



**INNOVATIONS** IN  
**TRANSPORTATION**

## Delivering Innovation

The U.S. Department of Energy's Oak Ridge National Laboratory develops knowledge and technologies that accelerate the deployment of new vehicles and efficient transportation systems powered by domestic, renewable, clean energy.

Through its Sustainable Transportation Program, ORNL brings together experts from across scientific disciplines to partner with government and industry in addressing transportation challenges. Current research is focused on developing technologies that speed the widespread use of electric vehicles, increase vehicle efficiency and security, enable use of renewable biofuels and natural gas, and enhance operability for the whole transportation system.

Using ORNL's world-class science capabilities, researchers are transforming new scientific discoveries into advanced technologies for commercialization by America's transportation industries.

## Collaborating with Industry

Industry can access ORNL's vehicle technologies expertise and research facilities through partnership mechanisms, including user agreements, sponsored research, and cooperative research and development agreements.

ORNL actively participates in government-industry partnerships such as U.S. DRIVE and 21st Century Truck. These partnerships encourage a continuous dialogue between scientists and industry leaders about the most beneficial targets for research and development.

## DOE's Most Comprehensive Transportation R&D Facilities



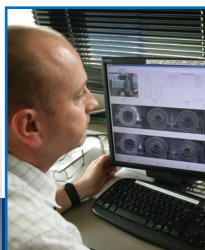
### Battery Manufacturing R&D Facility

Nation's largest open-access battery research facility



### Carbon Fiber Technology Facility

North America's unique and comprehensive carbon fiber development capabilities



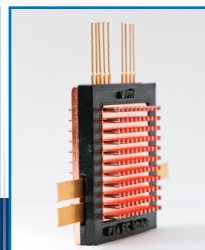
### Center for Transportation Analysis

Predictive information, analysis of big data, decision-making tools



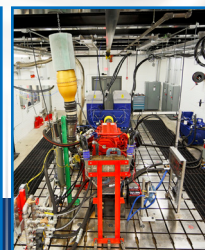
### Fuels, Engines, and Emissions Research Center

Unique tools and expertise for integrated research on combustion, fuels, and emissions



### Power Electronics and Electric Machinery Research Center

DOE's largest resource for electric drive technologies



### Vehicle Systems Integration Laboratory

Advanced powertrain systems integration



### ORNL's Core Science Capabilities

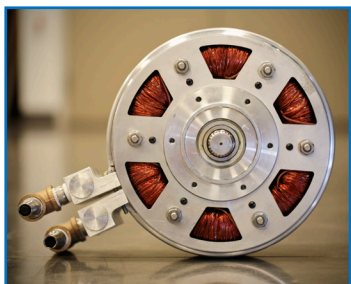
Neutron imaging, high performance computing, materials characterization



ORNL researchers developed the world's first high-power (20 kW) wireless charging system for passenger cars. The system achieves 90% efficiency at three times the rate of common plug-in systems.

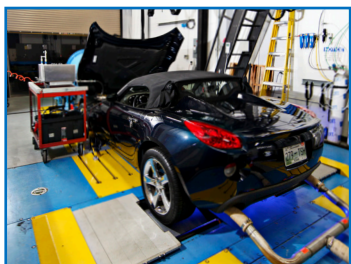
## R&D Focus Areas:

ORNL's sustainable transportation research objectives align with national goals for reducing U.S. dependence on foreign oil, regulating greenhouse gases to slow climate change, boosting America's economy, and improving national energy security.



### **Electrification**

*Developments in energy storage technologies, charging methods, fuel cells, electric machinery, power electronics, and advanced materials are speeding the deployment of electrified transportation systems.*



### **Vehicle Efficiency**

*Advances in efficiency are being achieved through development of lighter materials, advanced combustion technologies, new powertrain materials, and integration of vehicle systems.*



### **Alternative Fuels**

*Researchers are addressing barriers to effective use of non-petroleum-based fuels through the advancement of bio-based products and natural gas.*



### **Intelligent Transportation**

*ORNL produces decision-making tools, such as [www.fueleconomy.gov](http://www.fueleconomy.gov), and accelerates the development of intelligent technologies that enable safer, more efficient movement of passengers and freight.*



### **Award-Winning Science**

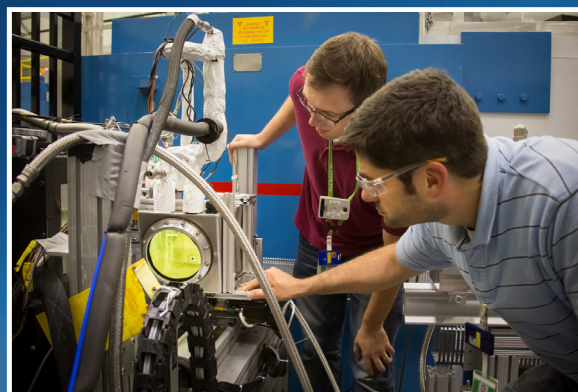
*ORNL's Sustainable Transportation Program has won 19 R&D 100 awards including the 2014 award in partnership with General Motors for developing a low-viscosity lubricant featuring ionic liquid antiwear additives that can boost fuel economy by 2% compared with commercially available synthetic 5W-30W oil.*



**ORNL materials and technologies are in millions of vehicles on the road today.**

## Applying Big Science Capabilities for Industry

In partnership with General Motors, researchers are using neutrons at ORNL's High Flux Isotope Reactor to analyze the spray inside fuel injectors, seeking the sources of efficiency-robbing cavitation. Researchers are also studying combustion with partners Ford Motor Company and Convergent Science, using Titan to simulate thousands of engine cycles with speed and accuracy.





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