



# 9th Annual Automotive Seating Innovators Summit

## Seating Comfort and Ergonomics

Although rarely mentioned in advertising and sales literature, the seating in a car is one of the most important components for the driver. It is the part of the car with which you will come into contact the most, and the comfort level of the seat plays a major role in the overall driving experience.

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### The Importance of Comfort and Ergonomics

It is thought that up to 10% of adults suffer from lower back pain, and one of the reasons for this is bad posture or sitting in the same position for prolonged periods. Long distance drivers and travelling salesmen will testify that sitting in a car and driving for several hours is akin to sitting in an office in front of a computer screen for the same amount of time. While we are all acutely aware of the need for good posture and regular breaks in the office, we do not always consider driving from the same viewpoint.

The spine constitutes several individual bones (vertebrae) which are joined together by intervertebral discs, ligaments and joints (1 ). This creates a strong but flexible 'S' shaped structure. When we are in a sitting position this natural curve flattens, and can cause pain over a long time period. Good, firm support for the lumbar (lower) region of the back can help to recreate the spine's curve and support the back in a comfortable position.

The ergonomic shaping of a seat, as well as the cushioning, are vital to the overall enjoyment of the driving experience; and ultimately to the perception of the individual vehicle. OEM's and seat manufacturers are constantly striving to find new ways to improve upon the ergonomics and comfort of their seats with a variety of different innovations, while continuing to develop new materials and processes to reduce the weight of the seating in line with car manufacturer's demands. While improved comfort and weight reduction appear to be at odds with one another, they should not be thought of as mutually exclusive; this article looks at a selection of seat manufacturers, and how they are tackling the issues of comfort and ergonomics.

### New Design Concepts in Seating Comfort

#### Lear

Lear is one of the world's largest manufacturers of the entire seat, and uses innovative concepts in each area of seating (2 ). Supplying a variety of different car manufacturers, Lear has developed a common frame for the seat structure and uses materials new to seat manufacture, such as magnesium, to give greater flexibility in design and better weight-to-strength ratios.

The foam used in car seats, typically polyurethane, has come under scrutiny as manufacturers look to lighter materials. Lear has developed its own SoyFoam seating which is environmentally-



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friendly, meets performance requirements for the automotive industry, and is lighter than PU foams. Lear's DECS (Dynamic Environmental Comfort System) is a layered design using SoyFoam, which is up to 50% lighter than other seating comfort systems. Lear has also added a recyclable softwood fibre padding to their seats, to replace conventional PU trim.

Lear's ComfortRest head restraint adds more flexibility for the driver as a single button controls up and down movement simultaneously with fore and aft adjustment. The technology allows 60mm adjustment in all directions. In the rear of the vehicle Lear has developed a ComfortSlide seat, which features adjustable cushions that allow 100mm movement, resulting in up to a 20 degree recline angle adjustment. This gives an extra dimension of comfort for rear-seat passengers.

## TU Delft



Source: TU Delft

One of the most prominent innovations in seating in recent years is the collaboration between the TU Delft University of Technology and BMW. Pictured below is the BMW show car unveiled at the IAA Motor Show Frankfurt in 2009, which incorporates the lightweight seat design with comfort contour. The BMW 7 series now includes the seating massage system designed by Mathias Franz as part of the project. The purpose of the research conducted for the design was to relate car seat comfort directly to the physiology of the human body.

The features developed were a comfort headrest, a new lumbar support, and a massage system. The intelligent massage system uses specific movement patterns to alter the pressure on the spine and reduce muscle tension. Positive test results by the university have shown that the system reduces muscle activity and improves comfort.

## Continental

Continental Automotives Seat Comfort Systems use a variety of different technologies and innovations to produce a very flexible seating system, with several integrated benefits ( 4 ). Up to eight axes of adjustment can be used to suit each particular driver, and the settings can be stored in the memory to retain your preferences, which can even be programmed into the keys for different drivers. The seats can be climate controlled, and include a massage system and dynamic lateral support to prevent movement when cornering.



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Heated and climate controlled seats offer an extra level of comfort. Although heated seats are common in cars, they are increasingly being used alongside climate control to remove excess moisture from the seats. With active cooling, the Continental seats can be cooled via elements to below the ambient temperature inside the car. The air flowing into the seat is cooled in advance, giving passengers a greater temperature range and greater comfort.

Seat adjustment is electronically controlled, and as well as the usual axes of adjustment – fore and aft, seat height, backrest angle, and head restraint height, the Continental seats offer further controls. Adjustment can be made to the seat angle, the seat length, the backrest width, the upper backrest angle and the footrest. The memory offers several key functions, as it is possible to program each individual users preference into the system, which can also be programmed into the key memory; therefore adjusting the seat automatically when you unlock the door. For coupes and smaller vehicles, Continental include an extra feature whereby the seat automatically moves into a position which allows the driver more room to enter or exit the vehicle, before returning to the users preference.

Their pneumatic massage system is another innovation built into the seat which provides an extra level of functionality and comfort. The seat has air chambers built into the backrest and head restraint which can be controlled by the driver to best suit their position, and can be automatically used as a massage system when driving. Individual air chambers are inflated and deflated as required, and the system is monitored by pressure sensors. Preferences can be stored in the system memory, and pressure sensors automatically control any fluctuation in pressure caused by driving conditions, such as driving up-hill.

## Johnson controls – IE:3 Demonstrator Vehicle

Johnson Controls is one of the worlds leading suppliers of seating systems and components, and display their innovative seating products in their 'Inspired Efficiency' demonstrator vehicle, pictured below (5 ). The seating incorporates several design concepts, including front row passenger seat flexibility, second row comfort seats, fold-flat seating to 0 degrees, with an extreme reclining position of 45 degrees, and Johnson Controls' 'Fasertec' which uses natural fibers.



Source: Johnson Controls

The front passenger seat uses a cantilever design which enables the seat to be folded flat for extra storage, while the extreme recline position of 45 degrees is supported by a cushion angle adjustment of 15 degrees. The reclining and fold flat systems are also extended to the rear seats,



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offering greater flexibility and comfort for rear passengers. Johnson Controls' modular seating system MS 2.0 includes a one piece back frame which helps to reduce the overall weight. The Fasertec technology uses bonded natural fibres which are covered in a non-woven material. Not only is this material environmentally-friendly, it also offers greater comfort and support while having a slimmer profile than other seating materials.

## Summary

Weight reduction is one of the key issues in automotive manufacturing today. Car manufacturers are required by EC legislation to reduce the weight of their fleet in order to meet targets for reduced carbon emissions. This has a knock-on effect on the seating sector, as the seating in a car can contribute significantly to the overall weight of the vehicle; in the region of 5-10%.

The challenge for OEM's and seating manufacturers is to reduce the weight of their seats and components while continually aiming to improve driver comfort, seating ergonomics, safety and functionality. It is essential for manufacturers to find new and innovative design concepts to develop the comfort of seating without impacting negatively on the weight. In general terms the heavier a seat, the more comfortable; it is the extra padding and cushioning which can increase the weight.

It is also necessary for manufacturers to research and develop new materials and new production processes which can reduce the weight and profile of seats, while increasing comfort at the same time. It is important for manufacturers not just to consider the seat as a stand-alone product, but to consider it in conjunction with the human body and its contours, to develop seating which supports and maintains the human posture.

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If you want to find out more about this topic, you can do so at the [9th Innovations in Automotive Seating Summit](#), July 27 - 29, 2015 in Detroit. Please visit our website to [request the brochure](#), find out who has joined us at past events, and glance at complimentary industry content.

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## References:

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