1996 FUTURECAR CHALLENGE

JUNE 17-24, 1996 DEARBORN, MICHIGAN

California State University, Northridge
Concordia University
Lawrence Technological University
Michigan Technological University
Ohio State University
University of California, Davis
University of Illinois at Chicago
University of Maryland
University of Michigan
University of Wisconsin, Madison
Virginia Tech
West Virginia University

THE VICE PRESIDENT
WASHINGTON

May 7, 1996

Dear Friends:

I am pleased to have this opportunity to welcome all of the student teams competing in the FutureCar Challenge.

As you embark on the most ambitious student vehicle competition to date, you can take great pride in the contributions made by all the university teams. You are stimulating our thinking to look beyond conventional automotive approaches, and you are playing a key role in developing and demonstrating the Partnership for a New Generation of Vehicles' automotive technologies that will carry us into the 21st Century. I feel strongly that the Partnership for a New Generation of Vehicles and other research efforts like the FutureCar Challenge will change the future of transportation.

The FutureCar Challenge is more than a competition. It is a collaboration that brings together the brightest minds of government, industry, and academia in an effort to "reinvent" the American automobile. The FutureCar Challenge will move us closer to the Supercar that is the goal of the Partnership for a New Generation of Vehicles. This Supercar will not only deliver exceptional fuel economy but, on a larger scale, will also help create a stronger, more robust domestic economy, improved international competitiveness, and a cleaner environment.

When all is said and done, everyone involved in the FutureCar Challenge will have won. Industry and government will gain greater insight into strategies and technologies that are just now becoming available for use in the automobile of the future. All of you participating in the Future-Car Challenge will get a premier education--practical engineering experience and exposure to state-of-the-art vehicle technologies, combined with skills in teamwork, management, business and leadership. You will be a talented resource for America's future corporate and government work force.

I am proud of the ingenuity and engineering skills you are demonstrating in the FutureCar Challenge. I wish you each success in the competition and beyond, as you take your places among the future leaders of the automotive industry.

Sincerely,

Al Gore

AG/lll

The **1996 FutureCar Challenge** is a student engineering competition cosponsored by the U.S. Department of Energy (DOE) and the U.S. Council for Automotive Research (USCAR), a joint research effort between Chrysler, Ford, and GM. The sponsors have encouraged the 12 participating universities to use the most advanced vehicle technologies to design a mid-size vehicle which approaches 80 miles per gallon (mpg) while still offering the same comfort, safety, and affordability that consumers expect from conventional vehicles.

The FutureCar Challenge is the first student vehicle competition co-sponsored simultaneously by all major U.S. auto manufacturers and DOE. The goals of the competition mirror those set by the Partnership for a New Generation of Vehicle (PNGV) (see page 3). Students from a variety of disciplines, including engineering, computer science, business, and communications will work together in vehicle development teams. Beginning with a conventional Lumina, Intrepid, or Taurus, each university team will make whatever modifications are necessary to approach 80 mpg. Most teams will make dramatic changes to the powertrain, add energy storage capability, and improve aerodynamics.

Safety, energy efficiency, improved emissions characteristics, affordability, and the use of advanced technologies are the cornerstones of the FutureCar Challenge.

The teams will compete in a series of dynamic and static events at the Ford Proving Grounds in Dearborn, Michigan. Emissions testing and fuel economy assessment will take place at the U.S. Environmental Protection Agency (EPA) National Vehicle and Fuel Laboratory in Ann Arbor. The teams will then embark on an over-the-road range event around the Detroit area.

At the conclusion of the competition events, awards will be presented at a ceremony at the historic Henry Ford Museum in Dearborn, MI.

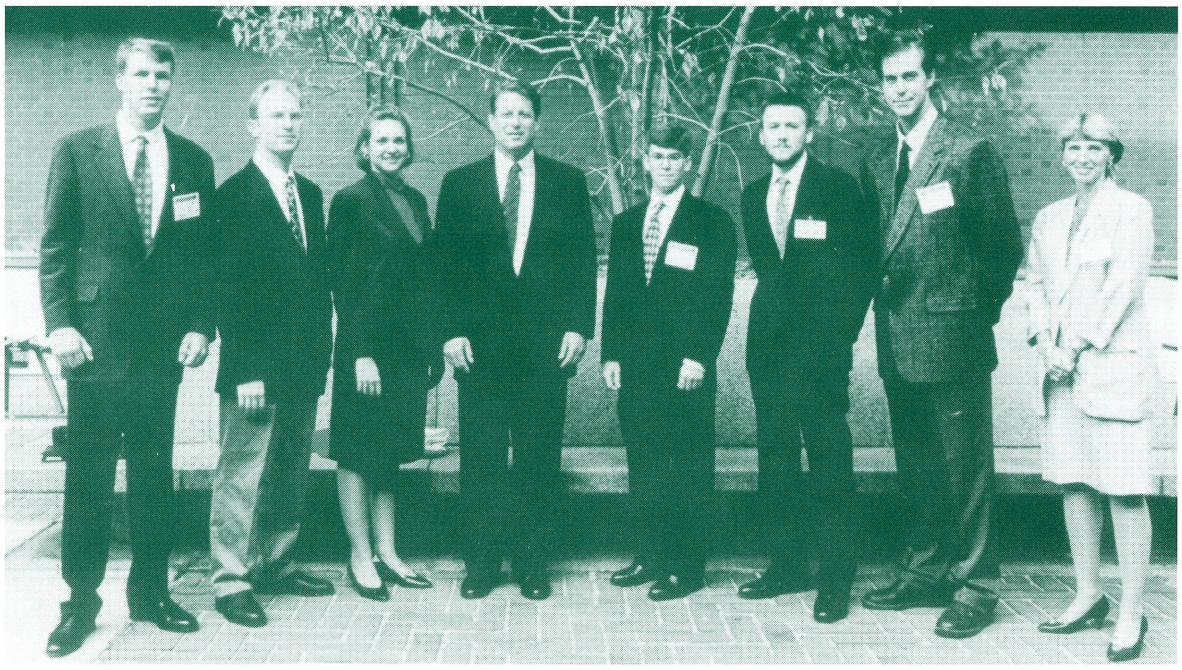
What is. . .

PNGV SM

Partnership for a New Generation of Vehicle?

Announced in September 1993 by President Clinton, Vice President Gore, and the CEOs of Chrysler, Ford, and General Motors, PNGV is a partnership between the U.S. Federal government and the nation's major automobile manufacturers. This historic government/industry partnership also includes research support from scientists and engineers at universities, automotive suppliers, and small businesses. PNGV aligns ongoing government research that supports each agency's core mission with efforts to achieve important national goals:

- Significantly improve U.S. competitiveness in manufacturing;
- Apply commercially viable innovations to conventional vehicles; and
- Develop technologies for vehicles that will achieve up to 80 miles per gallon while maintaining performance, safety and affordability.



FutureCar team members meet Vice President Gore prior to the 4th PNGV Symposium.

From left to right: Derek Kilmer, UC-Davis; Patrick McGuire, Univ. of WI; Lauren Sommershoe, Univ of MI; V.P. Gore; Doug Rowse, Univ of MD; Nigel Janes, Ohio State; Shawn White, Cal State-Northridge; Shelley Launey, DOE.

1996 FUTURECAR challenge

Key Sponsors

U.S. Department of Energy (DOE)

The Department of Energy has an aggressive R&D program in advanced vehicle technologies. DOE and its network of national laboratories support work in propulsion systems, advanced materials, alternative fuels, and heat engines. As a corollary, DOE has been sponsoring student vehicle competitions since 1989. These competitions are an effective way to demonstrate and test the technologies developed in the laboratory. Over 13,000 students have received hands-on engineering experience in these competitions. Many of these students move on to take jobs in the automobile industry, bringing with them an understanding of and enthusiasm for these technologies.

United States Council for Automotive Research (USCAR)

USCAR is an organization formed by Chrysler, Ford, and General Motors to strengthen the technology base of the domestic auto industry through cooperative precompetitive research. Collective research-and-development work among the three companies has been underway since 1988. USCAR was formed in 1992 to help coordinate administrative and information services for the companies' existing and future research consortia devoted to tackling shared technological and environmental concerns.

1996 FUTURECAR challenge

Other Sponsors

EPA

LEAR CORPORATION

UNITED TECHNOLOGIES AUTOMOTIVE

E.V. Racing

GOODYEAR

AlliedSignal AUTOMOTIVE

Aknowledgements:

Argonne National Laboratory

National Renewable Energy Laboratory

American Society for Engineering Education

1996 FUTURECAR challenge

Competition Schedule

Monday, June 17

The teams arrive and register their vehicles for the competition at the Mechanic's Lot at Ford facilities in Dearborn, MI. **Vehicle inspections** take place throughout the day beginning at 11:00 a.m. The **safety meeting** starts at 7:00 p.m. for all FutureCar participants. After the safety meeting, everyone is invited to join in on the **skit presentations**!

Competition Points

EVENTS		TOTAL POINTS POSSIBLE
ENERGY ECONOMY		**250**
City	150	
Highway	100	
EMISSIONS		**150**
ENDURANCE		**100**
ACCELERATON		**100**
HANDLING		**50**
CONSUMER ACCEPTABILITY		**150**
Static	50	
Dynamic	100	
DESIGN		**250**
Technical Report	100	
Quality/Execution	50	
Application of Advanced Technology	100	
Manufacturing Potential/Cost	Special award	
READINESS POINTS		**50**
Pre-Competition Inspection	15	
Competition Readiness	35	
TOTAL POINTS		**1,100**

Tuesday, June 18

The FutureCar Challenge will be open to friends, family, sponsors and other interested parties from noon to 8 pm. This is an opportunity to view the vehicles and talk to the teams as they make last minute changes.

Vehicles are expected to finish up **inspections** during the day. All of the vehicles must go through and pass **qualifying inspections** held at the Mechanic's Lot and at the Dearborn Proving Grounds (DPG) before participating in any dynamic events.

The sponsors and organizers will kick off the 1996 FutureCar Challenge at an **Opening Ceremony** at 6:00p.m.

Wednesday, June 19

The events take place concurrently starting at 8:00 a.m. in the morning. The teams will give oral presentations to groups of judges during three separate events: **Quality and Execution Review, Application of Advanced Technology Review,** and **Manufacturing Potential and Cost Review**.The design events are the first group of scored events to take place at the competition. When the vehicles are not in the Quality and Execution Review they are participating in the **coast down testing** at DPG. Most of the vehicles are then prepped and transported to EPA, Ann Arbor at the end of the day.

Thursday, June 20 and Friday, June 21

All of the vehicles go through extensive **emissions and fuel economy testing** at the EPA facility during these two days. The hybrid vehicles must go through multiple tests to account for electric-only capability for emissions and fuel economy. Non-hybrids are tested on the standard FTP and Highway Fuel Economy Tests.

Saturday, June 22

The teams and the vehicles return to the Dearborn Proving Grounds for dynamic events that start at 9:00 a.m. and go throughout the day. In the **Acceleration Event** vehicles run the 1/8th mile for the fastest time. The vehicles then participate in a solo autocross called the **Handling Event**. Finally, the teams, with their vehicles, participate in a two-part event called the **Consumer Acceptability Review**. In the dynamic portion of the event, a professional driver evaluates the vehicle performance (road noise, acceleration, ease of shifting, etc.) on a specified course. In the static portion of the event, a team of judges evaluates each vehicle on specific items such as seating comfort, driver egress, instrumentation, luggage capability, etc.

Sunday, June 23

The teams participate in the **Centennial Parade** that is part of the festivities recognizing 100 years of the U.S. automobile industry. The parade begins in Detroit and ends at the Michigan State Fairgrounds.

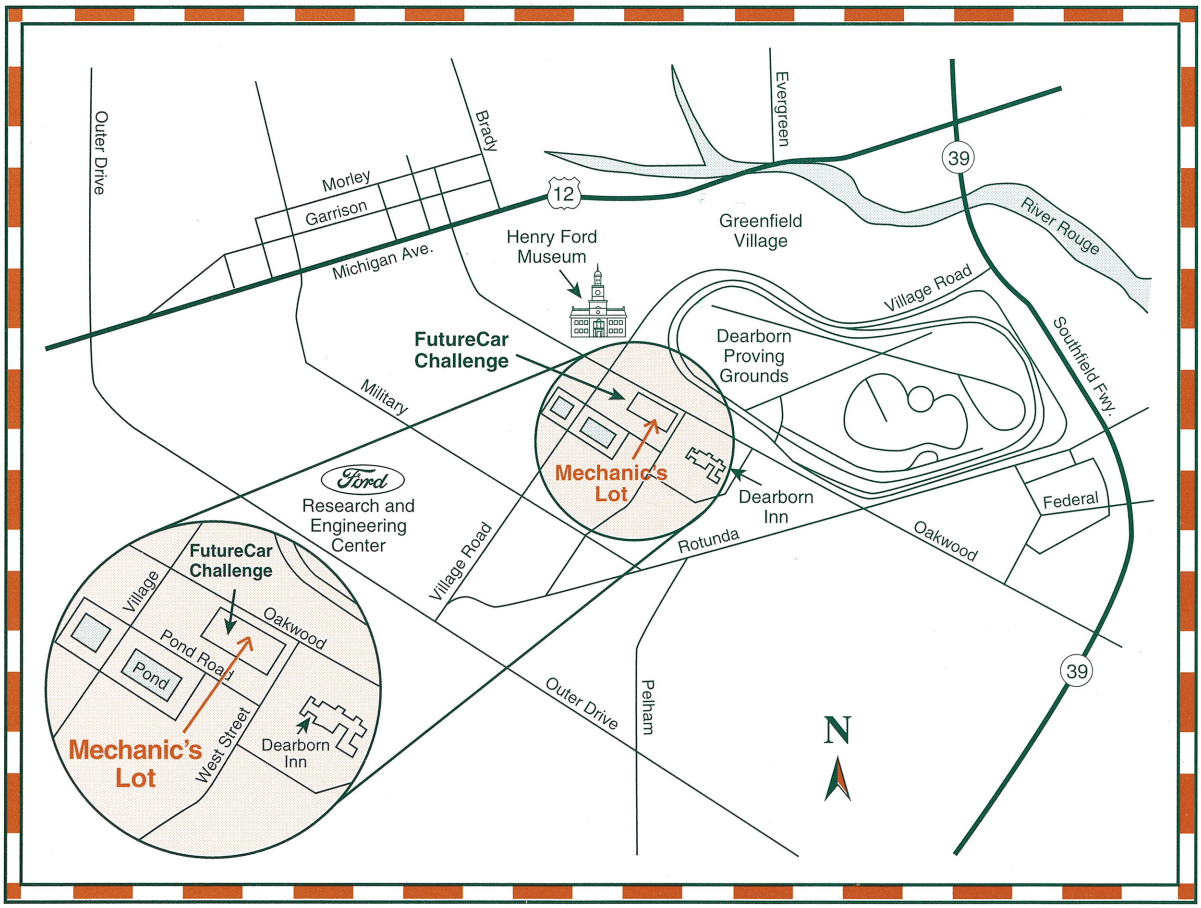
Monday, June 24

The **Endurance Event** starts out at Ford in Dearborn beginning at 8:00 a.m. The cars travel a 48-mile loop through the suburbs of Dearborn and head back to Ford by mid-morning (see page 6). The cars are regrouped before heading out on a second 48-mile route after the mid-morning stop. The cars end up at the Ford Dearborn Proving Ground in the early afternoon and finish up the event with laps on the Proving Ground track.

At 2:30p.m. is the **Executive Technology Review** where industry and government executives are invited to provide feedback to the top scoring teams on their design strategies and performance.

The competition wraps up with the **Awards Banquet** at the Henry Ford Museum at 6:00 p.m.

The 1996 FutureCar Challenge debuts at the Ford facilities in Dearborn, MI.



Meet the Teams

University of Maryland
at College Park

Team Leaders: Summer L. Gilbert,
Douglas G. Rowse

Faculty Advisor: Dr. David Holloway

Team Members: Arun Arumugaswamy, Michael Baker, Colin Bell, Harry Blake, Cherie Bulala, Jason Calderwood, Angela Choy, Scott Cooper, David Deik, Ron Denton, Boyd Despard, David Diller, James Driessen, Jonathan Eubank, Ian Evans, Jason Fishell, Matt Galleli, Summer Gilbert, Greg Harriot,Kiera Harris, Steve Hess, Andrew Huo, Bill Lawson, Jon Lee, Tina LeMarier, Chander Magoon, George Martin, Don Mase, Joseph McGinnity, Steve Mummey, Joey Newhouse, Steven NoE, Chris Olsen, Micah Reese, Chad Reithmeier, Miguel Rodas, Al Romack, Doug Rowse, Mayette SanJuan, Steve Shin, Dan Sosnosky, Harold Thomas, Ryan Vaughan, Susan Winters, Christina Wu, Daniel Yen

Vehicle Strategy: The University of Maryland FutureCar converted a Dodge Intrepid to a charge-sustaining, series hybrid electric vehicle with passive vehicle controls. Power to the 75kW traction motor is supplied by a 324V lead-tin battery pack. When the batteries reach a low state-of-charge, the ethanol-fueled 1.0 liter Geo (3 cycle) engine turns on and runs at its most efficient point, producing the required traction power and recharging the battery pack when excess power is available.

Concordia University

Vehicle Name: Dodge Re-Charger

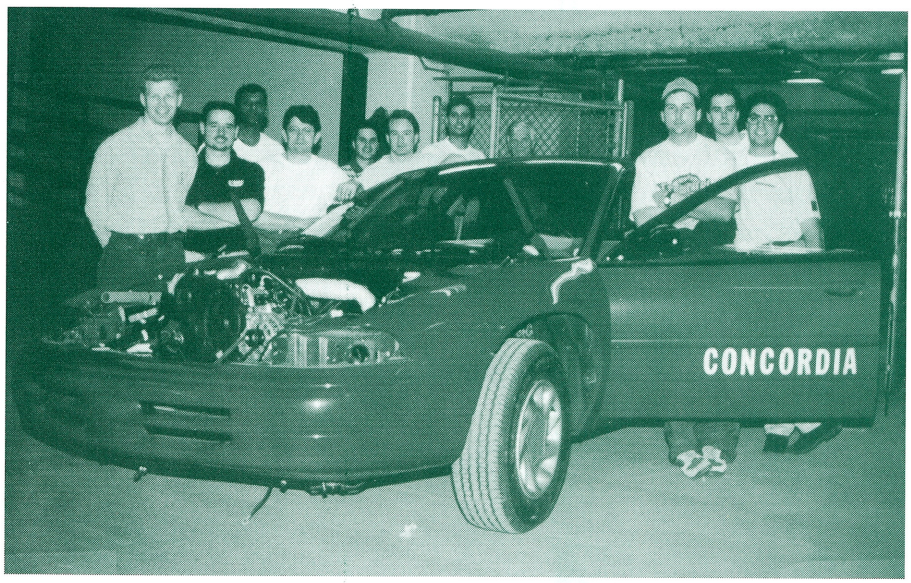
Team Leader: George Metrakos

Faculty Advisors: Dr. T. Krepec
Henry Hong

Team Members: Robert Caldwell, Luciano Martin, Reza Kazemi, Mohsen Zabiholahizaden, Douglas Monahan, Clement George, Federico Polidori, Anil Adinarayanareddy, Anthony Mainella, John Theofanopoulos, Achilles Nickopoulos, Michael Francioni, Ian Olthot, Brendan Montour, Brian Cooper.

Vehicle Strategy: Concordia University has converted a Dodge Intrepid to achieve low energy consumption and pollutant emission. Our strategy is as follows:

1. An efficient, direct injected, turbocharged and intercooled diesel engine with low pollutant emission coupled to the stock automatic transmission will be used as the main powerplant to minimize the energy consumption.
2. An efficient permanent magnet electric DC motor with electricity regeneration capability will be used as an auxiliary powerplant and also to recuperate the kinetic energy of the vehicle during deceleration and down hill driving, and to reduce the energy dissipated through braking.
3. The most efficient tires will be used with rolling resistance half that of conventional tires.
4. Special lubricant additives will be used to increase the mechanical efficiency of the powertrain.
5. To minimize the fuel consumption and NOx emissions, the engine will be run mainly at low speed and low temperature.
6. An oxidation catalytic converter will be used to reduce the CO and HC pollutant content.



University of Michigan

Team Leaders:
Heather Beaudoin
Brian Bishop
Janet Booth
Enrico Cacanindin
Sue Goryl
Dan Griffin
Jim Kane
Bala Krishnaraj
Rod Mach
Bryan Simmons
Carlene Slis

Faculty Advisors:
Prof. Ann Marie Sastry
Prof. Mehrdad Haghi
Dr. Tom Gillespie

Team Members: Ankur Agarwal, John Anthony, Max Bajcz, Dave Baker, Fred Barrigar, Josh Bretz, Ben Croy, Elizabeth Daugavietis, Duane DeMore, Jeff Falk, Marc Galli, Will Gorton, Nathan Hansen, Hasdi Hashim, Scott Henry, Ryan Hiligan, Jermel Holman, Spencer Hooks, Scott Jackson, Jin Kim, James Kovacs, Eileen Kuet, Linda Kuet, Steve Laux, Dan Lawrence, Jason Luke, Andy Mast, Stephanie Molnar,Scott Padilia, Mike Patrizi, Eric Pollmann, Erik Ranka, Bill Rimkus, Alex Sammut, Rahul Sharma, Mike Socks, Lauren Somershoe, Dave Vanspybrook, Marc Villella, Sarah Wasageshik.

Vehicle Strategy: University of Michigan is converting a Ford Taurus to a parallel configuration utilizing a highly efficient 1.9L turbo direct-inject diesel engine, as well as two 10.1KW electric motors powered by a NiCad battery pack. This configuration allows the vehicle to regain energy from braking while maintaining current consumer expectations of drivetrain power and handling.

California State University—
Northridge

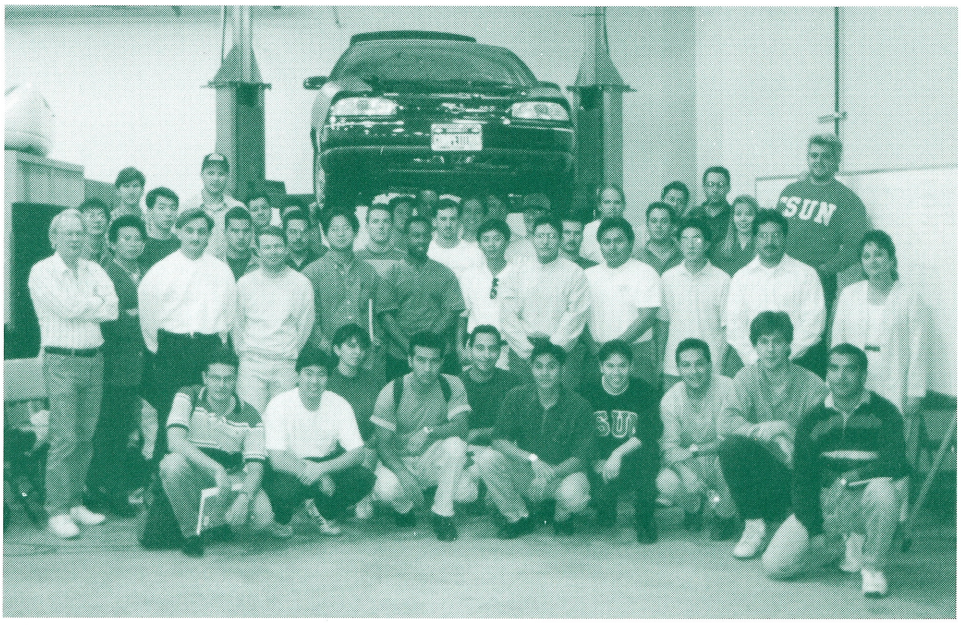
Team Leader: Shawn White

Faculty Advisor: Dr. Tim Fox

TeamMembers: **Mechanical Engineering:** Edson 'Bob' Campos, Douglas Ades, Oren Benami, Ivan Cazares, Glenn Ennis, Geoffrey Greenberg, Bertha Hernandez, Kathryn Henkel, Charles Glass, Albert Sicam, Michael Lawrence, Dominic Gallardo, Todd Diamond, Monir Beria, Ing Lu, Victor Lopez, Simon Chavez, Heberto Barajas, Andrew Wallace, Andrew Larosa, Teri Shank, Jerome 'Jay' Masikat, Alex Gutnik, Gerry Iglecia, Kuen-Wu Hsu, Curtis Krizer, Tam Le, Khanh Hoang, Jose Palacios, Keeweon Lee, Joseph Gerges, Ben Paul, Cameron Brenner, Ghassan Sakakine, Ziad Nakhoul, Gustavo Vargas Masaru Kent Kawai, Saeed Khan, Mario delgado, Dave Bayless, Alan Jaquis, Norberto Garcia, Neil Aragon, Thomas Barnes, Rick Chiapa, Mazyar Hamedi, Thomas Kim, Gary Longren, Samir Mawley, Eric Ramirez, Chuong Tran, Greg Dato, Mark Summer, Bill Hood.
Electrical Engineering: Asim Khan, Pierre Abboud, Jan Chang, Tooraj 'Terry' Soroor, Anthony Rudolph, Davinder Singh, Tony Baktyary, Duc Tree, Jose Franco, Ali Farhazahi, Lillian Soria, Racquel Glenn, Bela Tengan, Alfredo Rosales, Brian Johnson, Jose Rosales.

Design Strategy: CSUN'S "range-extending" parallel hybrid electric conversion of a 1996 Chevrolet Lumina integrates a 53 kW (75 kW peak) DC brushless electric motor developed by Unique Mobility, with a 1.1 liter, water cooled, 4 cylinder, 4 stroke, 4 valve per cylinder internal combustion engine from BMW. The combined torque to the front wheel drive passes through an 8.21:1 single speed reduction. A 0.78:1 overdrive allows for higher speeds and reduced engine noise at 70+ MPH highway cruise. An electrically heated catalyst, combined with closed loop stoichiometric control, effectively limits exhaust emissions. An EV mode is maintained below 45 MPH, subject to battery state of charge (SOC).

We have a 30+ mile EV range (FUDS) designed to meet California's new Equivalent ZEV requirements. Above and after a 3-minute sustained 45 MPH, the internal combustion engine comes on-line until the SOC recovers to 90%. This approach maintains the on-board electrical storage state, provides for EV urban driving, allows the electric motor to handle acceleration demands, and achieves desired driving range through the internal combustion engine.



University of California
Davis

Vehicle Name: Matador

Team Leader: Brian Johnston

Faculty Advisors: Dr. Andrew Frank,
Dept. of Mechanical Engineering
Dr. Andrew Burke,
Institute of Transportation Studies

Team Members: Tommie Takano, Doug Tietz, Nathan Cutler, Dave Funston, Kevin Burch, Ketan Ranade, Eric Chattot, Tim McGoldrick, David Budy, Rick Carrillo, David Wilkins, Tad Scheiblich, Bjorn Christiansen, Wes Garton, Hary Kwan, Rick Carlson, John Scola, Erick Galambos, Derek Kilmer, Kevin Behn, Isaac Fox, Mike Junemann, Cameron Frazier, Isaac Zacharias, Rich Giaramita, Frank Alioto, Chris Carlson, Scott Sutorious, Brett Kelley, Marcus Anderson, Craig Cockerhan, Peter Kucera, David Friedman, Nathan Fisher, Spencer Wang.

Vehicle Strategy: The UC Davis Matador is a Ford Taurus converted to a charge-depletion, parallel hybrid-electric vehicle. The parallel hybrid powertrain uses a Unique Mobility permanent magnet, brushless DC motor, a Honda Today 660 cc internal combustion engine, and a Honda Civic 5-speed manual transmission. Electrical energy is stored in Ovonic NiMH batteries, and the engine uses reformulated gasoline. A microcontroller monitors vehicle speed and battery state-of-charge to manage electric motor and engine operation. At high battery state of charge (SOC), the engine turn-on speed is around 45 mph. The engine turn-on speed decreases as the SOC decreases. This control strategy is used since the battery pack SOC depletes over a typical driving schedule. Battery pack SOC is increased by charging from the wall socket or regenerative braking, but not from converting the chemical gasoline energy into electrical energy.

University of Wisconsin—
Madison

Vehicle Name: FutureCow

Team Leader: Pax Maguire

Group Leaders: Kent Krajewski, Engine
Stephan Hayden, Mechanical
Ralph Teichmann, Electrical
Dan Nickchen, Controls
Neel Vasavada, Business

Faculty Advisors: Prof. Wayne Milestone
Prof. James Skiles

Team Members: Guy Babbitt, Joseph Bayer, Michael Beck, Steve Behrend, Spyro Blatseas, Adam Bodette, Ted Bohn, Richard Bonomo, John Butcher, Je Young Chung, Nathan Clark, Dave Clark, Jesse Daun, Michael DeCicco, Song Deng, Eric Eberhardt, Alan Eder, Jon Edgren, Anthony Eggert, Darin Engelhart, Jon Ertmer, Francisco Gonzalez, Curtis Greer, Michael Haasl, Aaron Halberg, Stephan Hayden, Allen Hill, Clark Hochgraf, Eric Hudak, Chad Humphrey, Mike Koplin, Kent Krajewski, Dan Kuchler, Jody Kunick, Tom Liebergen, Edward Lightbourn, Pax Maguire, Bryce Mecalf, Kevin Meuer, Dave Milestone, Duy Nguyen, Dan Nickchen, Brant Nieminski, JJ Nowlin, Matthew Orzewalla, Michael Overbo, Babu Rajalingam, Dan Ruawald, Ben Rubenzer, Michael Ryan, Peter Schwarz, Jeffery Serra, Stephanie Shrake, Mike Sloan, Craig Snyder, Ralph Teichmann, Matt Theil, Roman Tivyan, Irvin Tsang, Neel Vasavada, Jed Von Heimburg, Paul Weiss, Hsiao-Tung Yang, Hsiao-Tung Yetkin, Byron Yeung,

Vehicle Strategy:
The University of Wisconsin has converted a Dodge Intrepid to a diesel hybrid electric assist vehicle, integrating a turbo direct injection diesel with an appropriately sized electric motor in a parallel configuration. The two power sources will be controlled via an onboard computer to create a transparent vehicle operation that provides effective load leveling and regenerative braking.

The Ohio State University

Team Leader: Nigel Janes

Faculty Advisors: Prof. Yann Guezennec,
Prof. Giorgio Rizzoni

Team Members: Levent Erdogan, Dan Dennis, Bill Leisenring, Mohammad Marwali, Bogdan Proca, Ashkan Rahimi Kian, Kevin Ruck, Chris Sheenan, Dan Spuckler, Oscar Sung, Bryon Wasacz, Rob Wolfe, Kevin Wysocki.

Vehicle Strategy: Ohio State is modifying a Chevrolet Lumina by replacing the engine with a high-efficiency turbo-charged 1.9 liter direct injection diesel, and the automatic transmission with a 5-speed manual.

For the first year we are using simple tweaks to slightly increase the efficiency of the drivetrain. Small scale mass reduction and body modification decrease the power needed to accelerate the car and move it efficiently.

Michigan Technological University

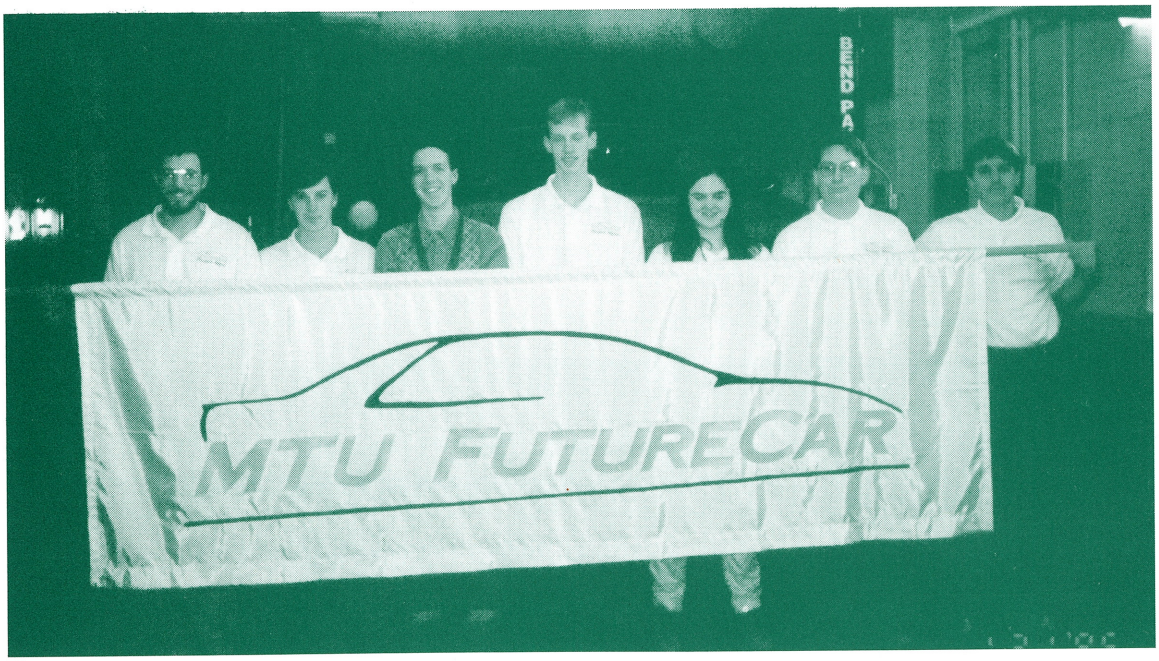
Vehicle Name: Northwind

Team Leaders: Matthew Hortop, Trevor Warfel

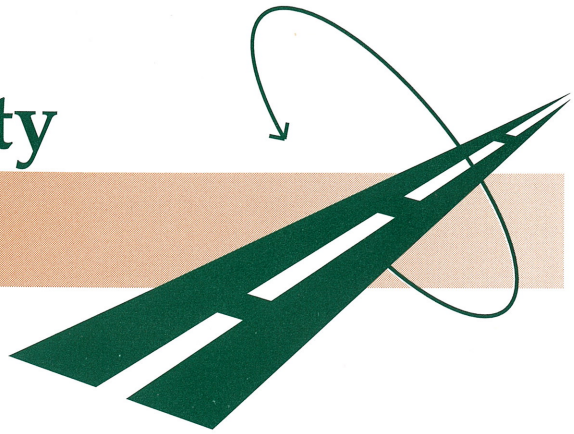
Faculty Advisors: Dr. Carl Anderson
Dr. Eric Baumgartner
(and many others)

Team Members:

Vehicle Strategy: Michigan Tech has converted a Dodge Intrepid to a load leveling, series hybrid electric vehicle. We will use adaptive control of a one-liter engine to provide near-constant power, under normal conditions, to an electric drive unit and/or stored in batteries for times of above average power draws during transient driving conditions.



West Virginia University



Team Leader: Wayne Taylor

Faculty Advisor: Dr. Chris Atkinson

Team Members: Loren Bartlet, Jeff Bone, Jason Hill, John Ingram, Bill Kellermeyer, Tom Spencer, James Sydenstricker, Wayne Taylor, John Woodman

Vehicle Strategy: West Virginia University converted a 1996 Chevrolet Lumina to a combined Parallel/Series configuration Hybrid Electric Vehicle. A permanent magnet, brushless, DC motor draws power from a 192 V nominal battery pack, which, in turn, is recharged by a permanent magnet, brushless DC alternator run by a Saturn 1.9 L engine converted to operate on compressed natural gas.

Virginia Tech

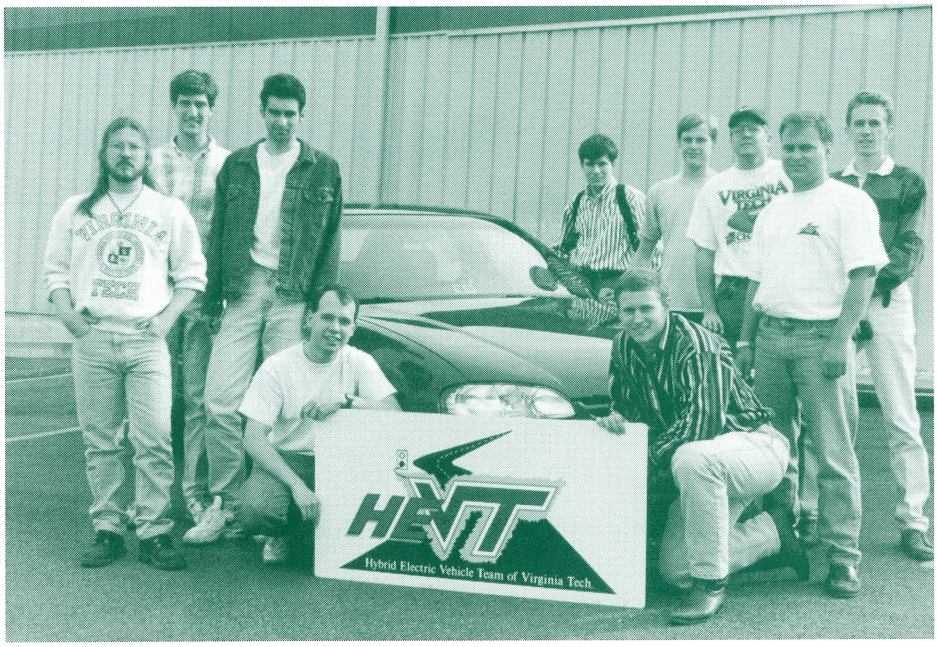
Vehicle Name: Animul

Team Leaders: Randy Senger, Mechanical
Matt Merkle, Electrical

Faculty Advisor: Dr. Doug Nelson

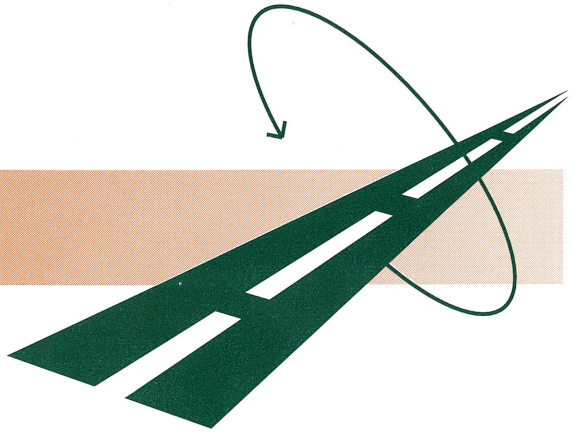
Team Members: Paul Atwood, Steven Battenfeld, Duane Blackburn, Matt Boothe, Brad Boutlilier, Damian Bruniany, Andrew Coe, Brian Colwell, Greg Dudley, Brian Edwards, Richard Flanagan, John Gerhardt, Ben Gilbert, Brian Girardi, Jeff Gordon, Hank Grabowski, Adam Grossmann, Jonathan Grunow, Louis Guido, Brian Hale, Keith Hall, Brett Harlow, Mark Heinrich, David Hill, Curtis Jacks, Lee Johnston, Dimos Katsis, Olin Kinney, Mike Lien, Ray Lee Lin, Kevin Mastropaolo, Chris Mazzanti, Lorenzo McCray, Tuan Nguyen, Ronald Nottingham, Dan Pepelko, Greg Pettit, Bryan Poertner, Chris Pollitt, Greg Pruett, Chris Saunders, Brian Seal, Bridget Sutphin, Wayne Swanson, Brian Tanner, Jeff Tatum, Jim Timko, David Ungar, Bill VanMullekom, Chuck Venditti, Gino Venditti, Paul VonHoene, John Walters, Te-Wei Wang, Shawn Wildman, Eric Wilkinson, Nathan Wilson, John Winters, David Young, John Young,

Vehicle Strategy: The 1996 Virginia Tech FutureCar Challenge entry consists of a 1996 Chevrolet Lumina converted to a series hybrid drivetrain. The electric drive motor is a General Electric 60kW, 3-phase AC induction motor. The main traction battery pack is made up of 27 12-volt Hawker Genesis sealed, lead-acid modules (26 A-h). The auxiliary power unit is a 3-cylinder, 1.0 L Geo Metro engine, operating on propane fuel, with a 20 kW Fisher 3-phase alternator permanently attached.



University of Illinois

Chicago



Vehicle Name: More Spare Time

Faculty Advisor: Mun Y. Choi

Team Members: Walter Gorczowski, Kevin Smith, Kevin Bishop, Eric Malapanes, Martha Suk, Brennon White, Bernedette Gillette, Rich Hannigen, Brad Ross

Vehicle Strategy: University of Illinois-Chicago (UI-C) is one of two FutureCar teams which is not using a hybrid drive train. UI-C is using an air injection system in conjunction with compressed natural gas (CNG) in its converted Ford Taurus. The air injection, or super-boosting system, works somewhat like a supercharger. Two small belt-driven compressors store air in a tank and lets it cool during times of low average power and braking. This air and additional fuel is injected into the engine under high load, thus giving higher peak power without the extra weight of batteries, motors, and the drag of the compressors. Using this innovative approach, our 850cc three cylinder engine operating on CNG can give outstanding fuel economy with adequate power for acceleration and passing manuevers.

Lawrence Technological University

Vehicle Name: Hyades

Team Leaders: Ken Haubert
Jim Swan
Mike Taila

Faculty Advisors: Prof. Nicholas Brancik, Dr. Gregory Davis, Prof. L. Donald Gschwind, Dr. Richard Johnston, Dr. James Lenze, Prof. Charles Schwartz, Dr. Jake Sheehy,

Team Members: Rukni Abboud, Eynas Al-Khazraji, Jeff Amalfitano, Michail Arnott, Don Baker, Rick Bauer, Lisa Blumerich, Mike Brown, Jason Buchanen, Andrea Burgess-Frye, Doug Buzcicki, Mike Byers, Gary Calender, Gino Catenacci, David Chronowski, Andre Clark, Chris Cole, Fred Cross, Shannon Dare, Brad Dragosch, Gary Dura, Craig Esler, Claudette Flavin, Scott Fraser, Greg Gac, Dave Gagnon, Tony Geisy, David Gersabeck, Jerry Griffith, Phillip Grobbel, Kevin Grondz, Guy Henza, Mark Hilfinger, Mark Kovalsky, Jennifer Larsen, Jeff Luther, Colleen Makarewicz, John McFadden, Dave McHale, Andre Mealy, Ivan Menjak, Dave Miah, Aaron Miller, Georgina Miller, Sarah Miller, Tom Mott, Paul Mrozek, Eric Pawelkowski, Peter Peratsakis, Mike Perecki, Todd Peterson, Mike Petkus, Jerry Phillips, Dave Plentis, Don Pozon, Chris Reynolds, Mark Rzepecki, Joel Scheffler, John Skuratowicz, Tom Skynar, Joe Smith, Ken Sovel, Brad Tremba, Andrew Valinski, Greg Voorman, Tim Welsh, Tracy Williamson, Brian Zientarski.

Vehicle Strategy: Hyades is a Ford Taurus converted to a charge depleting hybrid electric vehicle that uses the electric motor to propel itself from a stop. The diesel engine is engaged at 5 mph and used as the primary power source with variable electric assist. To improve fuel economy, the diesel engine is never allowed to idle. The electric motor is used as a generator so that energy normally lost as heat during braking is recovered as electricity through the use of opportunistic regenerative braking.

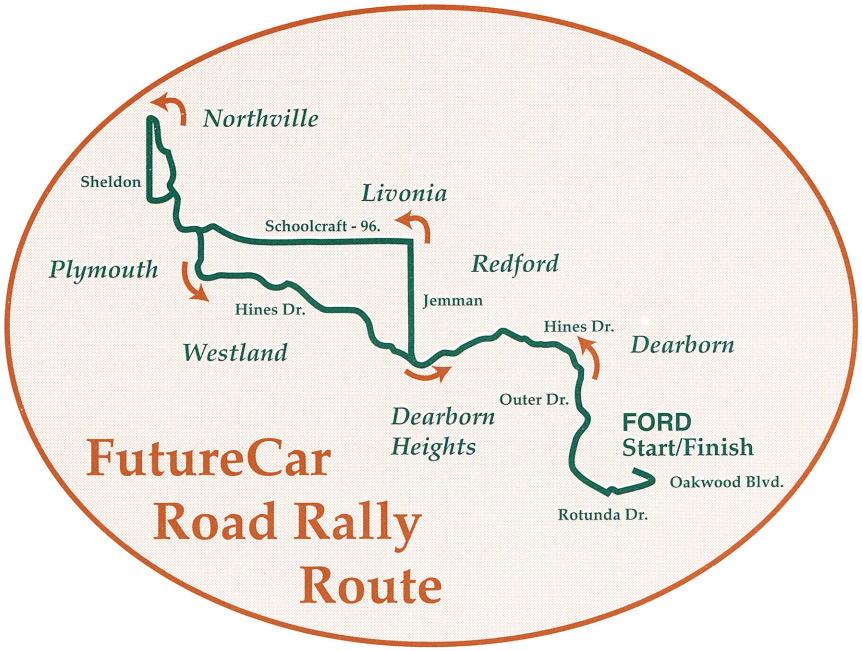
1996 FUTURECAR challenge

Road Rally

Format

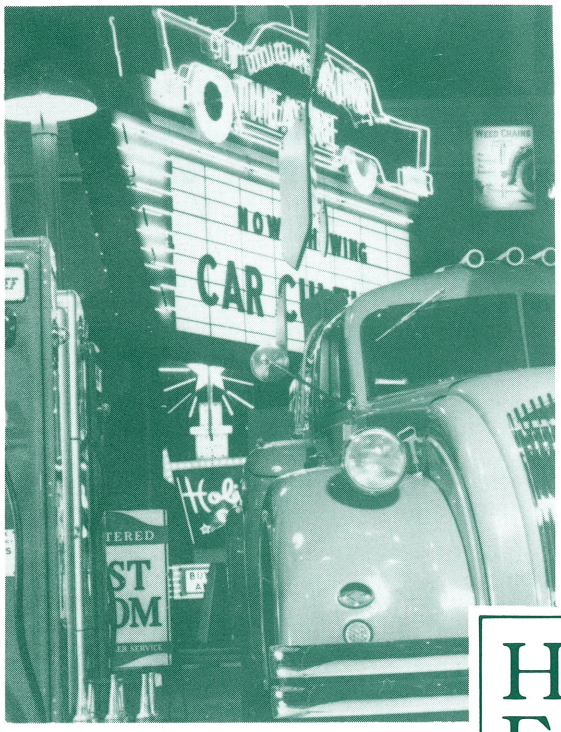
The Road RaIly event is designed to test the range of the vehicles and their reliability and performance in real world driving conditions. A driver and co-driver from each team will be in each competing vehicle during the event. A chase car will follow the competing vehicle and will carry an official observer. Because the Road Rally takes place on regular public roads, the vehicles must obey all traffic laws. The observers will log any infractions that the team commits during the rally, such as traffic violations and not following the proper route.

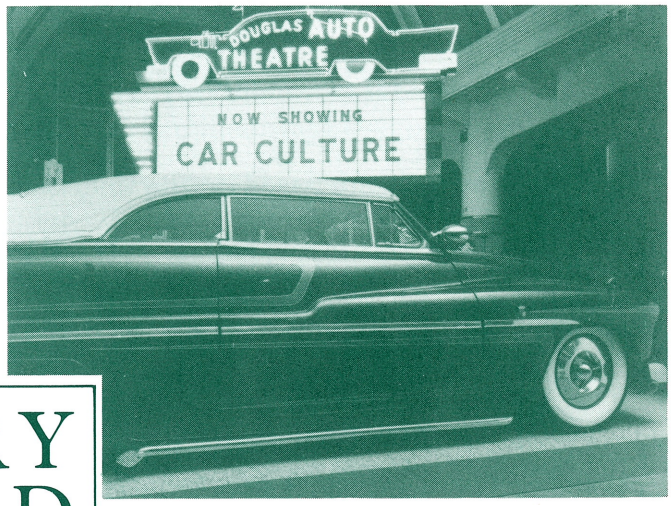
This event is not a race. Vehicles will be scored on how many legs of the route they complete within the allotted time window. At the end of the road portion of the event, laps will be run on the test track at Ford. Teams will be scored according to how close they can match the lap time of their first lap on the track. The results of this portion will be used to break any ties that occur in the road portion of the event.



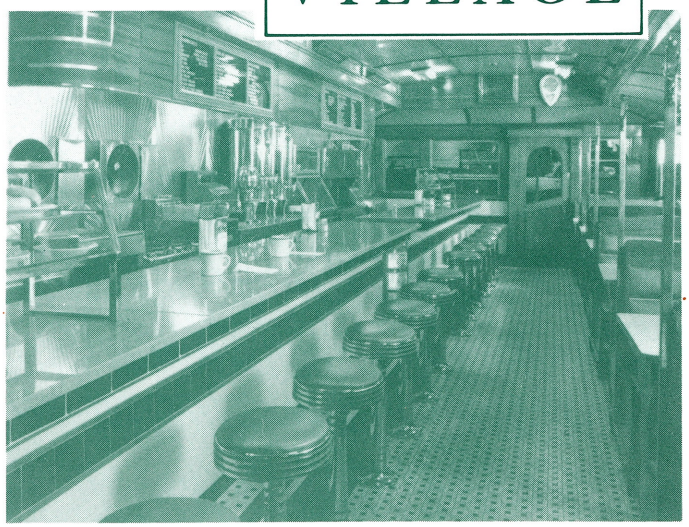
Route

The event will take place in two sections on Monday, June 24: one in the morning, and the second in the early afternoon. Both sections will cover a 48-mile loop starting and ending at Ford in Dearborn. The route passes through Dearborn Heights, Livonia, Northville, Plymouth, Westland and back into Dearborn. This route will take the teams through many different road conditions ranging from city streets to highways.





HENRY FORD MUSEUM & GREENFIELD VILLAGE



Henry Ford Museum & Greenfield Village

Dearborn, Michigan 48121

1996 FUTURECAR challenge

Awards

	Prize
• **Top Finishers**	
These awards are based on the final combined scores from all of the events.	
1st Place	$ 8,000
2nd Place	$ 6,000
3rd Place	$ 5,000
4th Place	$ 4,000
5th Place	$ 3,500
6th Place	$ 3,000
TOTAL TOP FINISHERS PRIZES	**$29,500**

Event Awards

• **Most Energy Efficient Vehicle** —Highest fuel economy as determined from the Energy Economy Event using the EPA combined city and highway cycle fuel economy method.	$ 5,000
• **Best Application of Advanced Technology**—Highest score awarded in this design evaluation.	$ 4,000
• **Best Consumer Acceptability**—Top combined score (static & dynamic) for the Consumer Acceptability Event	$ 3,500
• **Best Acceleration—**Fastest acceleration time in the normal mode of operation.	$ 1,000
• **Best Dynamic Performance** (Handling Event)—The fastest handling time.	$ 1,000
• **Best Over-the-Road Range**—Furthest distance traveled in the Endurance Event without a breakdown.	$ 1,000
• **Lowest Emissions**—Top scoring performer in the Emissions Event.	$ 1,000
• **Best Technical Report**—Top scoring report from the Technical Report Event.	$ 1,000
• **Best Engineering Design**—Highest sum of the scores from the Execution/ Quality and Application of Advanced Technology.	$ 1,000
• **Best Overall Dynamic Performance**—Highest sum of the scores from the Energy Economy, Emission, Endurance, Acceleration, and Handling events.	$ 1,000
TOTAL OF EVENT PRIZES	**$19,500**

Special Awards

- **Manufacturability & Cost Special Award**—Design best meeting the review requirements for cost and manufacturing of a vehicle component or subsystem. **$3,500**

- **Best Development & Application of Advanced Materials** —Best application of materials that may lead to increased fuel efficiency, lower production costs, and safer vehicles. This award is determined during the Engineering Design Review where teams have signed up for this evaluation. **$2,000**

- **Lowest Vehicle Driving Losses**—Lowest total amount of energy lost during the city and highway cycles due to vehicle losses (rolling friction & aero-dynamic). A computer model calculates vehicle losses based upon each vehicle's coast down testing data. **$1,500**

- **Best Safety**—Based on the extent of safety considerations incorporated into the vehicle's design and execution during the Execution/Quality Event. **$1,000**

- **Best Use of Alternative Fuels—**Highest combined scores for Emissions, Energy Economy, and Execution/Quality events. Only open to alternative fueled vehicles (E85, M85, CNG, LPG, and DME) **$1,000**

- **Best Workmanship**—Best combined interior and exterior vehicle presentation. Judged during the Quality and Execution Design Event. **$500**

- **Best Teamwork**—Greatest level of team performance throughout the competition to get the vehicle ready for the events. Awarded by the organizers. **$500**

- **Sportsmanship**—Highest level of assistance to other teams and organizers despite their own circumstance. Awarded by the organizers. **$500**

- **Spirit of the Challenge**—Most perseverance in the face of adversity and maintaining a positive attitude throughout the competition. **$500**

- **Best Skit**—Most votes received for the best skit from other teams. **Trophy only**

TOTAL SPECIAL AWARDS PRIZES **$11,000**

COMBINED AWARD TOTAL PRIZES **$60,000**

U.S.
Department
of Energy

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