Basic Research with A Purpose:
How DOE Science Helps U.S. Industry Compete

A View from the Auto Industry

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Basic Science Research and the Automobile: How are they connected?

Two main parts to the story:

- Our nation's past investments in basic science have made many of the technologies in today's automobiles possible.

- The unique tools used to answer basic science questions can also help auto industry researchers address current challenges.

Basic science research helps the auto industry to continue to innovate – bringing safe, sustainable mobility to our consumers.
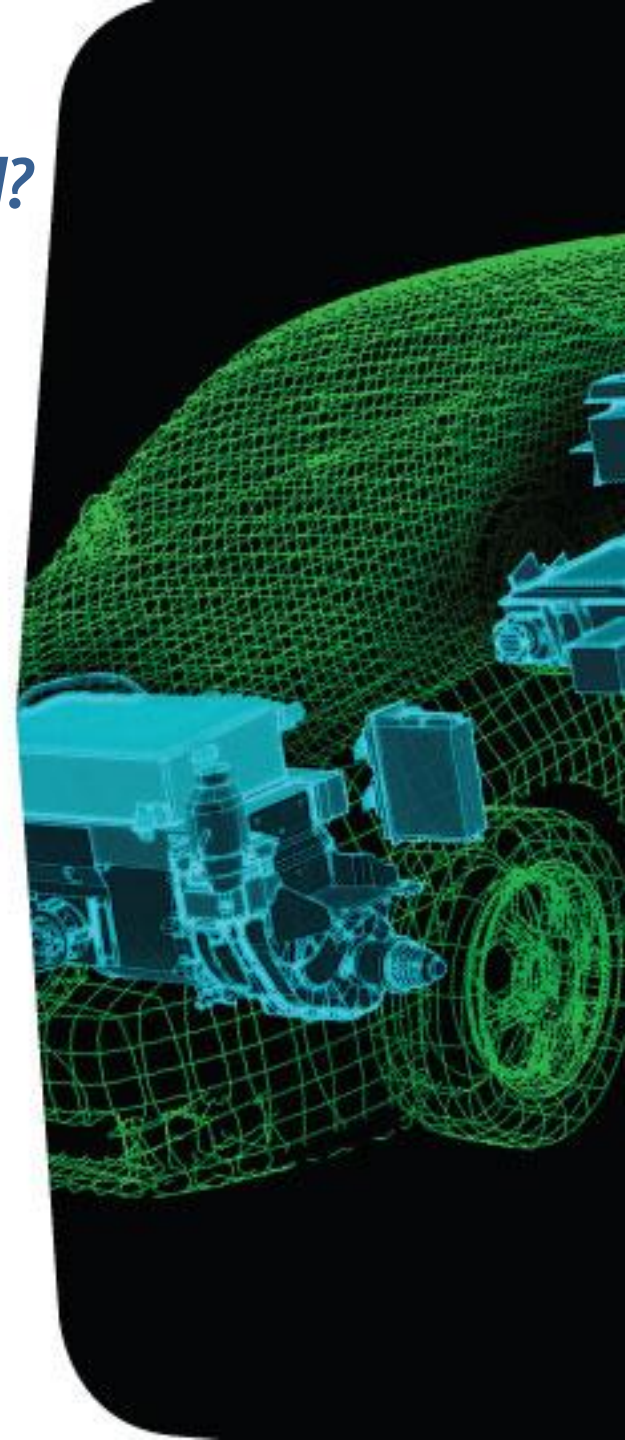
GPS-satellite technology

LCD screens

Catalytic Converters – NSF sponsored Ceramics Research

Micro-Electrical-Mechanical Devices (e.g. Airbag Deployment)

Shatter Proof Windshields

Tire tread design

Using Neutrons to Build Better Automobiles

•Neutron scattering is a powerful tool to study how materials are made and how they can be improved.

•SNS provides the most intense pulsed neutron beams in the world.

Auto industry partners are using SNS to:

•Develop thermoelectrical materials to use engine exhaust heat to power the vehicle's electrical systems – boosting fuel economy.

•Study batteries' charge and discharge systems, and how the battery materials change after many cycles.

High Performance Computing: Enhancing Vehicle Safety Technology

- Work is underway to use HPC tools to achieve breakthrough designs in automotive safety.

- Our challenge is to optimize vehicle safety by measuring the effects of a crash on all of the physical attributes of the human body.

- Such testing requires a mathematical model of the full human body, a "grand challenge" in itself to develop.

- Increasingly powerful high performance computers will allow industry researchers to integrate this full human model into already complex crashworthiness simulations.

High Performance Computing: Burning Fuels more Cleanly and Efficiently

- Combustion in an engine is an extremely complex process.

- After more than a century of the internal combustion vehicle, we are still learning about how to optimize engine combustion.

- Powerful computers are needed to capture:

  - the details of the engine configuration,
  - the fuel properties, and
  - the combustion behavior.