

Sustainable Transportation Update

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Seven ORNL researchers receive major awards from SAE International



Researchers (from left) Sujit Das, Derek Splitter, Jim Szybist, Brian West, Scott Curran, Scott Sluder, and (not pictured) Martin Wissink were honored at the SAE World Congress.

At the recent SAE World Congress, ORNL researchers received a host of honors for their research and leadership.

Jim Szybist and **Brian West** were awarded the prestigious Harry L. Horning Memorial Award for their SAE technical paper, "The Impact of Low Octane Hydrocarbon Blending Streams on the Knock Limit of E85." The honor is presented each year to the authors of the top SAE paper focused on the mutual adaptation of fuels and internal combustion engines.

Scott Sluder received SAE's Lloyd L. Withrow Distinguished Speaker Award, which recognizes individuals who have demonstrated outstanding presentation skills. Recipients must have previously received SAE's Outstanding Oral Presentation Award more than twice. Sluder was elected a fellow of SAE International in 2014, which was also acknowledged at this SAE Congress.

Scott Curran, Sujit Das, and **Derek Splitter** were presented the Forest R. McFarland Award for their contributions in facilitating the exchange of technical information through planning and organizing technical meetings, conferences, and professional development programs for the SAE engineering meetings board.

Curran was recognized for leading a new initiative that enables relationship building between young SAE

members and leading SAE professionals. Das was honored for developing sustainability sessions and promoting cooperation among SAE Congresses. He also served as chair of the sustainable development program committee. Splitter was awarded for helping organize the combustion track at the 2014 SAE World Congress and for his role as session chairperson.

Splitter and ORNL Postdoctoral Research Fellow **Martin Wissink** received the 2014 Myers Award, which recognizes the best SAE paper presented by a student. Splitter and Wissink were recognized for an "outstanding student paper" based on their thermodynamic and internal combustion engine research while at the University of Wisconsin. Splitter is now an R&D staff researcher for ORNL, and Wissink recently joined the FEERC team as a postdoc.

Aqueous processing saves production costs for lithium-ion batteries

A new process developed at ORNL that decreases the manufacturing cost of lithium-ion batteries (LIBs), which power electric and hybrid cars, could help put electric vehicles (EVs) on the highways faster and at a lower price.

Working toward that goal, researchers David Wood, Jianlin Li, and Claus Daniel found that using water as the solvent to manufacture the electrodes instead of the traditional solvent N methyl-2-pyrrolidone (NMP) not only is far less expensive, but also eliminates NMP's toxic, flammable vapors and their costly recovery. Aqueous processing comes with another benefit—it emits less CO₂ into the atmosphere during battery production.

The economic difference is significant: NMP is more than \$1.25 per liter and deionized water is \$0.015 per liter. By using water, the energy consumption associated with drying the electrodes is much less, too. (see [Aqueous on page 3](#))



Researcher Jianlin Li coats cathode material via aqueous processing for LIBs.

Features

ORNL leads stakeholder meeting about virtual vehicle initiative

Fuels, Engines, and Emissions Research Center (FEERC) Director Robert Wagner and STP Director Ron Graves organized an industry stakeholder meeting to assess interest and priorities in the development of an advanced, high performance computational architecture for accelerating vehicle innovations. Dubbed the “Full 3D High Fidelity Simulation Environment” or 3DHiSE, this powerful resource could take advantage of the increasing affordability of petascale computing to use 3-D simulation in tackling industry challenges such as optimal vehicle design and calibration. The concept has been known in the DOE system as “virtual vehicle” and is in the review process as a potential “Big Idea” initiative.

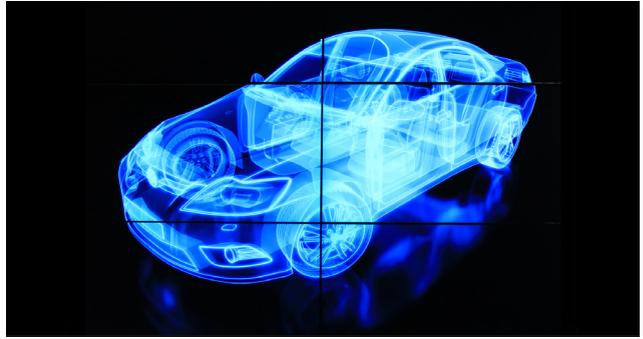
As Wagner explained, “With petascale computing expected to be affordable to industry within the next decade, now is the time to prepare. This is a great opportunity to build upon existing DOE investment across the national laboratory system in leadership computing and transportation to enable a disruptive change in simulation capabilities that would accelerate innovations to market.”

Gary Smyth, General Motors executive director for R&D, and Wayne Eckerle, Cummins VP of research and technology, kicked off the stakeholder meeting and set the tone for the event.

As the meeting progressed, industry participants gave many specific examples where a computational toolset like 3DHiSE would enable faster development and commercialization of fuel-efficient vehicles and powertrains. Examples include engine combustion; computational fluid dynamics; and fuels, materials, and structure co-optimization. Aerodynamic analysis combined with weight-reduction and thermal management presents another prime opportunity.



Attendees of the virtual vehicle meeting identify the top opportunities where high-fidelity simulation tools could result in game-changing advances in automotive technologies.



Advanced, high-fidelity modeling could accelerate innovation and assist industry in maximizing the potential of new fuel efficient technologies.

The toolset could help industry explore higher risk paths and capture real-world fuel economy that is missed due to shortcomings in the costly, time-intensive process of calibration. Complexity in calibration is increasing exponentially, creating challenges in reaching a fully optimized design. As one original equipment supplier put it, “Even if an optimal design solution is reached for a component or subsystem, the solution becomes suboptimal though calibration of the subsystems as a whole.”

The discovery of compatibility or compliance issues at the vehicle prototype stage is another issue that could be addressed by using high-fidelity simulation. Such discoveries are costly and difficult to correct late in the design process.

An adaptive modular computational toolset could enable the automotive industry to shorten the design cycle, reduce the time and expense of calibration, and increase innovation, delivering new efficient and affordable technologies to market quicker. Fuel-efficient technologies make an immediate difference in petroleum consumption and greenhouse gas (GHG) emissions, saving millions of gallons of fuel in the first year of use.

According to Ron Graves, “Early introduction of efficient technologies is crucial because that efficiency advantage persists through the 10- to 12-year life of the vehicle. Once the typical 15 million new cars are sold in a given year, there is no way to improve their efficiency while in use.”

The industry participants expressed considerable enthusiasm for moving forward with the virtual vehicle idea. Consensus was reached that there are valuable opportunities unique to this high-fidelity modeling framework. As a next step, the group recommended holding a technical planning workshop with industry and software vendors to ensure that critical needs are addressed in the development of the computational framework.

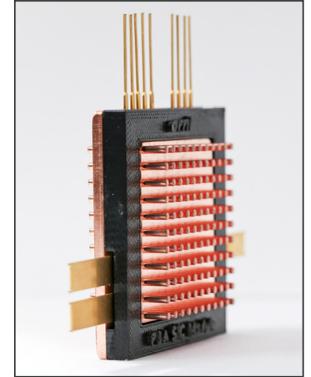
With support from the DOE Vehicle Technologies Office (VTO), the meeting was held in collaboration with five other national laboratories: Argonne, Sandia, Lawrence Berkeley, Lawrence Livermore, and the National Renewable Energy Laboratory (NREL).

Researchers develop novel SiC packaging technology

ORNL researchers developed a new set of packaging technologies that advance power electronics modules for electric vehicles (EVs), making considerable progress toward efficiency, power density, and cost targets for EV power electronics systems.

From research led by principal investigator Zhenxian Liang, the new modules combine the power of silicon carbide (SiC), a WBG semiconductor known for its excellent power-switching performance, and advancements in packaging. The innovative features include 3-dimensional planar electrical interconnects and integrated double-sided direct cooling suitable for both forced air and liquids.

Further integration of these features into one inventive packaging process leads to significantly lower manufacturing costs. The improvements include a 70 to 80% drop in parasitic electrical parameters, a 45% reduction in thermal resistance, and a size half that of the industry standard. The advancements are made possible by fully using the capabilities exclusive to WBG power semiconductors: small size, light weight, low power consumption, and high cost-effectiveness. This research was sponsored by DOE VTO.



New packaging technology integrates double-sided cooling and WBG materials for greater performance in a smaller package.

ORNL partners with Butamax on compatibility study

A team of ORNL researchers led by Mike Kass worked with Butamax Advanced Biofuels, LLC—a partnership of BP and Dupont—to conduct a compatibility study on how a gasoline blend of 10% ethanol (E10) and a blend of 16% isobutanol



Researchers evaluated the compatibility of ethanol and isobutanol with materials used in fuel delivery at the pump and throughout the infrastructure.

(iBu16) affect materials used in the fueling infrastructure. The coauthored study was published in the April 2015 issue of the *SAE International Journal of Fuels and Lubricants*. Like ethanol, isobutanol is an alcohol that is produced from agriculture as a biofuel and can be blended with gasoline.

“We had not done a compatibility study with E10 and plastics before,” said Kass. “We took that step with this project to enable a true 1:1 comparison in terms of the oxygen content in the two fuels.”

The results showed that an iBu16 blend performed the same as or

slightly better than E10 in how it interacts with plastics. Based on these results, isobutanol could provide another avenue to reach the 36 billion gallons of biofuel called for by 2022 in the US Environmental Protection Agency (EPA) Renewable Fuel Standard. With its lower oxygen content, iBu16 can be mixed with gasoline at higher volumes and still meet current fuel regulations.

This work is the latest in a series of Butamax-ORNL studies evaluating isobutanol-gasoline blends with fueling infrastructure and automotive materials.

Aqueous *(continued from page 1)*

This newly patented process is estimated to reduce the full battery pack cost by 8–10%, a sizeable decrease in production costs.

ORNL tackled the science and engineering challenges of applying aqueous processing to the diverse array of LIB cathodes by selecting appropriate water-soluble binders and mixing sequences, developing stable and uniform slurries, improving

electrode coating deposition, and optimizing drying procedures.

Preservation of optimum electrode structure during coating and primary drying (liquid water removal) and near complete removal of adsorbed moisture during secondary drying is particularly important as these factors are directly related to the durability and life of LIBs made via aqueous processing. With these steps in place,

LIBs processed with water retain capacity at a rate comparable to those manufactured with toxic solvents.

With support from the DOE VTO, the ORNL team is continuing research on novel design architectures that will best enable the production of high-performance batteries made with aqueous processing.

Researchers contribute to major bioenergy and sustainability report

A major report on bioenergy and sustainability released recently concludes the sustainable production of bioenergy can be an important tool for addressing climate change. Researchers Virginia Dale and Keith Kline contributed to the multinational United Nations (UN) document, which offers science-based evaluations of bioenergy issues including food and energy crop production and bioenergy as a climate change mitigation strategy.

Kline contributed to a chapter on land use for the UN Scientific Committee on Problems of the Environment (SCOPE) *Bioenergy & Sustainability* report. The chapter explores the subject of biomass and food crop production, concluding that the two can coexist or be complementary. Projected land demands for biofuel production fall well within conservative estimates of current and future land availability, and integrated systems for food and

energy production can improve food security.

Said Kline, “Biomass production not only has potential to make increasingly meaningful contributions to energy supply, but also can support practices to improve management of soils, forests, and croplands that are essential for increased mitigation of, and resilience to, impacts of climate change over time.”

Dale coauthored a chapter on biodiversity and ecosystem services. “Deploying biofuels in a manner to reduce effects on biodiversity and associated ecosystem services can be done with planning, monitoring, and appropriate governance,” Dale said.

The SCOPE *Bioenergy & Sustainability* report is the collective effort of 137 researchers at 82 institutions in 24 countries and documents and analyzes



Sustainable biomass production practices can support soil improvement and management of forests and croplands to increase their resilience to climate change.

impacts, benefits, and constraints related to the global expansion of bioenergy. Peer-reviewed data and scientific evidence from more than 2,000 sources were used to evaluate the documented and predicted effects of expansion of bioenergy production and use on energy security, food security, environmental and climate security, sustainable development, and innovation. The report is available at <http://bioenfapesp.org/scopebioenergy/index.php>.

Dale and Kline's work was supported by the DOE Bioenergy Technologies Office. —Bill Cabbage

New patents issued for STP technologies

Congratulations to the researchers involved in the following innovations.

Exhaust Gas Recirculation (EGR) probe measures CO₂

US Patent 9,000,374

Researchers Bill Partridge, Jim Parks, and Ji Hyung Yoo invented a probe in collaboration with Cummins that provides rapid and accurate measurement of CO₂ concentrations in a fluid stream, such as an engine intake or exhaust manifold. Previous methods for measuring CO₂ inside internal combustion engines require longer processing times for analytical techniques such as mass spectrometry and cannot sample fast enough to capture crank-angle variations in EGR. The patented EGR probe captures the spatial and temporal nonuniformities of CO₂ with incredible speed (5,000 measurements per second) and precision. Access to this detailed data can help engineers optimize combustion cycles, reduce automotive NO_x emissions, and accelerate the design of advanced-efficiency engines. This patent is the fifth issued in the past 5 years for technologies developed through the long-standing Cummins–ORNL collaborative research and development agreement. This work is conducted with support from DOE VTO.

Novel catalysts for low-temperature diesel engine emission treatment

US Patents 8,987,161 and 8,987,162

Researchers Chaitanya Narula and Xiaofan Yang developed new selective catalytic reduction (SCR) catalysts for use in diesel engine emissions treatment. These zeolite-based catalysts are highly active NO_x reduction catalysts at low temperatures under fast SCR conditions, filling an industrywide need for catalysts that function effectively in the cooler exhausts resulting from high-efficiency engine technologies. The two newly patented formulations vary in structure with the CuM-SSZ-13 catalyst exhibiting superior durability. CuM-SSZ-13 can be easily prepared from commercial catalyst Cu-SSZ-13 via ion exchange. These catalysts are suitable for on- and off-road diesel engines and lean gasoline engines. This research was supported by the DOE Industrial Technologies Program and DOE VTO.

RCCI technology demonstrated in a hybrid vehicle

Reactivity controlled compression ignition (RCCI) is an advanced combustion strategy that uses diesel fuel and gasoline in an engine simultaneously, controlling the fuel ratios to achieve increased fuel efficiency with significant reductions in specific pollutant emissions.

One advantage of RCCI over other advanced combustion strategies is the increased level of control over the combustion process. By controlling the timing of fuel injections into the engine and the ratio of gasoline to diesel, the fuel reactivity can be tailored to the engine speed and load. This maintains stable low-temperature combustion operation through a greater range of speeds and loads, which is critical for reducing NO_x emissions.

Until recently, RCCI has been studied using research engines evaluated

through dynamometer experiments with fuel economy being estimated through vehicle system simulations. The University of Wisconsin (UW) partnered with ORNL and Ford Motor Company to change that by conducting a proof of principle study using RCCI technology integrated into a series hybrid vehicle.

Undergraduate students from UW fabricated the hybrid electric drivetrain and installed the RCCI technology in a 2009 Saturn Vue series hybrid originally designed for the DOE-sponsored EcoCAR hybrid vehicle design competition. The series hybrid configuration allowed researchers to operate the engine consistently at its most efficient speed and load.

Vehicle dynamometer evaluations using the EPA highway fuel economy test were conducted at ORNL and the Ford Vehicle Emissions Research Laboratory. An aftertreatment system was installed for the ORNL experiments.

"This project marks the first time RCCI has been evaluated in a vehicle-scale



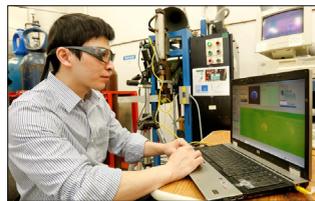
Researchers measured the fuel economy and emissions of a hybrid electric vehicle equipped with RCCI technology.

experiment with a full aftertreatment system," said ORNL principal investigator Scott Curran. "We gained insights into clear paths for improving the RCCI fuel economy and emissions results."

The initial vehicle experiments with RCCI showed remarkable ability to use the strategy in a real vehicle with the series hybrid configuration. Research continues with a focus on maintaining high performance during shifts in speed and load. Compatibility with after-treatment systems is another critical area of focus for future implementation of RCCI into a conventional vehicle powertrain. This research is sponsored by DOE VTO.

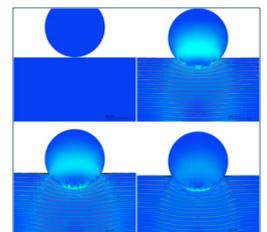
In the News

- The licensing of ORNL's infrared weld inspection technology to Tennessee-based APLAIR Manufacturing Systems received coverage in a variety of news outlets including Phys.org and World Industrial Reporter. The technology provides a real-time solution to manufacturers for assessing weld quality as parts are assembled on the production line. The achievement was highlighted by DOE on energy.gov.
- *The Knoxville News Sentinel* published a story about RMX Technologies and the atmospheric plasma processing technology they are developing in partnership with ORNL. The system can reduce carbon fiber production costs by 20%, which could enable increased volumes of low-cost carbon fiber for automotive and other applications.
- *Green Car Congress* highlighted ORNL's role in the new DOE Optima initiative, which is focused on codeveloping fuels and engine technologies to achieve significant vehicle fuel economy gains and GHG reductions.



Researcher Jian Chen views an infrared image taken with ORNL-developed weld inspection technology.

- *Automotive Manufacturing Solutions Magazine* recently published a feature on welding options for lightweighting vehicles, including the merits of friction bit joining technology developed by MegaStir and ORNL.
- Yahoo! Finance referenced researcher Bo Saulsbury and data posted on fuelconomy.gov in an article on maintaining fuel economy through the seasons.
- Researcher Andreas Malikopoulos developed new algorithms to optimize traffic flow and alleviate congestion received coverage in *R&D Magazine*, Informed Infrastructure, Science Daily and a host of other publications.
- *R&D Magazine*, EE Times Europe, Green Car Congress, and other media outlets covered the release of a new computational toolset for accelerating the design of high-performing safe batteries for electric vehicles. The Computer-Aided Engineering for Batteries (CAEBAT) software is available for download at www.batterysim.org.



CAEBAT software allows analysis of stress distribution in a pouch cell under external mechanical loading.

Briefs

Freightliner SuperTruck demonstrates 115% freight efficiency gain

As a member of the Freightliner SuperTruck Team, ORNL assisted with simulation and experimental evaluation of a novel waste heat recovery system. Parent company Daimler Trucks North America measured freight efficiency by evaluating the SuperTruck on highway routes in Oregon and Texas and through anti-idle testing in both a cold chamber and a hot chamber. The SuperTruck initiative is managed by the 21st Century Truck Partnership, which set an aggressive goal for freight efficiency gains of 50%. Through a host of innovations in aerodynamics, engine efficiency, lightweighting, waste heat recovery, and hybrid powertrain integration, the Freightliner SuperTruck surpassed the goal by 65%. An ORNL team lead by Dean Edwards conducts ongoing research with Daimler focused on advanced, high-efficiency combustion strategies, including dual-fuel operation with diesel and natural gas.

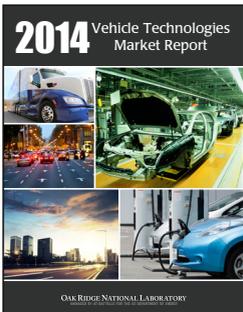


ORNL joins H₂USA

H₂USA brings together key stakeholders from industry and government to promote the commercial introduction and widespread adoption of fuel cell EVs and to collaborate on new R&D that addresses obstacles to establishing a hydrogen infrastructure. Key obstacles include station financing, construction, commissioning, accurate metering, safety, and long-term operation, as well as technical logistics associated with stationary high-pressure hydrogen storage and delivery. As ORNL Fuel Cell Technologies Program Manager, David Wood will represent the laboratory at various H₂USA working group and task team meetings, building on existing industry relationships through these activities. The organization's goals to improve America's energy security, reduce GHG emissions, validate new technologies, and enable the creation of a strong domestic hydrogen supply base align synergistically with ORNL STP's research objectives.

State supplies funding for industry to partner with ORNL

The State of Tennessee, University of Tennessee, and ORNL recently launched RevV!, a \$2.5 million pilot program that provides vouchers to Tennessee manufacturers to partner with ORNL in solving manufacturing challenges. The goal is to take advantage of the world-class capabilities and expertise at the laboratory to increase the competitiveness of the state's manufacturing sector. Though the relationship predates the launch of the RevV! program, Eagle Bend Manufacturing's work with ORNL has been highlighted as a key example of the positive impact of government–industry partnerships. ORNL provided the company with critical data used to prove the merit of a new stamping process to a major automotive manufacturer, securing Eagle Bend its biggest contract to date. Companies are invited to apply for RevV! funds through the ORNL partnerships office. Details are available at <http://www.ornl.gov/programs/revv>.



Vehicle Technologies Market Report published

A team led by researcher Stacy Davis recently released the sixth edition of the *Vehicle Technologies Market Report*. Sponsored by DOE VTO, this comprehensive report details the major trends in US transportation, including the use, markets, manufacture, and supply chains for light- to heavy-duty vehicles. The report includes a technology section outlining progress toward high-efficiency vehicles and alternative fuels, as well as a policy section on current and near-future federal policies like the Corporate Average Fuel Economy standards. The collected information provides policy makers, industry, and other key stakeholders with accurate data for strategic decision making. The report is available for download at <http://cta.ornl.gov/vtmarketreport>.

ORNL begins second phase of evaluations for EPA

Researchers in ORNL's Vehicle Systems Integration Laboratory are assisting EPA with the development and evaluation of test procedures and technologies associated with potential medium- and heavy-duty GHG certification processes. Engine cycle evaluations are now complete, and scientists are beginning work with full powertrains. Currently, an Allison automatic transmission coupled with a Cummins heavy-duty engine is being run through a series of simulated drive cycles. Next, an Eaton manual transmission will be paired with the Cummins engine to run a similar analysis. The results will inform the development of engine and powertrain test procedures for EPA's upcoming rule making.

Visits & Events



Attendees of the Cummins-ORNL materials conference gather with ORNL conference organizer Tom Watkins (far right).

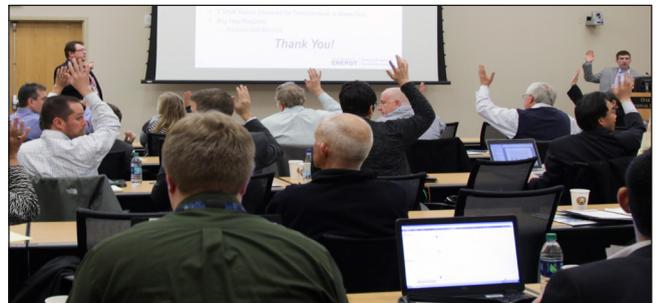
- Researcher Tom Watkins organized a 3-day conference on materials functional excellence with industry partner Cummins at ORNL. More than 40 attendees from Cummins toured facilities including the Spallation Neutron Source, Manufacturing Demonstration Facility, and High Temperature Materials Laboratory and participated in a series of presentations from both Cummins and ORNL personnel on diverse materials and transportation R&D topics. This conference was sponsored by the VTO Propulsion Materials Program, Materials Science and Technology Division, and Cummins, Inc.
- ORNL hosted the U.S. DRIVE Fuels Working Group (FWG), which consists of representatives from automotive manufacturers, petroleum companies, and DOE. FWG received an update on ORNL's high octane fuels research and toured FEERC laboratories.



Members of the U.S. DRIVE FWG listen to researcher Josh Pihl describe current projects in one of the FEERC catalysis labs.

- A team from FEERC recently hosted the 18th installment of the DOE Cross-Cut Lean Exhaust Emissions Reduction Simulations (CLEERS) Workshop at the University of Michigan-Dearborn. The workshop generated a high level of interest across industry, academia, and national laboratories; requests for both registrations and contributed presentations exceeded the available slots. The program included an industry panel discussion, 5 invited presentations, 29 contributed presentations, and 15 posters covering a wide range of emissions control topics.

- Gary Smyth, General Motors executive director for R&D, visited ORNL to discuss current and future research. He toured the FEERC and Power Electronics and Electric Machinery (PEEM) labs during his visit.
- The National Corn Growers Association Ethanol Committee met in Knoxville to discuss the future of ethanol fuel and strategies for ensuring continued demand growth for corn-based fuel. The group also toured the National Transportation Research Center.
- ORNL hosted a 2-day meeting for industry leaders to discuss potential additive manufacturing applications for fuel cells and building technologies. Potential near-term opportunities for crosscutting innovation were identified. The event was cosponsored by the DOE Advanced Manufacturing, Fuel Cell Technologies, and Building Technologies Offices.



Attendees participated in active discussions and breakout sessions during the industry meeting on additive manufacturing for fuel cells and building technologies.

- A team from ORNL's Center for Transportation Analysis participated in the Transportation Research Board (TRB) annual meeting through poster presentations, technical talks, and session organization and moderation. Sujit Das and Stacy Davis participated on the Transportation Economics and Transportation Energy Committees respectively. Ho-Ling Hwang made a presentation on her current work with the State of New York, and James Li participated in an invitation-only workshop to facilitate a TRB effort to develop a simulation manual. Stacy Davis also headed a Listening Session in the Freight Data Users Forum on a new truck use survey.
- Researchers Virginia Dale of ORNL and Cristina Negri of Argonne National Laboratory recently presented an Earth Day webinar about their work on how to develop biofuels that positively impact the nation in terms of environmental, socioeconomic, and technoeconomic sustainability. The DOE Bioenergy Technologies Office sponsors their work and hosted the webinar. *Biofuels Digest*, *Ethanol Producer Magazine*, and other media covered the event.

- ORNL's PEEM group participated in the Applied Power Electronics Conference (APEC) through panels, sessions, and hosting a booth. APEC focuses on the practical and applied aspects of the power electronics business, and this was a tech-to-market outreach activity for the laboratory. The ORNL display featuring an inverter, motor, packaging, wireless charging, and 3-D printing capabilities, received a lot of traffic. Researcher Omer Onar chaired three sessions and participated on a panel about wireless charging.
- Researchers from the Toyota Research Institute of North America visited the PEEM laboratory to discuss research on a variety of topics, including WBG devices, packaging, and integrated motors and inverters.
- Researcher Mike Kass led a webinar on propulsion optimization, technical challenges, and future directions for unmanned aircraft systems for the Association of Unmanned Vehicle Systems International.



The Optima team gathers at the DOE Big Ideas Summit. Pictured left to right: John Farrell of NREL, Robert Wagner of ORNL, DOE Fuel & Lubricant Technologies Program Manager Kevin Stork, Art Pontau of Sandia, Ann Schlenker of Argonne, and Bob Hwang and Marcey Hoover of Sandia.

- FEERC Director Robert Wagner serves on the steering committee and FY 2015 planning team for a new multi-laboratory research initiative called Optima, which focuses on co-optimization of fuel and engine technologies to significantly reduce GHG emissions and increase fuel economy. Wagner participated in discussions shaping this initiative with the Union of Concerned Scientists and DOE Advanced Research Projects Agency-Energy. This idea was presented to DOE Secretary Moniz at the Big Ideas Summit in April.

Outreach

Researchers showcase STEM at Career Day

The [ORNL Traveling Science Fair](#) drew a crowd at the annual Knox County Schools (KCS) Career Day, a free event open to all students in grades 8–12, as well as their parents. Researchers sparked interest in science, technology, engineering, and mathematics (STEM) careers with interactive displays focused on wireless charging, 3-D printing, climate change, batteries, carbon foam, hydrophobic coatings, energy efficiency, carbon fiber, and neutron science. The Energy and Environmental Sciences Directorate “Get into Green” trailer, the Physical Sciences Directorate “Extreme Science” trailer, and the Spallation Neutron Source’s ever popular “Become a Neutron” simulation engaged the kids in a variety of hands-on activities.



Researcher Jim Parks discusses how infrared imaging is used for energy research with students at the KCS Career Day.

Transportation seminars highlight advanced manufacturing and novel lubricants



Lonnie Love (*left*) and Jun Qu recently presented transportation science seminars.

Lonnie Love, group leader for ORNL's Manufacturing Systems Research Group, recently presented a seminar on advanced manufacturing opportunities for transportation research. Jun Qu, senior R&D staff scientist in the Materials Science and Technology Division, discussed the ongoing development of ionic liquids as novel lubricant additives for next-generation fuel-efficient engines.

The Transportation Science Seminar Series features the crosscutting capabilities of transportation and manufacturing R&D to encourage collaboration across the lab. To view past presentations, please contact Kim Askey at askeyka@ornl.gov or 865-946-1861.

Employee Excellence

DOE honors researchers for their tech-to-market successes

DOE Assistant Secretary for Energy Efficiency and Renewable Energy (EERE) David Danielson held an all-hands meeting during a recent visit to ORNL and discussed the EERE National Impact Initiative. He emphasized the importance of enhancing lab-private sector relationships, increasing and streamlining access to national lab capabilities, and demonstrating the value of lab-developed science and technology.

As part of his presentation, Danielson recognized eight researchers for their work in accelerating the transfer of technology to the marketplace. Among them were four researchers focused on vehicle technologies.

“These are excellent researchers doing excellent work,” said Sustainable Transportation Program (STP) Director Ron Graves. “It was nice to see them recognized for their innovative technologies and the impact they are having with industry partners.”

Madhu Chinthavali was recognized for developing a novel power inverter featuring a 3-D-printed heat sink and wide-bandgap (WBG) semiconductors. The prototype traction drive inverter has demonstrated an operating efficiency of nearly 99%, surpassing DOE’s power electronics target and setting the stage for more innovative designs that use these materials and manufacturing capabilities to fullest advantage.

Zhili Feng was honored for developing a newly licensed infrared weld inspection technology and for his work with Eagle Bend Manufacturing on novel stamping methods. Feng’s research demonstrated the new stamping method produced lighter, stronger parts that met industry standards, resulting in Eagle Bend securing its largest contract ever, a multi-million-dollar deal with a major automotive manufacturer.



Front row: Ed Vineyard, Ayyoub Momen, Bill Partridge, and Gui-Jia Su; *Back row:* Zhili Feng, Asst. Sec. David Danielson, Lonnie Love, Teja Kuruganti, Lab Director Thom Mason, Madhu Chinthavali, DOE’s Building Technologies Office Director Roland Risser, and DOE Advanced Manufacturing Office Director Mark Johnson.

Bill Partridge was selected for the many innovations developed through his long-standing and ongoing partnership with Cummins. Five patents in the last 5 years plus two R&D 100 awards are indicative of the valuable R&D conducted through this highly successful industry partnership. Partridge’s contributions as part of the Cummins-Peterbilt SuperTruck Team, which achieved a 75% improvement in fuel economy for heavy-duty trucks, were highlighted.

Gui-Jia Su was recognized for his numerous patents and successfully licensed electric drive technologies, the latest being a novel current source inverter. The new inverter not only converts direct current to alternating current, but also boosts the voltage by up to 3 times, enabling motors to operate at higher speeds. Tennessee start-up company New Hybrid Technologies licensed the technology.

In addition to the transportation researchers, ORNL’s **Lonnie Love** received recognition for being an advanced manufacturing “rock star,” while **Ed Vineyard** was awarded for his 20 collaborative research and development agreements with industry. **Ayyoub Momen** was honored for his work on the magnetocaloric refrigerator and ultrasonic dryer, and **Teja Kuruganti** was recognized for smart grid research.

Do you have news or information you would like to share?

Please submit to Kim Askey,
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