Technical Highlights
March 2013

Ford Ecoboost 1.6L Engine Arrives at the Fuels, Engines, and Emissions Research Center (FEERC)
Ford and the Oak Ridge National Laboratory's (ORNL's) FEERC are partnering to investigate the potential for use of high-octane rating fuels to enable vehicles with greater fuel economy. As part of this effort, Ford has provided FEERC with a state-of-the-art 1.6L Ecoboost 4-cyliner engine to support the work. The engine and supporting components arrived in March and are being readied for operation at the National Transportation Research Center (NTRC) facility. The 1.6L engine is currently produced for use in the 2013 Fusion and 2013 Escape vehicles. ORNL's work will focus on increasing the compression ratio of the engine to achieve low-load fuel economy benefits, while using the increased anti-knock properties of high-octane fuels to reduce fuel consumption due to knock avoidance at high-load conditions. This approach may enable greater use of downsizing and downspeeding to achieve better fuel efficiency in light-duty vehicles. The 1.6L engine will be the smallest passenger car engine being used within FEERC and is one of the smallest used in production vehicles in the U.S. market.

Society of Automotive Engineers (SAE) Highlights ORNL/Idaho National Laboratory (INL) Collaborative Battery Evaluation Effort
The March 5, 2013 SAE Magazine highlighted the Electric Drive Advanced Battery (EDAB) project being conducted jointly between ORNL and INL, along with ECOtality North America. There is a need to evaluate the performance of energy storage system (ESS) technology advances both in the laboratory and on the road. This allows for system characterization and the identification of areas for future improvement. In support of the U.S. Department of Energy's (DOEs) Advanced Vehicle Testing Activity, INL is collaborating with ECOtality North America and ORNL to evaluate advanced ESSs for the EDAB project. The Vehicle Research Laboratory, at ORNL's FEERC, is being used to perform in-lab reference performance evaluations. These laboratory evaluations allow for the calibration of the control system which is designed to emulate the loads an ESS would experience from a target vehicle.

The article, along with a paper (SAE 2013-01-1533) to be presented April 18th in Detroit as part of the SAE 2013 World Congress technical session called Advanced Battery Technologies (Part 4 of 4), describes the system's design and setup along with interim results to date. The article can be viewed at http://www.sae.org/mags/sve/11869/.

FEERC International Technology Exchange Continuing with Arrival of Student from Chalmers University (Sweden)
Chalmers University graduate student, K. Fredrik Gunnarsson, arrived in March and will be working closely with FEERC researchers to study the ability of low cost silver-alumina catalysts to reduce NOx using a series of ethanol-gasoline blends. His arrival continues the collaborations that FEERC has established with the leading emissions control research universities in Europe (in addition to Chalmers, Politecnico di Milano and ICT-Prague), and he is the fourth graduate student that FEERC has hosted from these institutions.

Invited Talks and Presentations

FEERC Post Doc Presents Invited Lectures to the Advanced Engine Cross-cut Team
FEERC Postdoctoral Research Associate Dr. Jon Yoo presented an invited lecture to the Advanced Engine Cross-cut Team at their meeting held January 10, 2013. The presentation was titled "Single-Cylinder

Information from Multi-Cylinder Engines: Measuring EGR Uniformity with Crank-Angle Resolution using a Practical & Minimally Invasive EGR Probe," and described application of the exhaust gas recirculation (EGR) Probe in the Cummins Cooperative Research and Development Agreement (CRADA) and SuperTruck projects to on-engine characterization of spatiotemporal EGR uniformity for assessing numerical design tools. The EGR Probe was developed in the DOE-funded ORNL-Cummins Combustion CRADA and further refined for the SuperTruck applications; Sam Geckler and David Koeberlein are the Cummins leads for these projects, respectively. FEERC Distinguished Research Staff Dr. W.P. Partridge is mentor to Dr. Yoo and the ORNL principle investigator for these two projects. Dr. Yoo gave a similar invited lecture to an international audience at the Cross-Cut Lean Exhaust Emissions Reduction Simulations (CLEERS) July 2012 teleconference which was broadly attended by industry, university, and national laboratory personnel. Both presentations generated significant interest and have resulted in follow-on industrial inquiries.

FEERC Staffmember Presents Two Invited Lectures at Universities in the Czech Republic

FEERC Distinguished Research Staff Dr. W.P. Partridge presented two separate invited lectures during a collaborative research trip in February to Prague, Czech Republic. These were to the Monolith Research Group of the Department of Chemical Engineering at the Institute of Chemical Technology, Prague (ICTP) and hosted by Prof. Miloš Marek and Dr. Petr Kočí and to the Department of Mechanical Engineering at the Czech Technical University hosted by Prof. Jan Macek and Dr. Michal Vojtíšek. The lectures were titled "Advanced Diagnostics for Automotive Catalyst, Exhaust Gas Recirculation & Oil Dilution," and highlighted development and applications of a wide range of diagnostics within the Cummins-ORNL CRADA for advancing DOE goals for energy efficiency and security; specifically covered were the spatially resolved capillary inlet mass spectrometer (SpaciMS), Fuel-in-Oil, EGR Probe, and optical-fiber-based species and temperature sensing. The visit was part of an ongoing collaboration to understand the mechanistic aspects of N_2O formation during lean NO_X trap (LNT)-catalyst regeneration; the work is based on combined experimental and numerical simulation at the two facilities and has resulted in numerous technical presentations. With separate funding from the Czech Republic through a Kontakt II project Dr. Kočí and his Ph.D. student have worked at ORNL as part of this collaboration benefiting the CLEERS and other DOE catalyst programs.

Invited Seminar at the University of Tennessee Bredesen Center

Robert Wagner presented a seminar to the University of Tennessee Bredesen Center for Interdisciplinary Research and Graduate Education on "High Performance Computing and Accelerating the Development of High Efficiency Engines." This presentation included thoughts on the state of internal combustion engines as well as future opportunities in making use of improved simulation and high performance computing for enabling the next generation of high efficiency engines. The presentation was followed by a tour of FEERC led by Scott Curran and Robert Wagner.

FEERC Staff Member Delivers Keynote Address at the 11th Engine Combustion Processes Symposium

Johney Green and Robert Wagner attended the 11th Engine Combustion Processes Symposium in Ludwigsburg, Germany. Robert presented the keynote address on "A Perspective on the Future of High Efficiency Engines." The meeting included two days of high quality papers and presentations on current problems and modern techniques with special sessions on diesel engines, fuels, measurement techniques, modeling, spark ignition engines, and injection and spray formation.

FEERC Research to be Highlighted at 2013 North American Catalysis Society Meeting (NAM)

FEERC catalysis and emissions research will be highlighted with a total of 10 presentations (8 oral and 2 posters), at the 2013 North American Catalysis Society Meeting to be held June 2–7 in Louisville,

Kentucky. Topics to be covered include advanced emissions control research, novel catalysis synthesis, catalytic deactivation and bio-oil upgrading. The research highlights the collaborative efforts that FEERC has fostered with academic researchers from Politecnico di Milano, ICTP, the University of Michigan, the University of Kentucky, the University of Tennessee and the University of South Carolina as well as national laboratories and industrial partnerships with NREL, Ford, GM, and Umicore.

Awards

Robert Wagner Nominated to Executive Committee of the American Society of Mechanical Engineers Internal Combustion Engine Division (ASME-ICED)

Robert Wagner of FEERC was nominated to be the incoming technical track member of the Executive Committee of the ASME-ICED. The ASME-ICED promotes the art and science of mechanical engineering of engines, encouraging and fostering research and development for mobile, marine, rail, generation, and stationary applications. This is a multi-year appointment which includes two years as Assistant Vice Chairman, two years as Vice Chairman, and one year as the Division Chairman.

Robert Wagner Appointed Faculty of the University of Tennessee Bredesen Center

Robert Wagner was appointed to the faculty of the Bredesen Center for Interdisciplinary Research and Graduate Education by the University of Tennessee Chancellor Jimmy Cheek and ORNL Director Thom Mason. The Bredesen Center unites extensive resources at the University of Tennessee with ORNL to advance science, technology, engineering, and mathematics research related to energy.

ORNL Researchers Attend Global Grand Challenges Summit

Johney Green and Robert Wagner attended the invitation-only Global Grand Challenges Summit in London, England. The summit was sponsored by the National Academy of Engineers, the Royal Academy of Engineering, and the China Academy of Engineering with the purpose to provide a new global platform for the world's leading thinkers to share their ideas with the next generation of engineers on how to develop the international frameworks, tools and collaborations needed to solve our common global challenges. Panel sessions included sustainability, health, education, enriching life, technology and growth, and resilience. A special guest speaker included Bill Gates (by video link).