The COMVEC™ Program – developed by the Executive Council & Technical Program Committees – provides information and diverse points of view to encourage debate among panelists and to stimulate follow-up exchanges with attendees.

• Symposia “hot-topic” tracks are focused on strategic and business-related issues, with the goal to have expert panelists provide their perspective and engage with attendees during Q&A.

• Expert panel discussions and technical paper presentations are in-depth sessions on specific topics and allow the technical panel to be an interactive session followed by Q&A. These sessions are geared toward individuals working in the technology area as well as individuals wanting to learn more.

• The L. Ray Buckendale Lecture provides procedures and data useful in formulating solutions and is directed primarily by an industry leader to the needs of young engineers and students with an emphasis on practical aspects of the topic.

“"Our industry is facing evolving emissions requirements, new paradigms in technology, and growing customer expectations creating tremendous uncertainty — and also opportunity to innovate. COMVEC will feature compelling keynotes and sessions exploring customer perspectives and market forces impacting the commercial vehicle industry, setting a precedent for the next 100 years of innovation."”

Jennifer Rumsey
Vice President & CTO, Cummins Inc.
## EVENT-AT-A-GLANCE

### MONDAY  September 9 - SOCIETAL NEEDS OF THE FUTURE

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 a.m. – 12 p.m.</td>
<td>Young Professionals Meet &amp; Greet</td>
</tr>
<tr>
<td>1 p.m. – 2:10 p.m.</td>
<td>Opening Keynote Speaker - Rich Freeland, President and COO &amp; Jennifer Rumsey, VP &amp; CTO, Cummins Inc.</td>
</tr>
<tr>
<td>2:15 p.m. – 3:45 p.m.</td>
<td>Meeting Basic Needs of Humanity</td>
</tr>
<tr>
<td>2:15 p.m. – 3:45 p.m.</td>
<td>Powertrain Paper Session</td>
</tr>
<tr>
<td>2:15 p.m. – 3:45 p.m.</td>
<td>Cross Technology Paper Session</td>
</tr>
<tr>
<td>3:45 p.m. – 4:00 p.m.</td>
<td>Networking Break</td>
</tr>
<tr>
<td>4:00 p.m. – 5:30 p.m.</td>
<td>Transportation and Mobility Needs of the Future</td>
</tr>
<tr>
<td>4:00 p.m. – 5:30 p.m.</td>
<td>Powertrain Student Session</td>
</tr>
<tr>
<td>4:00 p.m. – 5:30 p.m.</td>
<td>Aerodynamics #1 - Keynote</td>
</tr>
<tr>
<td>5:30 p.m. – 6:30 p.m.</td>
<td>Networking Reception in Exhibit Hall - Sponsored by Eaton Corp</td>
</tr>
</tbody>
</table>

### TUESDAY  September 10 - FUELING THE FUTURE

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 a.m. – 10:30 a.m.</td>
<td>Networking Break in Exhibit Hall - Sponsored by Sears Seating</td>
</tr>
<tr>
<td>10:30 a.m. – 12 p.m.</td>
<td>Off-highway Applications and Trends</td>
</tr>
<tr>
<td>10:30 a.m. – 12 p.m.</td>
<td>Disruptive Technologies, Part 1</td>
</tr>
<tr>
<td>10:30 a.m. – 12 p.m.</td>
<td>Dissipative Technologies, Part 1</td>
</tr>
<tr>
<td>12 p.m. – 1:30 p.m.</td>
<td>Networking Lunch in Exhibit Hall</td>
</tr>
<tr>
<td>12 p.m. – 12:30 p.m.</td>
<td>Young Professionals Speed Mentoring</td>
</tr>
<tr>
<td>1:30 p.m. – 3 p.m.</td>
<td>On-highway Applications and Trends</td>
</tr>
<tr>
<td>1:30 p.m. – 3 p.m.</td>
<td>Disruptive Technologies, Part 2</td>
</tr>
<tr>
<td>1:30 p.m. – 3 p.m.</td>
<td>Aerodynamics #3 - Platooning</td>
</tr>
<tr>
<td>3 p.m. – 3:30 p.m.</td>
<td>Networking Break in Exhibit Hall</td>
</tr>
<tr>
<td>3:30 p.m. – 5 p.m.</td>
<td>Alternative and Future Fuels</td>
</tr>
<tr>
<td>3:30 p.m. – 5 p.m.</td>
<td>Off-road Electrification</td>
</tr>
<tr>
<td>3:30 p.m. – 5 p.m.</td>
<td>Aerodynamics #4 - Aerodynamic Drag / Design</td>
</tr>
<tr>
<td>5 p.m. – 6 p.m.</td>
<td>Networking Reception in Exhibit Hall - Sponsored by Navistar</td>
</tr>
</tbody>
</table>

### WEDNESDAY  September 11 - CHARGING THE FUTURE

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>8:30 a.m. – 9 a.m.</td>
<td>Coffee</td>
</tr>
<tr>
<td>8:30 a.m. – 9 a.m.</td>
<td>Young Professionals Meet &amp; Greet</td>
</tr>
<tr>
<td>9 a.m. – 10 a.m.</td>
<td>Opening Keynote - Carla Bailo, President and CEO, Center for Automotive Research</td>
</tr>
<tr>
<td>10 a.m. – 10:15 a.m.</td>
<td>Networking Break - Sponsored by Oshkosh Corp</td>
</tr>
<tr>
<td>10:15 a.m. – 11:45 a.m.</td>
<td>Off- and On-Highway Applications and Trends</td>
</tr>
<tr>
<td>10:15 a.m. – 11:45 a.m.</td>
<td>CAE: Vehicle System Development</td>
</tr>
<tr>
<td>10:15 a.m. – 11:45 a.m.</td>
<td>Developments and Technical Approach in Highly Automated Vehicles</td>
</tr>
<tr>
<td>12:45 p.m. – 12:45 p.m.</td>
<td>Networking Lunch in Exhibit Hall</td>
</tr>
<tr>
<td>12:45 p.m. – 2:15 p.m.</td>
<td>Electric Infrastructure Challenges and Demands</td>
</tr>
<tr>
<td>12:45 p.m. – 2:15 p.m.</td>
<td>CAE: Vehicle Sub-system and Component Development</td>
</tr>
<tr>
<td>12:45 p.m. – 2:15 p.m.</td>
<td>Cybersecurity</td>
</tr>
<tr>
<td>2:15 p.m. – 2:30 p.m.</td>
<td>Networking Break in Foyer</td>
</tr>
<tr>
<td>2:30 p.m. – 4 p.m.</td>
<td>Globalization in Electrification</td>
</tr>
<tr>
<td>2:30 p.m. – 4 p.m.</td>
<td>Uncertainty Quantification and Robust Design</td>
</tr>
<tr>
<td>2:30 p.m. – 4 p.m.</td>
<td>Lateral Control and Its Mechatronics</td>
</tr>
<tr>
<td>5:30 p.m. – 7:30 p.m.</td>
<td>Networking Reception at the Indianapolis Motor Speedway (this event requires a separate ticket)</td>
</tr>
</tbody>
</table>

### THURSDAY  September 12 - INDY SPEEDWAY EVENT

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00 a.m. – 2:00 p.m.</td>
<td>Tech Demo &amp; Ride Along at the Indianapolis Motor Speedway (this event requires a separate ticket)</td>
</tr>
</tbody>
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**EXHIBIT HOURS**
- Monday: 5 p.m. – 6:30 p.m.
- Tuesday: 10 a.m. – 6:00 p.m.
- Wednesday: 8:30 a.m. – 10:00 p.m.

**REGISTRATION HOURS**
- Monday: 7:30 a.m. – 4:30 p.m.
- Tuesday: 7:30 a.m. – 4:00 p.m.
- Wednesday: 8:00 a.m. – 5:00 p.m.

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**EVENT-AT-A-GLANCE**

Sponsored by:

**PROFESSIONAL DEVELOPMENT SEMINARS**

- *Success Strategies for Women in Industry and Business*
  - September 9, 2019
  - 8:30 a.m. – 4:30 p.m.

- *Effective Writing for Engineering and Technical Professionals*
  - September 9-10, 2019
  - 8:30 a.m. – 4:30 p.m.

*separate registration required*
COMVEC™ KEYNOTE PRESENTATIONS

MONDAY OPENING KEYNOTE – 1:00 P.M.
Rich Freeland
President & Chief Operations Officer
Cummins Inc.

Jennifer Rumsey
Vice President & Chief Technical Officer
Cummins Inc.

TUESDAY BUCKENDALE LECTURE & BREAKFAST – 7:45 A.M.
Giorgo Rizzoni
Professor of Mechanical & Aerospace Engineering and of Electrical & Computer Engineering
The Ohio State University

TUESDAY OPENING KEYNOTE – 9:00 A.M.
Franklin R. Chang Diaz, Ph.D.
Chairman & Chief Executive Officer
Ad Astra Rocket Company

WEDNESDAY OPENING KEYNOTE – 9:00 A.M.
Carla Bailo
President & Chief Executive Officer
Center for Automotive Research
TECHNICAL SESSIONS
OUR SOCIETY IN THE FUTURE

SOCIETAL NEEDS OF THE FUTURE: MEETING BASIC NEEDS OF HUMANITY
2:15 p.m.

Commercial vehicles have evolved significantly over the past hundred years, changing and growing in capabilities to meet the needs of humanity. Through this time period, the basic needs of humanity may not have changed, but the environment around us certainly has. For example, clean air and water are not as accessible as they were 100 years ago. We are seeing more impactful natural disasters than ever before which affect our ability to provide shelter, food, and water. Continued global population increases drive challenges to ensure food for all of humanity. The environment around us will continue to change in the next hundred years. Within this panel, we will explore the trends and challenges of providing the basic needs of humanity and the requirements this could drive in commercial vehicles of the future.

MODERATOR
Timothy Johnson, Corning Inc.

PANELISTS
Kanlaya Barr, Deere & Company
Daniel S. Greenbaum, Health Effects Institute
Elizabeth Kocs, University of Illinois Chicago

CROSS TECHNOLOGY PAPER SESSION
2:15 p.m.

The papers in this session will cover aerodynamics and chassis technologies, as well as safety assessments of an autonomous vehicle.

AUTHORS
Daniel Aceituna, DISTek Integration Inc. - PreHaz: A Pre-Mortem Functional Safety Hazard Assessment Technique for Autonomous Vehicles
Yang Chen, Center for Vehicle Systems and Safety - Simulation Evaluation on the Rollover Propensity of Multi-trailer Trucks at Roundabouts
Erik Ostergaard, Metalsa - Concept for a Lightweight Heavy Truck Chassis with Aerodynamic Advantages
Krishna Zore, ANSYS, Inc. - Fast and Accurate Prediction of Vehicle Aerodynamics using ANSYS Mosaic Mesh

POWERTRAIN PAPER SESSION
2:15 p.m.

The papers in this session cover a variety of subjects related to powertrain technology.

AUTHORS
Jairo Sandoval, Cummins Inc. - Optimal Mission-Specific Dynamic Powertrain Calibration from Cloud for Class 8 Linehaul Truck Cruise Operation
Pengyue (Kevin) Wang, Univ. of Minnesota - TITLE TBD
Gary Neely, Christopher Sharp, Southwest Research Institute; Matthew S. Pieczko, James E. McCarthy, Jr., Eaton - Simultaneous NOx and CO2 Reduction Using Diesel CDA With NVH Setup Strategy on a Heavy-Duty Diesel Engine in a Dyno Test Cell Showing Means to Meet CARB Low NOx in Steady State, Transient and Low Load Cycle

AERODYNAMICS COMMITTEE: PANEL 1
4:00 p.m.

This year’s aero keynote will offer great insights in past and recent aerodynamic features and elements developed for INDYCAR. Just as race cars, commercial vehicles are pushed to deliver the best aerodynamic performance in a very competitive context.

PANELISTS
Tino Belli, INDYCAR
Brian McAuliffe, National Research Council Canada
TECHNICAL SESSIONS

OUR SOCIETY IN THE FUTURE

POWERTRAIN COMMITTEE: POWERTRAIN STUDENT SESSION
4:00 p.m.

The SAE Powertrain Committee is organizing this session to profile student research projects. Submissions were invited from both MS and PhD candidates. Topics to be addressed may include: air handling, combustions, friction reduction, controls, waste heat recovery, electrification, aftertreatment, NVH, vehicle operation, alternative fuels, transmissions and driveline.

Session Sponsored by

MODERATOR
Dheeraj Gosala, Cummins Inc.

AUTHORS
Jon Furlich, Michigan Technological Univ. - Improved Operator Comfort and Fleet Management with Sensor Proliferation
Mrunal Joshi, Purdue University - Diesel Engine Variable Valve Actuation to Enable Reduction in Engine Out Emissions with and without Requiring Exhaust Manifold Pressure Control
Luis Silva, Western Michigan Univ. - Experimental and Computational Studies of the No-Load Churning Loss of a Truck Axle
Siyuan Zhang, Univ. of Alabama Birmingham - A Mechanical Analogy for Modeling Distributed/Virtual Electric Drivelines

SOCIETAL NEEDS OF THE FUTURE: TRANSPORTATION AND MOBILITY NEEDS OF THE FUTURE
4:00 p.m.

Today, we move masses of people and goods with commercial vehicles. The levels of efficiency gains made in transportation and mobility have been impressive. Yet we are not done! Breakthrough technologies in e-commerce, cloud computing, and autonomy are becoming part of the fabric of mobility and we are continuing to uncover the value they can bring to society. How will transportation and mobility continue to evolve in the future? What does this mean for the transportation infrastructure and the commercial vehicles of the future?

MODERATOR
Claus Daniel, Oak Ridge National Laboratory

PANELISTS
Hailin Chen, Shanghai International Auto Parts
Boris Kort-Packard, FedEx Express
Diane Newton, HNTB Corp.
FUELING THE FUTURE: OFF-HIGHWAY APPLICATIONS AND TRENDS
10:30 a.m.

The diverse range of machine requirements results in specific challenges for the off-highway market. Traditional diesel powertrains have become more complicated while alternative fuel sources have advanced significantly. Is diesel still the best option? What will change the current state and in which markets and applications? Is a hybrid powertrain the goal, or just a steppingstone to an all-electric future? How will OEMs’ powertrain portfolios change to cover the product range?

MODERATOR
Navtej Singh, Navistar Inc.

PANELISTS
Shelley Knust, Cummins Inc.
Iain V. Ridley, AVL Powertrain Engineering Inc.
Michael Weinert, John Deere
Scott Woodruff, MTU America Inc.
John Zagone, BorgWarner Turbo Systems

POWERTRAIN COMMITTEE: DISRUPTIVE TECHNOLOGIES - PART 1
10:30 a.m.

Disruptive technologies are affecting the commercial vehicle industry from all directions, by presenting both challenges and solutions. From a powertrain perspective, perhaps the most disruptive technologies are those that result from new emissions regulations for 2024 and beyond. Fuel cell and battery technologies will finally be on a path to large-scale commercialization in hybrid and fully electric vehicles. With electrification, “disruptive technologies” will shape future powertrain designs in the heavy-duty diesel industry. This session will focus on innovations surrounding conventional powertrain systems emissions regulation challenges, improved fuel economy, and durability.

MODERATOR
Randal Goffe, PACCAR Technical Center

PANELISTS
Tracy Davis, Chevron
Michael Gerty, PACCAR Technical Center
Chung-Hsuan Huang, Cummins Inc.
Thomas Waldron, SuperTurbo Technologies Inc.

AERODYNAMICS COMMITTEE: PANEL 2 - TRACK TESTING
10:30 a.m.

Validating reduced aerodynamic drag coefficient or improve fuel economy in a full-scale environment on a closed track stays one of the crucial aspect in commercial vehicle developments. Novel measurements techniques are being developed to better assess the aerodynamic performance of bluff bodies.

MODERATOR
Ilhan Bayraktar, General Electric Aviation

PANELISTS
Bhargav Sowmianarayanan, Dassault Systems (USA)
Alexander Spoelstra, TU Delft
Bernard Tanguay, National Research Council Canada

AERODYNAMICS COMMITTEE: PANEL 3 - PLATOONING
1:30 p.m.

Just as with INDYCAR vehicles, commercial vehicles are drafting behind each other, but then on a public roads. Forming a platoon already proved to a positive impact on the fuel economy of all vehicles in the platoon. This session will dive in the specific platooning topics giving better insight in complex flow phenomena.

MODERATOR
Joshua Paul Kehe, PACCAR Technical Center

PANELISTS
Brian McAuliffe, National Research Council Canada
Patrick Smith, Auburn Univ.
Mart van Rijssingen, TU Delft
TECHNICAL SESSIONS
FUELING THE FUTURE

FUELING THE FUTURE: ON-HIGHWAY APPLICATIONS AND TRENDS
1:30 p.m.

Powertrain development continues to be driven by regulations in the on-highway sector, yet fuel is one of the major costs for on-highway business. Does the increased powertrain complexity provide an opportunity for alternative fuel sources, or just continue incremental technological change? Which on-highway markets and applications are most likely to accept alternative fuel sources and what are the drivers?

MODERATOR
Robert Wagner, Oak Ridge National Laboratory

PANELISTS
Bryan Dempsey, FedEx Ground
Carl Hergart, PACCAR Inc.
Charles Roberts, Southwest Research Institute
Christian Weiskirch, TRATON Group

POWERTRAIN COMMITTEE: DISRUPTIVE TECHNOLOGIES - PART 2
1:30 p.m.

Disruptive technologies are affecting the commercial vehicle industry from all directions, by presenting both challenges and solutions. From a powertrain perspective, perhaps the most disruptive technologies are those that result from new emissions regulations for 2024 and beyond. Fuel cell and battery technologies will finally be on a path to large-scale commercialization in hybrid and fully electric vehicles. With electrification, “disruptive technologies” will shape future powertrain designs in the heavy-duty diesel industry. This session will focus on integration strategies for powertrain, vehicle and fleet (e.g. platooning); which contribute to emissions control, fuel economy, and durability.

MODERATOR
David Gilson, SinterCast, Ltd.

PANELISTS
John Bennett, Meritor Inc.
Alexander Freitag, Robert Bosch GmbH
Philipp Rolke, IAV GmbH
Greg Shaver, Purdue University

TOTAL VEHICLE & MECHATRONICS COMMITTEE: CHARGING SYSTEMS FOR ELECTRIC VEHICLES
1:30 p.m.

Electric commercial vehicles are only as successful as their charging systems. This session will focus on charging systems both in the vehicle and in off-board charging equipment. What considerations must be made when designing the charging systems? What is the impact of charging system design on vehicle up time? How can interoperability between different charging equipment be guaranteed? What standards are in place to help address these questions? How can solar-powered charging systems supplement grid-based charging?

MODERATOR
Fred Cartwright, Pruv Mobility

PANELISTS
Emrah Arslanturk, Cummins Inc.
Jonas Leserer, Vector
Anup Sable, KPIT Cummins Infosystems Ltd. India
Jeff Wolfe, Tritium

AERODYNAMICS COMMITTEE: PANEL 4 - DRAG DESIGN
3:30 p.m.

Aerodynamic drag reduction is the main driver for improved fuel economy with commercial vehicles. This session is focusing on new innovative ways to reduce the aerodynamic drag or to manipulate the flow behavior around a road vehicle.

MODERATOR
John Kiedaisch, Navistar Inc.

PANELISTS
Onno Bartels, NLR
Jeffrey Levin, National Cheng Kung Univ.
Brian McAuliffe, National Research Council Canada
Roy Veldhuizen, Wabco
FUELING THE FUTURE: ALTERNATIVE AND FUTURE FUELS
3:30 p.m.

Market drivers and technology development are trending towards a future where diesel combustion engines are no longer the energy source for commercial vehicles. What are the likely alternatives to diesel engines and what will enable significant market penetration? What issues beyond the vehicle (such as fuel infrastructure) must be overcome? Are on-board fuels going to be superseded by plug-in electrical sources, or will there still be a place for on-board fuels in commercial vehicle?

MODERATOR
Lisa Farrell, Cummins Inc.

PANELISTS
Dennis Backofen, IAV GmbH
Yemane B. Gessesse, Cummins Inc.
Michael Traver, Aramco Research Center

POWERTRAIN COMMITTEE: OFF-ROAD ELECTRIFICATION
3:30 p.m.

The changes related to vehicle electrification can be seen across a wide range of both on- and off-highway vehicles. In the off-road space, equipment like draglines, electric rope shovels, mining trucks, and various pieces of underground mining equipment have employed electrification to varying degrees for decades. Now, this technology is finding new applications in equipment not previously employing partial or fully electrified powertrain systems. Advancements in all areas of technology surrounding electrification are marking this possible. It is expected that the proliferation and advancement of electrification technologies will shape future powertrain designs for off-road equipment.

MODERATOR
David Cramer, The Timken Company

PANELISTS
Beth A. Friling, Caterpillar
John Kimes, Sigma Powertrain
Rustam Kocher, Daimler Trucks North America LLC
TECHNICAL SESSIONS

CHARGING THE FUTURE

CHARGING FOR THE FUTURE: OFF- AND ON-HIGHWAY APPLICATIONS AND TRENDS
10:15 a.m.

Commercial vehicle and equipment powertrains have seen many changes over the past decades, however one of the most significant changes will be the broad-based adoption of hybridization and electrification. These new powertrains present many challenges to industry including, the system integration with conventional IC engines, emissions compliance across operating cycles, supporting infrastructure for charging, and service and maintenance. The service networks for these vehicles will require substantial retooling and training. The engineering organizations will be addressing multiple systems working in harmony. The OEM objective will be to make the operation of the equipment equal or improved from the conventional system to the operator’s perception. This symposium seeks to explore the approach of OEM’s and suppliers from different segments, discuss their approaches to the challenges and the unique aspects of the multiple applications.

MODERATOR
Michael D. Roeth, NACFE

PANELISTS
Julie Furber, Cummins Inc.
Gary Horvat, Navistar Inc.
Paul Snauwaert, CNH Industrial
Giordano G. Sordoni, Xos Trucks Inc.

CHASSIS COMMITTEE: CAE VEHICLE SYSTEM DEVELOPMENT
10:15 a.m.

This panel will focus on whole vehicle system level performance development using CAE tools. Topics could include but are not limited to:

- Impact of commercial vehicle electrification on chassis design, dynamic performance simulation, and hardware-in-loop study
- Differences in chassis design, performance evaluation, dynamics control, and fatigue/durability assessment among traditional commercial vehicles, semi-autonomous (including remotely controlled) commercial vehicles, and full-autonomous vehicles which may include but not limited to:
  - Facing external interference in dynamic environment
  - Dynamic constrains in dynamic environment
  - Electrification
  - Update of software related to vehicle dynamic performance
  - Accident avoidance
  - Efficiency vs. cost
  - Real-time simulation
  - Implementation of big data and AI technology on chassis maintenance plan development

MODERATOR
Lin Li, Liebherr Mining Equip Newport News Co.

PANELISTS
Mehdi Ahmadian, Virginia Tech.
Stefano Cassara, Navistar Inc.
Boris Kort-Packard, FedEx Express
Arda Kurt, TuSimple
TECHNICAL SESSIONS

CHARGING THE FUTURE

STANDARDS SESSION 1 - TRACTOR-TRAILER INTERCONNECTION FOR NORTH AMERICA AUTONOMOUS AND ELECTRIC VEHICLES
10:15 a.m.

This panel will focus on tractor trailer interconnections for North America looking beyond the current J560 and J318 connections. The panel will discuss how current North America tractor trailer interconnections are hindering technology advancements with autonomous, electric and long combination vehicles. The panel will discuss present and future options for tractor trailer interconnections and the path moving forward towards a new tractor trailer interconnection standard

MODERATOR
Dave Engelbert, Haldex Brake Products, Inc.

PANELISTS
Matthew Fry, Knorr-Bremse
Jon Intagliata, Bendix Commercial Vehicle Systems
Chris Lee, Great Dane Trailers, Inc.
Dennis Skaradzinski, Great Dane Trailers, Inc.
Wally Stegall, The Morey Corp.

TOTAL VEHICLE & MECHATRONICS COMMITTEE: DEVELOPMENTS AND TECHNICAL APPROACH IN HIGHLY AUTOMATED VEHICLES
10:15 a.m.

This panel discusses the technical challenges faced and overcome during the development of highly automated vehicles and the industry approach towards launching Highly Automated Vehicles.

MODERATOR
Ananda Pandy, ZF Friedrichshafen AG

PANELISTS
Cetin Mericli, Locomation
Chuck Price, TuSimple
Alex Rodrigues, Embark Trucks
Charles Yu, PlusAI

CHARGING FOR THE FUTURE: ELECTRIC INFRASTRUCTURE CHALLENGES AND DEMANDS
12:45 p.m.

Commercial vehicle and equipment powertrains have seen many changes over the past decades, however one of the most significant changes will be the broad-based adoption of hybridization and electrification. These new powertrains present many challenges to industry including, the system integration with conventional IC engines, emissions compliance across operating cycles, supporting infrastructure for charging, and service and maintenance. The service networks for these vehicles will require substantial retooling and training. The engineering organizations will be addressing multiple systems working in harmony. The OEM objective will be to make the operation of the equipment equal or improved from the conventional system to the operator’s perception. This symposium seeks to explore the approach of OEM’s and suppliers from different segments, discuss their approaches to the challenges and the unique aspects of the multiple applications.

MODERATOR
Mihai Dorobantu, Eaton

PANELISTS
Steven Boyd, U.S. DOE
Michael Buff, Electrify America LLC
Robbie Diamond, Securing America’s Future Energy (SAFE)
Ronald Thompson, Eaton
TECHNICAL SESSIONS

CHARGING THE FUTURE

CYBERSECURITY PANEL - HOW WOULD YOU PREVENT THIS BREACH?
12:45 p.m.

While engaging invited speakers and members of the audience, a genericized commercial vehicle network architecture will be followed to perform an analysis and devise an attack tree. The goal will be to determine responses to the following:

• Is there an advantage to a standardized analysis across commercial vehicles?
• What kinds of common attack surfaces are found, and do they lead to SAE standards work?
• Does common language exist or is there a need to specify terms & definitions?
• Can exercises, such as this session, be used to decide what SAE standards need to evolve or be developed?

MODERATOR
Larry Hilkene, Cummins Inc.

CHASSIS COMMITTEE: CAE VEHICLE SUB-SYSTEM AND COMPONENT DEVELOPMENT
12:45 p.m.

This panel will focus on vehicle sub-system and component level performance development using CAE tools. Topics could include but are not limited to:

• Transition from conventional steering system to electrified or hybrid replacement, as well as simulation and evaluation of electrified steering system using CAE tools
• Transition from conventional braking system to electrified or hybrid replacement, as well as simulation and evaluation of electrified braking system using CAE tools
• Impact of electrification on tire development and suspension design

MODERATOR
Fabian Koark, Invensity Inc.

PANELISTS
Christian Wolfgang Appel, Bosch Engineering Group
Oliver Baier, ebm-papst Inc.
Scott Duncan, Bendix Cvs
Jan Wei Pan, Autox Technologies
Guoguang Zhang, APTIV

STANDARDS SESSION 2 - BRAKING SYSTEMS FOR NORTH AMERICA AUTONOMOUS AND ELECTRIC VEHICLES
12:45 p.m.

This panel will focus on advancements in braking systems for autonomous and electric vehicles. The panel will discuss how autonomous and electric vehicles will benefit from having EBS and EMB systems respectively. The panel will discuss changes to existing and required new J-Standards to support the advancements in braking technology.

MODERATOR
Dave Engelbert, Haldex Brake Products, Inc.

PANELISTS
Wolfgang Hahn, WABCO
Alrik Svenson, NHTSA

CHARGING THE FUTURE: GLOBALIZATION IN ELECTRIFICATION
2:30 p.m.

Commercial vehicle and equipment powertrains have seen many changes over the past decades, however one of the most significant changes will be the broad-based adoption of hybridization and electrification. These new powertrains present many challenges to industry including, the system integration with conventional IC engines, emissions compliance across operating cycles, supporting infrastructure for charging, and service and maintenance. The service networks for these vehicles will require substantial retooling and training. The engineering organizations will be addressing multiple systems working in harmony. The OEM objective will be to make the operation of the equipment equal or improved from the conventional system to the operator’s perception. This symposium seeks to explore the approach of OEM’s and suppliers from different segments, discuss their approaches to the challenges and the unique aspects of the multiple applications.

MODERATOR
Stephan Tarnutzer, AVL Powertrain Engineering Inc.

PANELISTS
Jonah Leason, PACCAR Technical Center
Mark Mohr, ZF Friedrichshafen AG
Randy Sumner, Aptiv
Chang Rui, Foton Motor Company
TECHNICAL SESSIONS
CHARGING THE FUTURE

CHASSIS COMMITTEE: UNCERTAINTY QUANTIFICATION AND ROBUST DESIGN
2:30 p.m.
This panel will focus on the uncertainty quantification along with vehicle development using CAE tools. Topics could include but are not limited to:

• Vehicle parameter estimation under uncertainties
• Prediction of vehicle behavior under multi-vehicle interaction including vehicles within a fleet or different types of vehicles in the same operation
• Uncertainty quantification of sensor measurements on conventional commercial vehicle and autonomous commercial vehicles (single and/or platooning/multi-vehicle complexities)

MODERATOR
Nicholas Gaul, RAMDO Solutions

PANELISTS
Gavin Jones, SmartUQ
Eric J. Pesheck, MSC Software Corp.
Tana Tjhung, FCA US LLC
Xiaobo Yang, Oshkosh Corporation

TOTAL VEHICLE & MECHATRONICS COMMITTEE: LATERAL CONTROL AND ITS MECHATRONICS
2:30 p.m.
On the road to autonomous commercial vehicles our industry has many challenges ahead, one such challenge is lateral control of the vehicle/machine. Conventional CVs have enjoyed the advantage of a human operator directly controlling steering, often with a power assist system, autonomous systems will have mechanical, electrical, and controls challenges to overcome. This panel seeks to explore the On and Off-Highway lateral control challenges our industry has moving towards production autonomous commercial vehicles.

MODERATOR
Prasanna Srinivasan, Cummins Inc.

PANELISTS
Troy Schick, John Deere
TBA, ZF

STANDARDS SESSION 3 - STANDARDS FOR AERODYNAMICS, FUEL ECONOMY, TESTING METHODS AND APPLICATIONS
2:30 p.m.
Join standards development leaders as they discuss the working strategies used to identify and develop specific standard documents that support the industry adoption of emerging technologies. Specific topic areas to be discussed relate to current and future standards development activities associated with aerodynamics, fuel economy, testing methods and applications.

MODERATOR
Ilhan Bayraktar, General Electric Aviation

PANELISTS
Peter Kilcline, PACCAR
Brian McAuliffe, National Research Center Canada
Andrew Mosedale, Auto Research Center
Marius Surcel, FP Innovations
The COMVEC™ Technology Connection is designed for engineering professionals and academics of all levels to engage, learn, and collaborate in a casual, informal setting.

ATTIRE
Business Casual – Come untied!

ENGAGE with Executive Council Members
Each executive council member will be identified with a specific tag. We encourage you to introduce yourself and strike up a new business relationship.

REGISTRATION & HOTEL INFORMATION

REGISTRATION
Sponsored by Continental

REGISTRATION PRICING
(*Pricing reflects discounted rate. The rate will increase after August 23.)

SAE Members
  Full Conference: $875
  One-Day: $375
Non-Members: $1,275
Technical Program Participants
  Full Conference: $325
  One-Day: $150
SAE Student Member: $100
Non-Member Student: $150
Young Professionals (Under 35 years of age and less than 10 years of work experience): $100

Additional Items to Purchase
Networking Reception at Indianapolis Motor Speedway: $25
Technology Demo & Ride Along at Indianapolis Motor Speedway: $25

HOTEL INFORMATION

JW MARRIOTT INDIANAPOLIS
10 South West Street
Indianapolis, IN 46205

Room Rate: $229+
Room Block Expires: August 15, 2019
Hotel Parking: $44 per night for self-parking
NETWORKING RECEPTION AT THE INDIANAPOLIS MOTOR SPEEDWAY MUSEUM

Wednesday, 5:30 – 7:00 p.m.
Cost: $25

Networking Reception Sponsored by

Join your industry peers for a night out at the Indianapolis Motor Speedway Museum. The COMVEC networking reception provides the opportunity to continue building relationships with fellow attendees against a backdrop of one of the world’s premier collections of automotive and motor racing vehicles and artifacts, with special emphasis on the Indianapolis 500-Mile Race.

Pre-Registration is required for both events.

TECHNOLOGY DEMONSTRATIONS AT THE INDIANAPOLIS MOTOR SPEEDWAY

Thursday, 10:00 a.m. – 2:00 p.m.
Cost: $25

Participating companies will showcase new technologies for autonomous and electric vehicles from mid-size through Class 8 Trucks, plus off-highway equipment. Don’t miss your opportunity to see the infrastructure that is moving the commercial vehicle industry forward into the next generation.

Vehicle providers (as of May 30)

Bus transportation provided for Wednesday and Thursday events from the JW Marriott to and from the track

Sponsored by

READY, SET, LET’S BRICKYARD!

The Indianapolis Motor Speedway and SAE International would like to invite all SAE members, along with family and friends, to come experience the 26th edition of the Brickyard 400, on Sunday, September 8. As a member of SAE, the Indianapolis Motor Speedway is offering:

• Reserved Race Day tickets in Tower Terrace, NE Vista Turn, South Vista, or J Stand
• Access to walk on the IMS Track hours before the Race
• $5 retail discount voucher at IMS Gift Shops
• Discounted admission for Friday’s NASCAR Practice and Saturday’s Xfinity Race

Experience the breathtaking action that only the Indianapolis Motor Speedway can deliver. Purchase your tickets here.
EFFECTIVE WRITING FOR ENGINEERING AND TECHNICAL PROFESSIONALS

September 9-10, 2019
8:30 a.m. - 4:30 p.m.

Through a combination of class discussions, interactive workshop activities, assignments, checker teams (review teams) and job aids, this course delivers real-life technical writing techniques and tools that can be immediately applied. Attendees discover the importance of knowing their audiences and how to communicate technical information in a “user-friendly” style.

Fees: $1495.00
SAE Members: $1196.00 - $1346.00

Separate Registration Required.
COMVEC provides young professionals support in developing skills, identifying new career focuses, and building key professional relationships and networks in the commercial vehicle industry.

CONNECT WITH SUCCESS:
Discuss your future in the commercial vehicle market by connecting with experienced experts. Take advantage of direct access to influential engineering management and leadership from top companies. Ample mentoring sessions and networking opportunities are available throughout the three-day event designed to help you develop and strengthen your role.

HELPFUL TIPS FOR NEW ATTENDEES AND YOUNG PROFESSIONALS
https://www.sae.org/attend/comvec/attend/helpfultips

YOUNG PROFESSIONALS MEET AND GREET
Monday, 11:00 a.m. – 12:00 p.m.
Wednesday, 8:30 a.m. – 9:00 a.m.
The Young Professionals meet and greet is your chance to interact exclusively with other YPs and students.

MENTORING SESSIONS
Monday & Tuesday, 12:00 – 12:30 pm
Limited to the first 25 registrants. Sign up on the SAE registration page.
Sign up on the SAE registration page.

BUILD YOUR CAREER AT THE COMVEC™ TECHNOLOGY CONNECTION

NETWORKING RECEPTIONS
Monday Networking Reception, 5:30 – 6:30 p.m.
Sponsored by

Tuesday Networking Reception, 5:00-6:00 p.m.
Sponsored by

Daily morning and afternoon networking breaks

Making a global impact starts at COMVEC. Join us and be a part of redefining and advancing the commercial vehicle industry.

HIGH SCHOOL STEM STUDENTS
Welcome the next generation of engineers! Approximately one hundred high school STEM students will attend COMVEC on Tuesday, September 10. Students will have the opportunity to be matched with mentors, attend educational sessions, interact with exhibiting companies, and participate in the days networking functions.
• Columbus East
• Columbus North
• Hamilton Southeastern
• Lawrence Central
• Lawrence North
• Noblesville High School
• North Central
• Providence Cristo Rey
• Sheridan Community
• Westfield Washington School District

sae.org/comvec
EXHIBIT AND SPONSORSHIP OPPORTUNITIES AT COMVEC™

COMVEC brings together both on- and off-road engineering professionals from across the globe. The event provides a valuable engagement opportunity between engineers, supply managers, and executives.

WHO ATTENDS?

90% of attendees are influencers, decision makers, and/or purchasers (*based off 2017 registration)

86% of attendees use face-to-face time at conferences to become aware of new products, evaluate vendors for future purchases, and/or narrow their choices to preferred vendors (*data obtained from CEIR)

ATTENDEES FOCUS ON THESE TECHNOLOGY AREAS:

Design, Testing, Consulting, and R&D Services • Parts and Components Supplier • Tier 1 Supplier/ Tier 1 Systems Integrator • Heavy Duty – Heavy or Medium Truck • Heavy Duty – Industrial • Government • Aerospace incl. Suppliers, Commercial, Regional • Noise, Vibration, and Harshness • Heavy Duty – Agricultural • Automotive OEMs • Power & Propulsion incl. Environment, Emission, and HEV/EV • Vehicle Dynamics & Chassis/Vehicle Handling • Electrical/ Electronics & Electrical Systems; Avionics • Tests and Testing • Software and Software Engineering • Modeling/ Simulation • Human Factors and Ergonomics • Thermal Management incl. Climate Control • Materials • Safety

...ALL ENGAGED WITH THE ON-HIGHWAY, OFF-HIGHWAY, AND DEFENSE COMMUNITIES

HIGH-IMPACT WAYS TO ENGAGE THE COMVEC AUDIENCE

SPONSORSHIPS – Increase your organization’s brand recognition and distinguish yourself as a leading industry expert as a leading sponsor.

SPONSORSHIP BENEFITS

• Interact with individuals and other supplier companies to generate new business opportunities
• Create opportunities for expanded business
• Reconnect with current customers
• Establish contacts and potential customers
• Participate in the event as an attendee
• Company recognition in the Event Guide and Mobile app
• Company recognition on the Commercial Vehicle sponsor webpage with hyperlink to your web page
• Recognition on sponsor appreciation signage throughout event

EXHIBIT SPACE

Showcase your organization’s latest products or innovations as an exhibitor at COMVEC. Put your brand in front of key decision makers at the only industry event focused on on-highway, off-highway, agricultural, construction, industrial, military and mining commercial vehicles.

EXHIBIT FEATURES

• Exhibit Space includes – 10’ x 10’ booth space
• Two (2) full conference registrations (Includes access to: technical sessions, exhibition, lunches, networking breaks, and copies of oral only presentations)
• Company listing and profile in either the printed Event Guide* and/or electronic Exhibitor Directory as applicable

EXHIBITOR SPOTLIGHT: NEW PRODUCT & TECHNOLOGY SHOWCASE

COMVEC will provide its exhibitors a platform to present a commercial-based presentation - completely different from those held during the symposium. These TED-Like Talks will be held during the breaks in the exhibit hall.

Exhibitor list (as of May 30)

AC Business Media - OEM Off-Highway Magazine
Aptiv
Bill Austin and Associates Cummins
Diesel Progress
DISTek Integration, Inc. dSPACE Inc
Eaton
ESTECO
ETAS Inc
FEV
G.W. LISK
HBM Test and Measurement
HMS Networks
IAV Automotive Engineering Inc
KPIT Infosystems Inc
Mechanical Simulation Corp
Missouri Univ of Science and Tech
MS Precision Components LLC
Oetiker Inc
SEM Technologies Inc
Softing Automotive Electronics GmbH
Sonceboz Corporation
Thomas Magnete USA
TLX Technologies

INCREASE YOUR EXPOSURE WITH THE INDUSTRY’S MOST POWERFUL AUDIENCE

Don’t miss your chance to have a prominent presence at the COMVEC. Reserve your sponsorship or exhibit space today!

Secure Your Opportunity Today

For more details and information, please contact:
Megan McCoy Event Sales
o +1.724.772.4037
e megan.mccoy@sae.org

Have another idea? We can create a customized option that will help you achieve your goals and reach your targeted audience.
## COMVEC™ EXECUTIVE COUNCIL MEMBERS

<table>
<thead>
<tr>
<th>Name</th>
<th>Company/Position</th>
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<tr>
<td>Mehdi Ahmadian</td>
<td>Virginia Tech University</td>
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<tr>
<td>Elma Avdic</td>
<td>Cummins Inc.</td>
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<tr>
<td>Craig Barnes</td>
<td>CAB Consulting LLC</td>
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<td>Gregory Beauprez</td>
<td>Ricardo Inc.</td>
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<td>Alan Berger</td>
<td>CNH Industrial</td>
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<td>Frederick M. Cartwright, Jr.</td>
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<td>Charles Chilton</td>
<td>Navistar Inc.</td>
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<td>Michael Connolly</td>
<td>Robert Bosch LLC</td>
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<td>Del Costy</td>
<td>Siemens PLM Software</td>
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<td>Dan Cowan</td>
<td>Velodyne LiDAR</td>
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<td>Willard Cutler</td>
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<td>Michael Doseck</td>
<td>daVinci Technology Group Inc.</td>
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<td>Komatsu America Corp.</td>
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<td>Virginia Tech Transportation Institute</td>
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<td>Richard Holloway</td>
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<td>Kenneth Howden</td>
<td>U.S. Department of Energy</td>
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<td>Haoran Hu</td>
<td>Weichai Power Co. Ltd.</td>
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<td>Mark Smith</td>
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<td>Srinivasa Srinath</td>
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<td>Daniel Styles</td>
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<td>Stephan Tarnutzer</td>
<td>AVL Engineering, Inc.</td>
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<td>Jacie Unpingco</td>
<td>PACCAR Technical Center</td>
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<td>Peter Waeltermann</td>
<td>dSPACE Inc.</td>
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<tr>
<td>Hans Welfers</td>
<td>MAN Truck &amp; Bus AG (retired)</td>
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<td>Graham Weller</td>
<td>Horiba Automotive Test Systems Corp.</td>
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<td>Dana Holding Corp.</td>
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<td>Kevin West</td>
<td>Volvo Group Trucks Technology</td>
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<td>Daniel Williams</td>
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<tr>
<td>Lawrence Williams</td>
<td>Aptiv</td>
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**Melissa Jena**  
Event Manager  
Melissa.jena@sae.org  
+1.724.772.4008  

**Colette Wright**  
Program Developer  
Colette.wright@sae.org  
+1.724.772.8517  

**Megan McCoy**  
Exhibit Sales & Sponsorships  
Megan.mccoy@sae.org  
+1.724.772.4037  

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