1997 FutureCar Challenge

June 3-11

Warren, MI & Washington, DC

PARTICIPANTS

University of Michigan

University of Wisconsin, Madison

Virginia Tech

West Virginia University

California State University, Northridge

Concordia University

Lawrence Technological University

Michigan Technological University

Ohio State University

University of California, Davis

University of Illinois, Chicago

University of Maryland

The Secretary of Energy
Washington, DC 20585

May 5, 1997

Dear FutureCar Challengers:

I am pleased to have the opportunity to welcome all the university teams competing in the 1997 FutureCar Challenge.

For the past one hundred years, the United States has been manufacturing automobiles that use an internal combustion engine. The next twenty years will demonstrate more changes in these vehicles than have ever occurred in such a short period of time. The FutureCars that you have designed and built over the past two years demonstrate new options -- hybrid electric drivetrains with exceptional fuel economy, new weight reduction strategies and other new engine concepts. This vision of new technologies will carry us into the next century, when cleaner air, improved fuel economy and a greater reliance on domestically produced fuels will become even more of a necessity.

FutureCar Challenge is a competition, but there are only winners in this competition because regardless of your standing, you will have won an invaluable education -- practical engineering experience, exposure to state-of-the art vehicle technologies, and skills in working on teams and in problem-solving. Government and industry will win because they have both gained greater insight into the vehicle strategies we need for the future.

After graduation, many of you will take positions in the automobile industry. I am confident that the FutureCar experience will help to make you fine engineers and, in the not too distant future, industry leaders. I am proud to have played a part in this process.

Good luck to you in the competition and in the years ahead.

Sincerely,

Federico Peña

The 1997 **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 invited 12 universities to use the most advanced vehicle technologies to modify a mid-size vehicle that 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 the three 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 work together in vehicle development teams. Beginning with a conventional Lumina, Intrepid, or Taurus, each university team will make whatever modifications are necessary within the constraints of the existing vehicle to approach 80 mpg. Most teams have made dramatic changes to the powertrain, added energy storage capability, improved aerodynamics, and attempted to reduce vehicle weight.

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

In June, the teams compete in a series of dynamic and static events at the GM Technical Center in Warren, Michigan. Emissions testing and fuel economy assessment take place at the U.S. Environmental Protection Agency (EPA) National Vehicle and Fuel Laboratory in Ann Arbor. The teams then embark on an over-the-road endurance event from Warren to Washington DC, where they will participate in a vehicle display & awards ceremony on Capitol Hill.

What is. . . PNGV

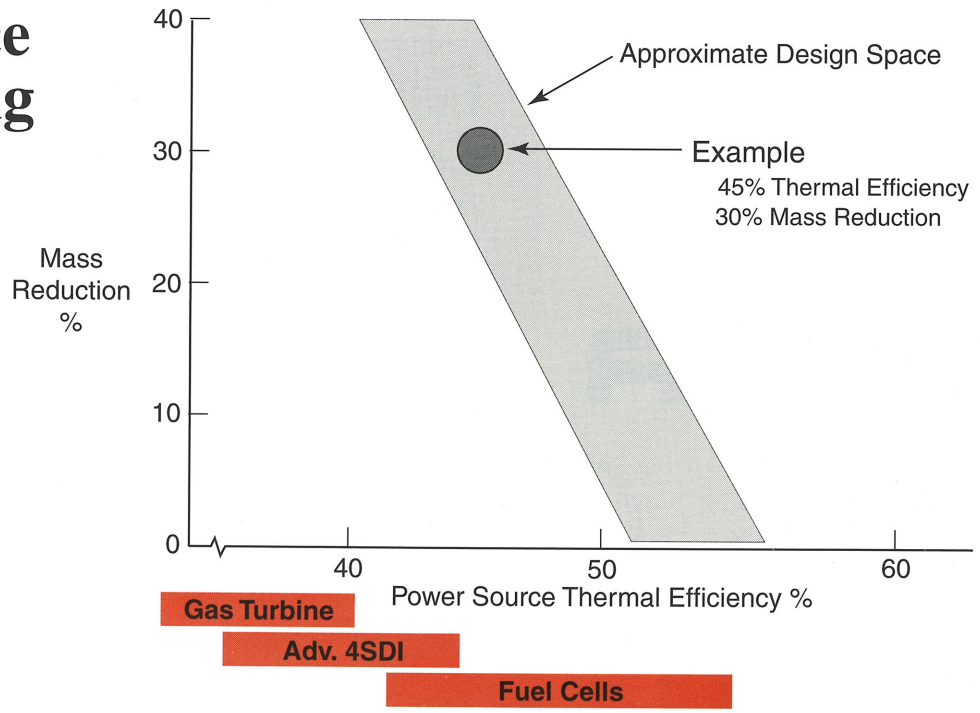
Partnership for a New Generation of Vehicles?

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 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.

There are many ways to achieve an 80 mile per gallon (mpg) vehicle, but each requires a delicate balance between vehicle fuel economy, power efficiency, and many other characteristics such as vehicle mass, aerodynamic drag, braking recovery efficiency, and accessory load. The chart below shows how, with varying power efficiencies and mass reductions, 80 mpg can be achieved. This display assumes efficiencies of 60% for regenerative braking, 90% for energy storage, a 20% reduction in aerodynamic drag, a 20% reduction in rolling resistance, and a 30% improvement in accessory load over conventional vehicles. Note that the greater the reduction in vehicle mass (or weight) that is achieved, the less improvement in power efficiency that is required. The display also shows the relative efficiencies of gas turbines, advanced 4-stroke, direct injection engines, and fuel cells.

Design Space for Achieving 80 mpg



1997 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, energy storage, 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.

USCAR SM
UNITED STATES COUNCIL FOR AUTOMOTIVE RESEARCH

United States Council for Automotive Research (USCAR)

U.S. Department of Energy

USCAR

CHRYSLER CORPORATION

Ford

GM General Motors

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 under way 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.

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Other Sponsors

EPA

AlliedSignal AUTOMOTIVE

GOODYEAR

Natural Resources Canada

Detroit Edison

NATIONAL SCIENCE FOUNDATION

Acknowledgements:

ARGONNE NATIONAL LABORATORY • UNIVERSITY OF CHICAGO

AMERICAN SOCIETY FOR ENGINEERING EDUCATION — ASEE

1997 FutureCar challenge

Competition Schedule

Tuesday, June 3

The competition site officially opens at 8 am when teams and their FutureCars begin arriving at the GM Technical Center in Warren, MI. Industry and government engineers perform Vehicle Safety Inspections on the FutureCars all day. At 7 pm, all competitors must attend the **Safety Meeting,** which is followed by the annual FutureCar Skits.

Wednesday, June 4

Safety Inspections continue all day. As each vehicle passes its inspection, it may proceed directly to **Qualifying** and **Coastdown Testing** on the test track.

Thursday, June 5

Thursday is the busiest day of the competition with **Application of Advanced Technology**, **Cost and Manufacturability**, **Quality & Execution**, and the **Materials Award** judging all taking place in the GM Design Dome. Press are welcome to attend the competition on Thursday, to view the vehicles and attend the **Opening Ceremony** hosted by General Motors, Ford, Chrysler, and the Department of Energy.

Friday and Saturday, June 6 & 7

The FutureCars will be at the Environmental Protection Agency Laboratory in Ann Arbor, MI for two days undergoing Emissions and Fuel Economy testing. In addition, the teams will give their **HVAC Design** presentations at the GM Technical Center on Friday.

Competition Points

EVENTS		TOTAL POINTS POSSIBLE
PERFORMANCE EVENTS (Dyno & Track)		**500**
ENERGY ECONOMY	230	
• City	130	
• Highway	100	
EMISSIONS	100	
ACCELERATION	60	
HANDLING	50	
ENDURANCE	60	
DESIGN EVENTS		**500**
TECHNICAL REPORT	70	
QUALITY AND EXECUTION	70	
APPLICATION OF ADVANCED TECHNOLOGY	130	
MANUFACTURING POTENTIAL AND COST	100	
CONSUMER ACCEPTABILITY	100	
• Static	50	
• Dynamic	50	
HVAC	30	
TOTAL POINTS		**1,000**
BONUS POINTS	20	
• Pre-Competition Inspection	10	
• Competition Readiness	10	

Sunday, June 8

On Sunday, the FutureCars take to the track again for the **Acceleration Event** and auto-cross style **Handling Event** in the morning. After lunch, the vehicles will be judged for **Consumer Acceptability** and **HVAC System Effectiveness**. At 7 pm, competitors, judges, and volunteers are welcome to attend a casual dinner and award ceremony where the day's winners will be recognized.

Monday, June 9

At 8 am, the **Over-the-Road Endurance Event** begins when the FutureCars leave the GM Technical Center and head south to the Goodyear Technical Center in Akron, OH for lunch and a press event. From Akron, the teams drive to Warrendale, PA, where SAE International is hosting an overnight stop.

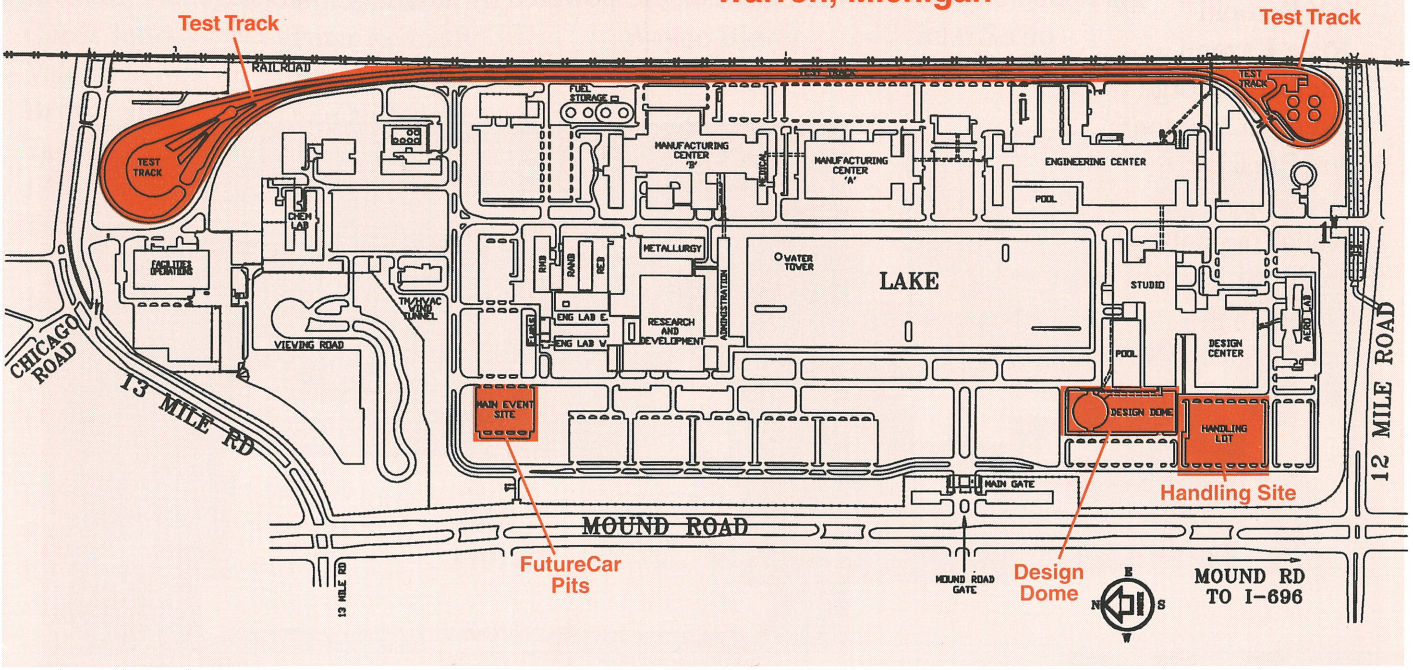
Tuesday, June 10

After an 8 am send-off by SAE International, the teams continue on to Washington DC where they will collect at Arlington National Cemetery. Together, the FutureCars will cross the Memorial Bridge into Washington DC and proceed to the finish line at L'Enfant Promenade, in front of the United States Department of Energy. Representatives from DOE and USCAR will be in attendance to publicly congratulate the teams on their engineering achievement.

Wednesday, June 11

At 8 am, the caravan of FutureCars will proceed to the Capitol for a display that begins at 9 am. The 1997 FutureCar Challenge wraps up with the Awards Ceremony Luncheon in the Caucus Room of the Cannon House Office Building starting at noon.

General Motors Technical Center, Warren, Michigan



Meet the Teams

Concordia University

Vehicle Name and Number: Recharger #2

Team Leader: Douglas Monahan

Faculty Advisor: Dr. Henry Hong

Technical Advisor: Dr. Mark VanVliet

Vehicle Strategy:

The Concordia Dodge Intrepid is a parallel hybrid with ZEV capabilities. The Concordia FutureCar employs an automotive clutch to allow the Volkswagen TDI diesel to be removed from the drivetrain. This gives the option to operate the vehicle on the Solectria electric motor only. The Solectria motor and contoller are used not only as propulsion, but also for stopping torque using the regenerative capabilities of the system. All accessories usually powered by the engine, such as the power steering and vacuum assist, are now powered by auxiliary motors.

Team Members:

Federico Polidori
Michael Bole
Melinda Burke
Shapoor Hoghoogi
Ali Pazooki
Reza Kazemi
Clement George
Brendan Montour
Val Bressi
Asiel Silva
Katia Campobassi
Junior St. Fleur
Giang Tang
Shady Sadeghian Araghi
Mario De Stefano

Virginia Tech

Vehicle Name and Number: "Animul" #01

Team Leaders: Randy Senger (ME), Matt Merkle (EE)

Faculty Advisor: Doug Nelson

Vehicle Strategy:

The Virginia Tech Chevrolet Lumina is a series hybrid electric vehicle. An AC induction motor with an IGBT inverter is used to drive the front wheels of the vehicle through a differential; this system also allows for the recapture of some braking energy. A battery pack, located under the rear seat, provides the transient power for the electric drivetrain and storage capacity for regenerative braking. A 3-cylinder, spark-ignited, internal combustion engine, which is fueled by propane, is coupled to an alternator which produces electricity to either recharge the batteries (if necessary) or power the electric drivetrain. All engine functions are microprocessor-controlled and the engine operates in a narrow speed and load range, which allows for precise tuning for low emissions and high efficiency.

Team Members:

Steve Irwin
Bryan Nevius
Bryan Poertner
Daniel Vandale
Ken Willis
Bobby Backofen
Travis Bowers
Richard Flanagan
Curtis Jacks
Valerie Myers
Bryant Sims
Taorid Brown
Jay Drischler
Tom Goodnight
Matt LePard
John Maiden
Chris Mann
Greg Pettit
Dung Pham
Chris Pollitt
David Schloff
Ryan Smith
Kandler Smith
Rene Tshiteya
ChuckVenditti
GinoVenditti
Keith Hall
Hai Huynh
Marc Jimenez
Greg Pruett
Brian Seal
Peter Kennedy
Brooks Moses
Lee Niffenegger
Craig Todd
Jeff VanDyke
Meredith Robertson
Chris Grunau
Dave Lahoda
Jonathan Gromatzky
Jonathan Grunow
Jason Mayfield
Brad Banks
Jeff Gordon
Joe Payne
Duane Blackburn
Wayne Biever
Dave Ungar
Celeste Soderberg
John Sozio
Michael Spruill

University of Maryland

Vehicle Name and Number: University of Maryland FutureCar #8

Team Leaders: Christina Wu, Steven Kutchi

Faculty Advisors: Dr. David Holloway (ME), Dr. Fwazi Emad (EE)

Team Members:

Samuel Abbay
Wendy Albrecht *
John Arkoian
Arun Arumunaswan
Mirella Bengero
Jack Bond
Gary Carr
Anderson Chu
David Diller
Marlon Garcia
Jay Gerst *
Barbara Glaser
Steve Hess
David Higdon
Michael Hoffman *
Andrew Huo *
George Konstantakopolous
Jennifer Liu
Kevin MacDonald
Ziad Madanat
Geoff Nelson
Davic Noppenberger
Hyun Jin O
Andrew Riggie
Honore Spencer
Edwin Surprin
Andrea Twarowski
Sandeep Vohra *
Henry Yoo
Darin Young

* Group leader or project manager

Vehicle Strategy:

The University of Maryland Dodge Intrepid employs a series hybrid electric powertrain configuration. A three cylinder, 1.0 liter Geo engine is directly coupled to a generator. A 100 HP traction motor (also used in the 1998 Chrysler electric minivan) powers the wheels. The batteries used in the FutureCar are 16 A-hr Hawker Genesis. They will provide a bus voltage of 324V (nominal). The vehicle is controlled by a 80486 processor packaged by Octagon Systems. The Maryland FutureCar will be able to detect city and highway driving and change control strategies based on the driving characteristics to enhance fuel economy and reduce emissions.

University of California – Davis

Vehicle Name and Number:
UC Davis Joule, #6

Team Leaders: Brian Johnston
Tim McGoldrick

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

Team Members:

Brooks Davis
Andrew Maynard
Tim Kono
Matt McCartney
Rick Carlson
Adam LaCourse
Frank Alioto
H. A. Mergen
Guilhem Malouet
Eric Chattot
Patrick Moreland
Doug Tietz
Marc Hirotsuka
Ta Ratana
David Wilkins
Marcus Anderson
Marcus Alexander
Jason Brubaker
Chris Carlson
Dave Funston
Jon Evans
Stepheny Kersten
Justin Peterson
Donny Chiu
Toan Lam
Chris Van Wert
Jesse Herbert
Olivier Lang
Nicolas Culaud
Harry Kwan
Sylvain Vugts
Brett Kelly
Scott Sutorius
Todd Bowman
Steven Lum
Rick Roller
Mike Junemann
Peter Kucera
Jeff Borra
Justin Heuser
David Friedman

Vehicle Strategy:

The UC Davis Joule, a converted Ford Taurus, is a charge-depletion, parallel hybrid electric vehicle. This style of hybrid was chosen to optimize energy efficiency and minimize emissions. A Unique Mobility permanent magnet, brushless DC motor and a Honda Today 660 cc engine using reformulated gasoline are mechanically coupled to a Honda Civic 5-speed manual transmission. This powertrain configuration has one-third of the rotating components of a conventional vehicle and eliminates all typical engine accessory loads. A 15.4 kWhr Ovonic NiMH battery pack powers the Unique motor and all vehicle accessories (power steering, HVAC, lights, etc.). This battery pack gives the Joule a 100 km all-electric driving range. As an HEV, the charge-depletion control strategy minimizes energy conversion losses associated with on-board electrical power generation. Battery state of charge (SOC) depletes over a typical driving schedule and is only replenished by charging from the utility grid or regenerative braking. A microcontroller monitors vehicle speed and SOC to manage electric motor and engine operation. At high battery SOC, the engine turn-on speed begins at approximately 50 kph and decreases with decreasing SOC. With this control strategy, the Joule has a city and highway driving range exceeding 400 km on one battery charge.

California State University – Northridge (CSUN)

Vehicle Number: #9

Team Leaders:
Phillip Aussem (Mfg E)
Eric Nerdrum (ME Controls)
Edson Campos (ME-Drivetrain)
Gabriel Perez (ME-Power)

Faculty Advisors:
Timothy Fox (ME)
Ben Mallard (EE)
Gerald Davis (Mfg E)

Team Members:

Nader Attalah
Mohammed Aziz
Fady Bishay
Forbes Black
Fernando Bonilla
Ramin Bouslani
Marcello D'Eli
Bassam Dailal
Sandip Desai
Glen Ennis
Lupamudra Ganguly
Jose Garcia
Oliver Garcia
Chuck Glass
Geoff Greenberg
John Hill
Jose Jimenez
Arbi Karapetian
Vahid Kashanpour
Jin Kim
Tam Le
Matias Lopez-Vega
Quan Luong
Chung Luu
Uriel Magallanes
Yeghiv Mahjoubian
Alfons Menanno
Albert Sicam
Bing Thi
Nelson Zelaya

Vehicle Strategy:

CSUN's range-extending, parallel hybrid electric conversion of a 1996 Chevrolet Lumina, integrates a water cooled, 53 kW (75 kW peak) DC brushless electric motor with a 63 kW, 1.1 liter water cooled, 4 cylinder, 4 stroke, 4 valve per cylinder internal combustion engine on a common shaft. 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 vehicle top speed and reduced engine noise at 70+ MPH highway cruise. An electrically heated catalyst combined with closed loop stoichiometric control, effectively limits exhaust emissions.

The control strategy provides for EV-only urban drive, subject to minimum battery state of charge (SOC), with hybrid drive at highway speeds. In hybrid mode, the motor becomes a generator and simultaneously recharges the lead acid battery pack. The configuration is designed to meet Califomia's expected Equivalent ZEV requirements.

University of Wisconsin – Madison

Vehicle Name and Number: FutureCow #10

Team Leader: Daniel J. Nickchen

Faculty Advisors: Wayne D. Milestone
James Skiles

Vehicle Strategy:

Team Paradigm's Dodge Intrepid is a diesel-electric, parallel hybrid vehicle. The vehicle includes a charge sustaining, load leveling, electric assist control strategy that is transparent to the driver.

Team Members:

Ben Bartsch
Tim Baumann
Joseph Bayer
Heidi Behling
Ted Bohn
Kristin Brown
Jonathan Butcher
Eduardo Cabre
Agatha Chen
Julie Cleary
Tim Delay
Chris DeSalvo
Jon Ertmer
Jason Feit
Ken Frederick
Joe Frost
Dean Galanos
Mike Haasl
Stephan Hayden
Chi-lok Ho
Clark Hochgraf
Eric Hudak
Andy Hull
Koh Keng Boon
Tadashi Kitamura
Timothy Klemp
Kent Krajewski
Tom Liebergen
Edward Lightbourn
Patrick Maguire
Carey Melnick
Bryce Metcalf
Mark Metoki
Paul Nelson
Duy Nguyen
Daniel Nomanbhoy
Kathy O'Brien
Naoki Ogishi
Bjorn Olson
Greg Ostroski
Andreas Pack
Andrew Paullin
Brad Pecore
Rebecca Perkins
Derek Phillips
Jamie Pitterle
Todd Puchalla
Micheal Ryan
Bulent Sarlioglu
Christine Shorey
Kristin Shuda
Aaron Sullivan
Matthew Thiel
Irvin Tsang
Chad Vande Hei
Jed Von Heimburg
Paul Weiss
Herman Wiegman
Dave Zimmerman
Craig Zonka

University of Michigan – Ann Arbor

Vehicle Number: #5

Team Leader: Dan Griffin

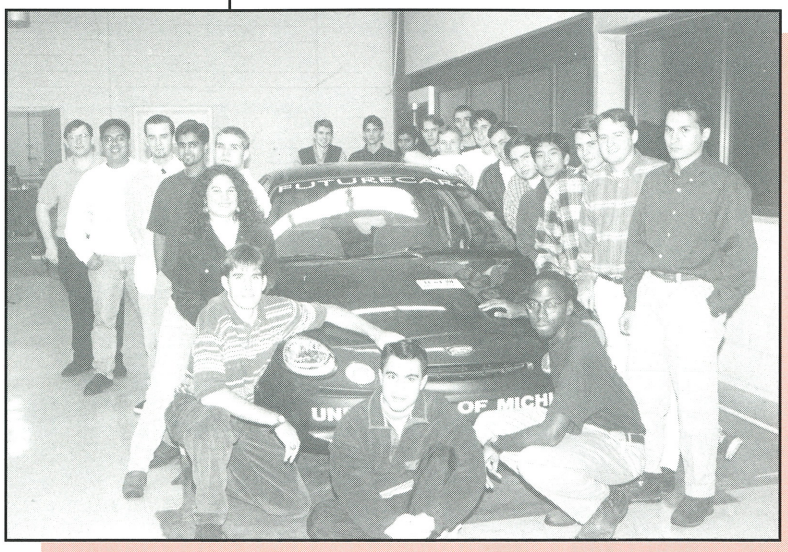
Faculty Advisor: Professor Valdis Liepa

Vehicle Strategy:

The University of Michigan Ford Taurus uses a parallel hybrid configuration with a Fisher electric motor and a Volkwagen 1.9L TDI diesel engine. Saft NiCad batteries are used for power storage. Many weight reduction techniques have been implemented as well as some aerodynamic improvements. New systems from last year include an Exhaust Heat Recovery System and a Heat Battery. An Eco-matic engine off at idle speeds is being pursued and is a possibility for this competition year.

Team Members:

John Anthony
Matt Griffin
Janet Booth
Steve Laux
Fred Barrigar
Jim Kane
Matt Little
Brett McGregor
Bala Krishnaraj
Alex Sammut



Michigan Technological University

Vehicle Name and Number:
MTU Northwind, #7

Team Leaders: Trevor Warfel
Todd Robinson

Faculty Advisor: Dr. Carl Anderson

Vehicle Strategy:

The Northwind, a converted Dodge Intrepid, is a charge sustaining series hybrid. The power train consists of a two-stroke engine with a permanent magnet alternator attached to the crankshaft. The direct injection 500 cc engine runs on reformulated gasoline. Power is stored in 26 lead acid batteries linked in series; the pack voltage is 330 volts. A dc-brushless traction motor capable of 66 kW coupled to an 8:1 one-speed transaxle completes the drivetrain.

Team Members:

Matt Hortop
Dennis Blanchard
Matt Kirklin
Dave Grupp
Jason Sabel
Phil Lukens
Scott Bang
Dan Tarnowski
Jeremy Worm
Matt Allington
Krishna Mohan
Cornelius Opris
Andrew Hector
Tom Przybyski
Ross Franke
Don Cambell
Brian Medema
Scott Floyd
Craig Mahr
Jon Hansen
Jake Eastman
Gary Shepard

Dan Brzezinski
Chris Lubowicki
Kurt Lafrance
Shawn Murphy
Aaron Thul
Melissa Trombley
Mark Venema
Shariful Islam
Dave Savage
Greg Thurston

Paul LaTarte
Brian Berquist
Greg Robinson
Amy Boyd
Michael LeCompte
Trevor DuPras
Jason Van Ark

Clyde Bulloch
Darrin Lemmer
Rian Slauf
Mike Yancheras
Vince Jelsema

Lawrence Technological University

Vehicle Name and Number:
Hyades, #4

Team Leaders:
Kosy Champadeng, Matthew Green,
Scott Luedke, Brenda Settle, Todd Peterson

Faculty Advisors:
Mr. Nick Brancik, Dr. Greg Davis,
Dr. Rick Johnston

Vehicle Strategy:

Hyades, a converted Ford Taurus, is a parallel drive Hybrid Electric Vehicle. Propulsion is provided by a direct injected, turbocharged diesel engine operating in parallel with a permanent magnet DC electric motor. The amount of motor assist is modulated in order to operate the engine in its optimum efficiency range. Electric energy storage is provided from nickel metal hydride batteries.

Team Members:

Erik Beattie
Kirsten Byrne
Jim Cleveland
Nick Cygnar
Robert Day
David Demaratos
John Dombrowski
Philip Gonzales
Jennifer Huckaba
Mark Kim
Paul Kornosky
Mark Liedke
Alejandro Martinez
Victor Michaels
Fabio Okubo
Garrett Patria
Ed Pokriefka
Jason Shawver
Richard Silas
William Smith
Jenny Spravsow
James Swan
Cheryl Tengler
Brian Valovick
Mike Wiegand
Lem Young

Ohio State University

Vehicle Name and Number:
DEP-V;
Diesel Electric Powered Vehicle #12

Team Leader: Nigel James

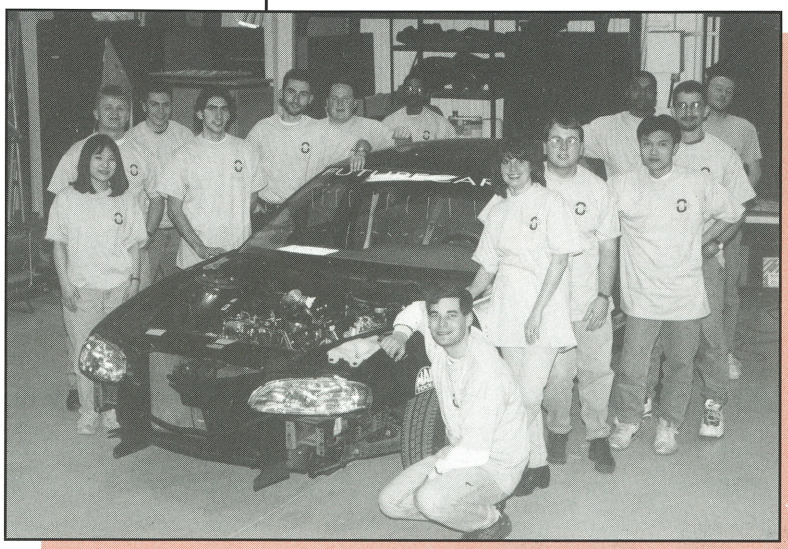
Faculty Advisors;
David Erb, Ali Keynani, Giorgio Rizzoni

Vehicle Strategy:

The Ohio State DEP-V, a converted Chevrolet Lumina, is a parallel hybrid with bias placed on the IC engine. A smaller electric motor and battery pack are used as part of a scheme to reduce idling losses, provide load-leveling, and recoup a measure of braking energy while adding very little to the total mass. This configuration will ensure that the vehicle remains fully operable in the case of an electrical malfunction.

Team Members:

Melanie Adams
Bernd Baumann
Todd Coyle
Levent Erdogan
Rusty Friend
Cody Garcelon
Lianhong (Lee) Guo
Nicodemus Hardi
Nathan Hinesman
Eric Hartenstein
Rick Hutchins
Ravi Kalluri
Hiroshi Kono
Seth Larris
Richard Marshall
Troy Miller
Mike Nation
Tony Rifici
Kevin Ruck
Tanto Sugiarto
Chad Taylor
Jeff Topoleski
Eric Trochan
Bryon Wasacz
Scott Weisgerber
Jerry White
Steve Wilms
Reiko Yoshida



University of Illinois – Chicago (UIC)

Vehicle Name and Number:
Future Flame, #11

Team Leader: Michael Svestka

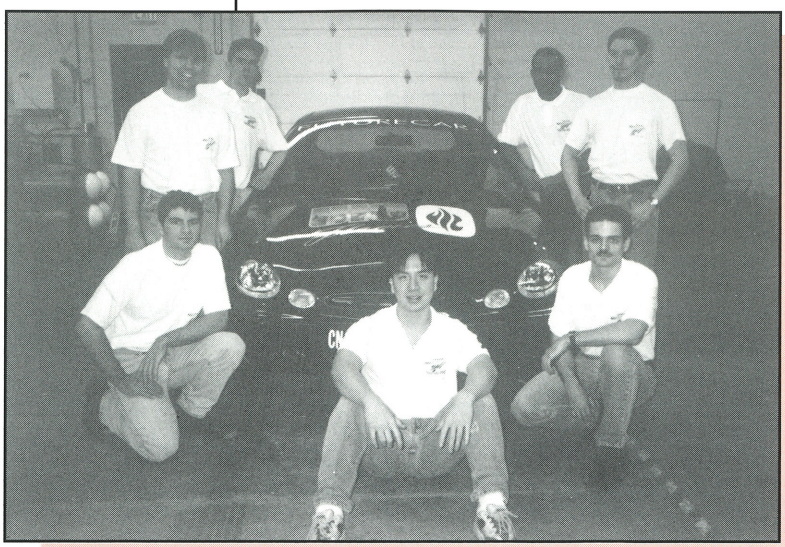
Faculty Advisor: Mun Y Choi

Team Members:

Phil Baranek
Nimesh Bhagat
Kevin Bishop
Mickey Choi
Walt Gorczowski
Ron Kmiecik
Arvind Patel
Bruno Porro
Rob Stye
Steve Venn

Vehicle Strategy:

UIC 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 allow it to cool during times of low average power and braking. This air and additional fuel is then 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.



West Virginia University (WVU)

Vehicle Number: #3

Team Leader: Wayne T. Taylor

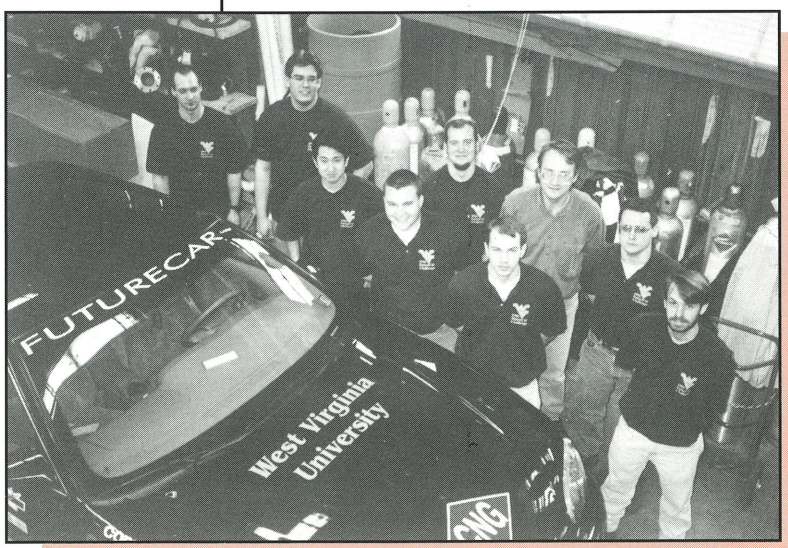
Faculty Advisor: Dr. Christopher M. Atkinson

Team Members:

Gearle Bailey
Patrick Collins
Jason Conley
Tsuyoki Hara
William Kellermeyer
Raymond Napier
Brad Ralston
Mike Snoberger
Thomas Spencer

Vehicle Strategy:

The WVU #3 Chevrolet Lumina is a series Hybrid Electric Vehicle. The electric drive motor is a Unique Mobility SR180 DC Brushless motor that draws power from a 180 volt (nominal) battery pack containing fifteen 12 V Hawker Genesis PbAcid batteries. A 1.9L 4-cyclinder Saturn DOHC spark ignited engine converted to operate on compressed natural gas provides mechanical power input to a Unique Mobility SR180 based alternator. The engine is optimized for high thermal efficiency and low exhaust emissions while operating unthrottled to provide power for the drive motor with excess power going to recharge the batteries. Accessory losses have been reduced by using more efficient, state of the art electric units.



1997 FutureCar challenge

Over-the-Road Endurance Event

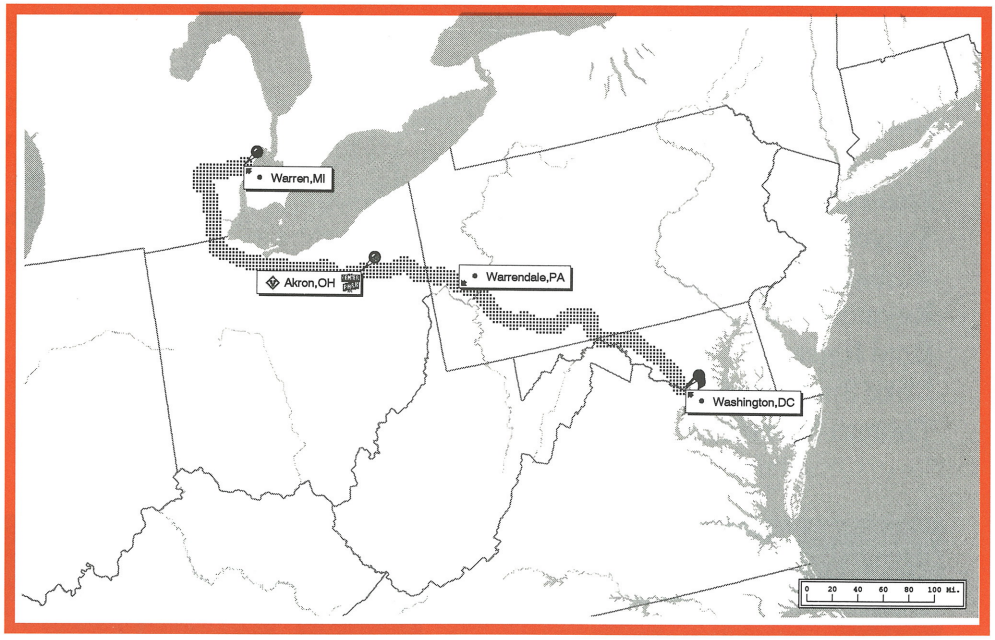
Sure, the FutureCars look great. . . Run great on the dynamometers. . . But can they make it in the real world? On real roads? With real hills and real potholes? Of course they can! And we'll prove it by sending them on a two-day journey from the Motor City to the United States Capital.

The Mission: To make the grade, literally, by traveling across five states to reach the goal, the United States Department of Energy, in Washington DC.

The Challenge: Remember, this is not a race. The teams must stay within posted speed limits in order to receive points for each leg. The first team to Washington DC will not necessarily win, although they will have the first shot at the snack trays. (The later finishers will get stuck with the stale oatmeal cookies instead of the gourmet chocolate chippers.)

The Route

Day 1 — The FutureCars will travel from the GM Technical Center in Warren, MI to the Goodyear Technical Center in Akron, OH for lunch. After a brief rest, the travelers take to the road again. Their target? SAE International Headquarters in Warrendale, PA, and dinner. With approximately 310 miles behind them, the FutureCars are allowed to refuel and recharge at SAE as well.

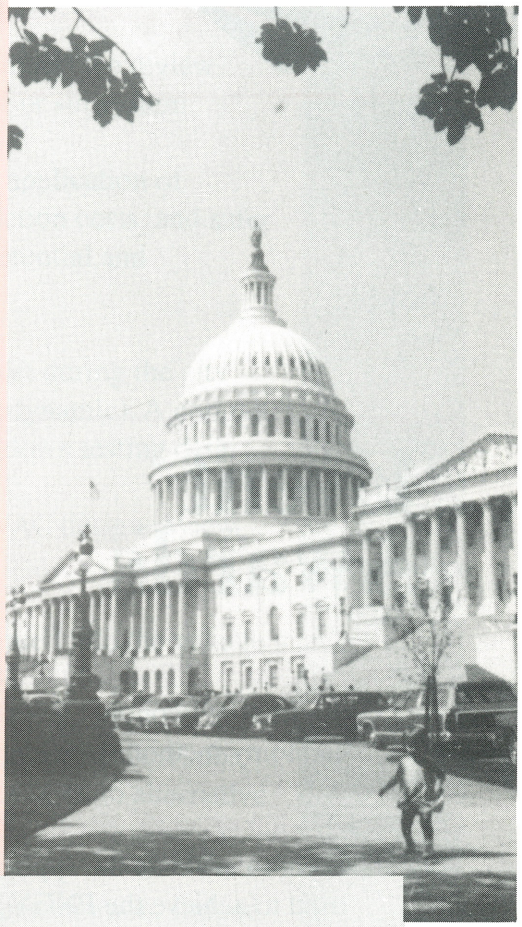


Day 2 — Precious few minutes after dawn, the travelers set out again, this time to face the ultimate challenge: The Alleghenies. (Did we forget to mention that there's a mountain range between Detroit and DC?) About 280 miles later, the teams will collect at Arlington National Cemetery before making their triumphant entrance into Washington DC and proceeding to the United States Department of Energy. There, with suitable fanfare, the teams can enjoy their status as national emissaries of Advanced Automotive Technology!

Day 3 — The FutureCars go on display for photo opportunities with Congressional representatives. At noon, our emissaries move to the Caucus Room in the Cannon House Office Building for a victory luncheon and award ceremony to collect their well-deserved awards.

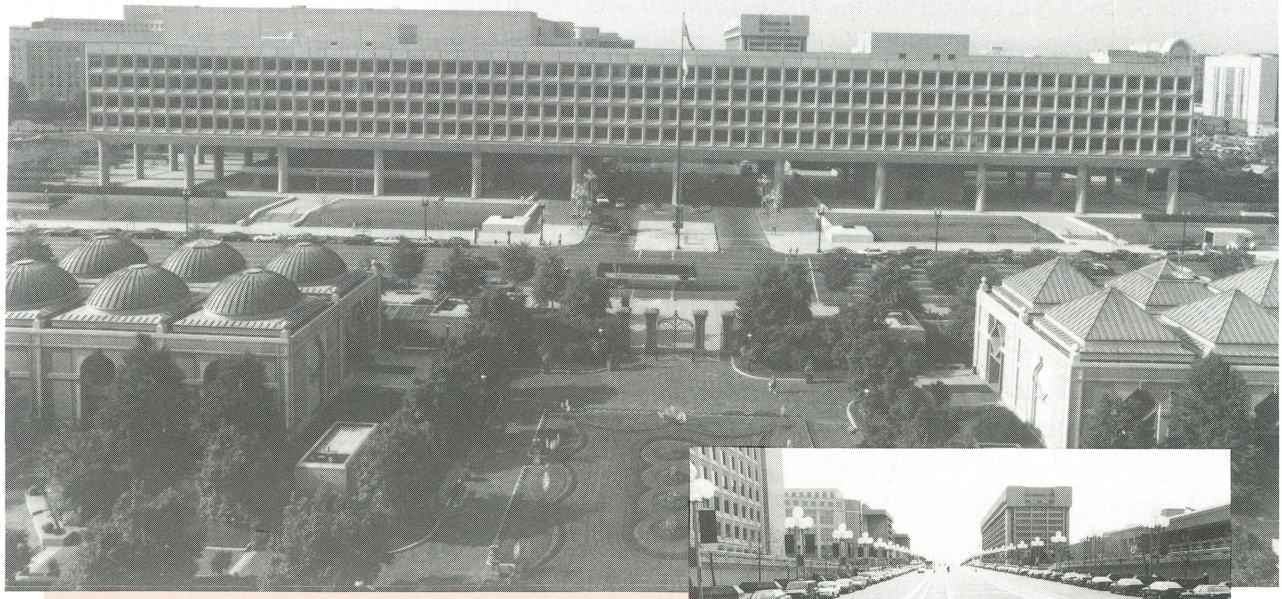
1997 FutureCar challenge

FutureCar Comes to Washington!



The 1997 FutureCar Challenge concludes with:

- ✔ a finish line ceremony at the U.S. Department of Energy (see photo)
- ✔ a vehicle display outside the Capitol (see photo)
- ✔ an award ceremony luncheon on Capitol Hill.



1997 FutureCar challenge

Awards

Top Finishers

These awards are based on the final combined scores from all of the events.

1st Place	$ 5,000
2nd Place	$ 4,000
3rd Place	$ 3,000
4th Place	$ 2,000
5th Place	$ 1,500
6th Place	$ 1,000
TOTAL TOP FINISHERS PRIZES	$16,500

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. **$2,000**

- **Best Application of Advanced Technology** — Highest score awarded in this design event to evaluate the application and implementation of all the advanced technologies used to achieve the PNGV goals. **$2,000**

- **Best Consumer Acceptability** — Top combined score (static & dynamic) for the Consumer Acceptability Event. The event is based on the consumer's point of view and addresses aesthetics, utility, comfort, and performance. **$1,000**

- **Best Acceleration** — Fastest acceleration time for a standing 1/8-mile run. **$ 500**

- **Best Dynamic Performance** (Handling Event) — The fastest handling time for a specific course that includes hard braking, accelerating, maneuvering around obstacles, etc. **$ 500**

- **Best Over-the-Road Fuel Efficiency** — Based on the energy efficiency for the first day of the road rally. **$1,000**

- **EPA 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 Quality & Execution** — Based on the qualities of the fit and finish of the vehicle and the thought process behind its construction. **$1,000**

Special Awards

• **Best Manufacturing Potential & Cost Award** — Design that best meets the review requirements for cost and manufacturing of a vehicle component or subsystem.	**$1,000**
• **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 Manufacturing Potential and Cost Review.	**$1,000**
• **Lowest Vehicle Driving Losses** — Lowest total amount of energy lost during the city and highway cycles due to vehicle losses (rolling friction & aerodynamic). A computer model calculates vehicle losses based upon each vehicle's coast down testing data.	**$ 500**
• **HVAC Evaluation & Review** — Best combined scores from the HVAC design review and the HVAC effectiveness evaluation.	**$1,000**
• **Best Safety** — Based on the extent of safety considerations incorporated into the vehicle's design and execution during the Execution/Quality Event.	**$ 500**
• **Detroit Edison Best Use of Alternative Fuels Award** — Highest combined scores for Emissions, Energy Economy, and Execution/Quality events. Only open to alternative fueled vehicles (E85, CNG, and LPG).	**$ 500**
• **Best Workmanship** — Best combined interior and exterior vehicle presentation. Judged during the Quality and Execution Design Event.	**Trophy**
• **Best Teamwork** — Greatest level of team performance throughout the competition to get the vehicle ready for the events. Awarded by the organizers.	**Trophy**
• **Sportsmanship** — Highest level of assistance to other teams and organizers despite their own circumstance. Awarded by the organizers.	**Trophy**
• **Spirit of the Challenge** — Most perseverance in the face of adversity and maintaining a positive attitude throughout the competition.	**Trophy**
• **Best Skit** — Most votes received from other teams for the best skit.	**Trophy**

NSF Faculty Award

Awarded to the faculty advisor who best integrates the FutureCar project into the engineering curriculum.

$20,000

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