

## **Case Study**

### **Passion for Performance**

#### **Bentley utilises RAMSIS to exceed comfort expectations of driver and passengers.**

All Bentley models have multiple secret test drivers! The concept layout, package, and design of the Continental GTC, Azure and Brooklands were tested and ergonomically improved with the human modeling tool RAMSIS. For five years, Bentley has been using the leading edge ergonomic software - in particular to develop new solutions for front seat positions, rear occupancy space, and confirmation of vision to primary components. "Prior to RAMSIS we had to create a physical model and a vehicle simulator (buck) to identify and resolve ergonomic concerns, a time-consuming and expensive process. RAMSIS allows Bentley to discover major package problems before a costly ergonomic buck or clay model is manufactured," says John Dickenson, Pre Development Cabin Zone Package Manager at Bentley. "The ergonomic software has helped to further streamline our design process."

#### **Seamless workflow integration**

RAMSIS studies are fundamental in our pre development and target-setting phase for a new vehicle. The upfront digital RAMSIS studies allow the pre development team to resolve basic problems and ensure that the first physical properties are well considered. We use the buck to validate the digital RAMSIS studies and demonstrate the package and ergonomic hard points to the rest of the business. As the style and design progresses we use RAMSIS to approve detailed changes such as the position of the air bag warning lamp.

RAMSIS also facilitates communication within departments. Bentley relies on the software's ability to create a frozen manikin surface. The pre development department produces a 2D package and hard point document that defines principle dimensions and package targets. RAMSIS is used to confirm the front seat and steering wheel adjustment by creating manikins that represent the shortest to tallest occupants. These manikins are frozen in position and released to engineering functions as a set of surfaces to represent space targets for knee room or headroom and hard points to define eye points. Previously, engineers only had simple 2D manikin templates to work with; great for creating sections but no help when developing trim surfaces. They now use a RAMSIS surface model to ensure 3D clearance targets are met.

### **Improved communication of ergonomic issues**

It can be very difficult to understand the ergonomic problems, such as vision, faced by a 5ft woman driver when you are a 6ft male. RAMSIS studies are key to understanding and demonstrating the ergonomic issues of occupants with a wide range of body sizes. RAMSIS ensures Bentley can be confident that their designs are suitable for all.

The Bentley team has even modeled their CEO and their chief engineer as RAMSIS manikins to better understand the subjective feedback received from the ergonomic buck. When they ask for more headroom or shoulder room we can create a surface model and release the requirement to engineering.

### ***Leading edge in ergonomics***

Five years ago – when introducing RAMSIS - Bentley validated the RAMSIS studies completed on the first projects on an ergonomic buck. The results were so similar that RAMSIS has become an important tool to assist decision-making. Major concept and ergonomic features are backed up digitally with ergonomic studies. For example, RAMSIS was used heavily in the concept and style feasibility phase of the Azure and Brooklands. Studies for these models focused on ensuring sufficient rear legroom and shoulder room. Both cars have class leading rear occupancy space. Further studies were undertaken to optimise the position of a new belt integrated front seat and improved steering column adjustment.

### ***Specific comfort targets***

Bentley has customised many features within RAMSIS, using the software to implement strategic targets. They have created unique manikins based on 'High Income Adult' anthropometrical data to ensure their vehicles meet the comfort expectations of all users. The adults in this database have, for example, a tendency towards broad shoulders. "We were able to use these manikins to define the rear compartment surfaces in the Azure and Brooklands.

### ***Advantage in comfort on long journeys***

Customers expect top comfort from a premium car brand. With RAMSIS Bentley can keep this promise with ease. Even on long car rides occupants will sit comfortably. RAMSIS can predict an occupant's seating position within the seat's adjustment range. This allows Bentley to optimise the position of a new seat in the vehicle. The seat positions are then used to define steering wheel position and armrest heights and to confirm vision to the kombi (main dials) through the steering wheel.

### ***More space for new ideas in cabin layout***

Good vision to the kombi is essential for comfortable and safe driving. However, Bentley's interior design creates unique challenges. The symmetrical design, use of solid wood and traditional style

dials, result in the dials being positioned close to the steering wheel. Most modern cars have dials set deep within a binnacle. Bentley dials, mounted behind the wood surface, appear larger in the steering wheel aperture potentially limiting the range of the column adjustment for each user. Therefore, they pay particular emphasis on the position of the column and dials to ensure all occupants are accommodated.

RAMSIS provides the Bentley engineers with greater flexibility for creative and innovative solutions within the typical Bentley style. "We can simulate a range of concepts for dial and column positions on the computer and give a quick response to Styling. The design can go through numerous digital iterations before we create the design in a buck or clay model." says John Dickenson.

#### **Future plans: international ergonomic studies**

Bentley is experiencing rapid growth in markets like Russia, India, and China. "We will develop manikins that reflect the anthropometrics and specific requirements for these regions".

Future projects at Bentley will use RAMSIS v5 to optimise occupant space and comfort. We will be working closely with our Styling team to ensure that our new models have the world's best interior design with minimal ergonomic compromise.