

# October 2014 Highlights

## ORNL Fuels, Engines, and Emissions Research Center

### TECHNICAL HIGHLIGHTS

#### **Fuels, Engines and Emissions Research Center (FEERC) Study Quantifies Light-Duty Powertrain Efficiency Improvements over Environmental Protection Agency (EPA) Drive-Cycles**

A Society of Automotive Engineers (SAE) journal paper was published this month (J. Thomas, "Drive Cycle Powertrain Efficiencies and Trends Derived from EPA Vehicle Dynamometer Results," pp. 1–11 in *SAE International Journal Passenger Cars – Mechanical Systems*, 7(4), October 2014, doi:10.4271/2014-01-2562) at the SAE 2014 International Powertrain, Fuels & Lubricants Meeting, October 20–23, 2014, Birmingham, United Kingdom (UK). The paper examines vehicle energy usage in same-model vehicles for model years (MY) 2005 and 2013 by using available EPA test data. A major goal was to provide up-dated energy use information on the FuelEconomy.gov website (see "Where the Energy Goes" <http://www.fueleconomy.gov/feg/atv.shtml>) and to quantify powertrain progress over this eight year period. The study examined 34 vehicle/powertrain pairs (2005 paired with a matching MY 2013 vehicle), which included many popular vehicles. On average, the 2013 powertrains showed a 12.5% and 10.0% gain in efficiency relative to the 2005 powertrains for the city and highway cycle respectively. Other MY 2005–2013 aggregate attribute changes were quantified with vehicle drag dropping 2.3% and 5.9% for the city and highway cycle, engine rated power increasing by 15%, and 12% downspeeding at 50 mph. Examination of hybrid powertrain efficiencies is also included. Citation of the paper occurred before publication; this effort was used and referenced (as a draft) in a July publication (*Environmental Science & Technology*, dx.doi.org/10.1021/es501217t); a result of correspondence with a UK researcher.

#### **Collaboration with Argonne National Laboratory Explores the Impact of Control Perturbations on Combustion Stability**

FEERC Researcher Brian Kaul visited Argonne National Laboratory's Engine Research Facility to discuss plans for collaborating on a study of the impact of perturbations in fuel injection quantity and spark timing on combustion stability for dilute combustion. In this collaboration, ORNL's expertise in using nonlinear dynamics to better understand cycle-to-cycle variations in combustion will be applied to interpret the experimental data being collected at Argonne. The results are expected to provide helpful guidance as to when variability in control inputs becomes an important consideration in combustion modeling efforts. Results will be published in a joint paper in 2015.

#### **Three FEERC staff named Associate Editors for the New Journal *Frontiers in Engine and Automotive Engineering***

Jun Qu, Jim Parks, and Robert Wagner have been named Associate Editors for a new journal, *Frontiers in Engine and Automotive Engineering*, which is a first-tier electronic journal that is part of the Nature Publication Group and aims to publish papers that describe advances in transportation and power generation technologies that improve energy utilization and reduce pollutant emissions from internal combustion, gas turbine and other engines, including hybrid electric systems.

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## HIGH-LEVEL OR NOTEWORTHY VISITS

### **Department of Energy (DOE), Industry, and other Organizations Tour FEERC in October**

This month Alison Goss-Eng from BETO and Connie Bezanson from VTO toured the FEERC and other ORNL laboratories. Paul Miles from Sandia National Labs also visited, giving a seminar and touring facilities. Additional tour groups included Virginia Tech, Smithsonian Institution, Dallara Automobili (Race Chassis Builder), the National Academies 21st Century Truck Committee, the Oak Ridge Institute for Continued Learning, and the Center for Compact and Efficient Fluid Power.

## INVITED TALKS AND PRESENTATIONS

### **FEERC Participation in Regional Alternative Fuel Conference**

FEERC researcher, Scott Curran, presented an invited panel talk at the Southeastern Alternative Fuel Conference in Raleigh, North Carolina, hosted by the North Carolina Clean Technology Center and the United States (U.S.) DOE Clean Cities. The panel was on the future of sustainable transportation; Scott highlighted the research and development efforts within FEERC on the efficiency gains and emissions reduction potentials of using alternative and future fuels. Assistant Secretary Rueben Sarkar gave the keynote address and regional leaders in sustainable transportation and alternative fuels across the Southeast attended the conference.

### **FEERC Postdoc Presents Gasoline Compression Ignition (GCI) Research at an American Society of Mechanical Engineers (ASME) Conference**

On October 21<sup>st</sup>, FEERC Postdoc Adam Dempsey presented at the ASME 2014 Internal Combustion Engine Division Fall Technical Conference in Columbus, Indiana. The presentation focused on low temperature GCI research that has been conducted as part of the Fuel Effects on Advanced Combustion Program at the Oak Ridge National Laboratory (ORNL). The presentation described how the study systematically determined the optimal fuel injection strategy for low temperature GCI operation on a multi-cylinder engine. This study is a portion of a much larger research program comparing single-fuel advanced combustion concepts using gasoline to dual-fuel concepts using gasoline and diesel fuel.

Reference: "Effect of Premixed Fuel Preparation for Partially Premixed Combustion with a Low Octane Gasoline on a Light-Duty Multi-Cylinder Compression Ignition Engine," ASME ICEF2014-5561.

### **FEERC Researcher gives Invited Presentation at the 7<sup>th</sup> Integer Emissions Summit and Diesel Exhaust Fluid (DEF) Forum USA 2014**

John Storey was invited to give a presentation at the 7th Integer Emissions Summit & DEF Forum USA 2014 in Chicago, Illinois, October 28–30. The Integer Emissions Forums bring together international experts in exhaust emissions measurement and control. In addition to presenting his paper on "Challenges of Decreasing Particulate Emissions in LDVs and Passenger Cars." Dr. Storey also served on an expert panel for a discussion on "Perspectives on EPA and CARB Emissions Standards for Light-Duty Vehicles" at the same conference with experts from Volkswagen USA, Daimler AG, and the Air Resources Board of California.

### **FEERC Researcher Gives Invited Presentation at a meeting of the American Institute of Chemical Engineers (AIChE)**

Jim Szybist delivered a presentation entitled "Opportunities for Improved Efficiency in Spark Ignited Engines" at the Knoxville-Oak Ridge section meeting of AIChE. The talk focused on ongoing work within FEERC that is grounded in thermodynamics and represents real opportunities to increase engine efficiency, specifically the potential of high octane fuel, exhaust gas recirculation (EGR) dilution, and fuel reforming to support higher levels of EGR dilution. The talk was well-received by an engaged audience and spurred a significant amount of discussion.

### **FEERC Director Leads Technical Program at Successful 2014 ASME Internal Combustion Engine Division Fall Conference**

FEERC Director Robert Wagner organized the technical program and coordinated the execution of the 2014 ASME Internal Combustion Engine Division Fall Conference in Columbus, Indiana. Cummins, Inc. served as local host of the meeting with exhibits including the Cummins SuperTruck, the 1951 Cummins Diesel Indy Racing Car, and a 3D Cummins Advanced Virtual Environment demonstrator. Dr. John Wall, Vice-President and Chief Technical Officer of Cummins, provided the keynote address. Gurpreet Singh of DOE presented an invited luncheon keynote on his program in the area of advanced combustion engines. This meeting had over 260 registrants and 105 presentations and peer-reviewed manuscripts. This was the largest number of registrants in the 50-year history of this meeting with over 25% more attendees than the previous record.

### **FEERC Director Presents Keynote Address at the Global Powertrain Congress**

FEERC Director Robert Wagner presented the keynote address for the Powertrain Session at the 22<sup>nd</sup> Global Powertrain Congress in Dearborn, Michigan. His presentation focused on fuel and combustion opportunities for the next generation of internal combustion engines.

## **AWARDS**

### **FEERC Director Presented with ASME Internal Combustion Engine Award at the 2014 Fall Conference**

FEERC Director Robert Wagner received the ASME Internal Combustion Engine Award at the 2014 Fall Conference in Columbus, Indiana. The award is given in recognition of eminent achievement or distinguished contribution over a substantial period of time, which may result from research, innovation or education in advancing the art of engineering in the field of internal combustion engines.

## **OUTREACH**

### **FEERC Staff Member Volunteering as Mentor for 'TN Achieves' to help High School Students Prepare for Post-Secondary Education**

Jim Szybist has volunteered as a mentor for TN Achieves, a partnering organization to Governor Haslam's Tennessee Promise. The goal of the program is to increase the likelihood of low income students earning a post-secondary education credential as they transition from high school to college. <https://www.tnachieves.org/>