Argonne NATIONAL LABORATORY

THE CENTER FOR TRANSPORTATION RESEARCH

The Road to Mobility Innovation Starts Here

Outstanding engineering expertise, superior facilities and unique tools make Argonne National Laboratory one of the nation's premier destinations for transportation research

A researcher uses the Thermal Test Cell at the Advanced Powertrain Research Facility to assess advanced component and vehicle performance under a wide range of temperature conditions

Not since the invention of the automobile has the future of transportation held such potential. The Center for Transportation Research (CTR) at Argonne National Laboratory is blazing the way forward, leading on advanced transportation research and development and contributing expertise, tools and facilities for innovation.

From system-level inquiries examining how individuals interact with their transportation surroundings to the effects of fuel and efficiency modifications on individual vehicles and components, the CTR's staff produce viable solutions to our nation's energy challenges. Argonne's CTR accomplishes this mission via nine distinct yet interconnected research platforms.

TRANSPORTATION ENERGY ANALYSIS

CTR researchers study a range of technologies including automated vehicles, connectivity and sensor-based infrastructure and advanced vehicle powertrain configurations—all aimed at decreasing travel times, increasing safety and saving energy. While promising, their eventual commercialization requires multidisciplinary research in critical Argonne strengths such as computationally enhanced mobility planning, connected and automated vehicles, behavioral and decision science, and multi-modal transportation—to name a few.

VEHICLE SYSTEMS ENERGY MODELING

From evaluating the energy and cost impacts of advanced technologies to developing vehicle-level control algorithms to minimize energy consumption, Argonne has developed a series of integrated tools and processes to efficiently gauge the mobility and efficiency impacts of advanced technologies and speed the product development process.

EV-SMART GRID INTEROPERABILITY

In order for electric vehicles (EVs) to gain wider market share and significantly influence America's energy portfolio, they need to be universally interoperable, reliable and simple to charge. Ensuring that EV charging meets those demands requires cooperation across a variety of stakeholders. In response, Argonne plays an active role in EV standards development and integrates plug-in vehicles, buildings and renewables via numerous research initiatives.

VEHICLE SYSTEMS RESEARCH

The laboratory's Advanced Powertrain Research Facility (APRF) staff performs focused research and technology evaluations critical to the development and commercialization of next-generation vehicles. CTR researchers use the APRF to evaluate technologies over a wide range of environmental conditions, driver use profiles and fuels.

ENGINES AND FUELS OPTIMIZATION

Increasing efficiency and fuel portfolio diversity requires an enhanced understanding of the interactions between fuels and engines. Superior high-performance computing capabilities (via the Argonne Leadership Computing Facility) provide the basis for critical modeling and simulation efforts. CTR researchers explore the fuel/engine relationship via a number of projects, including the evaluation of technologies for improved fuel efficiency; the study of renewable and alternative fuels and the characterization of engine particle emissions and catalysis.

COMBUSTION ENGINE DEVELOPMENT

Internal combustion engines propel more than 90% of America's vehicles and generate critical electrical power for manufacturing facilities. The CTR advances combustion research and development (R&D) via enhanced three-dimensional computational fluid dynamics modeling, high-fidelity combustion simulations and exploration of low-temperature combustion systems. Argonne researchers have conducted groundbreaking research aimed at better visualizing the flow inside an engine's fuel injector nozzle using X-ray beams at the Advanced Photon Source, work that requires high-level modeling tools to predict the influence of in-nozzle flow on fuel spray and combustion.

SURFACE AND LUBRICANT ENGINEERING

Argonne works with manufacturers across the transportation spectrum to increase efficiency and extend component life by understanding the interactions of lubricants and coatings with materials. This requires a robust and diverse research effort, including developing and applying laboratory-to-engine correlation techniques; advancing mechanistic models of material wear and failure mode analysis of metal and composite materials components and creating and evaluating lubricant systems and additives.

THERMAL SYSTEMS AND MATERIALS

The CTR's approach to reducing energy consumption and emissions includes innovative heat transfer concepts and novel energy storage concepts. Researchers use the laboratory's advanced facilities and tools for promoting advanced heat transfer technologies, utilizing one- and two-phase heat transfer and evaporative cooling, and developing applications for thermal energy storage using phase-change materials, among other critical efforts.

EDUCATION AND OUTREACH

For more than 26 years, Argonne has managed the Department of Energy's Advanced Vehicle Technology Competitions (AVTCs), providing a unique educational experience for next-generation engineers while accelerating the development and demonstration of advanced technologies. AVTCs not only provide a real-world training ground for future engineers, business and communications students; they also foster engagement with local communities and the larger public by illuminating the benefits of alternative and energy-efficient vehicles.

TOOLS FOR TODAY AND TOMORROW

CTR researchers have developed several tools used throughout the industry, including:

- **Autonomie**—simulation tool for vehicle energy consumption and performance analysis
- **POLARIS**—agent-based modeling framework designed to simulate large-scale transportation systems
- **VERIFI Multi-Dimensional Models**—high-fidelity, advanced engine combustion simulation tools

WORKING WITH THE CTR

Access to Argonne technology, facilities and research assistance is available to industries, universities and other federal agencies through a number of partnership models.

CONTACT

Ann Schlenker
Director
Center for Transportation Research
Phone: 630-252-5542
Email: aschlenker@anl.gov
www.anl.gov/energy-systems/facilities/center-transportation-research