



## **YEAR THREE: REFINEMENT & OUTREACH**

North America's Premier Collegiate Automotive Engineering Competition

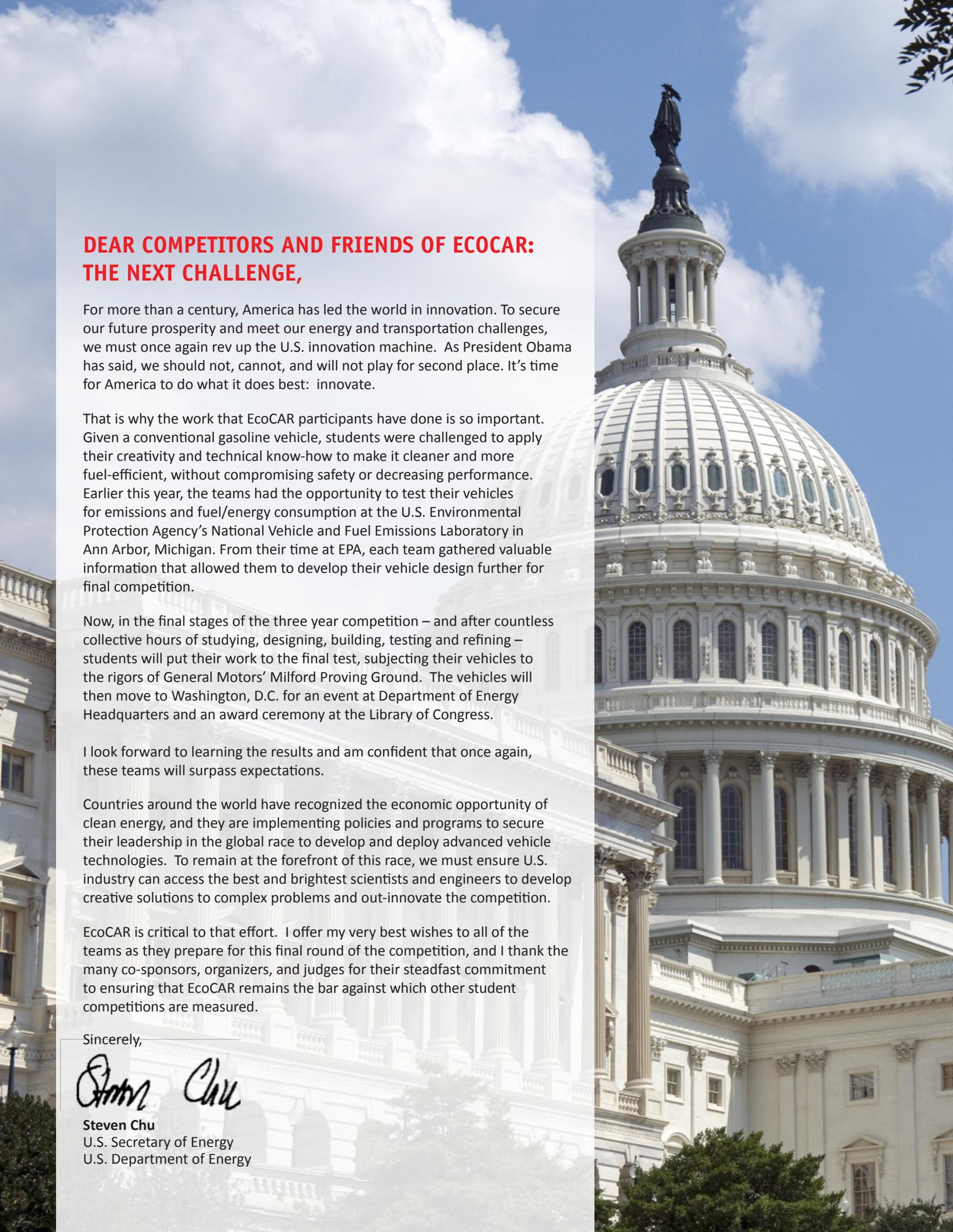


U.S. DEPARTMENT OF  
**ENERGY**



**2011 EcoCAR Competition Finals**

STAGE 1 Milford, MI June 5-12 • STAGE 2 Washington, D.C. June 12-16



## DEAR COMPETITORS AND FRIENDS OF ECOCAR: THE NEXT CHALLENGE,

For more than a century, America has led the world in innovation. To secure our future prosperity and meet our energy and transportation challenges, we must once again rev up the U.S. innovation machine. As President Obama has said, we should not, cannot, and will not play for second place. It's time for America to do what it does best: innovate.

That is why the work that EcoCAR participants have done is so important. Given a conventional gasoline vehicle, students were challenged to apply their creativity and technical know-how to make it cleaner and more fuel-efficient, without compromising safety or decreasing performance. Earlier this year, the teams had the opportunity to test their vehicles for emissions and fuel/energy consumption at the U.S. Environmental Protection Agency's National Vehicle and Fuel Emissions Laboratory in Ann Arbor, Michigan. From their time at EPA, each team gathered valuable information that allowed them to develop their vehicle design further for final competition.

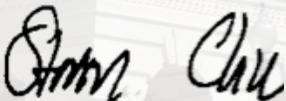
Now, in the final stages of the three year competition – and after countless collective hours of studying, designing, building, testing and refining – students will put their work to the final test, subjecting their vehicles to the rigors of General Motors' Milford Proving Ground. The vehicles will then move to Washington, D.C. for an event at Department of Energy Headquarters and an award ceremony at the Library of Congress.

I look forward to learning the results and am confident that once again, these teams will surpass expectations.

Countries around the world have recognized the economic opportunity of clean energy, and they are implementing policies and programs to secure their leadership in the global race to develop and deploy advanced vehicle technologies. To remain at the forefront of this race, we must ensure U.S. industry can access the best and brightest scientists and engineers to develop creative solutions to complex problems and out-innovate the competition.

EcoCAR is critical to that effort. I offer my very best wishes to all of the teams as they prepare for this final round of the competition, and I thank the many co-sponsors, organizers, and judges for their steadfast commitment to ensuring that EcoCAR remains the bar against which other student competitions are measured.

Sincerely,



**Steven Chu**  
U.S. Secretary of Energy  
U.S. Department of Energy



## DEAR COMPETITORS AND FRIENDS OF ECOCAR: THE NEXT CHALLENGE,

Welcome to EcoCAR: The NeXt Challenge finals!

EcoCAR participants have done some impressive work leading up to the competition’s final year. During the past three years, they have faced many challenges and consistently found smart and creative ways to address them. These challenges are the platform for Advanced Vehicle Technology Competitions (AVTCs) and how we are educating the next generation of automotive engineers.

The automotive industry is demanding these types of engineers, especially when advanced propulsion technologies are evolving so quickly and everyone is working to reinvent automotive DNA. We need new talent equipped with fresh ideas that can jump into today’s leading companies and move us toward a cleaner, more fuel efficient future.

Throughout the competition, these 16 universities have gone from researching and selecting propulsion technologies to integrating their subsystems into Chevrolet-donated vehicles. In year two, teams tested their “mule vehicles” at our Desert Proving Grounds in Yuma, Az., and then presented their work to judges in San Diego, Calif.

Even more exciting, they tested their vehicles this year at the U.S. Environmental Protection Agency’s National Vehicle and Fuel Emissions Laboratory in Ann Arbor, Mich. There, they evaluated for emissions and fuel/energy consumption in a real-world setting.

Now that we’re in our final stages, the teams will meet at our company’s Milford Proving Ground in Michigan where their vehicles will undergo tests that mimic traditional testing for production. They will then head to the Department of Energy Headquarters in Washington D.C., and later to the Library of Congress for the final awards ceremony. What an amazing opportunity!

The students’ goals are to prove 99 percent readiness and viability to sponsors, competition judges and organizers ... and we all know how tough this can be. So, as we come to a close, we want to thank everyone involved in this program - our industry, government and academic partners.

Again, congratulations to the teams for persevering through the challenging times, and be confident all of this hard work will pay off. Good luck!

Sincerely,

**Mary Barra**

Senior Vice President, Global Product Development  
General Motors

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## YEAR THREE REFINEMENT & OUTREACH



# EcoCAR

## The NeXt Challenge

**Since EcoCAR:** The NeXt Challenge kicked off in May 2008, the 16 participating North American university teams have been hard at work designing, building, and integrating their advanced propulsion technologies into a vehicle donated by General Motors.

Their challenge – to reduce the environmental impact of their crossover vehicle by improving fuel efficiency and reducing emissions, while retaining the vehicle’s performance and consumer appeal.

The competition is modeled after GM’s real-world vehicle development process (VDP) and is broken down into three academic years, each focusing on a different stage in the VDP:

- Year 1:** Vehicle architectures are selected using modeling and simulation, and hardware-in-the loop (HIL) systems are assembled to develop and test the team’s control strategies
- Year 2:** Virtual designs are turned into functioning prototype vehicles
- Year 3:** Vehicles are refined to near-showroom quality

In Year One, EcoCAR teams learned real-world automotive engineering practices through the use of Model-Based Design and graphical system design technologies that included HIL and software-in-the-loop (SIL) to help bring the students’ vehicle designs from concept to the road. Year One formed the foundation for the vehicle development and refinement tasks of Years Two and Three of the competition.

The teams received their GM-donated vehicles at the beginning of Year Two and began integrating their powertrain components and other subsystems to develop a running “mule vehicle.” During this second phase of the competition, the teams competed in engineering tests similar to those GM conducts to determine a prototype’s readiness for production.

Now in the third and final year, teams have been challenged to refine their vehicles into near-production quality prototype vehicles that demonstrate improved fuel economy and lower greenhouse gas emissions, while focusing on performance and consumer appeal. Teams will showcase their final vehicles at the Year Three Competition Finals in Milford, Michigan, and Washington, D.C. from June 5-16, 2011, where they will participate in more than a dozen dynamic and static events.

Headline sponsors, the U.S. Department of Energy and General Motors, have brought together this unique coalition of government, industry, and academia to explore sustainable vehicle solutions and to provide real-world experience and training to a new generation of engineers. The EcoCAR program is seeding the automotive industry with thousands of engineering graduates with real-world experience, and is better preparing these students for the transportation and energy-related challenges of the 21st century.

We encourage you to follow the teams during the Year Three Competition Finals and discover their contributions to future innovations in green vehicle technologies.

## YEAR THREE

### REFINEMENT & OUTREACH

#### TECHNICAL GOALS

- ▶ Incorporate technologies that reduce well-to-wheel (WTW) petroleum energy consumption
- ▶ Increase vehicle energy efficiency
- ▶ Reduce WTW greenhouse gas and criteria emissions
- ▶ Maintain consumer acceptability in the areas of performance, utility, and safety EcoCAR Propulsion

#### TECHNOLOGIES INCLUDE

- ▶ Plug-In Hybrid Electric Vehicles (PHEV)
- ▶ Extended-Range Electric Vehicles (EREV)
- ▶ Fuel Cell Plug-In Hybrid Electric Vehicles (FC-PHEV)
- ▶ Full-Function Electric Vehicles (FFEV)



# TEAM ARCHITECTURES

Team	Architecture, Top Level	Fuel	E-AWD/ FWD/ RWD	Detailed Architecture	Primary Fuel Converter	Transmission	Electric Motor 1	Electric Motor 2	Electric Motor 3	Energy Storage (kWh)	Voltage	Energy Storage System
EMBRY-RIDDLE	BIODIESEL PHEV	B20	FWD	B20 FWD POWERSPLIT PHEV	GM 1.3 L CI		GM 2MODE			12.8	330	A123
GEORGIA TECH	ETHANOL HEV	E85	FWD	E85 FWD POWERSPLIT HEV	GM 1.6 L SI		GM 2MODE			9.6	250	A123
MICHIGAN TECH	ETHANOL PHEV	E85	E-AWD	E85 E-AWD POWERSPLIT PHEV	GM 3.9L SI		GM 2MODE	AZURE DYNAMICS 55KW		21.3	360	A123
MISSISSIPPI STATE UNIVERSITY	BIODIESEL EREV	B20	E-AWD	B20 E-AWD EREV	GM 1.3 L CI		UQM 125 KW	145KW UQM	UQM 75 KW	21.3	360	A123
MISSOURI S & T	HYDROGEN FC-PHEV	H2	FWD	H2 FWD FUEL CELL PHEV	GM FUEL CELL		GM ETS 110 KW			16.1 KWH	413	A123
NORTH CAROLINA STATE UNIVERSITY	BIODIESEL EREV	B20	FWD	B20 FWD EREV	GM 1.3 L CI		GM ETS 110 KW	PERM 20 KW		21.3	360	A123
OHIO STATE	ETHANOL EREV	E85	E-AWD	E85 E-AWD EREV	1.8L SI		REMY 82 KW	GM EV1 DRIVE 103 KW		21.3	360	A123
PENN STATE	BIODIESEL EREV	B20	FWD	B20 FWD EREV	GM 1.3 L CI		GM ETS 110 KW	UQM 75 KW		12.8	330	A123
ROSE-HULMAN	BIODIESEL HEV	B20	E-AWD	B20 E-AWD PRE POST TRANS PARALLEL PHEV	GM 1.3 L CI	4T45E GM FOUR SPEED	TM4 37 KW	TM4 37 KW		11.3	350	ENERDEL
TEXAS TECH	ETHANOL PHEV	E85	FWD	E85 FWD POWERSPLIT PHEV	GM 1.6 L SI		GM 2MODE			12.8	330	A123
UNIVERSITY OF ONTARIO INSTITUTE OF TECHNOLOGY	FULL FUNCTION ELECTRIC	ELECTRIC	FWD	FWD FULL FUNCTION ELECTRIC			DELPHI S-10 EV DRIVE 110 KW			80	360	KOKAM
UNIVERSITY OF VICTORIA	ETHANOL EREV	E85	E-AWD	E85 E-AWD POWERSPLIT EREV	GM 2.4 L SI		GM 2MODE	UQM 145 KW		21.3	360	A123
UNIVERSITY OF WATERLOO	HYDROGEN FC-PHEV	H2	E-AWD	H2 FWD FUEL CELL PHEV	GM FUEL CELL		GM ETS 110 KW	BALLARD 67 KW		9.6	250	A123
UNIVERSITY OF WISCONSIN, MADISON	ETHANOL EREV	E85	E-AWD	E85 E-AWD EREV	750 MPE TURBO		DU 174 105 KW	UQM 75 KW		13.6	384	JCS
VIRGINIA TECH	ETHANOL EREV	E85	E-AWD	E85 E-AWD SPLIT PARALLEL EREV	GM 2.4 L SI	GM VUE 4-SPEED	MES 16 KW	UQM 125 KW		20.1	360	A123
WEST VIRGINIA UNIVERSITY	BIODIESEL PHEV	B20	FWD	B20 FWD POWERSPLIT PHEV	GM 1.3 L CI		GM 2MODE			12.8	330	A123



EcoCAR teams unveiled their vehicle architecture designs at the Washington Auto Show in February 2009. The diverse range of propulsion technologies being pursued include Plug-In Hybrid Electric Vehicles (PHEV), Extended-Range Electric Vehicles (EREV), Fuel Cell Plug-In Hybrid Electric Vehicles (FC-PHEV), and Full-Function Electric Vehicles (FFEV).

## PRE-COMPETITION DELIVERABLES

### Final Technical Report | 40 POINTS

#### Event Captain: Frank Falcone, Argonne National Laboratory

Teams were required to focus their Year Three Final Technical Report on the refinement of their Year One design and performance validation of vehicle technical specifications (VTS) produced through dynamic testing in the areas of energy efficiency, emissions, and performance/utility capabilities. The report presented the vehicle's architecture and background information to help the reader understand why their given architecture was chosen and how it might compare to the stock GM-donated vehicle. Major sections focused on powertrain refinement and optimization, and dynamic and dynamometer testing results.

*The team with the Best Technical Report will receive \$1,500 and a trophy.*

### Progress Reports | 40 POINTS

#### Event Captain: Technical Coordinator Team, Argonne National Laboratory and U.S. Department of Energy

In order to monitor the progress and refinement of the competition vehicles, teams were required to submit three progress reports throughout the year highlighting their vehicle development status. Similar to industry practice, teams were required to display a projected timeline of work completed, tasks to be done, and highlights of their development progress. These reports required digital photos and video submissions to visually document the completion of the vehicle, ensuring teams stayed on task and followed industry-level project management practices.

*The team with the Best Progress Reports will receive \$750 and a trophy.*

## COMPETITION DELIVERABLES

### Safety & Technical Inspection | PASS/FAIL

#### Co-Event Captains: Frank Falcone and Danny Bocci, Argonne National Laboratory

The Safety & Technical Inspections are the gateway to taking part in dynamic events at the EcoCAR Year Three Finals. The Inspections closely mirror those conducted previously in the year and cover a wide array of categories including in-vehicle documentation, fuel systems, high voltage systems, mechanical integration, and vehicle operation.

### On-Road Safety Evaluation (ORSE) | PASS/FAIL

#### Event Captain: Kyle Holihan, General Motors

The purpose of the On-Road Safety Evaluation (ORSE) is to evaluate the safe functionality of competition vehicles prior to competing in any dynamic events. The event utilizes tests that are currently used in real-world vehicle design programs to ensure that vehicles are safe to operate at city and highway speeds. Passing this event helps to ensure a high level of vehicle safety.

### Lane Change (Maximum Lateral Acceleration) | 20 POINTS

#### Event Captain: Kyle Holihan, General Motors

The Lane Change (Maximum Lateral Acceleration) event evaluates maximum lateral acceleration as the vehicle negotiates a decreasing radius turn at a present vehicle speed without excessive sliding or body lean. The event is a test of how well the vehicle handles with the new powertrain and mass characteristics by objectively evaluating the vehicle's weight distribution, spring and bar selection, and tire characteristics.

*Winners of the Best Lane Change event will receive \$500 and a trophy.*



## Acceleration (0-60 MPH and 50-70 MPH) and Braking | 65 POINTS

### Event Captain: Bryan Shevock, General Motors

The Acceleration and Braking events evaluate the vehicle's ability to accelerate and decelerate. Teams are challenged to demonstrate the best acceleration possible given their vehicle architecture design from 0-60 mph and from 50-70 mph, as well as stopping from a speed of 65 mph.

*The winners of the Best Acceleration and Shortest Braking Distance awards will receive \$750 and a trophy each.*

## Autocross | 25 POINTS

### Event Captain: Mike Neal, General Motors

This event demonstrates a vehicle's ability to navigate a serpentine, cone-lined course, and tests the vehicle's handling capabilities. Each vehicle is driven through the handling course up to three times by a GM driver, where the fastest time represents the winner of the Autocross event. After the GM driver portion of the event, one member from each team will be given the ability to drive their vehicle through the course a maximum of three times, where the fastest time will be the team's entry for the Autocross "Fun Run" award.

*The winners of the Best Autocross Time and Best Autocross "Fun Run" event will receive \$750 and a trophy each.*

## Fuel Consumption | 105 POINTS

### Co-Event Captains: Henning Lohse-Busch, Argonne National Laboratory and Jim Tulpa, General Motors

One of four measurements within the Emissions & Energy Consumption event, Fuel Consumption will be calculated based on the amount of fuel used and the distance traveled, with provisions for plug-in hybrid electric vehicle (PHEV) fuel consumption based on the upcoming J1711 SAE standard revisions. Final fuel consumption numbers will reflect the charge depleting and sustaining operational modes on a utility factor-based test method.

*The winner of the Best Fuel Consumption award will receive \$2,000 and a trophy. Runner-up will receive a trophy.*

## Towing Ability | 15 POINTS

### Event Captain: Jim Lasecki, General Motors

The goal of this pass-fail event is to demonstrate towing ability at a constant 45 mph speed up a 3.5 percent grade for 15 miles. This drive schedule tests real-world conditions that the production vehicle may experience. This effectively tests a team's ability to consistently pull a 1,500-pound load up a hill. At the conclusion of the Towing Ability event, each vehicle will accelerate from 45 mph to 70-75 mph and perform a high-speed passing maneuver.

*The winner of the Towing High Speed Passby Maneuver event will receive \$250 and an award.*

## Vehicle Testing Complete (VTC) | 35 POINTS

### Event Captain: Carol Johnson, General Motors

The Vehicle Testing Complete (VTC) event is an around-the-vehicle presentation reviewing the overall strategy employed to meet the targets specified in the Vehicle Technical Specifications (VTS) and test data showing the vehicle is at the 99 percent buy-off stage. At this stage of the vehicle development process, the vehicle should be complete, at a high level of refinement, and ready for final evaluation before being approved for production.

*The winner of the Best Vehicle Testing Complete award will receive \$1,000 and a trophy.*

## Well-to-Wheel Greenhouse Gas Emissions (GHG) | 105 POINTS

### Co-Event Captains: Henning Lohse-Busch, Argonne National Laboratory and Jim Tulpa, General Motors

One of four measurements within the Emissions & Energy Consumption event, the Well-to-Wheel Greenhouse Gas (GHG) calculation is determined by two components: (1) upstream fuel-cycle emissions and (2) tailpipe carbon dioxide emissions. The maximum points for this event will be awarded to the vehicle with the lowest GHG score. Each vehicle will be assigned upstream GHG emissions based on the type and amount of fuel used during the Emissions & Energy Consumption event, according to a peer-reviewed analysis of GHG emissions contained in the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model. This score will be combined with the measured tailpipe emissions and the lowest overall score will take first place.

*The winner of the Best Well-to-Wheel Greenhouse Gas Emissions (GHG) award will receive \$2,000 and a trophy. Runner-up will receive a trophy.*

## Petroleum Energy Use (PEU) | 105 POINTS

### Co-Event Captains: Henning Lohse-Busch, Argonne National Laboratory and Jim Tulpa, General Motors

One of four measurements within the Emissions & Energy Consumption event, the Petroleum Energy Use (PEU) calculation evaluates the vehicle's reduction of PEU on a well-to-wheel basis. Each competition vehicle consumes petroleum energy, either by using fuel to run the vehicle (tank-to-wheel) or the energy used during the production of the fuel (well-to-tank). Tank-to-wheel energy use is determined from the fuel consumed during the on-road energy use event and the petroleum content of the fuel. Well-to-tank petroleum use is determined according to a peer-reviewed analysis of PEU contained in the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model. The well-to-tank and tank-to-wheel values are added together for a final overall value and the lowest overall score takes first place.

*The winner of the Lowest Petroleum Energy Use award will receive \$2,000 and a trophy. Runner-up will receive a trophy.*

## Tailpipe Emissions | 105 POINTS

### Co-Event Captains: Henning Lohse-Busch, Argonne National Laboratory and Jim Tulpa, General Motors

One of four measurements within the Emissions & Energy Consumption event, the Tailpipe Emissions event measures regulated emissions from the vehicle's tailpipe including effects of all fuels on board. The event uses Sensors' SEMTECH portable exhaust gas analyzer to measure the vehicle's nitric oxides (NOx), total hydrocarbons (THC), and carbon monoxide (CO). The team's results are placed into bins and scored according to the highest bin number of the constituents. The lowest overall bin number takes first place.

*The winner of the Lowest Tailpipe Emissions award will receive \$2,000 and a trophy. Runner-up will receive a trophy.*

## AVL DRIVE Quality | 45 POINTS

### Event Captain: Roger Madsen, General Motors

This event assesses the vehicle's drivability through objective on-road evaluation in driving "modes," such as acceleration, cruising, and braking. AVL-DRIVE quantitatively analyzes the vehicle's drive quality utilizing a series of accelerometers and complex algorithms. The software captures significant data and vehicle parameters, such as longitudinal acceleration, velocity, pedal position, and vibrations.

*The winner of the AVL DRIVE Quality award will receive \$1,500 and a trophy.*

## Dynamic Consumer Acceptability (DCA) | 50 POINTS

### Co-Event Captains: Matt Satchell, Doug Moore, and Tim Bohn, General Motors.

The objective of this event is to subjectively and objectively score the vehicle's Noise, Vibration, and Harshness (NVH) and ride and handling performance through a series of dynamic road tests, using GM engineers. This event will test the vehicles over a variety of road surfaces and turns to determine the impact of the conversions as compared to their production counterpart.

*The winner of the Best Dynamic Consumer Acceptability award will receive \$1,500 and a trophy.*



## Static Consumer Acceptability (SCA) | 90 POINTS

### Event Captain: Al Houtman, General Motors

The Static Consumer Acceptability (SCA) event is a combination of a team presentation and a vehicle inspection designed to evaluate the consumer acceptability of the team's vehicle. The SCA event evaluates the vehicle in three distinct sections: the driver area, general vehicle interior, and general vehicle exterior. Added consumer features such as telematics, entertainment devices, and consumer convenience items will also be judged.

*The winner of the Best Static Consumer Acceptability award will receive \$1,000 and a trophy.*

## Technical Presentation | 35 POINTS

### Event Captain: Ed Argalas, General Motors

The Technical Presentation event is designed to evaluate the effectiveness with which the team executed the Year Three deliverables of EcoCAR (improvement, refinement, and efficiency). This presentation will focus on the mechanical and electrical engineering efforts put forth by the team to improve vehicle consumer acceptability, emissions, performance, and fuel consumption.

*The winner of the Best Technical Presentation award will receive \$1,000 and a trophy.*

## Controls Presentation | 35 POINTS

### Event Captain: Jim Kolhoff, General Motors

The Controls Presentation event for Year Three of EcoCAR is focused on the development and validation of control system architecture, control and diagnostic strategy selection, and simulation results that will meet the goals of the team and competition. The focus will be on demonstrating that the performance of the control system as validated in the vehicle achieves the performance requirements and meets the expectations of performance shown in analysis and simulation.

*The winner of the Best Controls Presentation Award will receive \$1,000 and a trophy.*

## Outreach Program | 80 POINTS

### Event Captain: Lynda Palombo, Natural Resources Canada

The purpose of the EcoCAR Outreach Program is to use various outreach strategies to educate and raise awareness about the benefits of advanced vehicle technologies and how it reduces

the overall impact of transportation on our environment and our economy. This year's outreach focused on media relations and the education of policymakers, youth, consumers, government officials, and non-governmental organizations. There was also a strong focus on social media outlets, such as Twitter, Facebook, and Flickr. While teams are challenged to implement more innovative, strategic, and comprehensive outreach activities, they are also expected to maintain some traditional outreach activities, such as maintaining their EcoCAR team website and updating their communications plans.

*The winners of the Best Influencer Campaign, Best Consumer Campaign, and Best Media Relations Program will receive \$1,000 each. Best Sponsor Success Story and Best Collaboration with a Clean Cities Coalition will receive \$750 each. The winner of the Best Website and Best Social Media Program will receive \$500. Winners of Most Creative Promotion of EcoCAR, Best Outreach Presenter, Best Outreach Presentation, and Spirit of Outreach will receive \$250 each. Winners of first, second, and third place Overall Outreach Awards will win \$1,500, \$750, and \$500, respectively.*

## SPECIAL AWARDS

### Best Engineering Fabrication and Workmanship Award

#### Event Captain: Frank Falcone, Argonne National Laboratory

This award is presented to the team with the best combined interior and exterior vehicle presentation. The vehicles are assessed by the vehicle inspectors during the preliminary vehicle inspections. The vehicle inspectors nominate the vehicle they believe best shows quality workmanship and attention to detail.

*The winner of the Best Engineering Fabrication and Workmanship Award will receive \$500 and a trophy.*

### Best Vehicle Appearance Award

#### Event Captain: Shannon Reeves, General Motors

The purpose of the Best Vehicle Appearance Award is to recognize a team's efforts to refine their vehicle's visual qualities. Judged by the GM mentors, vehicles are evaluated in a variety of areas: overall harmony of appearance, visual impact, graphics and sponsor decal organization, color, practical aesthetics, exterior fit and finish, and overall visual appeal. New paint schemes, telematics integration, improvements and changes to upholstery, and under-vehicle packaging also come into play.

*The winner of the Best Vehicle Appearance Award will receive \$500 and a trophy.*

## Ron Stence Spirit of the Challenge Award

This award, named in honor of Ron Stence, a long-time competition sponsor and organizer from Freescale Semiconductor, is given to the team that exhibits the following characteristics: exceptional perseverance in the face of adversity, maintaining a positive attitude throughout the competition despite significant challenges and obstacles, and pursuing exceptionally high technical standards for their team that best represent the spirit of the EcoCAR competition.

*The winner of the Ron Stence Spirit of the Challenge Award will receive \$500 and a trophy.*

## Most Improved Team Award

This award is presented to the team that demonstrates the most improved overall performance over last year's EcoCAR competition. Improvement may be determined by performance in individual events or the overall competition.

*The winner of the Most Improved Team Award will receive \$500 and a trophy.*

## Dr. Donald Streit Sportsmanship Award

This award is presented to the team that offers the highest level of assistance and support to other teams and organizers despite their own circumstances. The award is presented in honor of Dr. Donald Streit, who served as a dedicated faculty advisor to the Pennsylvania State University FutureTruck team and embodied the true meaning of sportsmanship. Although Dr. Streit's life ended prematurely, his memory and his example are carried on by the students who have and will continue to participate in Advanced Vehicle Technology Competitions for decades to come.

*The winner of the Dr. Donald Streit Sportsmanship Award will receive \$500 and a trophy.*

## SPONSORED AWARDS

### Women in the Winner's Circle Outstanding Women in Engineering Awards

#### Event Captain: Lyn St. James, Women in the Winner's Circle Foundation

The Lyn St. James Women in the Winner's Circle (WIWC) Foundation is sponsoring two awards to honor women engineering students who demonstrate outstanding technical excellence and accomplishments through the EcoCAR program. The Outstanding Women in Engineering and the Rookie of the Year awards are intended to encourage more women to study

engineering and pursue careers in automotive engineering after graduation. The WIWC Foundation is a non-profit educational organization that provides leadership, vision, resources, and financial support to create an open environment for women's growth in automotive fields.

*The winner of the Women in the Winner's Circle Outstanding Women in Engineering Award will receive \$1,000, and the winner of the Rookie of the Year Award will receive \$500.*

### National Science Foundation Outstanding Faculty Advisor Awards

#### Event Captain: Don Senich, National Science Foundation

The Outstanding Faculty Advisor Awards will be presented to the faculty advisor in each category who best promotes the goals, objectives, and activities related to EcoCAR. Specifically, the emphasis is on the success of the incorporation of the EcoCAR goals, objectives, and activities into the undergraduate engineering curriculum in the areas of mechanical, electrical, manufacturing, industrial, and other related engineering disciplines. Of special importance are the benefits students receive as a result of the EcoCAR program. Judges will attempt to determine from the applications submitted the faculty advisor who has created the best automotive engineering and engineering design experience for his/her students, and who has best used EcoCAR to enrich the university engineering program.

*The winners of the National Science Foundation Outstanding Incoming and Long-Term Faculty Advisor Awards will receive \$10,000 each.*

### Bosch Diversity Award

#### Co-Event Captains: Justin Kern & Karin Clement, Bosch

Bosch is pleased to announce the details for the EcoCAR Diversity Award. Bosch is an international and globally active corporation. Our associates come from and work in an extremely wide range of countries. This diversity is an ideal chance for the corporation and its associates alike to learn from other cultures and benefit from the wealth of perspectives and ideas. Bosch encourages EcoCAR teams to similarly embrace and benefit from the diversity within your teams and community. Participation is not required; however winning teams are eligible for recognition in the form of trophies and monetary awards. The monetary awards are in the amounts of \$750, \$500, and \$250 for teams that come in first, second, and third place, respectively. The awards are presented annually.

*The winners of the Bosch Diversity Award will receive \$750, \$500, and \$250 for first, second, and third place, respectively.*

## MathWorks Modeling Award

### Event Captain: Paul Smith, MathWorks

This award recognizes EcoCAR teams that exhibit the most creative application of MathWorks software products, including MATLAB and Simulink, to help achieve the overall competition objectives for the third year. Teams will be evaluated on how well they applied model-based design with MathWorks toolset to help achieve the overall competition objectives in the areas of plant modeling, controls design and tuning, data analysis and visualization, hardware implementation, the overall development process they followed, the quality of their presentation, and lessons learned.

*The winners of the Mathworks Modeling Award will receive \$750, \$500, and \$250 for first, second, and third place, respectively.*

## dSPACE Embedded Success Award

### Event Captain: Santhosh Jogi, dSPACE

The dSPACE Embedded Success Award is granted at the end of every competition year to the teams that demonstrate the most effective use of dSPACE HIL equipment to simulate vehicle architectures and develop their control strategies. The EcoCAR competition tasks students with creating new and complex vehicle configurations, with controls being one of the most challenging areas of development. dSPACE HIL simulators play a vital role by providing a real-time virtual test environment to simulate vehicle models and to use as a test platform for developing control algorithms. For the EcoCAR Year Three Competition Finals, the dSPACE Embedded Success Award will be presented to the team that demonstrates the most effective use of dSPACE tools in the development of vehicle supervisory control over the three years of competition. This year the sponsor award is open to all teams using any dSPACE equipment. The intent of this award is to recognize and promote best practices in control development with dSPACE products. For this final year, teams will be assessed on how effectively they have applied dSPACE tools to achieve their vehicle control objectives, be it a HIL system, a MicroAutobox, or both (and associated software).

*The winners of the dSPACE Embedded Success Award will receive \$750, \$500, and \$250 for first, second, and third place, respectively.*

## National Instruments Most Innovative Use of Graphical System Design Award

### Event Captain: Ian Fountain, National Instruments

The 2011 National Instruments Most Innovative Use of Graphical System Design Award will be given for the team that

demonstrates the most innovative use of graphical system design and National Instruments tools for any phase of the vehicle development cycle. With graphical system design, you can rapidly design, prototype, and deploy embedded systems using graphical programming software with off-the-shelf hardware. Take advantage of graphical and interactive software tools to model and simulate your design. Then improve the design by seamlessly prototyping with real-time computing, FPGA processing, and modular I/O. Finally, deploy the design to either off-the-shelf or custom hardware for shorter design cycles.

Example applications include: in-vehicle data acquisition systems, driver interfaces and displays, hybrid powertrain supervisory controllers, hardware-in-the-loop test systems, engine control prototyping systems, etc. Topics covered in this event should include an overview of the problem or challenge to be solved; a description of the design, prototyping, and deployment process; and a functional description of the final system.

*The winners of the National Instruments Award will receive \$750, \$500, and \$250 for first, second, and third place, respectively.*

## Freescale Innovation Award

### Event Captain: John Cotner, Freescale Semiconductor

The Freescale Innovation Award is presented to the EcoCAR team that exhibits the best use of innovation in the conception, design, and implementation of embedded electronics and controls. The intent of the award is to identify and reward the team who most effectively utilize the power of embedded processors, sensors, interfaces, and controls. Teams are scored on their ability to describe the technology-based innovations in their vehicle and the benefits that result.

*The winner of the Freescale Innovation Award will receive \$1,500 and a trophy.*

## A123 Systems Battery Workmanship Award

### Event Captain: Tony Knakal, A123 Systems

A123 Systems is sponsoring an award to recognize the best workmanship in battery construction. This award will go to the team that constructed a battery pack that met their design and performance needs while exemplifying quality workmanship in construction and a professional fit and finish like a consumer would expect to see in a production vehicle.

*The winners of the A123 Battery Workmanship Award will receive \$750, \$500, and \$250 for first, second, and third place, respectively.*

## FINAL TECHNICAL REPORT

**Marcus Alexander** is a Manager, Vehicle Systems Analysis, in the Electric Transportation program area of the Power Delivery and Utilization Sector for EPRI. His current focus is on managing the development of hybrid electric vehicle simulations, data analysis, and studies of the potential impacts of plug-in electric vehicles. Marcus received a bachelor's degree in mechanical engineering and a master's degree in electrical engineering from the University of California, Davis. While at UC Davis, Marcus spent nearly eight years at the Hybrid Electric Vehicle Research Center working on the development of prototype plug-in hybrid electric vehicles for vehicle design competitions and conducting research on hybrid powertrain design, embedded control systems, vehicle simulation, and high-voltage systems.

**Roger Clark** is senior manager of General Motors Energy Center. He also leads the GMNA Energy Expert Team and the Fuel Economy Learning Vehicle Program. Roger's responsibilities include working on the development and integration of vehicle energy and drive quality requirements, fuel economy and CAFE/CO2 strategy, and other new technologies for vehicle fuel economy leadership.

**Frank Falcone** is the Lead Vehicle Systems Engineer for Argonne National Laboratory's Advanced Vehicle Technology Competition program. He serves as a technical lead for the EcoCAR Challenge. Frank is a former Challenge X team leader from San Diego State University, where he earned his bachelor's and master's degrees in mechanical engineering.

**Dave Garrett** has been Director of Emission Compliance & Certification for General Motors since October 2006. His team, based at the GM Proving Grounds in Milford, Michigan, is responsible for interpretation, analysis, and influence of U.S. emission and fuel economy regulations; developing and executing certification plans; and fulfilling GM's in-use compliance obligations. Dave is a member of the Core Team for GM's Energy, Environment, and Safety Strategy Board; GM's Global Regulatory Team; and chairs GM's Global Mobile Emissions and Fuel Economy Team.

**Dr. Aaron Hoskins** is a research officer in the Transportation Energy Technology group at Natural Resources Canada. He represents Canada on the International Energy Agency Hydrogen Implementing Agreement Task 31 "Hydrogen Safety" and Task 24 "Wind Energy and Hydrogen Integration." He has previously been an external reviewer for ACOA, NSERC, and the U.S. Department of Energy's Hydrogen Program. Prior to joining Natural Resources in 2006, Aaron completed two post doctoral fellowships in Germany. His background is in metal hydride materials for hydrogen storage.

**Kevin Walkowicz** is the Team Leader for Fleet Testing and Evaluation at the National Renewable Energy Laboratory in Golden, Colorado, and one of the principle investigators for the U.S. Department of Energy's Advanced Vehicle Testing Activity. His primary focus is on capturing, analyzing, and reporting in-use data related to medium and heavy-duty electric drive vehicles. Prior to joining NREL in January 2001, he led fuel system and advanced evaporative emission control system development projects for GM at their Milford Proving Grounds. Prior to working at GM, he designed fuel system components for an automotive supplier. He holds a BSME from Lawrence Technological University and an MS in engineering from Rensselaer Polytechnic Institute.

## SAFETY & TECHNICAL INSPECTIONS

**Danny Bocci** is an Electrical Engineer at Argonne National Laboratory, where he leads the Electrified Powertrain and Renewable Fuels research facility at the Center for Transportation Research. He received a bachelor's degree in computer engineering and a master's degree in electrical engineering from the University of Wisconsin-Madison.

**Steven Boyd** is a Technology Development Manager for the Vehicle Technologies Program in the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy. Steven manages projects to develop improved components and systems for electric drive vehicles with national laboratories and industry partners. He received his MS in mechanical engineering from Virginia Tech in 2006, and has participated in Advanced Vehicle Technology Competitions as either a student or organizer for more than 10 years.

**Frank Falcone** See Technical Report

**Kurt Johnson** is a technical specialist in General Motors' Battery Algorithms and Controls group. In this role, he provides technical leadership for battery algorithms used in hybrid and electric vehicles. Kurt is a former Challenge X team leader and graduate of Virginia Tech.

**Dick Kauling** is an engineering group manager for General Motors' Global Powertrain Engineering Organization. His work currently focuses on global compressed natural gas and liquid petroleum gas applications. Prior to this role, Dick managed all the vehicle electrical and controls activity as part of GM's Canadian Regional Engineering Centre (CREC). He was also responsible for overseeing CREC's pre-production, computer-aided engineering, tests and validation, laboratory, and Kapuskasing Cold Weather Development Centre activities. Dick started his 30-year career at GM as a calibration engineer working on various powertrains.



## VEHICLE TESTING COMPLETE (VTC) PRESENTATION

**Mike Duoba** helped found and now is the technical lead for Argonne National Laboratory's Advanced Powertrain Research Facility. Mike wrote the original U.S. Department of Energy competition guidelines for FutureCar 1996-1999. Mike is an active member in SAE standardization committees. He is the chair of the task force revising "SAE J1711 – Recommended Practice for Measuring the Exhaust Emissions and Fuel Economy of Hybrid-Electric Vehicles" and the co-chair of the J1634 task force developing new battery electric vehicle test procedures.

**John Haraf** is currently the General Motors Director of Hybrid Vehicle Integration and Controls. In this position, he is responsible for vehicle-level hybrid system integration and controls development for all of GM's hybrid, extended-range electric, and electric vehicles. John began his career with GM in 1979 as an engine calibration engineer in the Cadillac Motor Car division and has held a wide range of leadership positions in GM's Powertrain organization including Premium V Engine Calibration manager, Diesel/Big Block Truck Engine Integration manager, Director of Engine Management System hardware design/release, and Director of Engine Development, Calibration, and Verification for all of GM's North American vehicle applications.

**Timothy Herrick** is the global vehicle chief engineer responsible for the engineering design, development, and validation of General Motors' global crossovers. He was appointed to this position in September 2009. Timothy began his GM career in 1983 as a reliability engineer at the Janesville, Wisconsin, truck assembly plant. He was promoted to vehicle chief engineer in 2000, responsible for the engineering, development, and validation of the Chevrolet Avalanche for which he holds a patent in the design of the vehicle's innovative cargo cover storage system. Timothy is also the recipient of GM's highest honor, the GM Chairman's Honor, for his engineering leadership in the development and launch of the Chevrolet Avalanche, as well as GM's new full-size SUVs. Timothy also served as vehicle chief engineer for full-size SUVs from 2002-08. Prior to his most recent appointment, he held the position of vehicle chief engineer responsible for the engineering design, development, and validation of GM compact crossovers, including the all-new Chevrolet Equinox and GMC Terrain.

**Santhosh Jogi** is the Director of Engineering for dSPACE Inc., responsible for technical operations in the company's North American market, and has held this position since 2007. Santhosh joined dSPACE in 1997 as a technical support engineer, later progressing into management, and today oversees product support, training, and application engineering services. Through the past 14 years, he has gained expertise in the application of tools and development methodology for embedded controls software, specifically in the area of Model-Based Design, including algorithm prototyping, automatic code generation, and verification and validation through Hardware-In-the-Loop (HIL) simulation.

**Carol Johnson** is the Program Engineering Manager for General Motors' compact crossover plug-in hybrid vehicle. She has been a leader in hybrid vehicle development since 2001, previously working as the Program Engineering Manager for the Saturn Vue Two-Mode Hybrid and also Electrical Engineering Group Manager for the Parallel Hybrid Truck. Carol holds a bachelor's and a master's degree in electrical engineering. She has worked at GM since 1985 in various other assignments in the Electrical organization.

**Jason Lambert** has more than 10 years of engineering leadership related to vehicle and powertrain systems integration for advanced technologies including hybrid electric, electric only, and hybrid hydraulic vehicles. He also provides systems integration expertise related to energy storage systems, electric machine integration, high voltage systems, BAS/BISG, EHPS/EPAS, braking/chassis systems, and thermal systems.

**Ron Lewis** is a Senior Application Engineer at Woodward, where he is currently the software lead for the Mobile Industrial platform. Ron is an alumnus of Mississippi State University and the Challenge X competition.

**Ian MacIntyre** is a research officer in the Transportation Energy Technology group at Natural Resources Canada. He has been working in alternative transportation fuels for 18 years and has been an active participant in student vehicle challenges since 1996. He has been active in the development of codes and standards, particularly in the area of hydrogen. He recently completed, in cooperation with industry, the development of an Electric Vehicle Technology Roadmap for Canada.

**Maria Peralta** is the Manager of the Laboratory Operations Division's Compliance Development Testing Group at the U.S. Environmental Protection Agency's National Vehicle and Fuel Emissions Laboratory. Previously Maria worked for the Advanced Technology Division with a focus on diesel combustion and after-treatment strategies for cleaner diesel engines. As a manager, Maria has led teams that have implemented new laboratory capabilities for engine and vehicle testing, and developed test methods to evaluate new technologies. Maria is currently working on compliance and regulatory implementation projects as well as a major initiative to further enhance the laboratory.

**Joe Salani** is a Principal Application Engineer for the New Business Acquisition Team at A123 Systems. His responsibilities include the assessment of initial customer requirements to recommend the proper A123 battery system for their application based on thermal, electrical, and mechanical evaluations. Prior to joining A123, Joe spent 15 years in the Advanced Engineering Department of Chrysler Corporation with

the last two years as a Vehicle Integration Manager in Chrysler's EVNI group, whose directive was to bring electric vehicles to market. He has bachelor's degrees from Michigan Technological University and Oakland University in natural resource management and mechanical engineering.

**David Scrivener** is an Emmy Award-winning automotive journalist with 22 years on staff for the PBS TV series MotorWeek, where he now works as senior producer, head writer and as a high-performance test driver. David specializes in the topics of automotive maintenance, advanced technologies and alternative fuels, and has researched, written and produced hundreds of feature segments and vehicle reviews in these subject areas.

**Tom Schrodt** is a senior project engineer in the Laboratory Operations Division at the U.S. Environmental Protection Agency's (EPA) National Vehicle and Fuel Emissions Laboratory in Ann Arbor, Michigan. He has worked for the EPA in the areas of quality assurance, implementation of new measurement systems, and operations management. Tom's current work focuses on process development, process improvement, measurement science, and project management. He also frequently represents EPA in industry forums and EPA rulemaking activities. Previously, Tom worked for Detroit Diesel Corporation in the areas of engine testing, process development, and operations management.

## STATIC CONSUMER ACCEPTABILITY (SCA) PRESENTATION

**Dennis Brown** See National Instruments Most Innovative Use of Graphical System Design Award

**Toby Dunmore** is currently the manager for the hybrid vehicle performance center at General Motors (GM). In this position, he is responsible for the early development of hybrid and electric vehicle performance requirements, controls architecture and feature development. Toby has held previous positions in GM's chassis organization and the performance vehicle division.

**Al Houtman** is the Vehicle Performance Manager for General Motors Front-Wheel Drive Hybrid Vehicles, responsible for mild, strong, and plug-in hybrid technologies. His education includes a BSEE from Clemson University and an MSE-ME from the University of Michigan. Al began his career at GM developing chassis control systems in 1989. He has been active in hybrid vehicle development since 2004.



**Joe Kuznicki** is the Vehicle Dynamics Engineer for General Motors Front-Wheel Drive Hybrid Vehicle applications. His education includes a BSME from Michigan State University and a MS in engineering management from the University of Detroit. Joe began his career at Ford Motor Company in 1993 and worked on various programs as a vehicle dynamics engineer, most notably on the Ford Explorer platform for eight years. Joe then moved to GM in 2007 and worked on advanced chassis control systems before moving to his current position in the hybrid organization.

**Phil Patterson** is an Industry Economist with the Office of Vehicle Technologies, Energy Efficiency and Renewable Energy, Department of Energy. He received his bachelor's degree in economics from DePaul University in 1963. He received a PhD in economics from Georgetown University in 1968. Phil has 42 years of experience in transportation analysis and has authored more than 70 papers and presentations.

## TECHNICAL PRESENTATION

**Chad Allison** is a senior engineer for A123 Systems in the Automotive Solutions Group, where his duties include developing module cooling techniques, cell testing, module testing, and module-level abuse testing. Prior to joining A123systems, Chad worked for Ford Motor Company in Research and Advanced Engineering, where he specialized in PEM fuel cell systems and helped develop the fuel cell systems that powered the Hyseries Edge and the Hydrogen 999.

**Kevin Anderson** is the Product Definition and Strategy Manager for Freescale's Analog Mixed Signal and Power Automotive products. He has been involved in automotive systems architecture and developing requirements for silicon-based automotive solutions for 20 years. He is a member of the IEEE and SAE, holds 2 patents, and has authored numerous conference and technical papers.

**Ed Argalas** is an engineering specialist in advanced vehicle dynamics at the General Motors North America Vehicle Dynamics Center, Milford Proving Grounds in Michigan. Since joining the vehicle development staff in 2000, Ed has developed production ABS technologies for GM truck products, led the development of advanced active damping systems for future vehicles, and was responsible for the tuning of the chassis control system on the Chevrolet Equinox Fuel Cell EV. Currently, he is leading a project simulating the dynamic and failsafe response of controlled vehicle suspension systems. He is a former Formula One technical inspector for the U.S. Grand Prix at Indianapolis Motor Speedway and Rally America series in Atlanta, Michigan.

**Jeff Cherry** is currently a Vehicle Technology Engineer for the U.S. Environmental Protection Agency's (EPA) Office of Transportation and Air Quality. As part of the Assessment and Standards division, Jeff provides technology research in support of EPA's regulatory work, laboratory projects, and in response to congressional requests. Prior to joining the EPA, Jeff had many years of experience in the transportation industry at the OEM and supplier levels developing new vehicle technologies including hybrid, electric, fuel-cell, ride control, and twin-clutch transmissions. Jeff has an MS in computer science and a BS in electrical engineering.

**Don Hillebrand** is currently the deputy director of the Energy Systems Division at Argonne National Laboratory. He has more than 20 years of experience in automotive engineering, research management, and government affairs. Don has also served as a senior policy advisor to the Executive Office of the President, White House Office of Science and Technology.

**Gary Horvat** is the Executive Director of Engineering Operations for General Motors' Powertrain Division. Included in the Engineering Operations are the Global Laboratories, Materials Engineering, and Pre-production Operations. Previously, he was the Global Chief Engineer and Global Program Manager for Transmission and Hybrid Controls. Gary joined GM in 1985 after previously being employed at Eaton Corporation. After working as a design release engineer for multiple engine components, he was appointed Engineering Group Manager (EGM) for the Small Block product team. He then served as EGM for the Exhaust Aftertreatment Group. Gary was named the Assistant Chief Engineer for V6 engines in 2001 and led the launch of multiple displacement engines at numerous GM locations. He was named to his current role in 2010. Gary received his Bachelor of Industrial Engineering, Master of Manufacturing Engineering, and Doctor of Engineering from Cleveland State University. He is a registered professional engineer in the state of Ohio.

**Aaron Hula** is a Technology Advisor for the U. S. Environmental Protection Agency's (EPA) Office of Transportation and Air Quality, Transportation and Climate Division. He provides technology and policy analysis in support of EPA's regulatory work, for EPA's CO2 and Fuel Economy Trends Report, and in response to congressional requests. Previously, Aaron worked for Ford Motor Company, where he worked with manufacturing facilities worldwide on environmental permitting and compliance, air dispersion modeling and stack testing, and environmental control equipment.

# EcoCAR YEAR THREE JUDGES

**Larry Johnson** serves as the director of the Transportation Technology R&D Center at Argonne National Laboratory. He has more than 30 years of transportation research experience and is the author or co-author of more than 70 publications and conference presentations on transportation topics.

**Justin Kern** is a senior calibration engineer at Bosch. He has worked at Bosch for six years, gaining expertise in Motronic engine control software for gasoline direct-injection engines. Prior to joining Bosch, Justin was employed at Argonne National Laboratory, where he worked with hybrid electric vehicles, and served as a technical coordinator for the Advanced Vehicle Technology Competition programs.

**Devin Koopmans** is a systems engineer at National Instruments for hardware-in-the-loop and real-time testing. He works closely with customers in the automotive and aerospace industries to ensure their success by providing training, support, custom development, and consulting. Devin was a member of the waterlooSPEED student team at the University of Waterloo, where he reverse engineered the stock ECU of a VW Jetta and implemented his own controller on NI hardware.

**Noel Mack** is the director of hybrid development for Magna Powertrain. He has been with Magna International Inc. for more than 10 years. Before joining the automotive industry, he spent a decade working in aerospace engineering. Noel is also an adjunct professor at the University of Detroit Mercy, where he teaches a post-graduate course in hybrid electric vehicle performance and design.

**Cheri Ann MacKinlay** is a Senior Technical Officer with the Transportation Energy Technology group at Natural Resources of Canada. Cheri is a graduate of the FutureTruck student vehicle competition, where she was team lead for the University of Alberta. Since joining NRCan, Cheri has been involved in a variety of hydrogen and fuel cell research and demonstration projects as well as the development of an Electric Vehicle Technology Roadmap for Canada. She also is a member of the EcoCAR Steering Committee.

**Vivek Modugal** is the Director of Sales for dSPACE Inc., responsible for sales operations in the company's North American market since 2003. Vivek joined dSPACE Inc. in 1993 as a technical support engineer and spent his first 10 years performing various roles for the engineering department, including supporting, executing, and managing software development projects. Throughout his tenure with the company, he has gained expertise in the application of model-based development tools for control software development and validation.

**Ed Owens** is supervisor of the hybrid electric systems and materials technology activities within . Ed has more than 30 years of experience in automotive research and development, and has published more than 35 papers on engine, fuel, and lubricant development and performance.

**Muneeb Shaik** is a Senior Project Engineer at General Motors' Canadian Regional Engineering Centre. In this role, he supports advanced technology work, validation, and alternative fuel efforts. Muneeb has more than 16 years experience in modeling and simulation for optimization, durability, crashworthiness, and vehicle dynamics. He has also worked on materials procurement, vehicle builds, setup, and full vehicle barrier testing to meet Federal Motor Vehicle Safety Standards.

**Lee Slezak** is the Vehicle Systems Manager for the Vehicle Technologies Program in the Office of Energy Efficiency and Renewable Energy at the U.S. Department of Energy.

**Bob Storc** is Senior Manager - Advanced Development for Magna E-Car Systems. He has eight years of experience with automotive suppliers including specialty car and component suppliers, and specialized skills in automotive vehicle creation and packaging for ground-up vehicle design. Bob has more than 36 years of experience with GM, and experience in Wankel engines, all-wheel drive, vehicle development, interior trim, body, fasteners, chassis, vehicle packaging, vehicle integration, and new product creation and strategy. Bob has 10 patents including the Midgate™.

## CONTROLS PRESENTATION

**David Anderson** is a technology development manager for the U.S. Department of Energy's Vehicle Technologies Program. As a member of the Vehicle and Systems Simulation and Testing team, he is responsible for managing DOE's vehicle modeling and simulation efforts, as well as vehicle component and systems evaluation activities. He previously worked as a design engineer in the semiconductor industry. David has conducted research in the advanced automotive battery industry and has experience in motorsports at both the amateur and professional levels.

**Stephen Barrett** is a systems engineer at National Instruments, where he provides engineering support services that include pre-sales concept development, benchmarking, on-site training and consulting, and creating software add-on components for NI's real-time testing platform. Stephen is a former member of the Texas Tech University Challenge X team and has been assisting the EcoCAR teams since the competition kick-off in 2008.



**John Cotner** is a senior applications engineer for the Field Automotive Systems Team of Freescale Semiconductor. John has held a variety of positions within the automotive electronics industry for the past 21 years, including six years of work on hybrid vehicle control and powertrain electronics at Freescale. John received both bachelor's and master's degrees in electrical engineering from the University of Michigan. He is also a member of SAE and IEEE and holds four patents.

**Tom Ender** is the engineering group manager for General Motors of Canada's Chassis Control Team. His responsibilities have included electronic fuel pressure regulation and diagnostics, HVAC climate control, hybrid vehicle system diagnostics, pressurized fuel system control, electric vehicle drive control, diagnostics for stability control, and electric trailer brake systems. Tom joined GM of Canada in 1997 as part of the Alternative Fuels Team. From 2003 to 2007, Tom served as the Challenge X team mentor for his alma mater, the University of Waterloo.

**Tim Grewe** is the chief engineer for General Motors Global Rear-Wheel Drive hybrid system. Tim is responsible for the design and release of rear-wheel drive hybrids ranging from a 60-foot articulated city bus to the Chevrolet Tahoe. Tim is also director of global hybrid power electronics and controls. Tim's education includes a BSEE from Rensselaer Polytechnic Institute and a MSEE from Syracuse University. He started his career with General Electric developing distributed power systems for aircraft and locomotive transportation products. Tim is the holder of numerous patents and is active in the hybrid development industry.

**Donna Haiderer** is the Chief Engineer and Program Manager for Global Engine Controls at General Motors. She joined GM in 1983 as a Software Development Engineer for Small Block engines and GM Motorsports. Prior to her current position, Donna held numerous assignments in the engine design and development arena, including Assistant Chief Engineer for the Northstar Engines.

**Santhosh Jogi** See Vehicle Testing Complete

**Jim Kolhoff** is the Global Chief Engineer for front-wheel drive hybrid drive units at General Motors. His organization is responsible for the drive unit hardware for front-wheel drive hybrids and EREVs, including the Chevrolet Volt. Jim was previously director of transmission controls, and director of software engineering for GM Powertrain. He has 25 years of experience in automotive powertrain engineering.

**Pete Maloney** is a Senior Principal Consulting Engineer for MathWorks. His main areas of focus at MathWorks are powertrain calibration tool development and application, large-scale control modeling, physical system modeling, and large-scale system optimization for automotive customers. Before joining MathWorks in 2000, he designed and developed electronic engine control algorithms for Ford Motor Company and Delphi Automotive Systems over a 10-year period, resulting in 15 related patents. Pete has a BSME from Texas Tech University, and an SMME from the Massachusetts Institute of Technology.

**Jason McConnell** is Chief Engineer for AVL Powertrain Engineering, where he focuses on the development of hybrid and electric drive vehicles and related sub-systems. Previously, he held positions with IAV Automotive Engineering, Visteon Corporation, and Eaton Automotive. Jason has specific expertise in powertrain control systems, hybrid electric vehicle energy management, and modeling and simulation. He holds a BSEE from GMI and a MSEE from Michigan State University.

**Arvon Mitcham** is Program Manager/Engineer for the U.S. Environmental Protection Agency's Office of Transportation and Air Quality, Compliance and Innovative Strategies Division. As part of the Light-Duty Vehicle Group, Arvon is EPA's national expert on vehicle on-board diagnostics. He is also responsible for vehicle compliance including emissions durability, in-use fleet compliance, OBD-based inspection and maintenance program support, and other compliance and enforcement-related activities.

**Aymeric Rousseau** is the manager of the Vehicle Modeling and Simulation Section at Argonne National Laboratory. For the past 12 years, he has been leading the development of both PSAT and Autonomie. The tools are currently used by more than 150 companies worldwide to support the development, analysis, and introduction of advanced component and vehicle technologies.

**Ben Sinsheimer** is a senior engineer for A123 Systems in the Automotive Solutions Group, where his duties include developing embedded software for the battery management system. Ben graduated from The Ohio State University with bachelor's and master's degrees in electrical engineering, while working on the hydrogen fuel cell-powered Buckeye Bullet 2 (the world's fastest hydrogen powered car), the Buckeye Bullet (the first electric car to exceed 300 mph), and the Smokin' Buckeye (an electric "Indy" style race car).

## OUTREACH PRESENTATION

**Alicia Alvin** has been the marketing manager for dSPACE Inc., the North American headquarters for dSPACE, in Wixom, Michigan, since 2006. She has more than 20 years of experience in marketing communications. Alicia has worked extensively in the automotive, quality, and environmental industry sectors.

**Andrea Arnold** is the public relations manager for AVL Americas Inc., which offers combined solutions of powertrain engineering, simulation software and testing, and instrumentation systems. Andrea was previously a senior account executive at Eisbrenner Public Relations. She has a bachelor's degree in communication from Michigan State University.

**Connie Bezanson** manages the Education and Outreach activities within the U.S. Department of Energy's Vehicle Technologies Program Office. In addition to managing the Advanced Vehicle Technology Competition activity, she manages the Graduate Automotive Technology Education and a portfolio to support the transition to advanced electric transportation systems. She received a BS in mechanical engineering from The Catholic University of America.

**Dan Borgasano** is the public relations manager at A123 Systems, where his responsibilities include managing all media communications for the company and helping to develop and disseminate corporate messaging and positioning via press releases, case studies, social media outlets, and other forms of marketing collateral. Prior to joining A123, Dan spent seven years at public relations firm Schwartz Communications, where he managed the public relations programs for dozens of clients in the clean tech and information technology industries. He earned a bachelor's degree in communications from the S.I. Newhouse School of Public Communications at Syracuse University.

**Maureen Maher** joined MathWorks in 2001 and currently manages the Education Marketing Communications team. Maureen's team is responsible for programs that support MathWorks business in academia worldwide. These include sponsorships for student competitions and curriculum development, fellowships, engineering education society relationships, and MathWorks' extensive book program. Before joining MathWorks, Maureen held executive positions at CEO Express, an internet portal service, and at SilverPlatter Information Inc., a global electronic publisher serving academic and medical libraries.

**Andy Mastronardi** joined Freescale Semiconductor in September 1999 and is Global Director of the Freescale University Programs. Prior to Freescale, Andy spent 26 years in the education industry, both as a teacher and in educational

publishing. Andy completed his undergraduate studies at SUNY Potsdam and graduate studies at Fordham University and Long Island University. His background is in mathematics, mathematics education, and marketing.

**Lynda Palombo** is Senior Manager, Business Strategy for the, Transportation Energy Technologies at Natural Resources Canada. Lynda is responsible for strategic planning, reporting, and business development for alternative transportation energy technologies. She has worked on the U.S. Department of Energy's Advanced Vehicle Technology Competitions for more than 11 years and is a member of the EcoCAR Steering Committee.

**Shannon Brescher Shea** is the Clean Cities communications manager in the Vehicle Technologies Program at the U.S. Department of Energy (DOE). She began her DOE career in 2008 as a Presidential Management Fellow, where she did a detail in the Division of Earth Life and Sciences at the National Academy of Sciences, focusing on climate change and energy communications. Previously, Shannon wrote for *The Conservationist*, the New York State Department of Environmental Conservation's official magazine. Shannon has a BS from Cornell University in Communications and Natural Resources and a MS from Oxford University in Nature, Society, and Environmental Policy.

**Mary Beth Stanek** is responsible for the planning and execution of General Motors' global fuel cell vehicle demonstration and commercial programs, business development for the Chevrolet Volt, and fuel cell vehicle policy and infrastructure initiatives related to GM's electrically driven vehicles. Mary Beth continues to lead biofuels infrastructure development, government and business relations, and liaison with GM's Vehicle Sales, Service and Marketing Organization. She began her GM career in 1982 and has completed assignments in several staffs including Purchasing, R&D, and Public Policy. Mary Beth is currently leading many of the co-marketing E85 partnership activities with fuel retailers and ethanol suppliers.

**Joann Jackson-Stephens** has worked at the U.S. Environmental Protection Agency's (EPA) Office of Transportation & Air Quality as an Environmental Protection Specialist since 1992. She currently works on marketing efforts and on the supply chain partnership program as the Brand Manager for the SmartWay Team in the Transportation & Regional Programs Division. Prior to working on SmartWay, Joann served as the agency lead for the DOT/EPA "It All Adds Up to Cleaner Air" Initiative, worked on issues such as transportation and market incentives, and contributed to the development of fuel and engine regulations. Joann earned a Master of Public Policy from University of Michigan in 1992 and has a Bachelor of Arts degree from Spelman College.



## WOMEN IN THE WINNER'S CIRCLE FOUNDATION — OUTSTANDING WOMEN IN ENGINEERING AWARDS

**Pamela Fletcher** is the Global Chief Engineer for Volt and Plug-In Hybrid Electric Powertrains. She is responsible for the extended range electric vehicle propulsion system in the Chevrolet Volt. Pamela holds a bachelor's degree in mechanical engineering, awarded from GMI Engineering & Management Institute as well as a master's degree in mechanical engineering, awarded from Wayne State University. She also graduated from the Executive Development Program, within the Kellogg School of Management at Northwestern University, and is an active member on the Board of Advisors for the College of Engineering at the University of North Carolina Charlotte.

**Lyn St. James** is the founder of the Women in the Winner's Circle Foundation, a non-profit organization that focuses on worldwide activities and programs for driver development, advocacy, diversity, and education, particularly for women who aspire to become race car drivers and/or work in the automotive industry. As a former professional IndyCar driver, Lyn is one of the few women to successfully race in the Indianapolis 500, and the first woman to win the Indianapolis 500 Rookie of the Year award. During her celebrated driving career, she held 31 international and national closed circuit speed records and won races such as the 24 Hours of Daytona. Lyn also currently serves as a motivational speaker and was selected by Automotive News as one of the top 100 Women in the Automotive Industry in 2010.

**Cindy Svestka** is the Engineering Group Manager for GM Powertrain's North American Cranking Systems and Electronic Sensors Group. Since joining GM in 2000, she has worked on the design and development of ethanol fuel systems for full-size trucks; overseeing the energy and drive quality performance of the Chevrolet HHR; meeting the fuel economy and vehicle performance targets for the FWD 2-Mode Hybrid program; and serving as the executive technical assistant for Powertrain Vehicle Integration. Throughout her time at GM, Cindy has been engaged as a Technical Lead for EcoCAR, Challenge X, FutureTruck, and the Ethanol Vehicle Challenge. Prior to joining GM, Cindy worked for Argonne National Laboratory on the Advanced Vehicle Technology Competition program and was a student team leader in the Propane Vehicle Challenge.

## NATIONAL SCIENCE FOUNDATION OUTSTANDING FACULTY ADVISOR AWARDS

**Connie Bezanson** See Outreach Program

**Kristen De La Rosa** is director of the Advanced Vehicle Technology Competition program at Argonne National Laboratory, where she has organized 18 competitions since 1996. Today, she manages all day-to-day activities of the EcoCAR competition and is responsible for establishing more than \$80 million of financial and in-kind support to successfully execute the three-year EcoCAR program.

**Frank Falcone** See Final Technical Report

**Steve Gurski** is an Algorithm Design Engineer in General Motors' Hybrid and Electric Systems Engineering group. Before joining GM, Steve was a lead engineer for the Advanced Vehicle Technology Competition program at Argonne National Laboratory. Steve is a former FutureTruck team leader from Virginia Tech, where he earned his bachelor's and master's degrees in mechanical engineering.

**Lynda Palombo** See Outreach Program

**Don Senich** is the Senior Advisor for Academic Programs in the Industrial Innovation and Partnerships Division in the National Science Foundation. He is responsible for implementing \$52 million in academic and industrial collaborative research in the Engineering Directorate and is the procurement interface with the Small Business Administration's Office of Government Contracting.

## dSPACE EMBEDDED SUCCESS AWARD

**John Haraf** See Vehicle Testing Complete

**Santhosh Jogi** See Vehicle Testing Complete

**Vivek Modugal** See Controls Presentation

## NATIONAL INSTRUMENTS MOST INNOVATIVE USE OF GRAPHICAL SYSTEM DESIGN AWARD

**Dennis Brown** is an Engineering Group Manager for General Motors Hybrid Electric Vehicles, responsible for battery thermal management, propulsion, and human interface control systems. His education includes a BSEE from Lawrence Technological University and an MSES from Rensselaer Polytechnic Institute. Dennis began his career at GM developing propulsion control systems in 1994. His responsibilities have included being the Controls Application Engineer in Rüsselsheim, Germany, for the Ecotec Engine and the Controls Electrical Engineering Supervisor in Honeoye Falls, New York, for Fuel Cells. Dennis has been active in the development of alternative propulsion systems since 2003.

**Chris Washington** is the senior product manager for Real-Time Testing and HIL Simulation at National Instruments. During his tenure at NI, Chris spent three years in Detroit as a field engineer, where he provided consulting and support services for various applications, such as hardware-in-the-loop testing; rapid control prototyping; noise-vibration-harshness testing; in-vehicle data logging; and real-time test cell development. Additionally, Chris has worked as an applications engineer and a LabVIEW instructor. He received his BS in electrical engineering from Texas A&M University with a focus on digital electronics and control systems.

## MATHWORKS MODELING AWARD

**Chris Fillyaw** has more than 10 years of experience applying MathWorks products in various application areas. As an Application Engineering Manager in the Detroit office, Chris manages a team of engineers focused on working with customers in the automotive and commercial vehicle industry to address the systems integration challenges posed by increased adoption of electronics in these industries. Chris graduated from Michigan Technological University with bachelor's degree in electrical engineering and received his master's degree in electrical engineering from the University of Michigan – Dearborn.

**Brad Hieb** is a Principal Applications Engineer at MathWorks. Brad has more than 14 years of experience with embedded systems design at Ford, comprising advanced engine controls development, Formula 1 powertrain and vehicle controls, and vehicle dynamics simulation activities. After Ford, Brad joined MathWorks as an application engineer working with customers to help them understand how to apply model-based techniques and MathWorks tools to develop embedded controls for a variety of applications. Brad holds an MSE from the University of Michigan and a BS from Iowa State University, both in electrical engineering.

**Kent Helfrich** is the Executive Director of Electronic Controls and Software at General Motors. He is responsible for all global powertrain and vehicle software and controls engineering at GM. He was previously Director of Powertrain and Chassis Software and Controls Engineering. Kent is GM Powertrain's co-executive leader of the EcoCAR Challenge. He is a licensed professional engineer and a member of SAE and IEEE.

**Paul Smith** is the director of consulting services for MathWorks. He has been with the company for more than 10 years in various customer-facing, engineering positions. Paul previously worked for a major automotive company developing powertrain control and diagnostic strategies for 13 years. Prior to that, he served as a naval nuclear engineer in the U.S. Navy submarine force. Paul holds a BSEE from Michigan Technological University and an MSECCS from Wayne State University.

## A123 SYSTEMS BATTERY WORKMANSHIP AWARD

**Ed Argalas** See Technical Presentation

**Tony Knakal** is a program manager for A123 Systems, where his responsibilities include government-related automotive programs. These range from U.S. Department of Energy projects to military projects. Prior to A123 Systems, Tony worked for General Dynamics Land Systems as a Project Engineer. Tony earned a bachelor's degree in mechanical engineering from Purdue University and an MBA from the University of Michigan.

**Joe Salani** See Vehicle Testing Complete

# EcoCAR YEAR THREE JUDGES



# EcoCAR 2011 SCHEDULE

DATE	TIME	ECOCAR EVENT	LOCATION
<b>Sunday, June 5</b>	11:00 PM - 2:30 PM	EcoCAR Registration	MPG, Lundstrom House
	11:30 PM - 4:00 PM	Teams Move Into Pits	MPG, Bldg. 16, South Garage
	5:00 PM - 8:30 PM	Team Welcome Night	Lucky Strike, Novi
<b>Monday, June 6</b>	7:00 AM	Pits Open	MPG, Bldg. 16, South Garage
	7:30 AM	Team Leader Meeting	MPG, Bldg. 3, Room 3A/3B
	8:00 AM - 12:30 PM	Safety & Technical Inspections	MPG, Bldg. 16, South Garage
	12:30 PM	Lunch	MPG, Bldg. 105, Cafeteria
	1:30 PM - 6:30 PM	Safety & Technical Inspection	MPG, Bldg. 16, South Garage
		Qualifying – Braking, Lane Change,	MPG, VDTA
		Low Speed Steering, Highway Stability	MPG, VDTA
	2:00 PM – 6:30 PM	Braking & Acceleration	MPG, Military Straightaway
8:00 PM	Pits Close		
<b>Tuesday, June 7</b>	6:00 AM - 6:30 PM	Emissions & Energy Consumption (E&EC)	MPG, Circle Track
	7:00 AM	Pits Open	MPG, Bldg. 16, South Garage
	7:30 AM	Team Leader Meeting	MPG, Bldg. 3, Room 3A/3B
	8:00 AM - 12:30 PM / 1:30 PM - 6:30 PM	Safety & Technical Inspections	MPG, Bldg. 16, South Garage
		Qualifying – Braking, Lane Change,	MPG, VDTA
		Low Speed Steering, Highway Stability	MPG, VDTA
		Braking & Acceleration	MPG, Military Straightaway
		Lunch	MPG, Bldg. 105, Cafeteria
	12:30 PM	Pits Close	MPG, Bldg 105 Cafeteria
8:00 PM	Pits Close		
<b>Wednesday, June 8</b>	6:00 AM - 6:30 PM	Emissions & Energy Consumption (E&EC)	MPG, Circle Track
	7:00 AM	Pits Open	MPG, Bldg. 16, South Garage
	7:30 AM	Team Leader Meeting	MPG, Bldg. 3, Room 3A/3B
	8:00 AM – 12:30 PM / 1:30 PM - 6:30 PM	Safety & Technical Inspections	MPG, Bldg. 16, South Garage
		Qualifying – Braking, Lane Change,	MPG, Garage
		Low Speed Steering, Highway Stability	MPG, VDTA
		Braking & Acceleration	MPG, VDTA
		AVL DRIVE Quality	MPG, Military Straightaway
		Dynamic Consumer Acceptability	MPG, N/S Straightaway
	12:30 PM	Lunch	MPG, Ride & Handling Road
	8:00 PM	Pits Close	

# EcoCAR 2011 SCHEDULE

DATE	TIME	ECOCAR EVENT	LOCATION
<b>Thursday, June 9</b>	6:00 AM – 6:30 PM	Emissions & Energy Consumption (E&EC)	MPG, Circle Track
	7:00 AM	Pits Open	MPG, Bldg. 16, South Garage
	7:30 AM	Team Leader Meeting	MPG, Bldg. 3, Room 3A/3B
	8:00 AM – 12:30 PM / 1:30 PM – 6:30 PM	Safety & Technical Inspections	MPG, Bldg. 16, South Garage
		Qualifying – Braking, Lane Change, Low Speed Steering, Highway Stability	MPG, VDTA
		Braking & Acceleration	MPG, Military Straightaway
		AVL DRIVE Quality	MPG, N/S Straightaway
		Dynamic Consumer Acceptability	MPG, Ride & Handling Road
		Towing	MPG, Circle Track
		Lunch	MPG, Bldg. 105, Cafeteria
	12:30 PM	Pits Close	MPG, Bldg 105 Cafeteria
	8:00 PM	Pits Close	
<b>Friday, June 10</b>	6:00 AM – 4:00 PM	Emissions & Energy Consumption (E&EC)	MPG, Circle Track
	7:00 AM	Pits Open	MPG, Bldg. 16, South Garage
	7:30 AM	Team Leader Meeting	MPG, Bldg. 3, Room 3A/3B
	8:00 AM – 12:30 PM / 1:30 PM – 4:00 PM	Qualifying - Braking, Lane Change, Low Speed Steering, Highway Stability	MPG, VDTA
		Braking & Acceleration	MPG, Military Straightaway
		AVL DRIVE Quality	MPG, N/S Straightaway
		Dynamic Consumer Acceptability	MPG, Ride & Handling Road
		Towing	MPG, Circle Track
	12:30 PM	Lunch	MPG, Bldg. 105, Cafeteria
	4:00 PM	Panoramic Photo	MPG, City Course
	5:30 PM - 7:30 PM	Autocross	MPG, City Course
		GM Driving Experience	MPG, City Course
	6:00 PM - 8:30 PM	Bar-B-Q Dinner	MPG
	9:00 PM	Pits Close	
<b>Saturday, June 11</b>	ALL DAY	Outreach Coordinators Travel to D.C.	
	6:00 AM – 6:30 PM	Emissions & Energy Consumption (E&EC)	MPG, Circle Track
	7:00 AM	Pits Open	MPG, Bldg. 16, South Garage
	7:30 AM	Team Leader Meeting	MPG, Bldg. 3, Room 3A/3B
	8:00 AM - 11:00 AM	Pit Clean Up	MPG, Bldg. 16, South Garage
	8:00 AM - 12:00 PM	Braking & Acceleration	MPG, Military Straightaway
		AVL DRIVE Quality	MPG, N/S Straightaway
		Dynamic Consumer Acceptability	MPG, Ride & Handling Road
		Towing	MPG, Circle Track

# EcoCAR 2011 SCHEDULE

<b>Saturday, June 11</b>	<b>TIME</b>	<b>ECOCAR EVENT</b>	<b>LOCATION</b>
	11:30 AM - 12:30 PM	Judge Briefing & Registration	TBD
	12:00 PM	Lunch	MPG, Bldg. 105 Cafeteria
	1:00 PM - 6:30 PM	Vehicle Testing Complete	MPG, Bldg. 16, Garage
		Static Consumer Acceptability	MPG, Bldg. 16, Garage
	8:00 PM	Pits Close	
<b>Sunday, June 12</b>	6:00 AM - 6:30 PM	Emissions & Energy Consumption (E&EC)	MPG, Circle Track
	7:00 AM	Pits Open	MPG, Bldg. 16, South Garage
	7:30 AM	Team Leader Meeting	MPG, Bldg. 3, Room 3A/3B
	8:00 AM - 6:30 PM	Teams Pack up Pits	MPG, Bldg. 16, South Garage
	8:00 AM - 8:00 PM	Outreach Practice Sessions	Banneker Room, Westin Alexandria
	8:00 AM - 12:00 PM	Braking & Acceleration	MPG, Military Straightaway
		AVL DRIVE Quality	MPG, N/S Straightaway
		Dynamic Consumer Acceptability	MPG, Ride & Handling Road
		Towing	MPG, Circle Track
	12:00 PM	Lunch	MPG, Bldg. 105, Cafeteria
	1:00 PM - 6:30 PM	Vehicle Testing Complete	MPG, Bldg. 16, Garage
		Static Consumer Acceptability	MPG, Bldg. 16, Garage
	6:30 PM	Judges Debrief	TBD
	6:30 PM	Pits Close	
<b>Monday, June 13</b>	ALL DAY	Teams Drive/Fly to Washington, D.C.	
	7:00 AM - 8:00 AM	Outreach Judges Breakfast	Bell Room, Westin Alexandria
	8:00 AM - 8:30 AM	Outreach Judges Briefing and Registration	Banneker Room, Westin Alexandria
	8:30 AM - 12:10 PM	Outreach Presentations	Banneker Room, Westin Alexandria
	10:30 AM - 10:40 AM	Break	
	1:00 PM - 4:40 PM	Outreach Presentations	Banneker Room, Westin Alexandria
	3:10 PM - 3:20 PM	Break	
	5:00 PM - 6:30 PM	RMT/SMT Briefing	Banneker Room, Westin Alexandria
	6:00 PM - 8:00 PM	Judges Registration	Curie Room, Westin Alexandria
	6:00 PM	Faculty Reception & Dinner	Brabo Restaurant, Alexandria
<b>Tuesday, June 14</b>	6:00 AM - 11:00 AM	RMT	Carver Room, Westin Alexandria
	7:00 AM - 12:30 PM	Practice Sessions	Westin Alexandria
	7:00 AM - 8:00 AM	Judges' Breakfast	Salon D, Westin Alexandria
	8:00 AM - 11:00 AM	Women in Engineering Sponsored Award Presentation	Whitney Room, Westin Alexandria
	8:00 AM - 12:10 PM	Outreach Presentations	Banneker Room, Westin Alexandria
	8:00 AM - 11:00 AM	Judges' Registration	Salon D, Westin Alexandria

# EcoCAR 2011 SCHEDULE

<b>Tuesday, June 14</b>	<b>TIME</b>	<b>ECOCAR EVENT</b>	<b>LOCATION</b>
	10:00 AM - 10:10 AM	Break	
	11:00 AM - 12:30 PM	Controls Judges' Briefing	Salon A, Westin Alexandria
		Technical Judges' Briefing	Salon C, Westin Alexandria
	12:10 PM - 1:10 PM	Outreach Lunch	Salon D, Westin Alexandria
	12:30 PM - 1:20 PM	Controls/Technical Lunch	Salon D, Westin Alexandria
		Team Leader Meeting	
	1:10 PM	Outreach Judges Debrief	Banneker Room, Westin Alexandria
	1:20 PM - 5:30 PM	Judged Presentations	
		Technical	Salon B, Westin Alexandria
		Controls	Wright Room, Westin Alexandria
	3:20 PM - 3:30 PM	Break	
	4:30 PM - 5:30 PM	Sponsor Exhibit Set-Up	Pre-function Area, Westin Alexandria
	6:00 PM - 7:00 PM	Sponsor Social Reception	Pre-function Area, Westin Alexandria
	7:00 PM	Sponsor Social Dinner & Awards	Edison Ballroom, Westin Alexandria
<b>Wednesday, June 15</b>	6:00 AM - 11:00 AM	SMT	Outside of Westin Alexandria
	6:30 AM - 7:40 AM	Judges Breakfast	Salon D, Westin Alexandria
	7:40 AM - 11:50 AM	Judged Presentations	
		Controls	Wright Room, Westin Alexandria
		Technical	Salon B, Westin Alexandria
	7:40 AM - 11:50 AM	Sponsored Awards	
		National Instruments	Salon C, Westin Alexandria
		MathWorks	Salon A, Westin Alexandria
	10:00 AM - 12:00 PM	NSF Judging	Salon G, Westin Alexandria
	10:20 AM - 10:30 AM	Break	
	11:50 AM - 12:20 PM	Lunch	Salon D, Westin Alexandria
	12:20 PM - 3:00 PM	Judged Presentations & Sponsored Awards Resume	
	3:00 PM - 3:30 PM	Controls/Technical Judges Debrief	
	3:00 PM	Evening on your own	
<b>Thursday, June 16</b>	6:30 AM	Stage Vehicles	U.S. DOE, Washington, D.C.
	10:00 AM - 11:30 AM	DOE Finish Line & Media Ride and Drive	U.S. DOE, Washington, D.C.
	11:30 AM - 12:30 PM	Ride and Drive	U.S. DOE, Washington, D.C.
	12:30 PM - 1:30 PM	Lunch	U.S. DOE, Washington, D.C.
	7:00 PM - 11:00 PM	Awards Ceremony & Dinner	Library of Congress
<b>Friday, June 17</b>	ALL DAY	Teams Depart back to Universities	



## EMBRY-RIDDLE AERONAUTICAL UNIVERSITY

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**FACULTY ADVISORS:** Darris White and Marc Compere

**TEAM LEADER:** Sean Carter

**SUB-TEAM LEADERS:** Brian Harries, Zachary Karstetter, Stephen Renick, Ketan Prassana, and Brandon Smith

**OUTREACH COORDINATOR:** Ryan Antidel

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### TEAM DESCRIPTION

The Embry-Riddle EcoEagles, led by Sean Carter, is split into four primary task groups: Mechanical led by Zachary Karstetter and Stephen Renick; Electrical led by Ketan Prassana; Controls led by Brian Harries; and IDEA led by Brandon Smith. Each group has several major vehicle tasks assigned to them, which the group leaders distribute accordingly. Business and Outreach tasks are handled by outreach coordinator Ryan Antidel.

### VEHICLE DESIGN

The EcoEagles' vehicle is a plug-in hybrid electric vehicle (PHEV), consisting of a GM 1.3 L diesel engine running on B20 biodiesel, a GM two-mode transmission, and an A123 Systems 330 V, 12.9 kWh lithium-ion battery pack. The vehicle will be able to drive approximately 20 miles on electric-only power. Once the battery is depleted, the vehicle switches to hybrid mode with the engine turning on to sustain the battery and power the vehicle.

## GEORGIA TECH

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**FACULTY ADVISORS:** Tom Fuller and David Taylor

**TEAM LEADER:** Carlos Cubero Ponce

**OUTREACH COORDINATOR:** Kary Winkler

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### TEAM DESCRIPTION

The Georgia Tech (GT) EcoCAR team is led by Carlos Cubero Ponce. Working in conjunction with the chemical engineering faculty advisor, Dr. Thomas Fuller, and the electrical and computer engineering faculty advisor, Dr. David Taylor, the team is divided into the following groups: Battery led by Harsha Vempati; Electrical led by Scott Paik; Controls led by Carlos Cubero Ponce; Mechanical led by John Arata; and CAD led by Alex Mariuzza. Outreach initiatives are led by Kary Winkler.

### VEHICLE DESIGN

The GT team has investigated several hybrid vehicle architectures and components to determine which will allow the team to achieve the competition goals of: increasing vehicle mileage; decreasing net well-to-wheels (WTW) greenhouse gas (GHG) emissions; decreasing WTW petroleum consumption; and maintaining vehicle performance and consumer acceptability. The GT team has decided to implement a split hybrid powertrain, in which the vehicle dynamically changes between parallel and series operational modes. The team plans to double the vehicle's city mileage and increase its highway efficiency by 40 percent by replacing the 2.4 L engine with a 1.6 L ethanol engine and adding a hybrid transmission, electric motor and gearing, and a lithium-ion battery pack.



## MICHIGAN TECHNOLOGICAL UNIVERSITY

**FACULTY ADVISORS:** Josh Loukus and Adam Loukus  
**CO-TEAM LEADERS:** Jason Socha and Sarah Cavanagh  
**OUTREACH COORDINATOR:** Jamie Kleinendorst

### TEAM DESCRIPTION

The Michigan Technological University's EcoCAR team consists of three major subteams: Mechanical led by Travis Spilling and James Parissot; Electrical led by Jake Dunda; and Controls also led by Jake Dunda. Marketing and Outreach is led by Jamie Kleinendorst. All four of these teams are overseen by team leaders Jason Socha and Sarah Cavanagh and faculty advisors Josh Loukus and Adam Loukus.

### VEHICLE DESIGN

Michigan Technological University's proposed design consists of a GM E85-compatible, 3.9 L engine longitudinally mounted in the engine bay with a two-mode transmission. A 55 kW Azure Dynamics electric motor mated to a Corvette differential drives the rear wheels, giving the vehicle all-wheel drive capabilities. Plug-in charging allows the vehicle to be charged when not in use. The power is stored in a 21.3 kWh battery pack provided by A123 Systems.

## MISSISSIPPI STATE UNIVERSITY

**FACULTY ADVISOR:** Marshall Molen  
**TEAM LEADER:** Matt Doude  
**OUTREACH COORDINATOR:** Lee Pratt

### TEAM DESCRIPTION

The Mississippi State University EcoCAR team is headed by a team leader and is divided into six subgroups that focus on specific areas of the vehicle design and implementation. The subgroups include: Powertrain, Mechanical, Controls, Electrical, Emissions, and Outreach.

### VEHICLE DESIGN

The Mississippi State University team has chosen to build an extended-range electric vehicle (EREV). The vehicle's 21.3 kWh A123 Systems battery pack provides an all-electric range of greater than 60 miles. Once the battery is depleted, the vehicle relies on a 1.3 L GM turbodiesel engine coupled to a 75 kW UQM generator to power the vehicle during its charge-sustaining mode. Tractive power is provided by 125 kW and 145 kW UQM motors powering the front and rear wheels, respectively.





## MISSOURI UNIVERSITY OF SCIENCE & TECHNOLOGY

**FACULTY ADVISOR:** John Sheffield

**TEAM LEADER:** Kevin Martin

**OUTREACH COORINATOR:** Michelle Taylor

### TEAM DESCRIPTION

The Missouri University of Science & Technology EcoCAR team consists of four subteams (Mechanical, Electrical, Control, Business, and Marketing), each with a team leader. The team leverages the interdisciplinary nature of the team by incorporating various majors into each subteam. Regular membership is supplemented by incorporating special identified projects into numerous courses. Weekly meetings are held to coordinate the efforts of team leadership and the participating undergraduate and graduate students.

### VEHICLE DESIGN

The Missouri S&T team is designing a cutting-edge hydrogen fuel cell plug-in hybrid electric vehicle (FC PHEV). This technology represents a dramatic transformation of the vehicle's powertrain system. The powertrain consists of a 95 kW polymer electrolyte membrane (PEM) hydrogen fuel cell, coupled with an 80 kW continuous power electric motor that includes regenerative braking. Additional power and range is provided by a 16.1 kWh lithium-ion battery pack.

## NORTH CAROLINA STATE UNIVERSITY

**FACULTY ADVISOR:** Terry Gilbert

**TEAM LEADER:** Ali Seyam

**OUTREACH COORDINATOR:** Divya Ramamurthi

### TEAM DESCRIPTION

The North Carolina State University EcoCAR team is headed by faculty advisor Terry Gilbert and graduate student Ali Seyam, and is comprised of both course credit and volunteer students. Course credit students solve problems that require engineering analysis, while our volunteer force addresses smaller refinements on the vehicle. Outreach efforts are currently headed by Divya Ramamurthi.



### VEHICLE DESIGN

The NC State team is working on an extended-range electric vehicle (EREV) architecture. Major donated components include the GM 101X ETS electric drive motor, a 1.3 L SDE four-cylinder diesel engine from GM, and a cutting-edge prismatic lithium-ion battery from A123 Systems. The team is using B20 biodiesel as the fuel to extend the range of their EREV.



## THE OHIO STATE UNIVERSITY

**FACULTY ADVISORS:** Giorgio Rizzoni and Shawn Midlam-Mohler

**CO-TEAM LEADERS:** Eric Schacht, Beth Bezaire, and John Kruckenberg

**OUTREACH COORDINATORS:** Abbey Underwood and Sarah Jadwin

### TEAM DESCRIPTION

The Ohio State University team is comprised of undergraduate and graduate students divided into

Engineering and Outreach segments. The Engineering segment has Mechanical, Electrical, Controls, and Design subteams and is responsible for vehicle design, construction, and testing. The Outreach segment is an interdisciplinary group responsible for educational and marketing activities.

### VEHICLE DESIGN

The Ohio State University team's vehicle architecture is an extended-range electric vehicle (EREV). The design features a 21.3 kWh lithium-ion battery pack with a 103 kW rear electric machine to provide primary drive power and regenerative braking. In addition, the design utilizes a 1.8 L high-compression engine recalibrated for E85 fuel, coupled with an 82 kW front electric motor/generator via an innovative twin-clutch transmission. This transmission design allows the vehicle to operate in a series or parallel hybrid mode and enables front axle regenerative braking.

## PENNSYLVANIA STATE UNIVERSITY

**FACULTY ADVISORS:** Daniel C. Haworth and Gary Neal

**CO-TEAM LEADERS:** Michael Zahradnik and Max Ripepi

**OUTREACH COORDINATOR:** Allison Lilly

### TEAM DESCRIPTION

The Penn State Advanced Vehicle Team is headed by co-team leaders Michael Zahradnik and Max Ripepi, and consists of four subteams (Mechanical, High Voltage Electronics, Controls, and Outreach). Mechanical is headed by Jason Hopkins; Controls is headed by Michael Grady; and High Voltage Electronics is headed by Brandon Slaney. The Outreach team, led by Allison Lilly, consists of 11 public relations students who are part of Happy Valley Communications, Penn State's student-run public relations firm. The subteams work together to develop the vehicle and are directed through weekly project management meetings.

### VEHICLE DESIGN

Penn State's vehicle architecture is an extended-range electric vehicle (EREV) with an electric range of 30-40 miles. The vehicle uses a 1.3 L GM diesel engine to drive a 75 kW electric generator that produces electricity to charge the energy-dense, air-cooled lithium-ion battery pack. Finally, a 120 kW electronic traction system will be used to propel the vehicle.





## ROSE-HULMAN INSTITUTE OF TECHNOLOGY

**FACULTY ADVISORS:** Zachariah Chambers and Marc Herniter

**TEAM LEADER:** Chad Conway

**OUTREACH COORDINATOR:** Jennifer Spector

### TEAM DESCRIPTION

Rose-Hulman stands apart in the EcoCAR competition because the school focuses on undergraduate engineering and has only a small master's program. Therefore, most of the Rose-Hulman EcoCAR team is made up of undergraduate students. The team is led by Chad Conway, a junior mechanical engineering major. Additional knowledge and insight to the team is given by faculty advisors Dr. Zac Chambers and Dr. Marc Herniter, and GM mentor, Art McGrew. Jon Nibert leads the Electrical team, Patrick Hudson leads the Vehicle Controls team, Ryan Schulten leads the Mechanical team, and Kyle Mason leads the Computer Aided Design team. Outreach is led by Jennifer Spector.

### VEHICLE DESIGN

The Rose-Hulman EcoCAR team's vehicle is an all-wheel drive parallel pre/post transmission hybrid-electric powertrain. A 1.3 L, four-cylinder GM turbodiesel engine rated at 71 kW (95 hp) using B20 biodiesel is assisted by 37 kW (50 hp) TM4 electric motor, both of which are connected to a GM four-speed transmission. A second 37 kW TM4 motor is attached to the rear axle for enhanced vehicle acceleration and regenerative braking. In addition, a custom 11.3 kWh EnerDel lithium-ion battery powers the TM4 motors and offers electrical storage for the regenerative braking. The battery pack can also be charged from any 120 or 240 volt outlet. Finally, the Rose-Hulman EcoCAR vehicle has the capability to run in three different powertrain modes: electric only, diesel only, and hybrid.

## TEXAS TECH

**FACULTY ADVISORS:** Dr. Richard Gale, Dr. Stephen Bayne, and Dr. Tim Maxwell

**TEAM LEADER:** Sam Ceuvas

**OUTREACH COORDINATOR:** Ari Basu

### TEAM DESCRIPTION

Hailing from Lubbock, Texas, the Texas Tech Advanced Vehicle Engineering Team is led by team captain Sam Ceuvas, team coordinator Joey Garnsey, Controls lead Kunal Patil, Mechanical lead Chad Austin, and Electrical co-leads Eddie Hernandez and Bejoy Pushpakaran. The team consists of more than 20 students, a majority of which are undergrads. The advisors are Dr. Richard Gale, Dr. Stephen Bayne, and Dr. Tim Maxwell. The team's Outreach program is led by outreach coordinator Ari Basu. Texas Tech is proud to have competed in the U.S. Department of Energy's Advanced Vehicle Technology Competitions for 22 years.

### TEAM ARCHITECTURE

The Texas Tech parallel hybrid utilizes a 1.6 L GM Europe four-cylinder engine running on E85 ethanol mated to the GM front-wheel drive, two-mode transaxle. The two-mode has four traditional fixed gears and two 55 kW electric motors. The motors are powered by a 330 V, 12.7 kWh A123 Systems battery pack. The battery pack allows the vehicle to use only electric power at low speed and the second electric motor allows the vehicle to be more efficient at highway speed with the engine on. The vehicle also sports Texas Edition badges adding flair to match the Texas flag on the roof.





## UNIVERSITY OF ONTARIO INSTITUTE OF TECHNOLOGY

**FACULTY ADVISOR:** Greg Rohrauer

**CO-TEAM LEADERS:** Gavin Clark and Joseph Brennan

**OUTREACH COORDINATOR:** Lesley McLelland

### TEAM DESCRIPTION

The University of Ontario Institute of Technology (UOIT) EcoCAR team is comprised of four subteams:

Mechanical, Controls, Energy Storage, and Outreach. It includes over 20 students from a variety of engineering disciplines who have collaborated to produce the competition's only full function electric vehicle (FFEV). Co-team leaders Gavin Clark and Joseph Brennan, both currently pursuing their master's degrees in automotive engineering, are the graduate students of faculty advisor Dr. Greg Rohrauer, who has provided his invaluable experience, financial assistance, and expertise throughout the competition. The team's GM mentor, Amanda Kalhous, is a software engineer, who has the gratitude of the team for her continued support and encouragement.

### VEHICLE DESIGN

The UOIT vehicle is the only FFEV in the EcoCAR competition. The vehicle operates solely from an in-house, custom-designed, liquid-cooled energy storage system consisting of 90 Dow Kokam lithium polymer cells. The stored energy capacity is approximately 80 kWh, which gives the vehicle a range of over 200 miles.

## UNIVERSITY OF VICTORIA

**FACULTY ADVISORS:** Curran Crawford and Zuomin Dong

**CO-TEAM LEADERS:** Jeff Waldner and Trevor Davis

**OUTREACH COORDINATOR:** Jason Mayard

### TEAM DESCRIPTION

The University of Victoria's team brings together faculty advisors, undergraduate, and graduate students with a range of interests, backgrounds, skills, and research topics, under the common goal of reducing the environmental impact of today's technologies. A first-time participant in the U.S. Department of Energy's Advanced Vehicle Technology Competitions, the University of Victoria team has shown its dedication to this goal through strong finishes in the first two years of the competition, and the establishment of new and innovative hybrid vehicle research areas and corresponding facilities on campus.

### VEHICLE DESIGN

The University of Victoria's vehicle design is an extended-range electric vehicle (EREV) with 40 miles of all-electric plug-in range provided by a high capacity A123 Systems lithium-ion battery. The use of a GM two-mode power-split transmission and separate rear traction motor also enable AWD functionality. The team's 2.4 L Ecotec engine is flex-fuel capable and can run on E85 for reduced emissions and petroleum use. The flexibility of this design is expected to yield low fuel consumption and emissions, while providing a high level of performance.





## UNIVERSITY OF WATERLOO

**FACULTY ADVISORS:** Michael Fowler, Roydon Fraser, and Steven Waslander

**CO-TEAM LEADERS:** Michael Giannikouris and Carl Chan

**OUTREACH COORDINATORS:** Eric Mallia and Mohanad Elshafie

### TEAM DESCRIPTION

The University of Waterloo Alternative Fuels Team (UWAF.T) is based on a cooperation of Business and Engineering students. Both areas have a managing director which helps to provide direction and student learning opportunities, while also maintaining the interaction between the two groups. Engineering opportunities are divided into Mechanical, Electrical, Controls, and Fuel System Design

streams. Student involvement on the Business team primarily consists of opportunities for activities in community outreach, education, fundraising, media relations, online marketing, and website development.

### VEHICLE DESIGN

UWAF.T's entry into EcoCAR is a fuel cell plug-in hybrid electric vehicle (FC PHEV). The vehicle will have an all-electric mode using battery modules from A123 Systems with grid charging capabilities. This all-electric operation will be blended with a GM hydrogen fuel cell engine that, together with the battery, will power an electric traction system to propel the vehicle.

## UNIVERSITY OF WISCONSIN

**FACULTY ADVISOR:** Glenn Bower

**TEAM LEADER:** Stacey Ley

**OUTREACH COORDINATOR:** Andrea Sotirin

### TEAM DESCRIPTION

The University of Wisconsin Hybrid Vehicle Team is advised by Dr. Glenn Bower and the team is led by Stacey Ley. The team, primarily composed of undergraduate engineering students, is divided into the Mechanical, Electrical, Powertrain, and Business subteams.

### VEHICLE DESIGN

The team's vehicle design is considered an extended-range electric vehicle (EREV). A 60 kW electric motor, coupled with a 750 cc turbocharged Weber engine running E85 fuel, powers the front wheels and also has the capability to generate electricity to recharge the battery pack. Additionally, a 75 kW motor is used to power the rear wheels. The lithium-ion battery pack, donated by Johnson Controls-Saft, is capable of propelling the vehicle approximately 25 miles on full electric power.





## VIRGINIA TECH

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**FACULTY ADVISOR:** Doug Nelson

**CO-TEAM LEADERS:** Patrick Walsh and Lynn Gantt

**OUTREACH COORDINATORS:** Rachel Dobroth and Kaitlyn Redelman

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### TEAM DESCRIPTION

The Hybrid Electric Vehicle Team (HEVT) of Virginia Tech is composed of senior mechanical engineering students and several underclassmen volunteers from different engineering disciplines. The team is divided into three subteams: Controls, Mechanical, and Electrical. The subteams work together to design and implement the vehicle architecture. In addition,

team members are responsible for the outreach, business, and financial aspects of team operations. Outreach and media activities are organized by a team of communication students, who also report to the team leadership. For Year Three of EcoCAR, HEVT worked with the Virginia Tech chapter of Public Relations Student Society of America to recruit the outreach team.

### VEHICLE DESIGN

HEVT has designed, built, and refined a split parallel extended-range electric vehicle (EREV). The vehicle can plug into a standard wall outlet to charge a high energy capacity A123 Systems battery, and run in electric-only mode for more than 65 km (40 miles). Tractive power in electric-only mode is provided by a rear axle-mounted 125 kW UQM permanent magnet electric motor with regenerative braking capability. Once the battery has been depleted, a 2.4 L GM FlexFuel engine provides additional driving range by burning E85 ethanol and driving a multi-speed automatic transmission on the front axle. A second 8 kW MES-DEA electric motor is used as a belted alternator starter to allow for engine idle-stop, electric energy generation, and engine loading.

## WEST VIRGINIA UNIVERSITY

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**FACULTY ADVISOR:** Scott Wayne

**TEAM LEADER:** Zachary Cohen

**OUTREACH COORDINATOR:** Nicholas Cavender

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### TEAM DESCRIPTION

The EcoCAR team at West Virginia University (WVU) consists of 13 enrolled students pursuing degrees in mechanical engineering. The team's Outreach program is run by Nicholas Cavender, a journalism graduate student, and consists of five public relations majors and two marketing students. The WVU Engineering team is led by team captain Zachary Cohen and team radar Nathan Levine. The team is overseen by Dr. Scott Wayne of the Mechanical and Aerospace Engineering Department with the assistance of graduate research assistant Zhenhua Zhu.



### VEHICLE DESIGN

The heart of WVU's vehicle is the GM two-mode electrically variable transmission (EVT), which provides two continuously variable EVT modes and four fixed gear ratios, enabling flexibility to optimize performance efficiency and emissions for a wide range of driving conditions. A fuel efficient 1.3 L, four-cylinder SDE turbodiesel engine rated at 71 kW (95 hp) and 200 N-m (147 ft-lb) peak torque fueled with B20 biodiesel fuel will provide primary propulsion power. Electrical energy storage will be accomplished with a lithium-ion battery pack composed of four 25S2P battery modules from A123 Systems. Simulation results indicate that the vehicle should achieve 6.2 L/100 km (35 mpg) gasoline equivalent, with well-to-wheels (WTW) greenhouse gas (GHG) emissions of approximately 150 g/km and WTW PEU of 0.40 kWh/km.

## HEADLINE SPONSORS



**General Motors** For more than 15 years, General Motors (GM) has joined the U.S. Department of Energy (DOE) to sponsor several successful student engineering competition programs. Most recently, GM and DOE have teamed up as headline sponsors of EcoCAR: The Next Challenge, the latest advanced vehicle technology competition program.

The three-year competition, modeled after the GM global vehicle development process, brings students into the real world of vehicle development and better prepares them to make a faster contribution to the engineering profession and the automotive industry.

Each participating university team is re-engineering a vehicle donated by GM, with three basic goals: reduce energy consumption, decrease emissions, and maintain the performance and utility features of the stock vehicle. For this competition, the teams are also required to emulate the vehicle categories from the California Air Resources Board (CARB) zero emissions vehicle (ZEV) requirements. They are encouraged to explore a variety of technology solutions including electric, hybrid, plug-in hybrid, and fuel cells.

GM donated vehicles to each of the university teams at the end of the first year of the competition. GM also provided each university team with seed money and donated the use of its engineering, testing, and proving ground facilities for student workshops and competitions. Finally, GM provides highly controlled access to its intellectual property as well as engineering staff support and mentoring — including a program manager, team mentors, and event judges—and communications support for the competition series.

**About General Motors:** General Motors, one of the world's largest automakers, traces its roots back to 1908. With its global headquarters in Detroit, GM employs 204,000 people in every major region of the world and does business in some 140 countries. GM and its strategic partners produce cars and trucks in 34 countries, and sell and service these vehicles through the following brands: Buick, Cadillac, Chevrolet, GMC, GM Daewoo, Holden, Opel, Vauxhall, and Wuling. GM's largest national market is the United States, followed by China, Brazil, Germany, the United Kingdom, Canada, and Italy. GM's OnStar subsidiary is the industry leader in vehicle safety, security, and information services. General Motors acquired operations from General Motors Corporation on July 10, 2009, and references to prior periods in this and other press materials refer to operations of the old General Motors Corporation. More information on the new General Motors can be found at [www.gm.com](http://www.gm.com).



U.S. DEPARTMENT OF  
**ENERGY**

**The U.S. Department of Energy**, through Argonne National Laboratory, provides overall competition management, team evaluation, and technical and logistical support for EcoCAR, the premier DOE-sponsored student vehicle competition. U.S. Department of Energy (DOE) launched its student vehicle competition program in 1989 to demonstrate and

test technologies developed in laboratories. By combining the next generation of technical innovators with emerging advanced transportation technologies, the EcoCAR competition helps ensure a sustainable, environmentally responsible transportation future. DOE and its network of national laboratories maintain an aggressive research and development program in advanced vehicle technologies, including fuel cells, energy storage, hybrid systems, advanced materials, alternative fuels, and heat engines. DOE continues to develop new technology to improve vehicle efficiency and lessen our dependence on foreign oil. Through the student vehicle competition program, close to 20,000 students have received hands-on engineering experience and many of them have moved on to take jobs in the automotive industry, bringing with them an understanding of and enthusiasm for advanced vehicle technologies. For more information, visit [www.eere.energy.gov/vehiclesandfuels](http://www.eere.energy.gov/vehiclesandfuels).

# EcoCAR SPONSORS

## DIAMOND SPONSORS



Government  
of Canada

Gouvernement  
du Canada

The **Government of Canada** has been a longtime supporter of the U.S. Department of Energy's Advanced Vehicle Technology Competition program, providing technical and program support for more than 21 competitions over 18 years. EcoCAR underscores the Government of Canada's commitment to addressing greenhouse gas reductions and supporting sustainable energy policies and advanced automotive technologies. Support to EcoCAR is provided by Natural Resources Canada and Transport Canada.

Natural Resources Canada provides knowledge, expertise, and program activities for the sustainable development and use of Canada's natural resources and to support the global competitiveness of its resource and related sectors. This includes energy activities that encompass policy development, market development programs, and international activities in energy efficiency, renewables, transportation technologies, alternative fuels, and conventional fuels. Transport Canada is responsible for transportation policies and programs. It ensures that air, marine, road, and rail transportation are safe, secure, efficient, and environmentally responsible.

## PLATINUM SPONSORS



The **U.S. Environmental Protection Agency's (EPA) Office of Transportation and Air Quality's (OTAQ)**

mission is to reconcile the transportation sector with the environment by advancing clean fuels and technology, and working to promote more liveable communities. OTAQ is responsible for carrying out laws to control air pollution from motor vehicles, engines, and their fuels. Mobile sources include: cars and light trucks, large trucks and buses, farm and construction equipment, lawn and garden equipment, marine engines, aircraft, and locomotives. Activities include: characterizing emissions from mobile sources and related fuels; developing programs for their control, including assessment of the status of control technology and in-use vehicle emissions; carrying out a regulatory compliance program, in coordination with the Office of Enforcement and Compliance Assurance, to ensure adherence of mobile sources to standards; fostering the development of State Motor Vehicle Emissions Inspection and Maintenance Programs; and implementing programs for the integration of clean-fueled vehicles into the market.

The EPA's National Vehicle and Fuel Emissions Laboratory (NVFEL) is part of OTAQ. Established in 1971 shortly after the creation of EPA, NVFEL is located in Ann Arbor, Michigan, and has about 400 employees with staff expertise spanning a variety of technical and public policy fields. The NVFEL provides emission testing services for motor vehicle, heavy-duty engine, and non-road engine programs in support of U.S. EPA-OTAQ rulemakings, enforcement actions, and procedures development. Testing activities include certifying that vehicle and engines meet federal emissions and fuel economy standards, testing vehicles and engines for in-use compliance, and analyzing fuels, fuel additives, and exhaust compounds.

EPA is proud to be a part of the EcoCAR program. We look forward to working with the other sponsors and academic participants to promote and advance the mission of developing energy-efficient and environmentally beneficial technology under the EcoCAR program.

### California Environmental Protection Agency **Air Resources Board**

**California Air Resources Board** California's state legislature established the Air Resources Board in 1967 to protect public health, the economy, and the state's ecological resources through the reduction of air pollution. With the passage of AB 32, the agency must now also develop and implement strategies to reduce greenhouse gas emissions. Since its formation, the ARB has successfully worked with the public, environmental groups, businesses, and local and federal agencies to cooperatively reach our clean air goals. While many problems persist, California now enjoys its cleanest air in more than 50 years.



**A123 Systems** (NASDAQ: AONE) develops and manufactures advanced Nanophosphate<sup>®</sup> lithium ion batteries and energy storage systems for the transportation, electric grid, and commercial market. The company was founded in 2001 based on novel nanoscale technology initially developed at the Massachusetts Institute of Technology and currently employs more than 2,200 people globally.

A123's high-performance Nanophosphate lithium-ion battery technology delivers high power and energy density combined with excellent safety performance and extensive life cycling in a lighter-weight, compact package. A123's growing list of blue-chip customers in the automotive market includes leading passenger car makers (including Fisker Automotive, GM, and SAIC, the largest automaker in China) as well as companies focused on the truck/bus market (including Eaton, Navistar, and BAE Systems).

# EcoCAR SPONSORS

**dSPACE** **dSPACE, Inc.** is a market innovator and leading producer of engineering tools for embedded controller development. We provide integrated systems for prototyping control algorithms, automatic production code generation, controller testing, controller calibration, and engineering support services. We look forward to participating in the EcoCAR competition as an opportunity to empower student engineers to quickly develop innovative solutions to the challenges of reduced emissions, increased performance, and driver satisfaction. Our robust and comprehensive ECU development environment can dramatically reduce development time and costs, while providing increased flexibility for continuous process modifications. Today, more than 15,000 dSPACE systems are in use worldwide, serving customers in the automotive, aerospace, commercial/off-highway, agricultural, educational, engineering, robotics, and noise and vibration industries. Visit [www.dspaceinc.com](http://www.dspaceinc.com) for more information.

**NATIONAL INSTRUMENTS** **National Instruments** For 30 years, National Instruments (NI) has been a technology pioneer and leader in virtual instrumentation—a revolutionary concept that has changed the way engineers and scientists in industry, government, and academia approach measurement and automation. Leveraging PCs and commercial technologies, virtual instrumentation increases productivity and lowers costs for test, control, and design applications through easy-to-integrate software, such as NI LabVIEW, and modular measurement and control hardware for PXI, PCI, PCI Express, USB, and Ethernet. Headquartered in Austin, Texas, NI has more than 4,500 employees and direct operations in over 40 countries. For the past 11 years, FORTUNE magazine has named NI one of the 100 best companies to work for in America. In addition to providing an NI application engineer advisor to each team for product support and expertise through all phases of the competition, NI has also donated more than \$750,000 in software, hardware, and training products to participating teams. Through its support of the EcoCAR competition, NI continues its commitment to education by providing tomorrow's engineering leaders with tools to be successful today and in the future.

**MathWorks** **MathWorks** The MATLAB and Simulink product families are fundamental computational tools at the world's educational institutions. Adopted by more than 5,000 universities and colleges, MathWorks products accelerate the pace of learning,

teaching, and research in engineering and science. MathWorks products also help prepare students for careers in industry, where the tools are widely used for research and development. MATLAB and Simulink users are making better and faster progress in vital areas. Using techniques like Model-Based Design they are changing how systems as diverse as automobiles, cell phones, robots, washing machines, and wind turbines are developed. Mathematical models, formerly the province of research, are now used to analyze, design, implement, and test these increasingly complex systems, addressing the competitive need to innovate while reducing development costs and time-to-market. In education, these same approaches are providing students with a stronger systems perspective, while enabling more engaging and hands-on learning.

**Freescale Semiconductor** is a global leader in the design and manufacture of embedded semiconductors for the automotive, consumer, industrial, and networking markets. The privately held company is based in Austin, Texas, and has design, research and development, manufacturing, and sales operations around the world. For more information, visit [www.freescale.com](http://www.freescale.com).

**AVL Powertrain Engineering** is the world's largest privately owned and independent company for the development of gasoline, diesel, and alternative fuel powertrain systems, as well as fuel cell and hybrid technologies. For more than 60 years, AVL has been active in the development of engines and powertrains providing low fuel consumption. Powertrain Engineering activities embrace all functions from concept definition through to production development. Supported by comprehensive in-house research, AVL's engineering specialists design and develop engines for both stationary and mobile applications, transmissions, and complete powertrain systems.

The company offers combined solutions of powertrain engineering, simulation software, and testing and instrumentation systems. AVL guarantees close cooperation with customers by affiliates and local offices worldwide. AVL's North American headquarters is located in the Detroit suburb of Plymouth, Michigan.

By supporting EcoCAR, AVL is proving its commitment to the future of our industry with the ongoing, hands-on education of tomorrow's engineers and leaders. For more information, visit [www.avl.com](http://www.avl.com).

# EcoCAR SPONSORS

## GOLD SPONSORS



U.S. Department of Energy

**Clean Cities** is part of the Vehicle Technologies Program in the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy. Clean Cities strives to advance the nation's energy, environmental, and economic security by supporting local decisions to reduce our dependence on imported petroleum. Clean Cities has a network of approximately 90 volunteer coalitions, which develop public/private partnerships to promote alternative fuels and advanced vehicle technologies, such as electric drive vehicles, and other petroleum reduction practices, such as idle reduction technologies and fuel economy initiatives.

The Clean Cities program is funding the EcoCAR outreach coordinators fellowship. This presents a great opportunity for graduate students to participate in the EcoCAR marketing efforts and support their local Clean Cities coalitions through summer internship programs, while working toward their degrees.



**National Science Foundation** The National Science Foundation (NSF) is a longtime supporter of the U.S. Department of Energy's Advanced Vehicle Technology Competitions. In addition to providing financial support to EcoCAR, each year the NSF provides two \$10,000 awards to faculty members who have made significant contributions to the goals of the EcoCAR program and to engineering education. This year will be the 10th year for the outstanding faculty advisor(s) award sponsored by NSF. NSF is an independent federal agency that supports fundamental research and education across all fields of science and engineering, with an annual budget of approximately \$6.5 billion in fiscal year 2009. NSF funds reach all 50 states through grants and cooperative agreements to nearly 2,000 universities and institutions. Each year, NSF receives about 55,600 competitive requests for funding, and makes about 13,000 new funding awards. The NSF also awards over \$425 million in professional and service contracts yearly.

**WOODWARD** **Woodward** is an electronic system integrator and a leader in the application of code generation onto the production controller. Woodward is the supplier of MotoHawk® model-based software development tools used by many EcoCAR teams. Woodward's MotoHawk Control Solutions product line supplies electronic systems, tools, and controller hardware to the industrial, power generation, automotive, marine, recreational, and aviation industries. Woodward enables its customers to be electronic system integrators using tools including MotoHawk® for the following applications: Gasoline Engine and Transmission

Control, Diesel Engine/Emissions Control, Hydraulic Hybrid, Electric Hybrids/Plug-In Electric, Integration—Multiplexing/CAN Based Control, Chassis—Hydraulics control, Autonomous Vehicles and Small Engine EFI.



**BOSCH**

**The Bosch Group** is a leading global supplier of technology and services.

In the U.S., Canada, and Mexico, the Bosch Group manufactures and markets automotive original equipment and aftermarket products, industrial drives and control technology, power tools, security and communication systems, thermotechnology, packaging technology, household appliances, solar energy, and healthcare products. Having established a regional presence in 1906, Bosch employs over 20,000 associates in more than 70 locations, with reported sales of \$7.3 billion in fiscal 2009.

Bosch's involvement in EcoCAR mirrors our future and results focus by fostering the development of future engineering talent. Additionally, Bosch associates come from an extremely wide range of countries. This diversity is an ideal chance for the company and its associates alike to learn from other cultures and benefit from the wealth of perspectives and ideas. Bosch is sponsoring an EcoCAR Diversity Award to encourage EcoCAR teams to similarly embrace and learn from the diversity within teams and the community. For more information on the company, visit [www.boschusa.com](http://www.boschusa.com).



**Sensors, Inc.** Since 1969, Sensors has built a worldwide reputation in the design and manufacture of high-quality emissions analyzers. Today, we are the leading manufacturer of laboratory grade, in-use emissions test systems. Using proprietary analytical techniques, Sensors' SEMTECH range of products accurately measure all criteria pollutants emitted by internal combustion engines, whether generated in a test cell, on the production line or under real-world operating conditions.

Sensors' Testing Services team puts SEMTECH equipment to use every day. Conversant in worldwide emissions regulations and with over a decade of experience in in-use emissions testing, the team is uniquely qualified to handle a broad range of testing needs. The team conducts regulatory compliance testing and reporting and undertakes performance evaluations to support the development of engines, vehicles, non-road equipment, and fuels.

Today, Sensors' SEMTECH emission measurement solutions are deployed worldwide for the measurement of CO, CO<sub>2</sub>, NO, NO<sub>2</sub>, THC, NMHC, O<sub>2</sub> and particulate mass. Sensors' customer base includes regulatory agencies in the U.S., Europe, and Asia, as well as by engine and vehicle manufacturers and their sub-system suppliers.

## SILVER SPONSORS

**Snap-on.** **Snap-on Incorporated** To know Snap-on® tools is to love Snap-on tools. The Snap-on family of brands offers a broad range of products that are considered treasured objects by a wide variety of professional tool users. That's because associates in our company are obsessed with innovation. Never satisfied, Snap-on's designers, engineers, and product managers are continuously looking for ways to improve the company's products.

Snap-on Incorporated is a leading global producer and distributor of tool, diagnostics, shop equipment, and software solutions to the marketplace. All the brands in the Snap-on family are known for the highest possible quality and breakthrough innovation. Customers include professionals in transportation repair, industrial companies, government, education, agriculture, and other commercial industries.



**Magna E-Car/Magna Powertrain** Magna is the most diversified automotive supplier in the world. We design, develop, and manufacture technologically advanced automotive systems, assemblies, modules, and components, and engineer and assemble complete vehicles, primarily for manufacturers of cars and light trucks. As an organization that values teamwork, innovation, and the entrepreneurial spirit, we are proud to sponsor the EcoCAR competition and the talented engineering students who participate.

**vector** **Vector CANtech, Inc.**, located in Novi, Michigan, was established in 1997 as a wholly owned North American subsidiary of Vector Informatik GmbH. Vector is the leading provider of software tools, embedded software components, and services to OEMs, their suppliers, and various other industries. Vector tools equip engineers with the finest capabilities for design, diagnostics, calibration, and testing of distributed networking systems. Parent company Vector Informatik GmbH was founded in 1988 and currently employs over 900 people together with Vector Consulting GmbH. In addition to its headquarters in Stuttgart, Germany, Vector also has an international presence with subsidiaries in the U.S., Japan, France, United Kingdom, Sweden, and the Republic of Korea.

Vector is proud to sponsor EcoCAR: The NeXt Challenge and programs that benefit universities and future engineers. For over 10 years, Vector has been committed to providing students and faculty access to our premium in-vehicle networking tools: CANoe, CANalyzer, and CANape. To learn more about the Vector story, please visit us at [www.vector.com](http://www.vector.com).

## BRONZE SPONSORS

**PROTEC FUEL** **Protec Fuel** is one of the largest and most diverse suppliers of E85 in the United States. Headquartered in Boca Raton, Florida, Protec Fuel provides comprehensive alternative fuel management and supply programs for E85 and E10 as well as other types of transportation fuel. Protec Fuel also provides turnkey services, expertise, and equipment for E85 stations including dispenser conversions, new dispensers, tanks, and piping; and the development of fleet and retail customers.

**SIEMENS** **Siemens PLM Software**, a business unit of the Siemens Industry Automation Division, is a leading global provider of product lifecycle management (PLM) software and services, with 6.7 million licensed seats and more than 69,500 customers worldwide. Headquartered in Plano, Texas, Siemens PLM Software works collaboratively with companies to deliver open solutions that help them turn more ideas into successful products. For more information on Siemens PLM Software products and services, visit [www.siemens.com/plm](http://www.siemens.com/plm).

**EPRI** | ELECTRIC POWER RESEARCH INSTITUTE **The Electric Power Research Institute, Inc. (EPRI)** conducts research and development relating to the generation, delivery, and use of electricity for the benefit of the public. An independent, nonprofit organization, EPRI brings together its scientists and engineers as well as experts from academia and industry to help address challenges in electricity, including reliability, efficiency, health, safety, and the environment. EPRI also provides technology, policy, and economic analyses to drive long-range research and development planning, and supports research in emerging technologies. EPRI's members represent more than 90 percent of the electricity generated and delivered in the United States, and international participation extends to 40 countries. EPRI's principal offices and laboratories are located in Palo Alto, California; Charlotte, North Carolina; Knoxville, Tennessee; and Lenox, Massachusetts.

# EcoCAR SPONSORS

**DELPHI** The Delphi Foundation is the independent, charitable foundation established by Delphi Corporation. Delphi is a leading global supplier of electronics and technologies for automotive, commercial vehicle, and other market segments. Operating major technical centers, manufacturing sites, and customer support facilities in 30 countries, Delphi delivers real-world innovations that make products smarter and safer as well as more powerful and efficient. Connect to innovation at [www.delphi.com](http://www.delphi.com).



**EcoMotors** “Clean, Efficient and Lightweight Propulsion Systems for a Better World” is the essence of our mission, as well as of our passion. EcoMotors’ journey comprises the quest for ever-greater power density, and the enabling of globally relevant applications of our technologies.



### Women in the Winner's Circle Foundation

Founded in 1994 by Lyn St. James, the Women in the Winner's Circle Foundation is a 501(c)(3) organization that focuses on worldwide activities and programs for driver development, advocacy, diversity, and education, particularly for women who aspire to become race car drivers. The Foundation is dedicated to making a difference and reaching the point in time when “opportunity” and “diversity” are no longer concerns—they are taken for granted.

The Foundation’s mission is to provide leadership, vision, resources, and financial support to help create an environment of opportunity for women’s growth in the automotive and competitive motorsports fields.



**igus**®. Young Engineers Support (Y.E.S.) Program offers product donations to students and educators for use in design competitions, school projects, and engineering curriculums. Through the Y.E.S. Program, students can use free Energy Chain® cable carriers, Chainflex® continuous-flex cables, iglide® plastic bearings, igubal® spherical bearings, and DryLin® linear bearings and slides. For information, visit [www.igus.com/yesprogram](http://www.igus.com/yesprogram). To learn more about igus®, visit [www.igus.com](http://www.igus.com).



**CarSim** simulates the dynamic behavior of race cars, passenger cars, light trucks, and utility vehicles. CarSim animates simulated tests and outputs over 700 calculated variables to plot and analyze, or export to other software such as MATLAB, Excel, and optimization tools. CarSim is a real-time driving simulator from Mechanical Simulation Corporation, a technology leader in the development and distribution of advanced software used to simulate vehicle performance under a wide variety of conditions. The Ann Arbor, Michigan, company was established in 1996 to provide car, truck, and motorcycle simulation and hardware-in-the-loop (HIL) systems to more than 50 vehicle OEMs, 80 Tier 1 suppliers, and over 120 universities and government research groups worldwide. The company also develops engineering quality driving simulators with fixed-base and six DOF motion platforms. For more information, visit [www.carsim.com](http://www.carsim.com).



**XM Radio** SIRIUS XM Radio is America’s satellite radio company delivering to subscribers commercial-free music channels, premier sports, news, talk, entertainment, and traffic and weather. SIRIUS XM Radio has content relationships with an array of personalities and artists. SIRIUS XM Radio is the leader in sports programming as the official satellite radio partner of the NFL®, MLB®, NASCAR®, NBA®, NHL®, PGA TOUR®, and major college sports.

SIRIUS XM Radio has arrangements with every major automaker. SIRIUS XM Radio also offers SIRIUS Backseat TV, the first ever live in-vehicle rear seat entertainment featuring Nickelodeon, Disney Channel, and Cartoon Network; XM NavTraffic® service for GPS navigation systems delivers real-time traffic information, including accidents and road construction, for more than 80 North American markets.



**OnStar**, a wholly owned subsidiary of General Motors, is the leading provider of connected safety and security solutions, value-added mobility services, and advanced information technology. Currently available on more than 40 2011 GM models, OnStar soon will be available for installation on most other vehicles already on the road through local electronics retailers, including Best Buy. OnStar safely connects its more than six million subscribers, in the U.S., Canada, and China, in ways never thought possible. OnStar Stolen Vehicle Slowdown is a recipient of the 2010 Edison Award for Best New Product in the technology category. More information about OnStar can be found at [www.onstar.com](http://www.onstar.com).

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- Michigan Technological University
- Mississippi State University
- Missouri University of Science and Technology
- North Carolina State University
- The Ohio State University
- Pennsylvania State University
- Rose-Hulman Institute of Technology
- Texas Tech University
- University of Ontario Institute of Technology
- University of Victoria
- University of Waterloo
- University of Wisconsin
- Virginia Tech
- West Virginia University

### ADVANCED VEHICLE TECHNOLOGY COMPETITIONS



This competition year marks the 22nd anniversary the U.S. Department of Energy has sponsored Advanced Vehicle Technology Competitions (AVTC) through Argonne National Laboratory.

Over the past two decades, more than 45 competitions have been held with more than 85 participating universities for more than 15,000 students.

The AVTC program is seeding the automotive industry with thousands of engineering graduates with real-world experience, better preparing them for the transportation and energy-related challenges of the 21st century.

#### KRISTEN DE LA ROSA

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NORTH AMERICA'S PREMIER COLLEGIATE  
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