

# Ford uses PAM-CRASH for human modeling to advance automotive safety research

Featuring  
PAM-CRASH

## THE CHALLENGE

- Understand occupant impact injury mechanisms during vehicle crashes
- Apply research & development findings at an industrial level
- Participate in NHTSA\* and US government industry meeting to improve safety regulation
- Pursue research to better define occupant injury criteria

\* National Highway Traffic Safety Administration in the USA

## THE STORY

*“PAM-CRASH is a tailored simulation tool for advancing researches in biomechanics in replacement of impact tests with human body models.”*

Dr. Jesse Ruan, Technical Specialist, Biomechanics and Human Body Modeling at Ford Motor Company

## THE BENEFITS

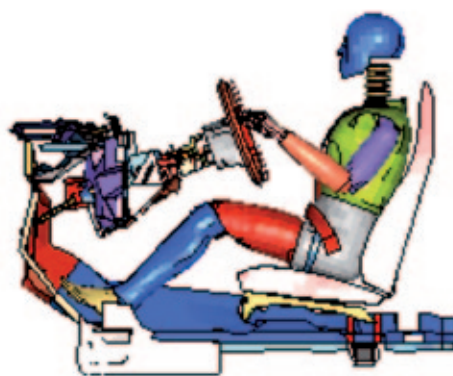
- Successfully develop a realistic human body model using Finite Element Method
- Provide primary research tool for occupant impact simulation

Ford Motor Company is a global automotive industry leader based in Dearborn, Michigan, USA. Ford Motor Company manufactures and distributes automobiles across six continents. The company owns several automotive brands including Ford, Lincoln, and Mercury which offer a variety of cars, trucks, SUVs, cross over and many other products and services to the automotive consumer.

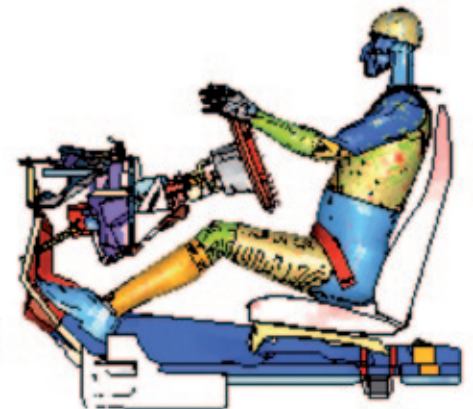
## A LONG-STANDING RELATIONSHIP

Ford Motor Company and ESI have had a long-standing relationship since the early nineties. It is then that Ford Motor Company started using PAM-CRASH for advanced biomechanics simulation in research and development, and it still does today. PAM-CRASH is ESI's structural crash analysis application software, included in Virtual Performance Solution.

Ford used PAM-CRASH for biomechanics research since the early 1990s. The project started with human head injury modeling and carried on building the whole human body model. Ford is one of the few carmakers developing human body modeling techniques today. With these technologies, virtual human crash tests can be realized. The virtual human models are savvy alternatives to study the dynamic responses of real humans during blunt impacts, since using actual human subjects for physical testing is undesirable, if not impossible.



Crash Simulation with Dummy Model



Crash Simulation with Human Body Model

## DEFINING IMPACT INJURY CRITERIA

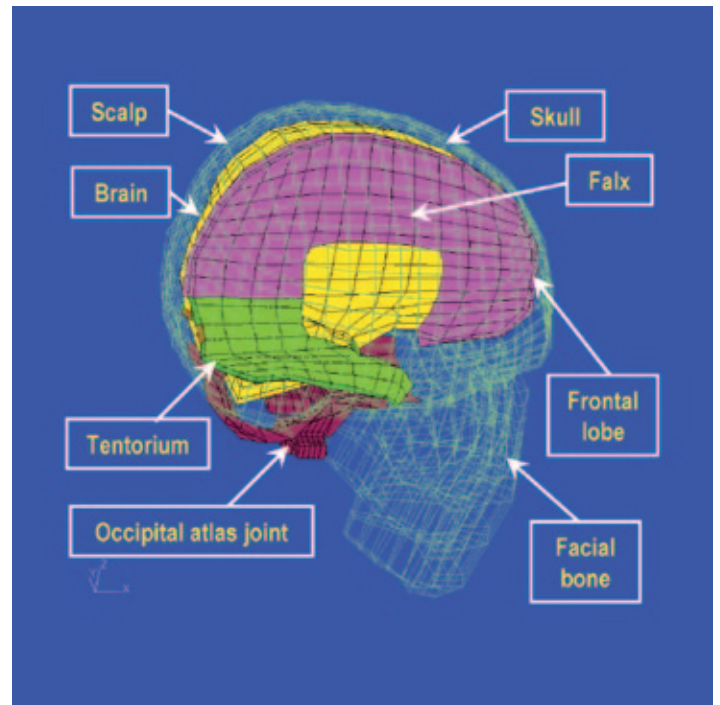
Ford Motor Company uses PAM-CRASH mostly to perform impact biomechanics research. Engineers set up model and related parameters to measure the impact responses of the vehicle and different parts of the occupant - including brain, chest, thorax, abdomen and low extremity - during vehicle crashes.

The starting point of the project is brain injury modeling, which is obviously of high importance and complexity in vehicle safety. Then the rest of the body is modeled.

It is a very important aspect to have the model as close as possible to the real human, and that includes accurate model geometry and human-like material properties.

Stress-strain analysis are performed on the deformable model, as stresses/strains are the physical parameters related to injury, recovery, and growth of biological tissues.

Injury criteria are then defined once the mechanisms of injury are known through the impact simulations with the human body model.



Human Head Injury Finite Element Model

To find out more on about ESI's biomechanics and safety offer, please visit: [www.esi-group.com/biomechanics](http://www.esi-group.com/biomechanics)

## ABOUT FORD MOTOR COMPANY

Ford Motor Company, a global automotive industry leader based in Dearborn (MI, USA), manufactures or distributes automobiles across six continents. With about 200,000 employees and about 90 plants worldwide, the company's automotive brands include Ford, Lincoln and Mercury. The company provides financial services through Ford Motor Credit Company. For more information regarding Ford's products, please visit [www.ford.com](http://www.ford.com).

## ABOUT ESI GROUP

ESI is a pioneer and world-leading provider in virtual prototyping that take into account the physics of materials. ESI has developed an extensive suite of coherent, industry-oriented applications to realistically simulate a product's behavior during testing, to fine-tune manufacturing processes in accordance with desired product performance, and to evaluate the environment's impact on performance. ESI's solutions fit into a single collaborative and open environment for End-to-End Virtual Prototyping, thus eliminating the need for physical prototypes during product development. The company employs over 750 high-level specialists worldwide covering more than 30 countries. ESI Group is listed in compartment C of NYSE Euronext Paris. For further information, visit [www.esi-group.com](http://www.esi-group.com).



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