

Internal Combustion Engine



From the Editor

Suri Rajan

This Spring 2008 edition of the ASME ICE Division Newsletter brings new announcements about the upcoming Chicago Conference in April, and exciting picturesque memories from the highly eventful Fall Technical Conference held last Fall at historic Charleston, SC. We hope you will enjoy them and will make your plans to participate in the upcoming events. ▶

Spring 2008 ICE Meeting to be held in Chicago, IL, April 28-30, 2008

Tim Calahan

Chicago! What a great city to host the Spring 2008 ICE technical conference. The conference location is in close proximity to many of the U.S. engine manufacturers and is easily accessible by air via the O'Hare airport. The Sheraton Gateway Suite Hotel near the Chicago O'Hare airport in Chicago, Illinois is the conference hotel. Complimentary shuttle service to and from O'Hare Airport is available 24 hours a day. For those arriving by car, onsite parking is available for a \$12 per day fee. Additional hotel information is available on the conference web site at <http://www.asmeconferences.org/ices08/>.

The technical program will highlight a variety of technical areas including topics in advanced combustion, combustion modeling, technologies for light- and heavy-duty diesel engines, alternate fuels, engine performance and emissions, engine simulation and modeling. A special international CIMAC session is planned with a focus on large bore engines.

The technical tours are scheduled

on Wednesday, April 30, 2008 and will visit Ricardo Chicago Technical Center in Burr Ridge, Illinois and International Truck and Engine Company facilities in Melrose Park, Illinois. The buses will depart the hotel at 8:00 a.m. and return to the hotel before 12:00 p.m. One bus will be provided for each tour and will return to the hotel upon completion of that tour. Only one tour will be available per attendee on a first registered basis and each tour will be restricted to a maximum of 30 attendees.

Ricardo is a leading provider of technology, product innovation, engineering solutions and strategic consulting to the world's automotive, transport and energy industries. The Ricardo Chicago Technical Center is the lead office for Heavy-Duty Engine Engineering in North America. It is also the lead office for Software Development and Support. Skills include analysis, simulations, design, and testing. The tour will visit the Ricardo Chicago Technical Center which is equipped with four fully capable

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heavy-duty transient test cells for performance and emissions development. Additional information about Ricardo can be found at <http://www.ricardo.com>.

International Truck and Engine Company (ITEC), Navistar International Corp. is a holding company whose individual units provide integrated transportation solutions. Based in Warrenville, Illinois, the company produces International brand commercial trucks, mid-range diesel engines and IC brand school buses, and Workhorse brand chassis for motor homes and step vans. The International Engine Group has three locations including the one in the Chicago Area. The tour will visit the Melrose Park Plant which produces the MaxxForce DT (the legendary DT 466), MaxxForce 9 and MaxxForce 10 on its 1.5 million sq. ft. manufacturing floor. Additional information about International Engine Group can be found at <http://www.internationalengines.com/>. ▶

Fall 2007 Charleston Conference Awards Winners

Abnash Narula

The 2007 Fall Technical Conference Honors and Awards Banquet was held on Monday, October 15, 2007 at the Doubletree Guest Suites, in Historic Downtown Charleston, South Carolina. The banquet is a special event to recognize the outstanding achievements and dedicated efforts of our ICE Division colleagues. Abnash Narula, of Wm. W. Nugent & Co., Inc., who is the Chair of the Honors and Awards Committee, presented the awards.

Andrew J. Pope, of JEM Manufacturing, Inc., received the Retiring Chairman Certificate for his service on the Executive Committee of the Internal Combustion Engine Division from 2002 to 2007 and serving as Chairman from 2006 to 2007.

Eduardo Tomanik, of Mahle, Brazil Technical Center, received the ICE Division Speaker Award for the able presentation of his paper titled "Low friction Ring Pack for Gasoline Engines" presented at the 2006 Fall Technical Conference in Sacramento, California.

Chris Quillen, of Drivven, Inc., received the ICE Division Speaker Award for the able presentation of his paper titled "Friction Reduction Due to Lubrication Oil Changes in a Lean-Burn 4-Stroke Natural Gas Engine" presented at the 2007 Spring Technical Conference in Pueblo, Colorado.

Andrea E. Catania, of the Politecnico di Torino, received the ICE Division Most Valuable Technical Paper Contri-

bution Award for the able presentation of his paper titled "Numerical-Experimental Study and Solutions to Reduce the Dwell Time Threshold for Fusion-Free Consecutive Injections in a Multijet Solenoid-Type C.R. Systems" presented at the 2006 Fall Technical Conference in Sacramento, California.

Ronald J. Duda, of Unlimited Design International, Inc., and Razi Nalim, of Indiana University-Purdue University Indianapolis (IUPUI), were awarded the ICE Division Meritorious Award for many years of loyal service and worthy contributions on numerous committee assignments within the Internal Combustion Engine Division.

Neil X. Blythe, of GE Transportation Systems, was awarded the Richard S. Woodbury Award for eminent achievement and distinguished contribution to the management of those engaged in the design, development, application and operation of internal combustion engines.

Paul R. Danylyk, of Danyluk Technology Services, Inc., received the ASME Internal Combustion Engine Award for significant contributions to gas and

diesel engine technology, particularly in the areas of emissions control and fuel efficiency improvements.

Steve Fritz, of Southwest Research Institute was recognized for his election to the grade of ASME Fellow. The Fellow Grade is the highest elected grade of membership within ASME, the attainment of which recognizes exceptional engineering achievements and contributions to the engineering profession. Victor W. Wong, of Sloan Automotive Laboratory (MIT) will be recognized at the upcoming conference for election to the grade of ASME Fellow.

Frank W. Aboujaoude, of Fairbanks Morse Engine, and Edgar Humble, of Blackbaud Inc., received a plaque for their efforts as Chair of the local arrangements committee for the 2007 Fall Technical Conference. ▶



Professor Catania receives the ICE Division Most Valuable Technical Paper Contribution Award



Ronald J. Duda receives the ICE Division Meritorious Award



Razi Nalim receives the ICE Division Meritorious Award



Neil Blythe is awarded the Richard S. Woodbury Award



Steve Fritz is presented with the ASME Fellow plaque



Paul R. Danyluk receives the ASME Internal Combustion Engine Award

Charleston Fall Technical Conference Highlights

Frank Aboujaoude and Stuart Neill

The 2007 Fall Technical Conference was held at the Doubletree Guest Suites in beautiful Charleston, South Carolina. This was only the second time in recent memory that the ICED has held a conference on the east coast of the United States. Many of the conference attendees took advantage of the prime hotel location in the Historic Downtown district to visit the nearby Charleston City Market and the numerous sites within walking distance of the hotel.

The conference opened with a reception on Sunday evening, where the regulars gathered to rekindle old friendships and first-time attendees introduced themselves and made new friends. As usual, the ICED Chair's Hospitality Suite was a favorite gathering place in the evenings to enjoy your beverage of choice, a late night snack, the companionship of your colleagues, as well as to catch up on industry and personal news.

The conference was officially kicked off with the 2007 Keynote Speech entitled "Cummins MerCruiser Marine Products and Industry Changes" which was delivered by Jim Kahlenbeck, Director Worldwide Cummins MerCruiser

Diesel (CMD) Engineering. Jim did an excellent job of educating us about the inboard marine industry, particularly CMD's recent propulsion system innovations. Thanks again, Jim, for teaching us the difference between a "Pod" and an "iPod!"

Four concurrent sessions were held for the presentation of the technical papers. The technical program covered a diverse range of subjects including diesel engine technology, homogeneous charge compression ignition combustion, alternative fuels, sensors, lubrication and engine design. The technical papers were published in the Conference Proceedings on a searchable CD provided to all registrants. For those who were unable to attend the conference, the Proceedings CD can be ordered directly from ASME. For further details of the technical papers content, please read the accompanying report by Diesel-Net.



Faeza Khan, John Vronay and David Gardiner at the Marina entrance

The Honors and Awards Banquet was another highlight of the conference. This is a unique event held annually at the Fall Conference to recognize and honor the outstanding achievements and service of our colleagues to the internal combustion engine field. This year's Monday evening banquet featured a nice dinner at the conference hotel, the Awards ceremony (see separate article for the award winners) and concluded with outstanding entertainment by Mick Ayres, who provided a unique blend of magic, music and storytelling to keep the audience laughing in all the right places.

On Tuesday evening, CMD hosted a special event at the Charleston Harbor Marina, which was well attended by the conference attendees and their families. Upon arrival at the Marina, hors d'oeuvres and cold beverages were served, followed by a dinner buffet. Several well-equipped boats highlighting the entire range of CMD products were on display for everyone to view and tour. CMD technical staff did a wonderful job of explaining the features and technologies incorporated into the various recreational and commercial products on



Dr. Ghazi Karim planning his afternoon in the hotel courtyard

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Charleston Conference Report

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The ASME Internal Combustion Engine Division (ICED) 2007 Fall Technical Conference was held on October 14-17 in Charleston, South Carolina. The ICED meeting is one of the most important venues for presenting engine research work done by the academia, as well as the industry. The conference was hosted by Cummins Mercuriser Diesel (CMD) and Robert Bosch LLC. About 70 papers were presented covering such topics as combustion, component and system design, emissions, and emission aftertreatment.

Combustion & Fuels

Argonne National Laboratory, Wayne State University and Electro-Motive Diesel (EMD) reported (ICEF2007-1637) on spray characterization work on the modular common rail injection system (MCRIS) for locomotive applications. System development has been supported by Robert Bosch AG at Argonne. EMD has fitted its 4-stroke H-engine with a new version of MCRIS for testing. Cam-driven unit injector systems and unit pump systems are currently being used in EMD two-cycle and four-cycle locomotive diesel engines, respectively. Conventional common rail systems used in passenger-car diesel engines have limited potential for use in large diesel engines because of high-pressure pulsations in the rail and injectors, and the high cost of high-pressure piping. MCRIS minimizes the high-pressure pulsations that are generated on the pump side with two-stage damping volumes—one of which is incorporated in the injector. This allows much smaller fuel supply lines between the rail and the injector and allows for more flexibility for split injections. 15-20% NO_x reductions over unit pump systems at an equivalent BSFC have been reported in the past.

Argonne also reported on several projects related to light-duty common rail. One project (ICEF2007-1663) quantified diesel fuel spray variability in the near nozzle region of a Bosch light-

duty common rail injector. Little variability was found at the leading edge of the spray. At the trailing edge however, some variability—in the form of spray pulses after the apparent end of injection—was observed. This was believed to be a result of needle bounce on injector closing.

Using the same Bosch common rail light-duty diesel injector, another Argonne project (ICEF2007-1735) looked at biodiesel injection characteristics. Measurements of the injected fuel quantity showed that as fuel viscosity (D100, B50 and B100) increased, the injected volume decreased and the variability in the injected volume tended to increase. This effect was affected by nozzle geometry. The rate-of-injection was quite similar for D100 and B100 when using a straight, lightly hydro-ground nozzle but a significant reduction in peak injection rate for B100 was observed for a highly hydro-ground nozzle.

Engine Design & Components

Mahle reported (ICEF2007-1639) on new EGR system concept that uses a rotational flap (SLV-R) in the intake air system. The rotational flap is placed in the intake system and functions similarly to an intake throttle except that only a temporary period of intake depression is created, as the flap rotation is synchronized with engine rotation. Significant increases in EGR rate and NO_x reductions were demonstrated on a 2005 Cummins ISX. Further work is required to optimize the engine calibration and to show the effect on fuel consumption.

Hyundai (ICEF2007-1629) presented experimental results studying the possibility of achieving NO_x emissions about 20-30% below the current IMO limit with one of their medium speed diesel engines (6H21/32). Injector hole and piston bowl geometry modifications appear to be all that is required to reach this NO_x level while still meeting Hyundai's fuel consumption target.

The Indian Ministry of Railways, Indian Institute of Technology Kanpur

and MICO Bosch (ICEF2007-1651) reported on the development of a double helix fuel injection pump for ALCO 251 locomotive engines that are commonly used in India. The double helix design allows optimization of injection timing at different notch positions by retarding timing as engine speed decreases (injection timing is essentially fixed with single helix pump designs). An overall 1.2% improvement in fuel consumption is claimed.

RWTH Aachen University, Flame Spray Industries, Land Rover, Caterpillar, and Jaguar discussed (ICEF2007-1745) the use of plasma transferred wire arc thermal spray coatings for cylinder liners. The process allows a number of options for coating cylinder liner bores including low carbon steel coatings that can reduce piston/ring/liner friction. The process is also being considered by a number of manufacturers such as Caterpillar, Land Rover and Jaguar as a means to remanufacture worn cylinder bores. Durability testing with a remanufactured Caterpillar 3116 has shown promise. Caterpillar already used thermal sprays to remanufacture cylinder head faces and engine block top decks.

Emission Characterization & Measurement

Universität Karlsruhe reported (ICEF2007-1709) on experimental investigations into soot concentration and particle size distribution impacts of fuel injection pressure. The work was carried out in a single cylinder version of the heavy-duty OM450 engine used DaimlerChrysler Actros trucks. The results showed that while increased injection pressure reduced soot emissions and particle numbers, it has little impact on particle size. At engine idle, the particle size distribution was dominated by particle in the 20 nm size range and while soot emissions decreased, particle number actually increased with injection pressure.

The Royal Military College of Canada provided an update (ICEF2007-

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Charleston Conference Report

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1739) on their efforts to develop a spark discharge particulate matter sensor. Signal stability has been significantly improved through efforts to control sensor temperature. Engine test results comparing sensor output to AVL smoke meter readings showed good correlation. Additional work is required to overcome some remaining temperature sensitivity and improve on the current 6-7 second response time.

Emission Aftertreatment

SwRI, MIRATECH and Transportation Technology Center reported (ICEF2007-1626) on the application of a base metal catalyzed DPF to 2-stroke EMD switcher locomotives with a view to possible application to future Tier 4 locomotives. The DPF was equipped with a HUG fuel burner for regeneration. The filtration efficiency was measured at 80%, which was below the expectation. The low efficiency was thought to be mainly a result of high levels of condensable hydrocarbons

(SOF) in the 2-stroke engine exhaust. Installation of a DOC upstream of the DPF is planned to improve the SOF conversion. One of the two locomotives is due to be retested this fall after being in service for one year. Some issues noted during the demonstration included: poor ignition reliability of the burner used for regeneration and white smoke emissions at the beginning of regeneration during idle or light load operation. The ignition reliability issue was rectified with burner modifications. The white smoke is thought to be a result of condensed hydrocarbons collected on the DPF when exhaust temperature is low.

University of Michigan investigated (ICEF2007-1733) the effectiveness of a conventional Pt based DOC to control emissions from premixed compression ignition (PCI) combustion. While it may not be surprising that a DOC becomes ineffective at low temperatures and/or under rich conditions, it was found that the DOC remained inactive during rich PCI combustion even at sufficiently high temperatures, and with oxygen present. The authors hypothesize

that the catalyst was deactivated by high CO concentrations, with CO molecules occupying all available Pt sites. The implication is that DOC formulations for diesels using rich operation (rich low temperature combustion or lean/rich switching to regenerate NO_x adsorbers) may need to be different from conventional DOCs. The researchers also developed a HC speciation method from low temperature combustion (ICEF2007-1632).

Oak Ridge National Laboratory reported (ICEF2007-1628) on an aqueous-based wash process to restore NO_x adsorber activity. The system uses water-soluble potassium adsorbent, and has been designed for stationary natural gas engines. After sulfur poisoning, the poisoned adsorbent is washed out from the catalyst followed by the application of a new adsorbent. The process does not involve reapplication of the precious metal component of the catalyst. ▶

Charleston Fall Technical Conference Highlights

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display. The fall evening weather was very pleasant, especially for those of us coming from colder climates. Thanks again to CMD for hosting the event and agreeing to entertain us well past the 8:30 p.m. scheduled departure time. A great time was had by all!

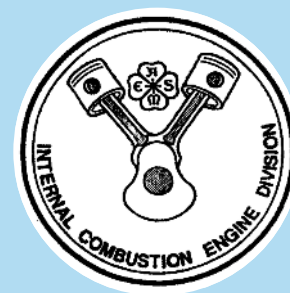
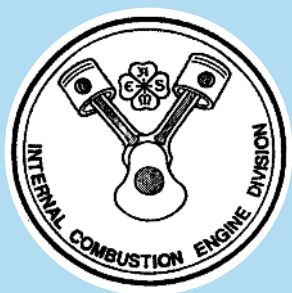
The conference concluded with technical tours of CMD and Robert Bosch facilities on Wednesday morning. The CMD tour covered their Assembly and Test facility and their Marine Technical Center, which highlighted their test cells. The second tour was to Robert Bosch's diesel fuel injection component manufacturing facility, which builds common rail injectors, pumps, rails and unit injectors. The two technical tours provided the opportunity for conference attendees to see the real-world application of advanced engine technologies. Thanks again to CMD and Robert Bosch for sharing their impressive facilities with us. ▶

Future ICED Conferences

Our 2008 Spring Technical Conference will be held in Chicago, Illinois on April 27-30, 2008 (see separate article for this conference). Following our new conference model, published in last summer's newsletter, ICED will not hold a 2008 Fall Technical Conference. Our 2009 Spring Technical Conference will be hosted by Waukesha Engine in Milwaukee, Wisconsin on May 3-6, 2009. It will include a tour of Waukesha's large bore engine manufacturing facility. The Call for Papers for this conference is provided elsewhere in this newsletter. Additional information on future conferences will be forthcoming shortly. ▶

Call For Papers

Internal Combustion Engine Division ASME International



Invites Papers for the
2009 Spring Technical Conference
May 3–6, 2009 • Milwaukee, Wisconsin

Hosted by
Waukesha Engine

The 2009 Spring Technical Conference of the ASME Internal Combustion Engine Division will be held in beautiful Milwaukee, Wisconsin, from May 3–6th. In addition to a stimulating two-day technical program, the conference will include a tour of Waukesha Engine manufacturing, assembly and production test facilities.

Papers are invited for publication and presentation on all topics related to automotive, marine, locomotive, off-highway, and industrial internal combustion engines. Papers may address any aspect of the design, development or application of compression-ignition, spark-ignition, rotary, or reciprocating engines. Light-duty and heavy-duty engines, as well as large-bore internal combustion engine systems for power generation and transportation propulsion are welcome.

It is anticipated that technical sessions will span the wide range from fundamental research to practical in-use applications. Examples of topics include, but are not limited to, Advanced Combustion, Fuels, Emissions Control, Engine Design, Lubrication, Instrumentation & Controls, Engine Applications (including hybrids), and Numerical Simulation. Papers dealing with large bore engine technology are particularly encouraged.

Authors of all accepted papers must present their papers at the conference. Papers will be published in the Conference Proceedings. A list of conference papers recommended for journal publication will be sent directly to the Editor of ASME Journal of Engineering for Gas Turbines and Power by the Technical Program Chair. Outstanding papers will be approved for fast-track journal publication, while papers requiring revisions will receive rapid additional reviews by the editorial team. The Editor (and/or the Technical Program Chair) will directly inform authors of the status of their journal papers. To prevent duplication and confusion, authors submitting papers to the ICED conferences should not directly submit their papers to the journal. Exceptional written papers and presentations will be considered for ASME ICE Division Conference awards. ASME review and publication policies apply. The conference website, www.asmeconferences.org/ICES09/, will be activated shortly to accept your 400-word (or less) abstract in text format. For further information, contact:

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Important Dates

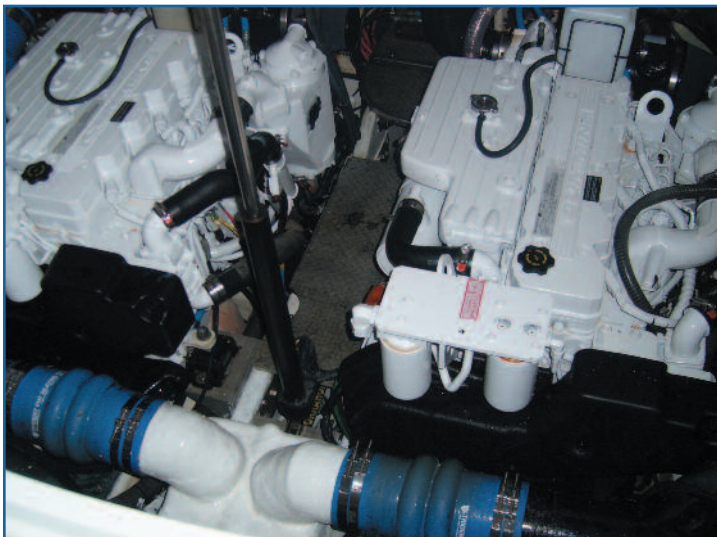
October 10, 2008	400-word abstract due, please submit online
December 5, 2008	Draft manuscript due for review
February 27, 2009	Final manuscript & copyright form due



Tim and Kathy Callahan and Ben and Beth Myers relaxing on a boat



Attendees enjoying a beautiful evening at the Marina



Twin CMD engines power this boat



Conference Participants at the Awards Banquet



Andy Pope and Joe Kindling enjoying a cold beverage



Dennis Assanis and his family at the Marina