

Uncertainty Quantification (UQ) for Passenger Restraint Designs

This case study shows how RAMDO® software, when used in conjunction with vehicle crash simulations, provides greater insights into which human population segments are most at risk for injury.

Using RAMDO UQ, engineers are able to consider the variability of age, stature, BMI, and gender in their designs of passenger restraint systems...ultimately protecting more human lives.

CHALLENGES

Since people come in so many shapes and sizes, it can be difficult to design a passenger restraint system that will accommodate everyone. Because physical prototypes and crash test dummies are expensive and limited in testing all the possible outcomes, engineers turn to computer simulations to model crash tests.

But simulations don't account for the variations of the people being modeled, predicting which population segments are most at risk, and being able to cost-effectively evaluate all the desired scenarios.

OBJECTIVE

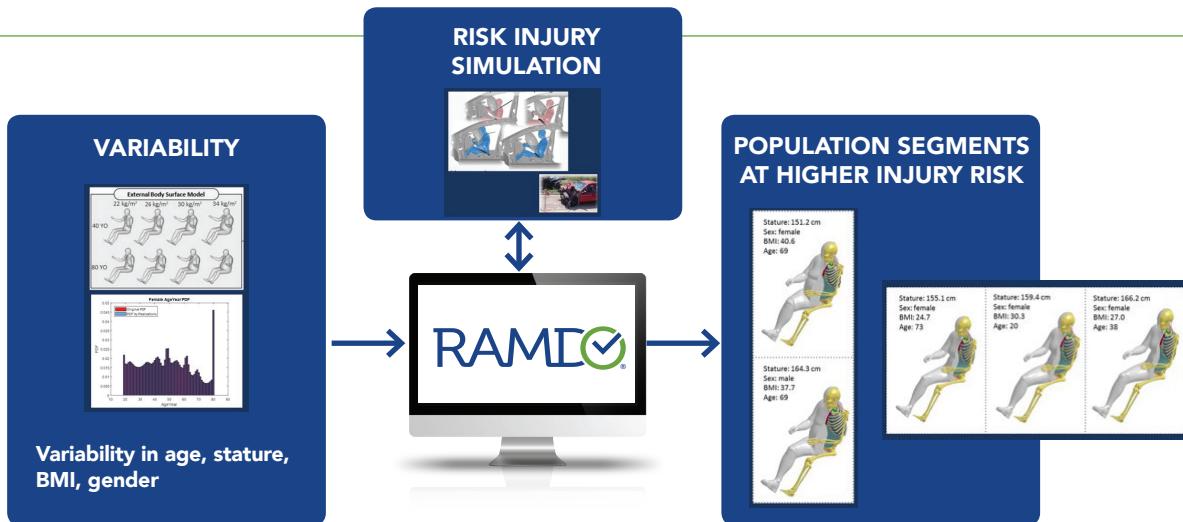
Provide engineers with a tool to reliably predict which human populations are more at risk for injury in vehicle crashes, guiding the design of passenger restraint systems to protect more lives.



METHOD

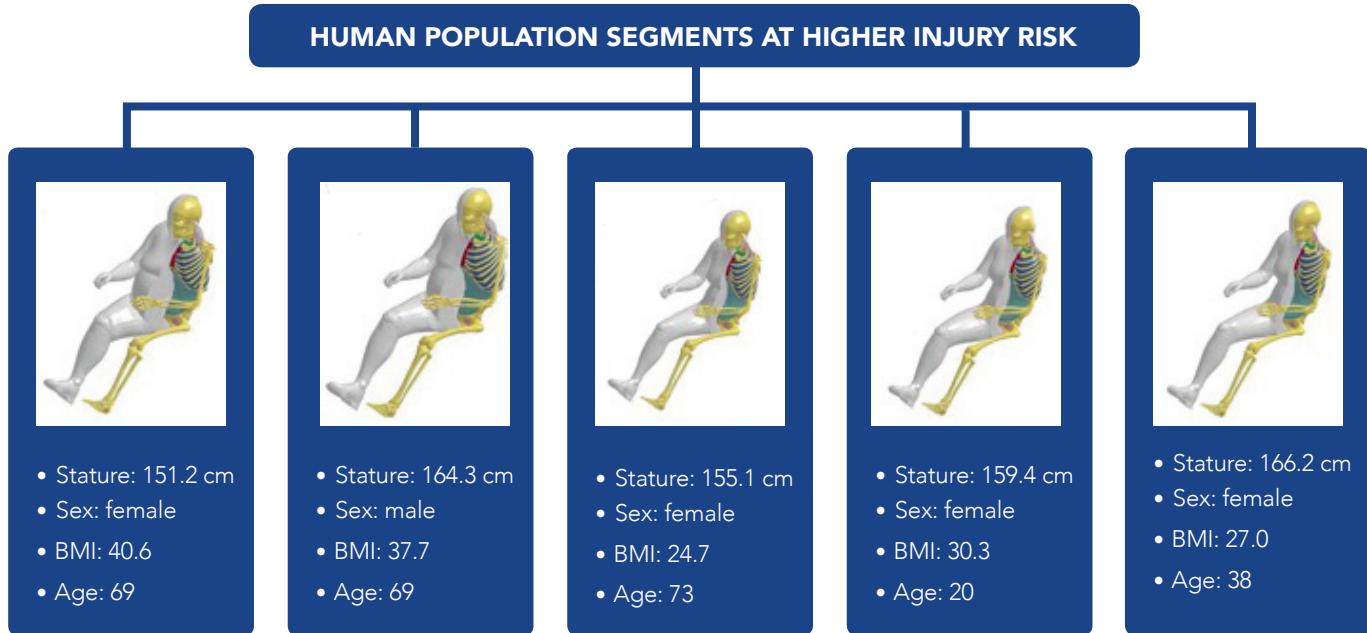
RAMDO works in conjunction with the simulation model, allowing engineers to define the variability of the input parameters. It then builds a surrogate (math) model to approximate the simulation model. This allows RAMDO to efficiently and cost effectively run many more scenarios for any given simulation. The simulation output is provided as a statistical distribution, showing the entire range of potential results and the given probability of each outcome.

RAMDO's proprietary computational methods, surrogate modeling techniques (Dynamic Kriging™), and sampling methods (Variance Window™) make all this possible in an efficient, user-friendly, and cost-effective manner.



RESULTS

RAMDO's methods provide greater insight to human populations more at risk for injury, allows designers to create passenger restraints to protect more lives, and does all of this in a cost-effective and efficient manner.



ADVANTAGE

Crash simulations only accounting for a small portion of the population leave many lives at risk. Passenger restraints designed for the average size male, only protect a portion of the human population. RAMDO can help identify population segments more at risk, guide designers to passenger restraint improvements, and ultimately save lives!

SUMMARY

With the ability to consider multiple input variabilities in crash simulations, RAMDO provides the added information necessary to help engineers produce better and safer passenger restraint systems for everyone.