer

spacer



## joining concept

- Spacer and welding positions





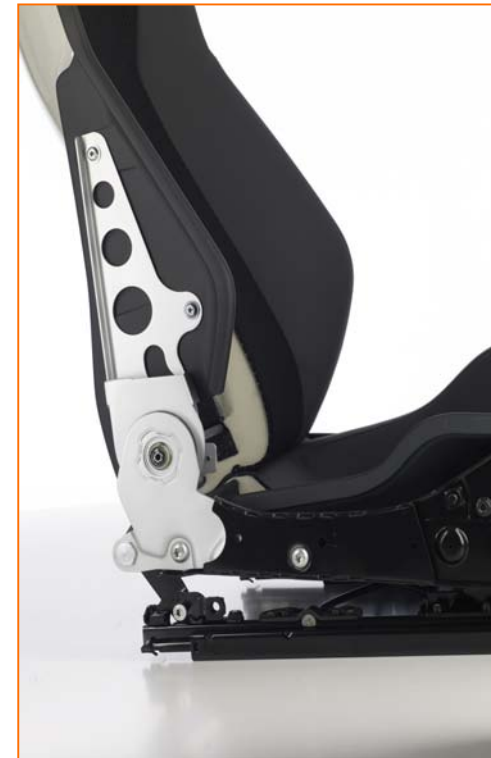
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### RECARO Values: **Modularity**

- RECARO's innovative composite backrests provide OEM customers with an ideal modular seat system. They can be adapted to any seat structure desired and provide a simply and quickly adaptable solution for almost any vehicle model, including models which already exist.



### RECARO Values: **Weight**

- As a specialist in full shells – with solid expertise from professional motor racing – RECARO is accomplished in developing lightweight shells made of any composite materials for series production.

The ergonomic seat contour provides a fully formed basis for comfortable and healthy seating, without having to use visible comfort extras such as lumbar supports.





### RECARO Values: **Safety**

- Our many years of experience designing for motor racing under the most difficult of conditions, in combination with the use of innovative technologies and the best materials, constantly influences our development of safe car seats.

The latest crash tests have once again provided testimony to the impressive safety and strength of the RECARO racing shells. They comply with the latest FIA requirements in every respect.



### RECARO Values: **Comfort**

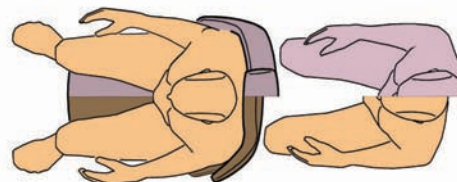
- Ergonomics and comfort are a top priority at RECARO and are a crucial quality standard. RECARO follows the philosophy that ergonomically designed backrests and seat shells are the most important factor in creating a comfortable seat. Supplemented only by the most important adjustable settings, this ensures that your RECARO seat will support your posture while sitting in your car for many years.



### RECARO Values: Roominess

- The especially sleek design of RECARO composite shells creates new possibilities in vehicle design. It also provides more legroom for the rear passengers.

The overall size of the vehicle can be reduced while the passengers still enjoy the same amount of space. This reduces weight, aerodynamic drag, fuel consumption and emissions.



### RECARO Values: **Individualisation**

- RECARO seats are easy to individualise thanks to the design of the back shells, which are made from composite materials (lower investment due to identical tooling). Using foam, covers or individually designed back shells, a seat design can be adapted to individual requirements and implemented across different car lines – ideal for special editions or top models of a series.



### RECARO Values: **Design**

- It is not just ergonomics and comfort that make a genuine RECARO something special – the possibility of creating a unique look for the car interior design is also a central feature.
- brand's history from over 100 years and 40 years of success in motorsport.
- appearance from ergonomic comfort to sporty and dynamic.
- optimally designed seats. always as simple as possible and as expressive as necessary.
- RECARO design does not follow short-lived trends but focuses on the four main factors:  
function, comfort, sportiness and look-and-feel.
- RECARO achieves an especially attractive, sleek seat design through the use of slender back rests made of composite materials.



**RECARO**








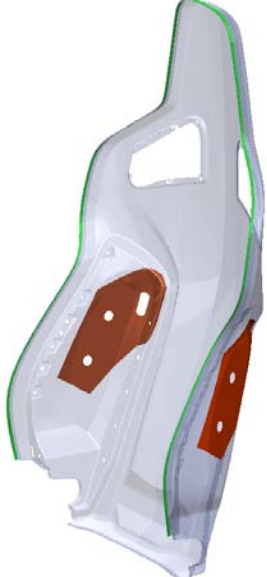
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- Manufacturing methods used by RECARO

	Laminat / Autoclave	RTM (Resin Transfer Moulding)	injection moulding	injection moulding IPPC	GMT, GMTex
	EP-GFK - EP-CFK	EP-GFK - EP-CFK			
Weight (g) seatshell / backrest	5500 (GFK) - 3500 (CFK)	1450 / 2760 (LBS)	1560 / 2840 (AE215)	1600	950+150 / 2270+190 (AE249)
Density (g/cm <sup>3</sup> )	1,45 - 1,25	1,5	1,6 (PA-GF50)	1,5 (CF) - 1,8 (GF)	ca. 1,3 (PP)
E-Modul (MPa) (for RT)	ca. 16.000	ca. 22.000	up to 16.000	ca. 22.000 (GF)-58.000 (CF)	> 20.000
E-Modul (MPa) (at 80°)	ca. 14.500	ca. 20.000	ca. 8.000	-	ca. 18.000
Fibre volume contents (%)	ca. 50-60	ca. 40-60	ca. 50	ca. 35 - 60	ca. 40
Fibre length	endless (tissues, mats...)	endless (tissues, mats...)	short <1mm	endless	ca. 50 mm resp. endless (GMTex)
Matrix	Duroplast	Duroplast	Thermoplast	Thermoplast	Thermoplast
economically by quantities:	100 - 1000/a	up to 5.000/a	> 10.000/a	> 10.000/a	as off 5000/a
cycle time	30-240 min (depending autoclave)	ca. 20 - 40 min	60 - 90 sec	ca. 60-120 sec	ca. 3 min
surface quality (without laquering)	very good	good (not Class A with GFK)	good (not Class A)	good (not Class A)	unsuitable
reworking	high effort	high effort	minimal (gate)	minimal	medium
	(demolding, edge trimming etc.)	(demolding, edge trimming etc.)			(abh. von Wzg.-Qualität)

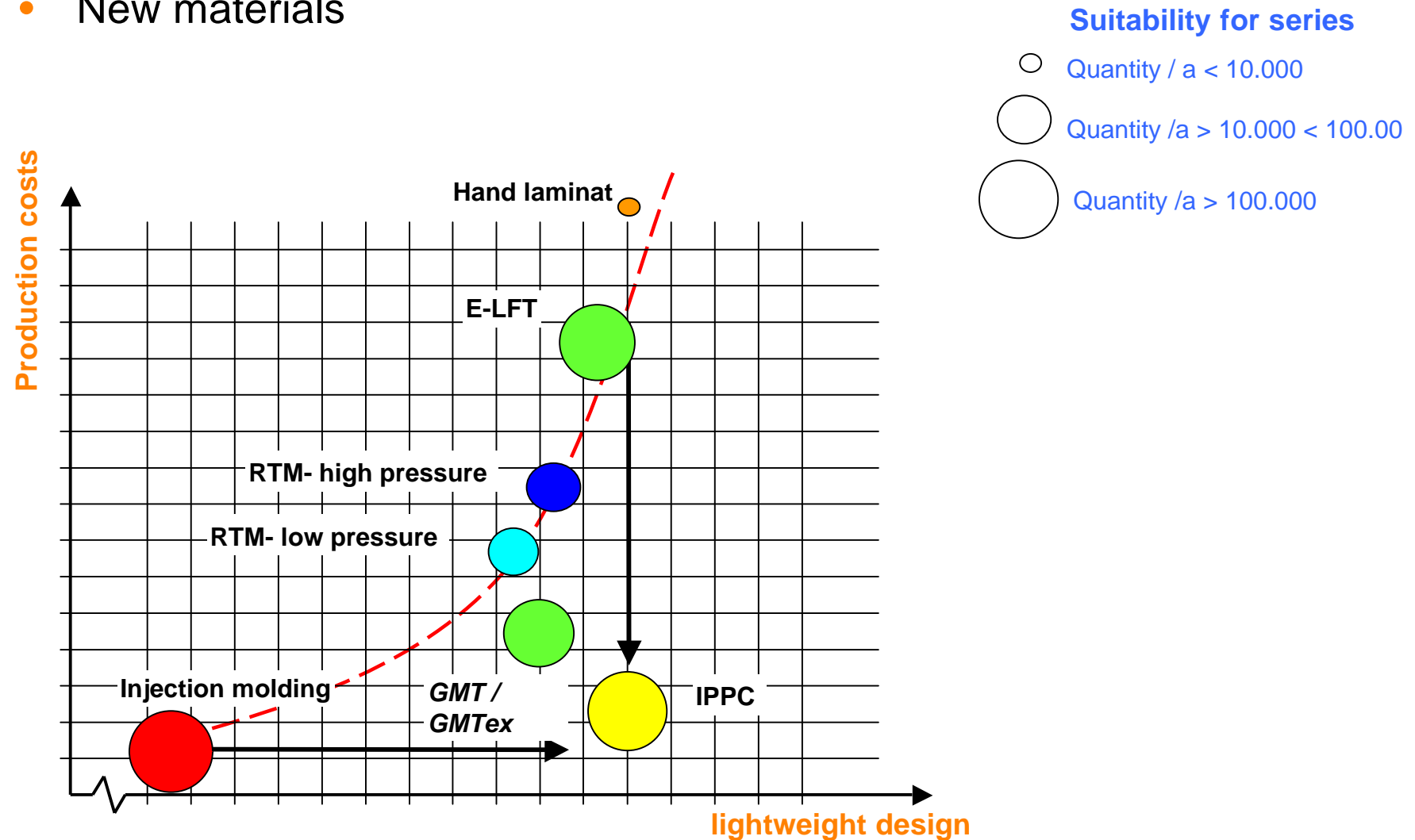
- Parts with different methods of fabrication

RTM		Injection moulding	GMTex	IPPC
high pressure (GFK)	Low pressure (GFK)			With organo sheets and rowing inserts
 <p><b>LBS (2004)</b> 2.550g</p>	 <p><b>AE168 (2007)</b> 2.500g</p>	<div>  <p><b>AE179 (2006)</b> 2.460g</p> </div> <div>  <p><b>AE215 (2007)</b> 2.840g</p> </div> <div>  <p><b>AE252 (2009)</b> 3.280g</p> </div> <div>  <p><b>AE264 (2009)</b> 3.400g</p> </div>	 <p><b>AE249 (2010)</b> 2.270g</p>	 <p><b>Pilot project (2010)</b></p>

Increasing performance requirements



- New materials

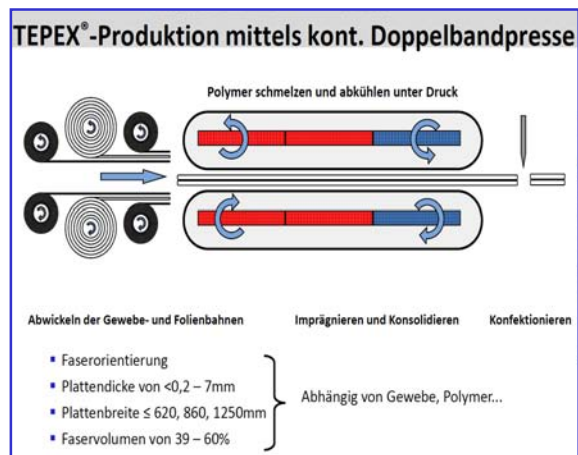


- Pilot project: composite backrest AI 324 mit IPPC
  - **IPPC** (Integrated Processing of Polymer Composites)
    - A new patent-registered technology for Hybrid manufacturing methods (integrated tow + organ sheet)
    - Combines composites with injection moulding
    - Light, robust and locally reinforced injection moulded parts
    - Applicable for high volume
    - Weight advantages within same cost range compared to metal sheet parts
  - Target:
    - Reduce weight
    - Keep cost
    - Achieve customer requirements



Quelle: KB Components

- Organic sheet (semi-finished products with thermoplastic matrix):
  - semi-finished products (panels with wall thicknesses of 0.05 mm - 0,2mm - 7 mm)
  - continuos fibres (glass = GF, coal = CF, aramid) embedded in a thermoplastic matrix
  - tensile strength 430 MPa (GF) to 800 MPa (CF); (steel: 410 – 510 MPa)
  - suitable for production of hybrid components
  - high mechanical strength



Quelle: Bond Laminates GmbH



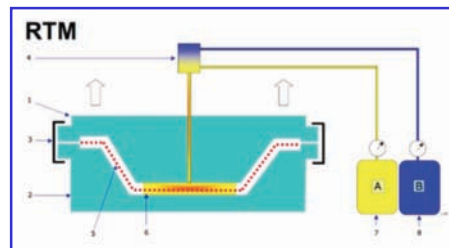


- Overview serial process for composites at RECARO

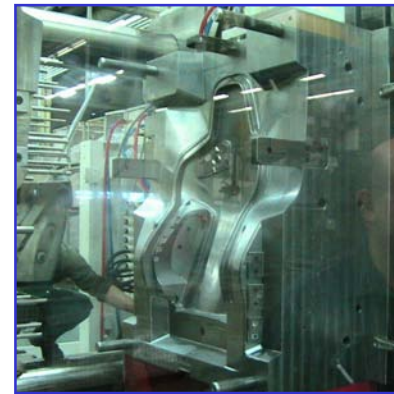
## Autoclave-technology



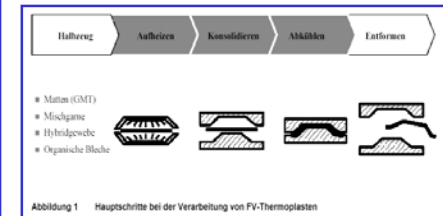
## RTM



## Injection moulding



## GMTex







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### Optimized concept

- Ergonomic comfort as usual
  - Airbag integrated backrest
  - No more side covers
  - Pilot project for new processing / IPPC
- 
- Designed for cross carline:
    - Fits to most existing OEM substructures
    - sample is also built up on RECARO owned substructure AI 219 with the lowest H- Point of 145mm
    - integrates the latest recliner generation of Keiper: Taumel 3000





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FOR FURTHER INFORMATIONS  
VISIT THE RECARO EXHIBITION STAND



THANK YOU  
FOR YOUR ATTENTION

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