



“By leveraging ORNL’s world-class facilities in high-performance computing, data analytics, and transportation, we’re able to develop and deliver interdisciplinary solutions for next generation mobility.”

Jacky Rios-Torres
Researcher, Connected and
Automated Vehicles



Driving Innovations in Transportation

Oak Ridge National Laboratory (ORNL) is accelerating the pace of research and development (R&D) for efficient, safe, secure, and environmentally friendly transportation. By leveraging the National Transportation Research Center (NTRC)—the Department of Energy’s (DOE’s) only dedicated user facility focused on transportation—our researchers identify new materials for next-generation systems; provide decision-making tools and intelligent technologies for secure, efficient movement of passengers and freight; and create economic opportunity for the nation by improving the energy efficiency of light-, medium-, and heavy-duty vehicles.

Next-Generation Research

Electrification and fast wired and wireless charging—

Early-stage technologies to speed deployment of electric vehicles, including extreme fast charging; advanced batteries, fuel cells, electric machinery, and power electronics; and roll-to-roll technologies.

Data science, automated technologies, and vehicle cybersecurity—

Unique security expertise to detect and prevent cyberintrusions; advanced sensors, controls, algorithms, and other technologies to safely and efficiently guide automated and connected vehicles; and analysis of transportation fuel economy and fleets.

Materials for future vehicles—Durable, cost-effective, lightweight materials and advanced processes for next-generation vehicles, including high-temperature alloys for engines, advancements in carbon fiber, 3D printing, and advanced materials joining techniques.

Fuels, engines, and emissions research—Co-optimization of advanced fuels and engines, low-temperature catalysts, and emissions controls; breakthroughs in biofuels production; and integration of vehicle systems.



ACCELERATING

extreme fast charging for electric vehicles



ADVANCING

technologies for automated and connected vehicles



DEVELOPING

durable, lightweight materials for next generation vehicles



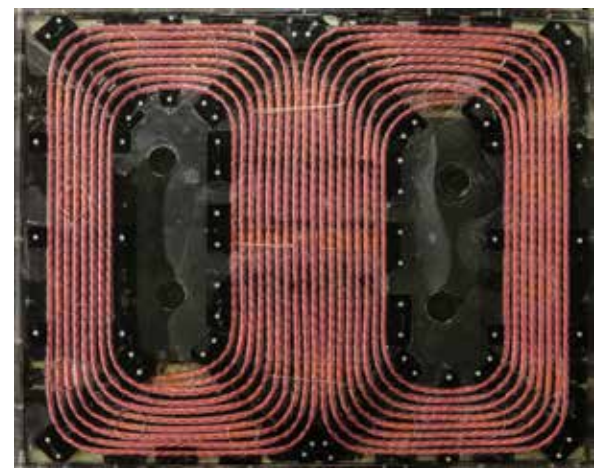
CO-OPTIMIZING

advanced fuel and engine technologies



APPLYING

data science for vehicle cybersecurity and fleet efficiency



ORNL demonstrated a 120 kilowatt wireless charging system for vehicles providing six times the power of previous technology.



Impacts and Partnerships

- Using neutrons at ORNL’s High Flux Isotope Reactor and Spallation Neutron Source to analyze the spray inside fuel injectors; seeking the sources of efficiency-robbing cavitation. Partner: General Motors.
- Using Titan, the nation’s fastest supercomputer, to study combustion by simulating thousands of engine cycles with speed and accuracy. Partners: Ford Motor Company, General Electric, and Convergent Science.
- Applying characterization, modeling, and simulation capabilities to accelerate the design of a new traction power inverter for the 2016 Chevy Volt. Partner: Delphi.
- Developing new high-temperature aluminum alloys for automotive cylinder heads using materials characterization expertise and high-performance computing. Partners: FCA US LLC, Nematik.
- Using analytical chemistry and materials science to develop new catalyst technologies that operate effectively in the low-temperature exhaust from next-generation engines.
- Using the VULCAN instrument at the Spallation Neutron Source to investigate the performance of a new aluminum alloy in a gasoline-powered engine; measuring strain and stress on a cylinder head cast from aluminum-cerium alloy.

22 R&D 100 Awards

145 Industry Partners

32 University Partners

178 Publications in FY 2018

Licensed Technologies

Carbon fiber precursor—LeMond Composites licensed ORNL’s process to convert acrylic textile material into carbon fiber, cutting costs by 50%.

Carbon fiber production—RMX Technologies licensed ORNL plasma oxidation technology to reduce energy consumption by 75%, shorten production time by 2.5 to 3 times, and cut production costs by 20%.

Lithium-sulfur batteries—Solid Power Inc. licensed a portfolio of ORNL battery technologies to develop safe solid-state rechargeable batteries with high energy density.

iDriving real-time data—SanTed Project Management LLC licensed technology to determine how driving style affects fuel economy for the trucking industry.

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DOE’s Most Comprehensive Transportation R&D Facilities

The **National Transportation Research Center** helps industry, academia, and other agencies accelerate the development and deployment of efficient and secure transportation technologies. Research focuses on electrification, efficiency of combustion and emissions, data science and connected vehicles, and materials for future systems.

The **Carbon Fiber Technology Facility** (CFTF) is developing methods using low-cost feedstocks to assist industry in overcoming the barriers of carbon fiber production cost, scalability of processes, and development of fiber-reinforced polymer composites for end use.

The **Battery Manufacturing Facility** (BMF) is the country’s largest open-access battery and research development center focused on high-performance, low-cost water-borne processing technology, high-speed curing for advanced electrodes, low-cobalt and cobalt-free cathodes, and high-performance computing for advanced processing, performance validation, and life prediction.