Center for Advanced Automotive Technology
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The Future of Automotive Technology - Keeping Your Curriculum Up-to-Date

CAAT Webinar

October 2, 2014

Webinar will begin at 1pm ET

Macomb Community College
Education • Enrichment • Economic Development
Discover. Connect. *Advance.*

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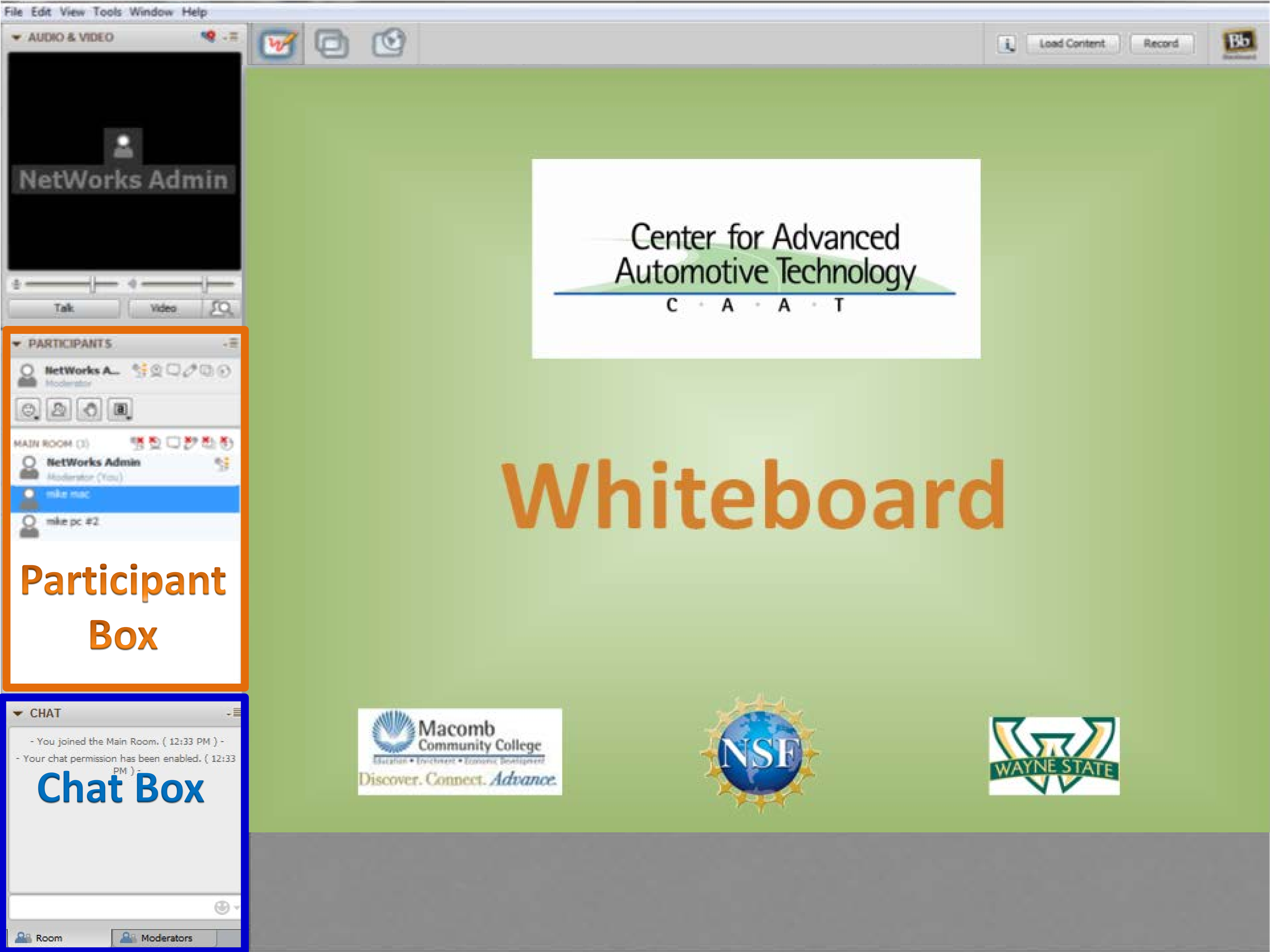
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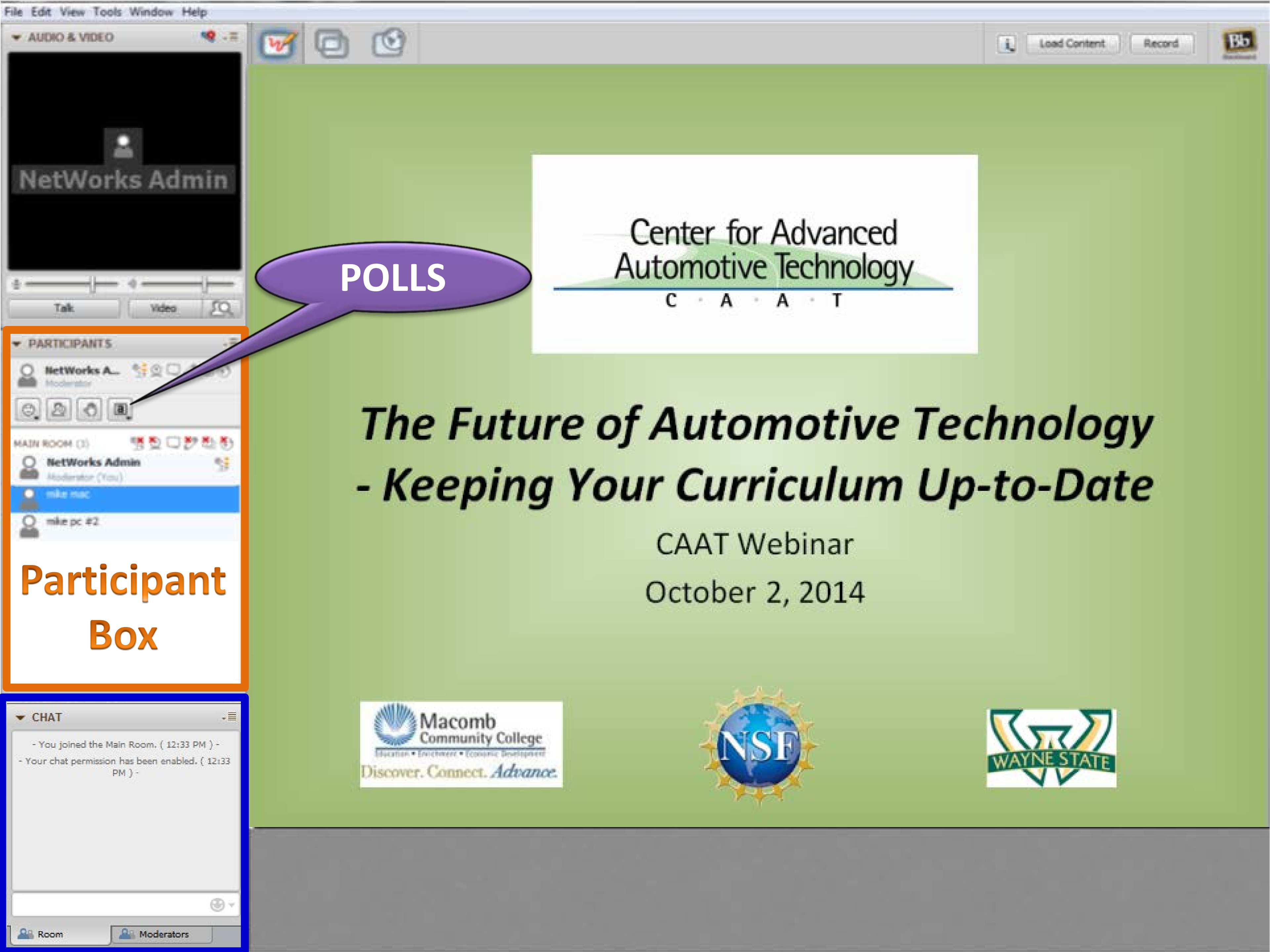
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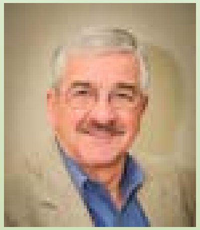
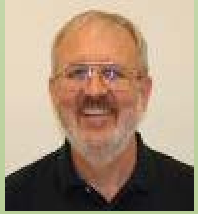
Presenters

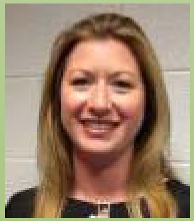


Bob Feldmaier, Director of the CAAT, Macomb Community College

Doug Fertuck, Assistant Director for Energy and Automotive Programs, Macomb Community College



Charlie Standridge, Assistant Dean of the College of Engineering and Computing, Grand Valley State University



Shannon Williams, Career & Technical Education Teacher Leader, Utica Community Schools

Sherri Doherty, Assistant Director-Communications for CAAT, Macomb Community College

Webinar Roadmap

- Setting the Stage
  - Who we are (Center For Advanced Automotive Technology)
  - Recap of Webinar of April 17, 2014
- Highlights of CAAT Annual Conference of May 2, 2014
- Updated Industry Needs in Advanced Automotive Technology
  - Continuing in Vehicle Electrification
  - Expanded in Vehicle Lightweighting
  - Expanded in Automated and Connected Vehicles
- New Seed Funding Opportunities
- Where We Go from Here

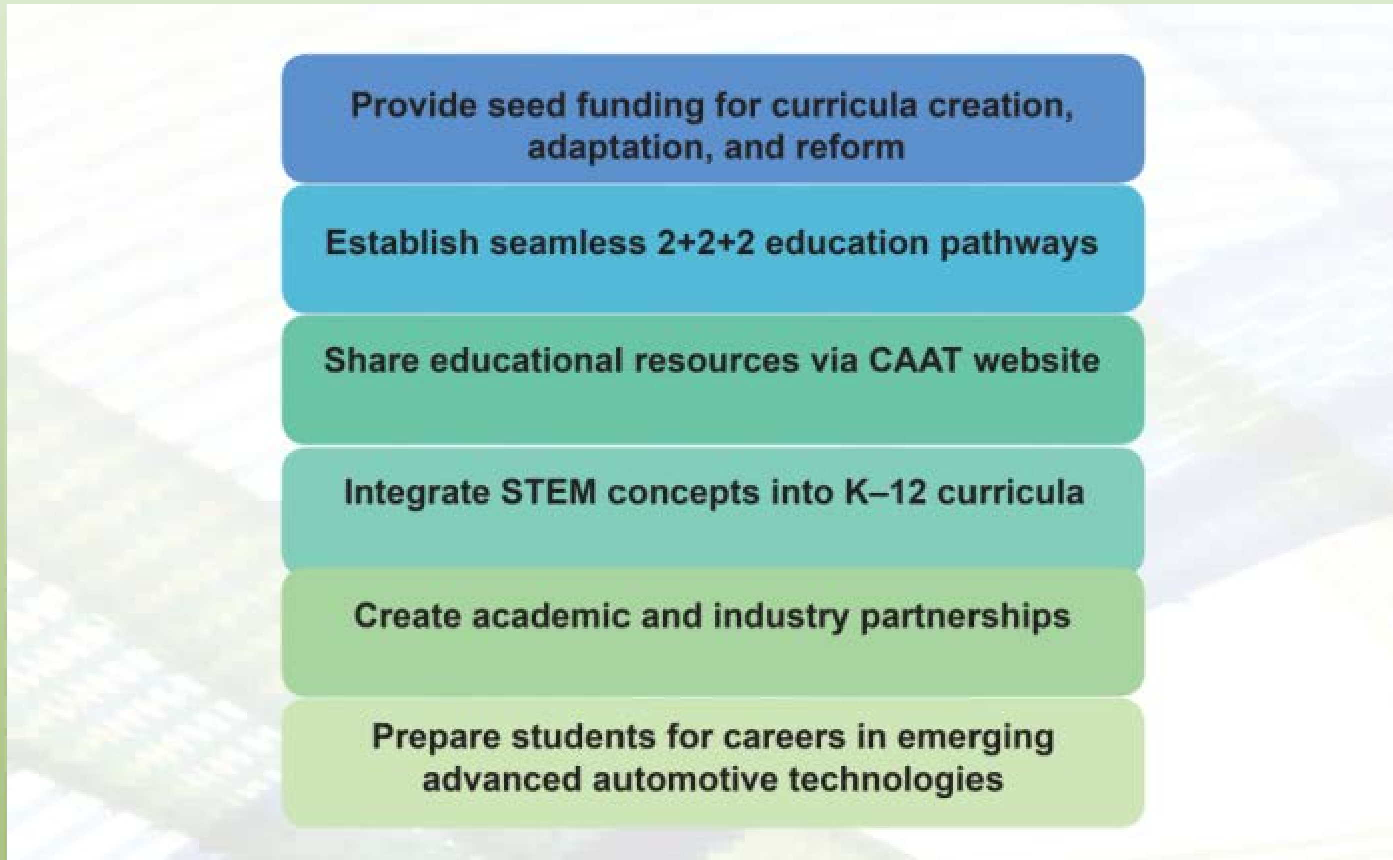
About the Center for Advanced Automotive Technology (CAAT)

- Located at Macomb Community College South Campus
- Partnered with Wayne State University
- Became an Advanced Technological Education Center in 2010 funded by the National Science Foundation ($2.8M Grant)
- Mission
  - Advance the preparation of skilled technicians for the automotive industry’s more environmentally friendly and safer vehicles.
  - Be a regional resource for developing and disseminating advanced automotive technology education.

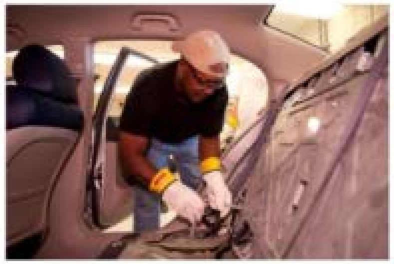
CAAT’s Priorities

- Preparing automotive technicians and designers in community colleges for advanced technology jobs
- Increasing the flow of students through the pipeline to jobs
- Collaborating and sharing across educational institutions
- Partnering with industry to understand their needs

CAAT's Strategic Plan



Strength and Value through Partnerships



CAAT’s NSF Grant is Renewed for 3 More Years

- Received additional NSF funding of $2.0M through July 31, 2017.
- Mission remains preparing technicians and technologists to work on advanced automotive technology
- Technical scope is extended to include the materials lightweighting and automated and connected vehicles

Presenter

Doug Fertuck
Assistant Director for Energy and Automotive Programs
Macomb Community College

Poll

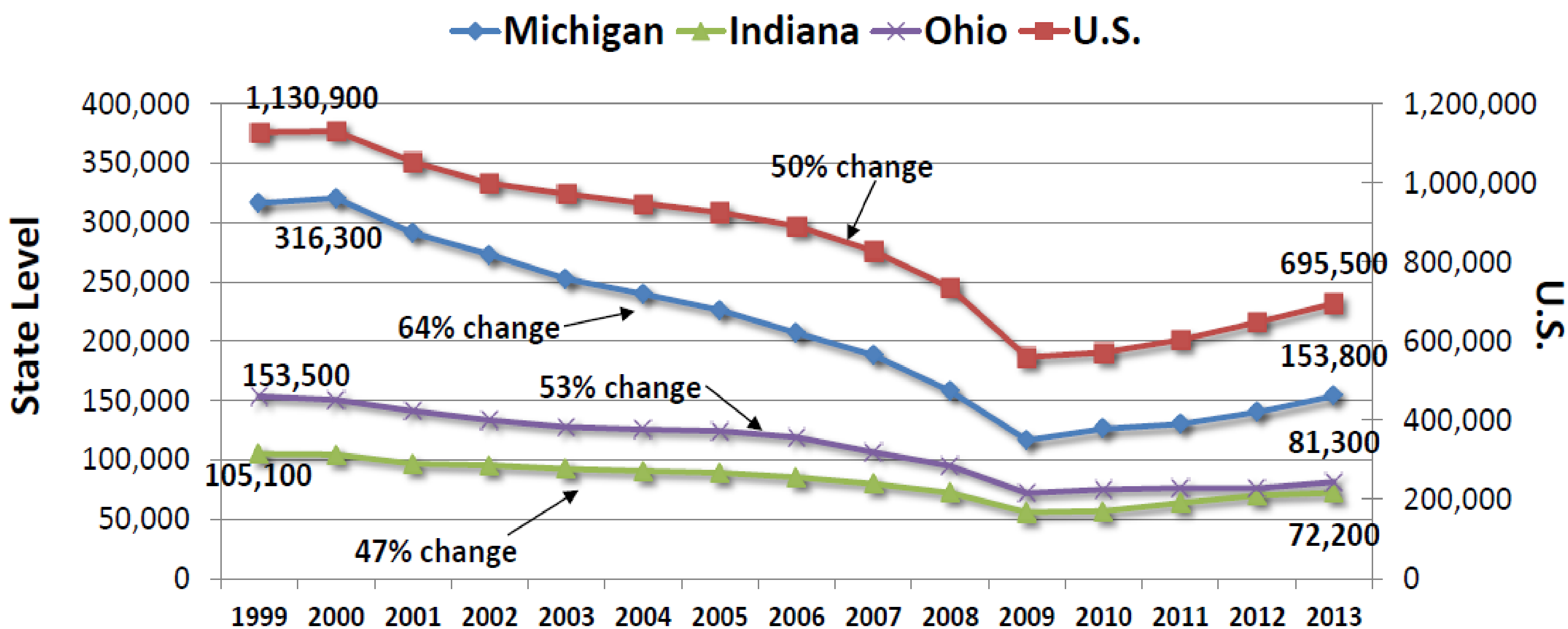
What is your view of the future for the US auto industry?

A. Bright
B. Dim
C. Not sure
D. Other (please use the chat box)

Recap of Agenda for CAAT Webinar of April 17,2014

- Who we are (Center For Advanced Automotive Technology)
- Smarter, Greener Cars
  - US Auto Industry has Rebounded
  - Auto Technology Is Advancing in Propulsion Technologies, Design, , Automation, and Communications
- Smarter Students:
  - Curriculum development and dissemination
  - Professional development
  - Technical and educational resources

Auto Industry Employment Remains Huge and is Now Growing



Source: U.S. Department of Labor Bureau of Labor Statistics

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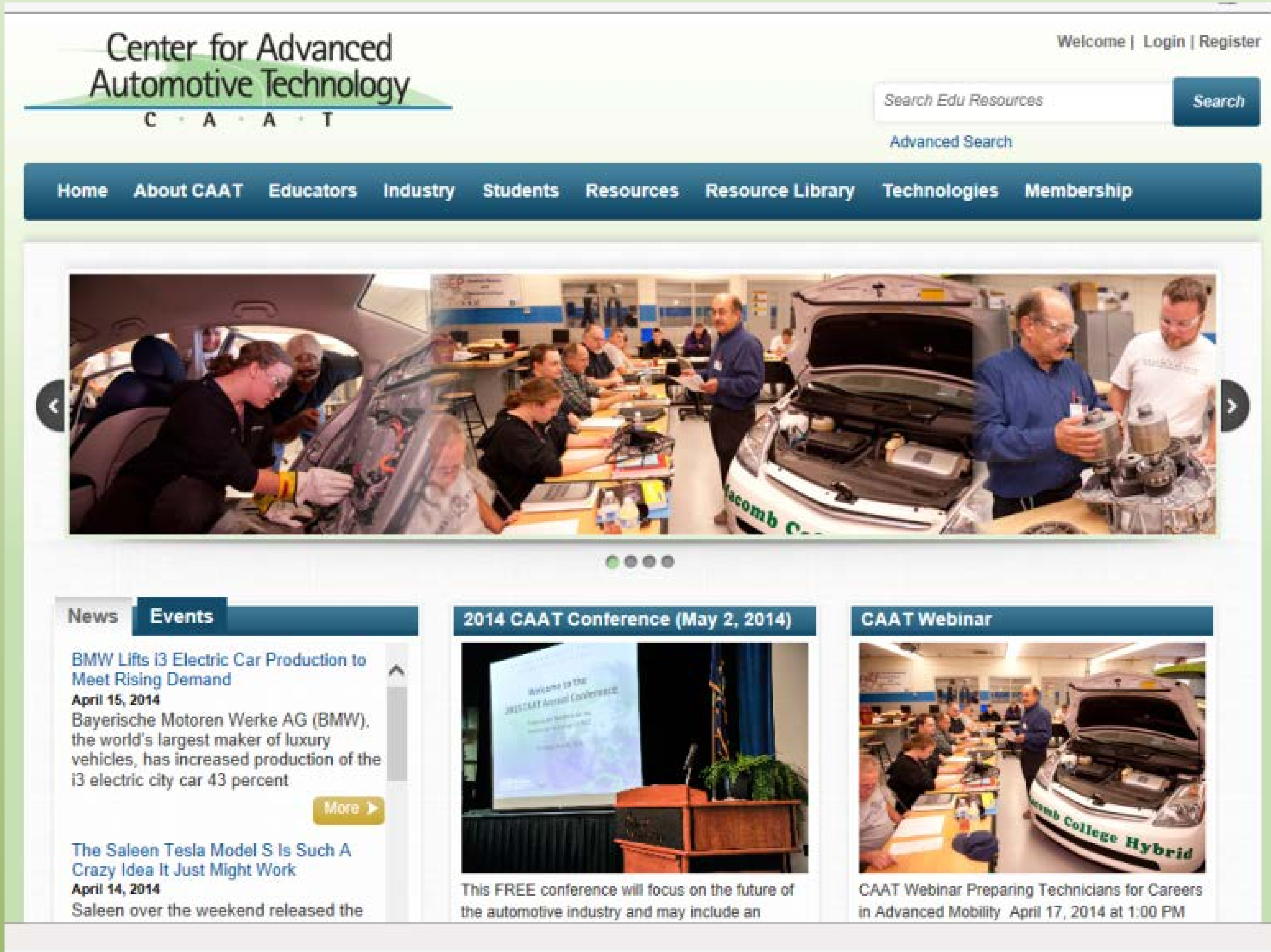
Drivers of the Auto Industry Future within CAAT's Scope

Source: Automotive Industry Office, Michigan Economic Development Corporation

CAAT Website - www.autocaat.org



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2014 CAAT Conference, May 2, 2014

Keynote speakers on the future of the automotive industry:

- **Nigel Francis**: Senior Automotive Advisor to the State of Michigan & Senior Vice President, Automotive Industry Office, Michigan Economic Development Council (MEDC)

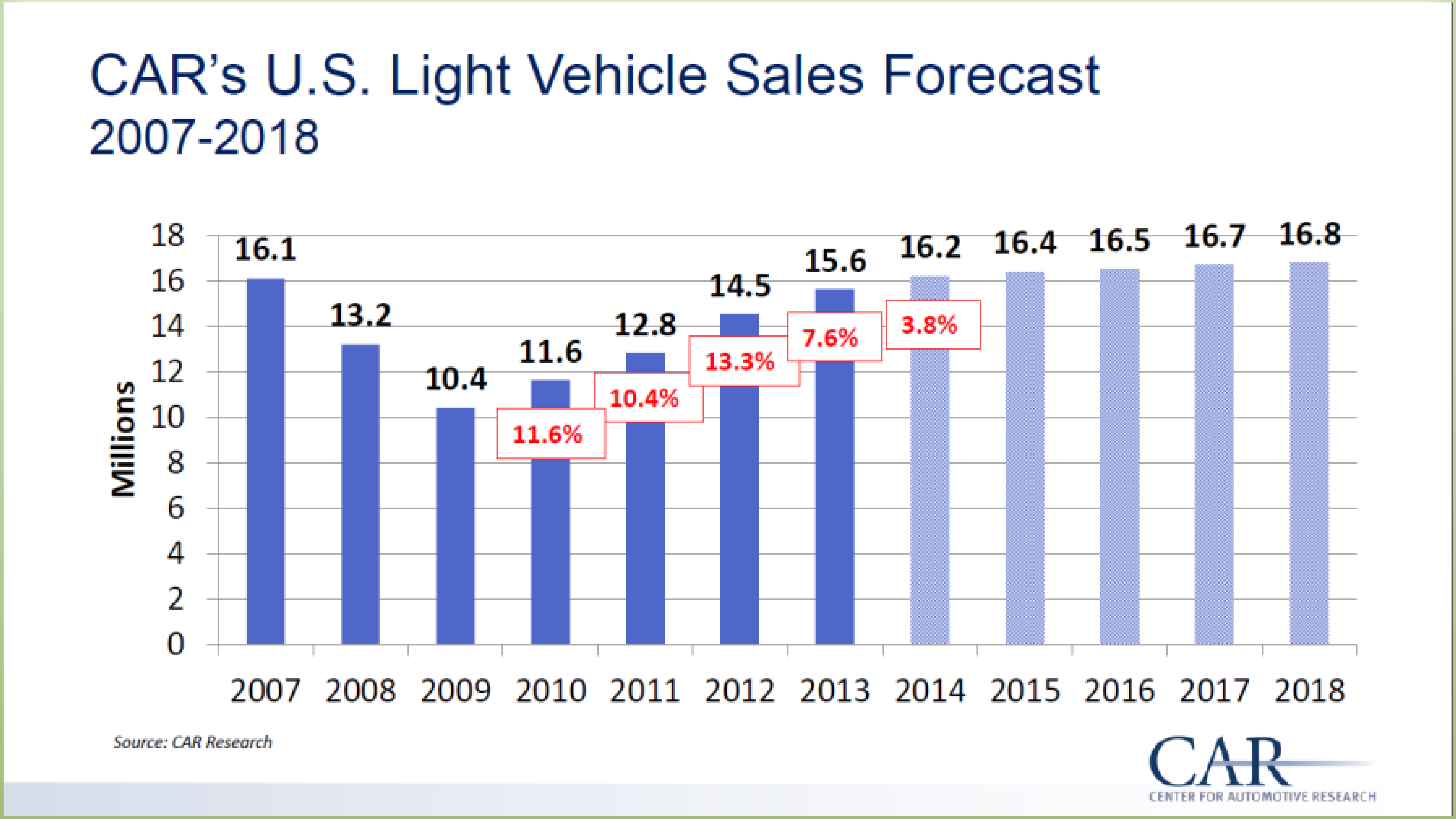
- **Kristen Dziczek:** Director, Labor & Industry Group and Assistant Research Director, Center for Automotive Research (CAR)

- **John McElroy:** Automotive analyst and host of "Autoline Daily," and the television program "Autoline This Week," broadcaster of five radio segments daily on WWJ Newsradio 950, and writer of a weekly blog for Autoblog.com and a monthly op-ed article for Ward's Auto World

2014 CAAT Conference

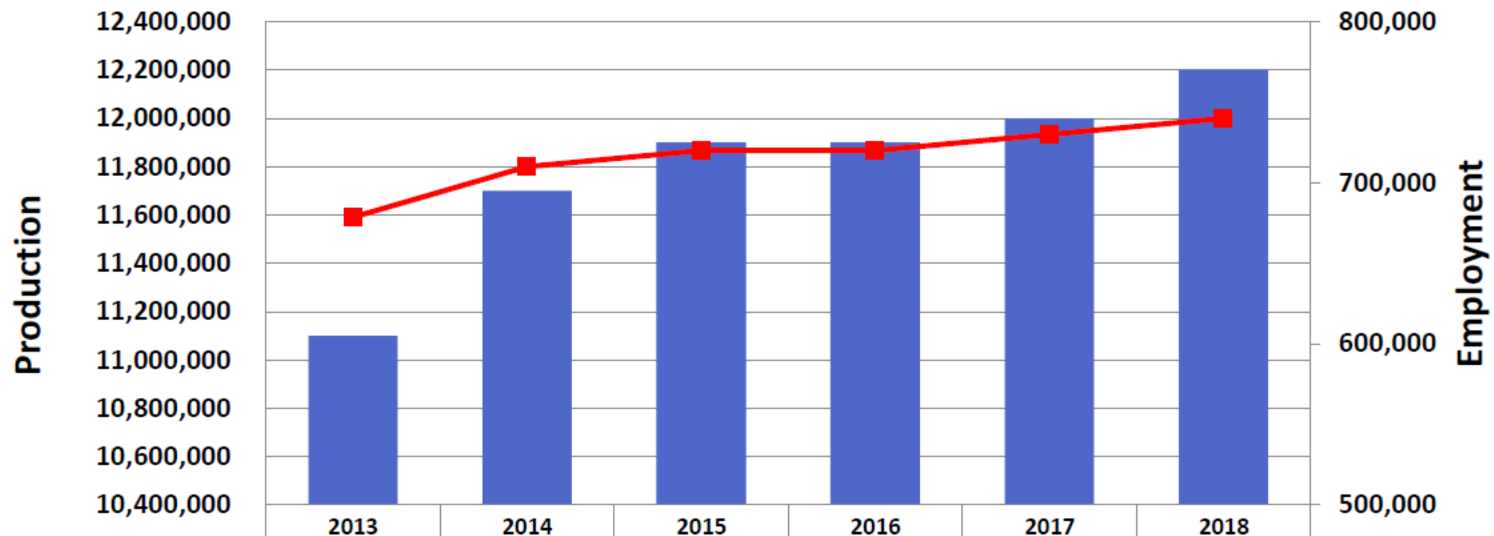
- Technical sessions
  - **Electric Vehicle Taxonomy**, presented by Macomb Community College
  - **Lightweighting, the New Chevrolet Corvette**, presented by General Motors
  - **Ann Arbor Connected Vehicle Project**, presented by the University of Michigan Transportation Research Institute (UMTRI)

Vehicle Sales Forecast is Stable



US Auto Employment to Grow Slightly

U.S. Vehicle Production & Automotive Employment Forecasts, 2014-2018



	2013	2014	2015	2016	2017	2018
Vehicle Production	11,100,000	11,700,000	11,900,000	11,900,000	12,000,000	12,200,000
Automotive Employment	678,500	710,000	720,000	720,000	730,000	740,000

Source: Automotive News; CAR Research; U.S. Department of Labor, Bureau of Labor Statistics, January 2014

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Drivers of the Auto Industry Future within CAAT's Scope

Source: Automotive Industry Office, Michigan Economic Development Corporation

Future Automotive Technologies Drive a Need for New Skills

Future Automotive Technologies Drive a Need for New Talent

Common Talent Needs for All Technology Areas Below

- **Computer software engineers, applications and systems software**
- **Systems engineering/integration**
- **Electrical engineers and technicians**
- **Chemical engineers and technicians**
- **Electronics engineers and technicians (except computer)**
- Industrial engineers
- Quality engineers
- All skilled trades
- Commercial and Industrial designers
- Database administrators and analysts
- **Project and program managers**

Connected & Automated	Powertrain & Propulsion	Advanced Materials/Lightweighting	Manufacturing, Supply Chain & Logistics
• **Electrical and electronics drafters** • **Electromechanical technicians** • **Engineering technicians, except drafters, all other** • **Electrical and electronics installers and repairers, motor vehicles** • **Network and computer systems administrators** • **Network systems and data communications analysts**	• **Computer hardware engineers** • **Electrical and electronic engineering technicians** • **Mechanical engineers** • **Electromechanical equipment assemblers**	• **Materials scientists** • Environmental engineers • **Simulation/modeling** • **Computer-controlled machine tool operators, metal and plastic** • **Extruding and drawing/forging/rolling /cutting/punching/press machine setters, operators and tenders, metal and plastic** • **Machinists** • **Welders, cutters, solderers and braziers and machine setters, operators and tenders**	• **Mechatronic, Robotics and Automation Engineers and Technicians** • **Network and computer systems administrators** • **Network systems and data communications analysts** • **Supply chain analysts** • Purchasing agents • **Logistics managers**

Sources: 1) MEDC, 2) Center for Automotive Research

Michigan occupation shortages in **bold**[1]; under-produced occupations in **red**[2]

From State of Michigan Automotive Strategic Plan

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Poll

How prepared is the workforce in your area to work with the technologies required by the auto industry to meet future fuel economy standards?

A. Ready
B. Partially Ready
C. Not Ready
D. Not Sure

Electrification Alternatives

Total Emissions

Conventional Gasoline

350 miles~
0 miles

Hybrid

400 miles~
<2 miles
$ 2 to 4 K

Plug-in Hybrid

400 miles~
20 -40 miles~
$ 6 to 15 K

Electric

100 miles~
100 miles~
$ 10 to 20 K

Cost
Battery Size
Petroleum Reduction
Environmental Friendliness

---- Total Range
---- All Electric Range
---- *Price Premium*

Overview of Electrified Vehicle Systems

Vehicle Drive System	ICE	Stop/Start Starter	Regener-ative Braking	Starter Generator 36-42v	Motor/ Gen at Flywheel 100-160v	Parallel Electric Motor 200-330v	Series Electric Motor 200-500v	External Battery Charging
Conventional ICE (Int. Combustion Engine)	X							
Start/Stop	X	X						
Mild HEV (Hybrid Electric Vehicle)	X		X	X				
Medium HEV	X		X		X			
Full HEV	X		X			X		
Plug-In Series HEV	X		X				X	X
BEV (Battery Electric Vehicle)			X				X	X

Center for Advanced Automotive Technology

Note: In parallel systems, power flows from either ICE or the electric motor or both. In series systems, all power flows from the electric motor.

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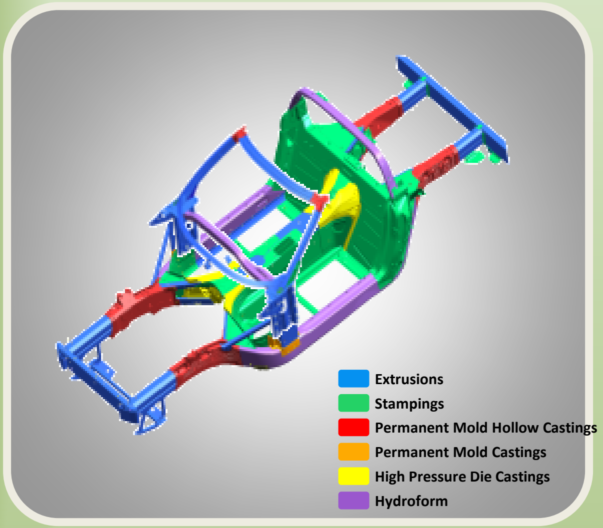
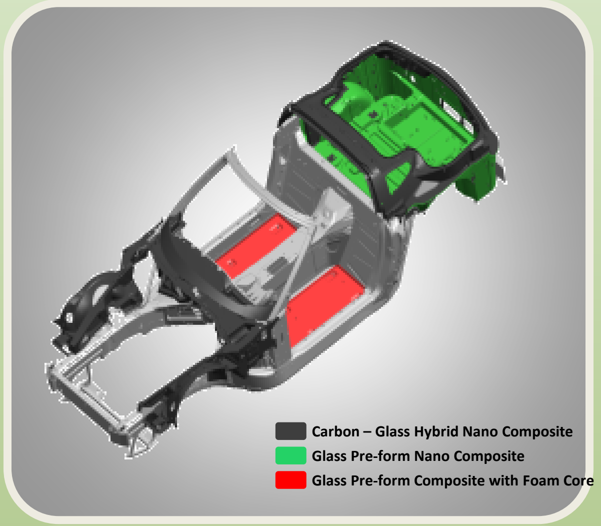
Design Overview of The New 2014 Corvette

CORVETTE Body Structure and Assembly

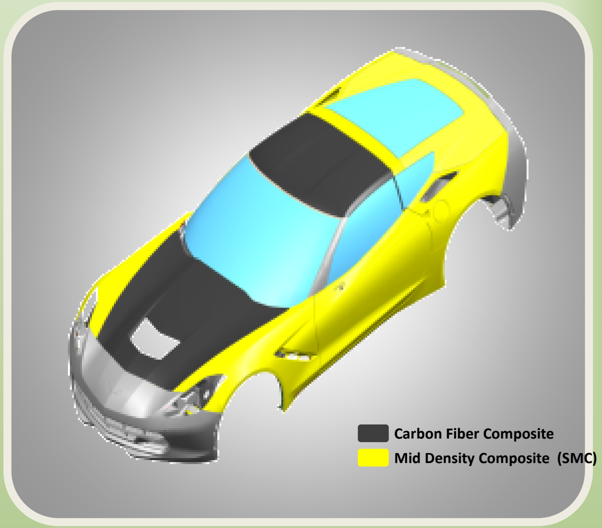
Aluminum Frame



Structural Composites

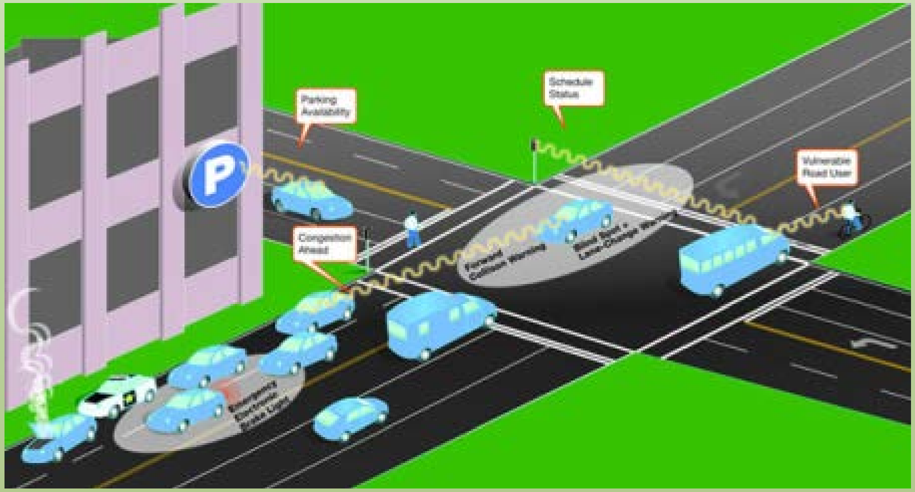


Exterior Composites



Connected & Automated Vehicles Defined

- Connected and automated vehicles use any of a number of different communication technologies to communicate with:
  - The driver
  - Each other
  - Roadside infrastructure
  - The "Cloud"
  - Satellites



John McElroy's Comments

- Big changes to the auto industry will continue.
- Fuel economy improvements are getting much tougher. Mass reduction will be necessary.
- Collision repair for aluminum and Carbon fiber lags that of steel.
- Energy consumption must be examined over the entire vehicle life cycle (raw materials, manufacturing, service and repair, and recycling/reuse/disposal).
- Car sharing offers tremendous energy savings in urban environments (average personal vehicle sits unused 22 hours per day). Big Opportunity for Electric Vehicles?

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Updated Industry Needs in Advanced Automotive technology

Transportation Challenges

Safety
- 32,367 highway deaths in 2011
- 5.3 million crashes in 2011
- Leading cause of death for ages 4, 11–27

Mobility
- 5.5 billion hours of travel delay
- $121 billion cost of urban congestion

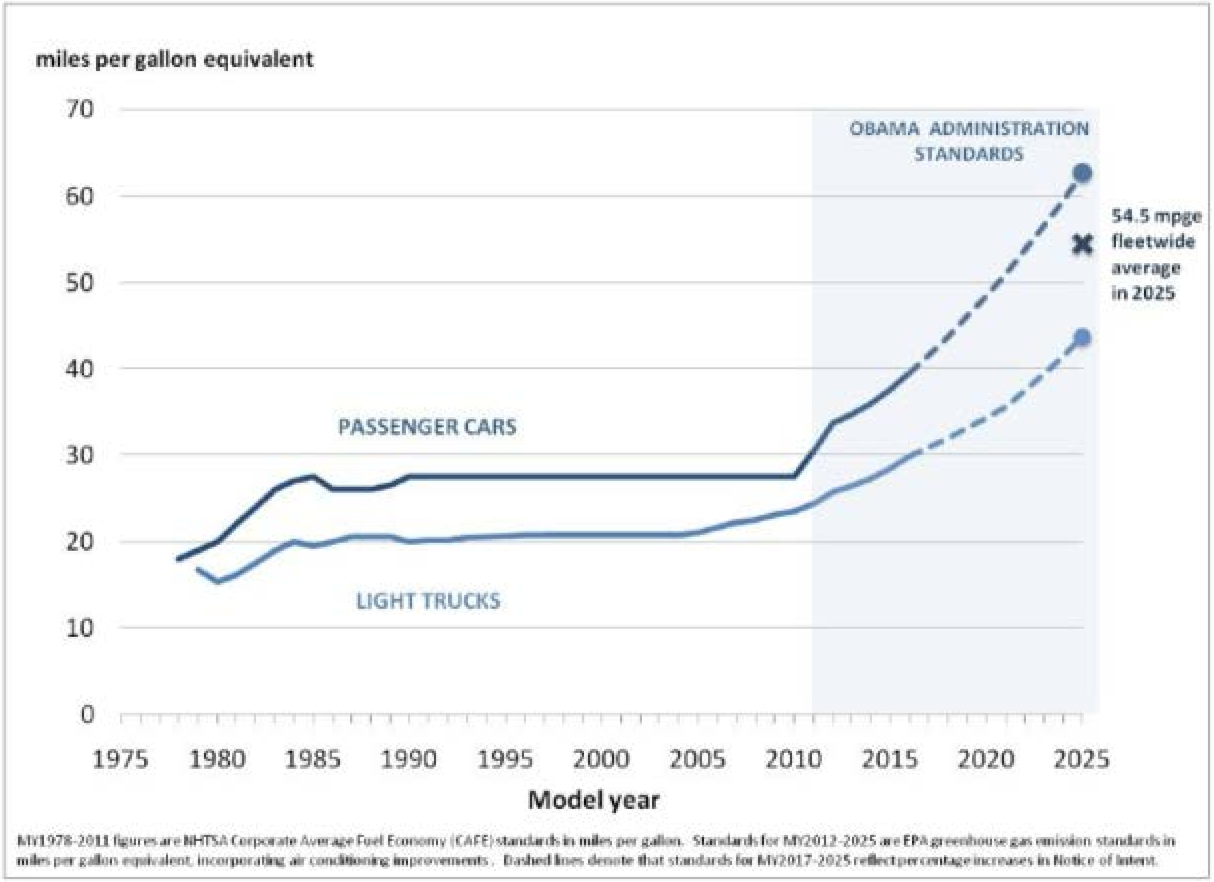
Environment
- 2.9 billion gallons of wasted fuel
- 56 billion lbs of additional CO_2

Poll

What issue do <u>you</u> think is the biggest challenge for automotive transportation?

A. Environment
B. Mobility
C. Safety
D. Other
E. Other (please use the chat box)

Coming Fuel Economy Standards Embody The Drive to Improve the Environment

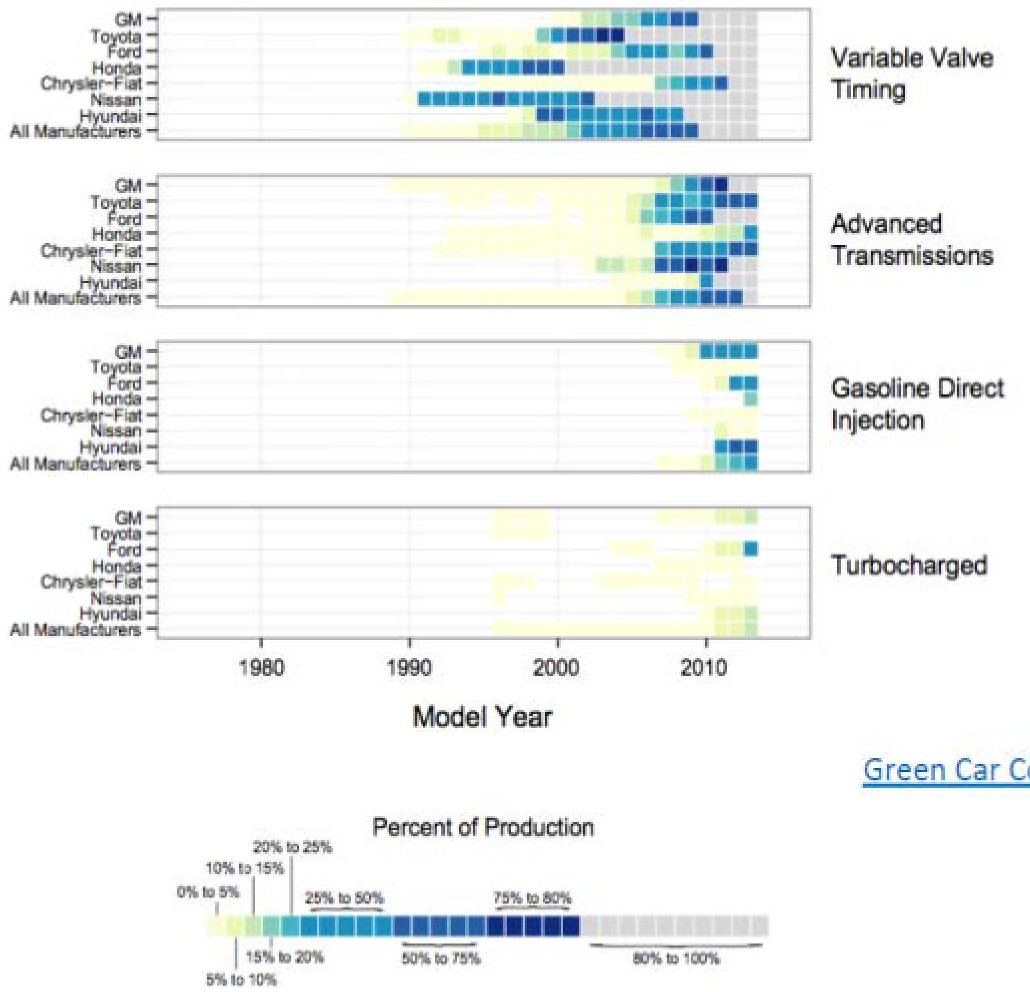


WardsAuto Annual Survey of Industry Engineers on Fuel Economy Strategies

- Question: What technology is your company focused on to help the industry meet 2025 fuel economy standards (multiple answers permitted)?
  - 49%, lightweighting
  - 39%, engine efficiency
  - 26%, vehicle electrification
  - 11%, downsizing
- For the 2011 survey, engine efficiency was the area of largest focus.

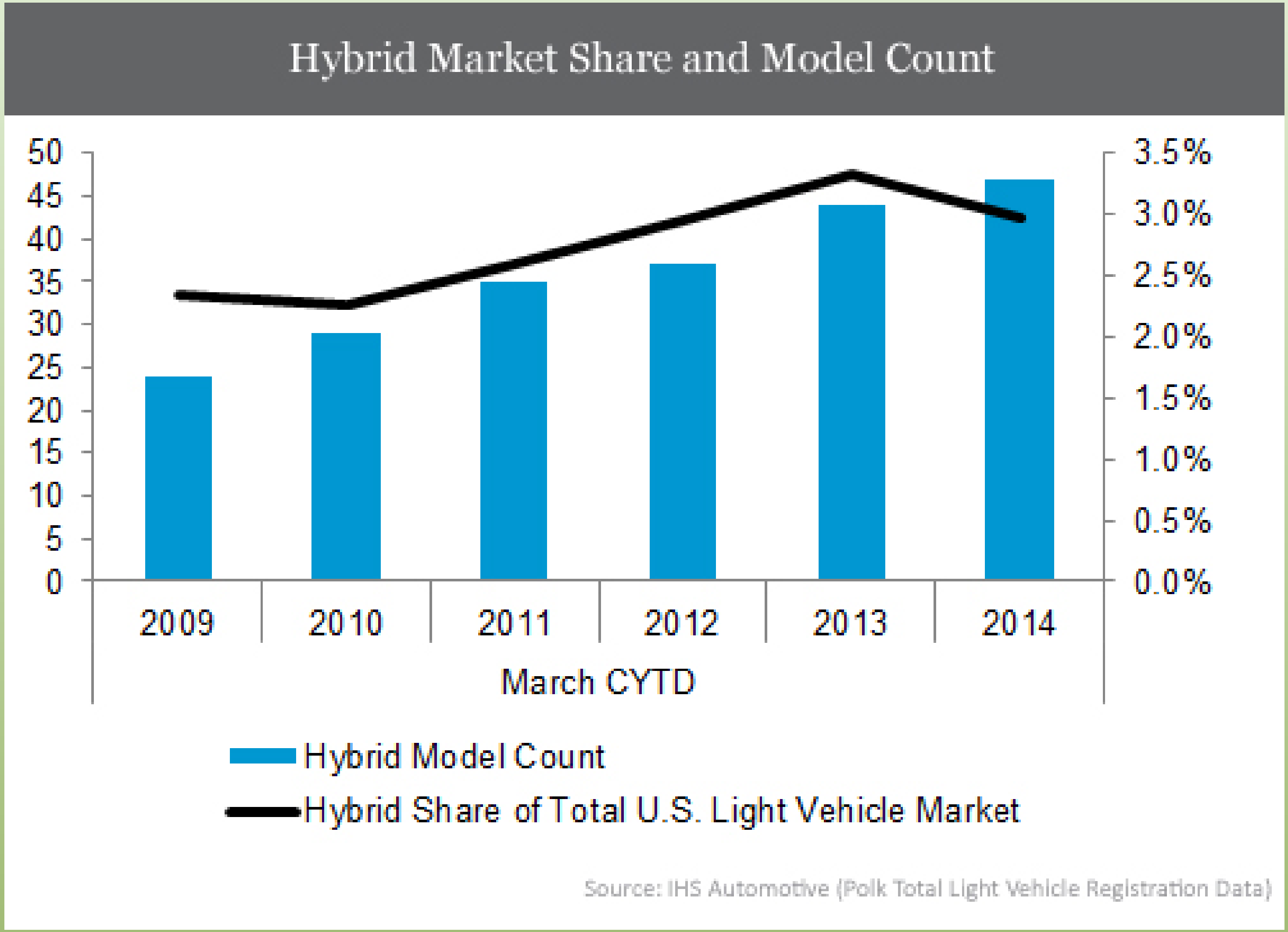
Source: 2014 WardsAuto, DuPont Automotive Trends Benchmark Study

Advanced Powertrain Technologies Are Being Widely Applied

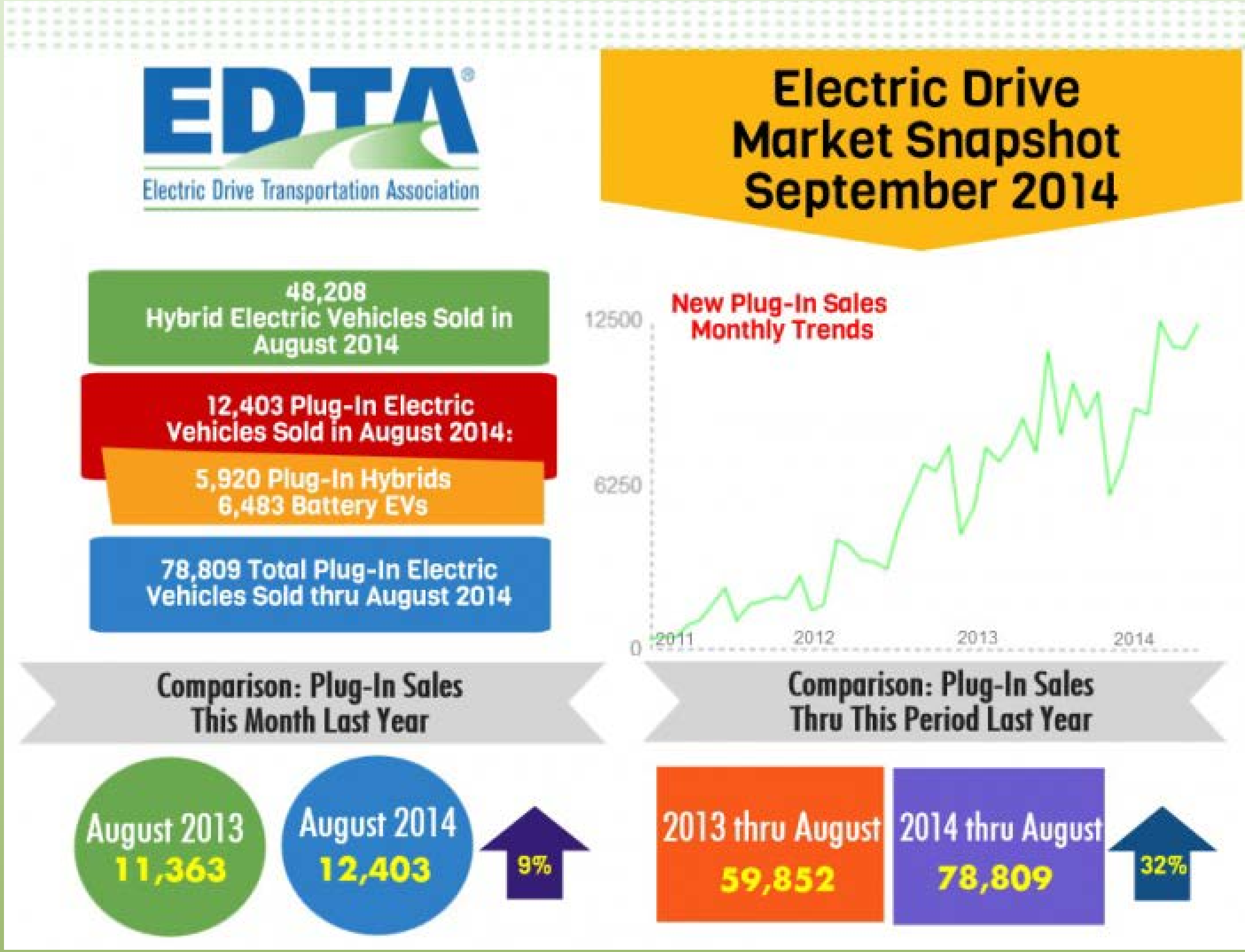


Green Car Congress, Dec 2013

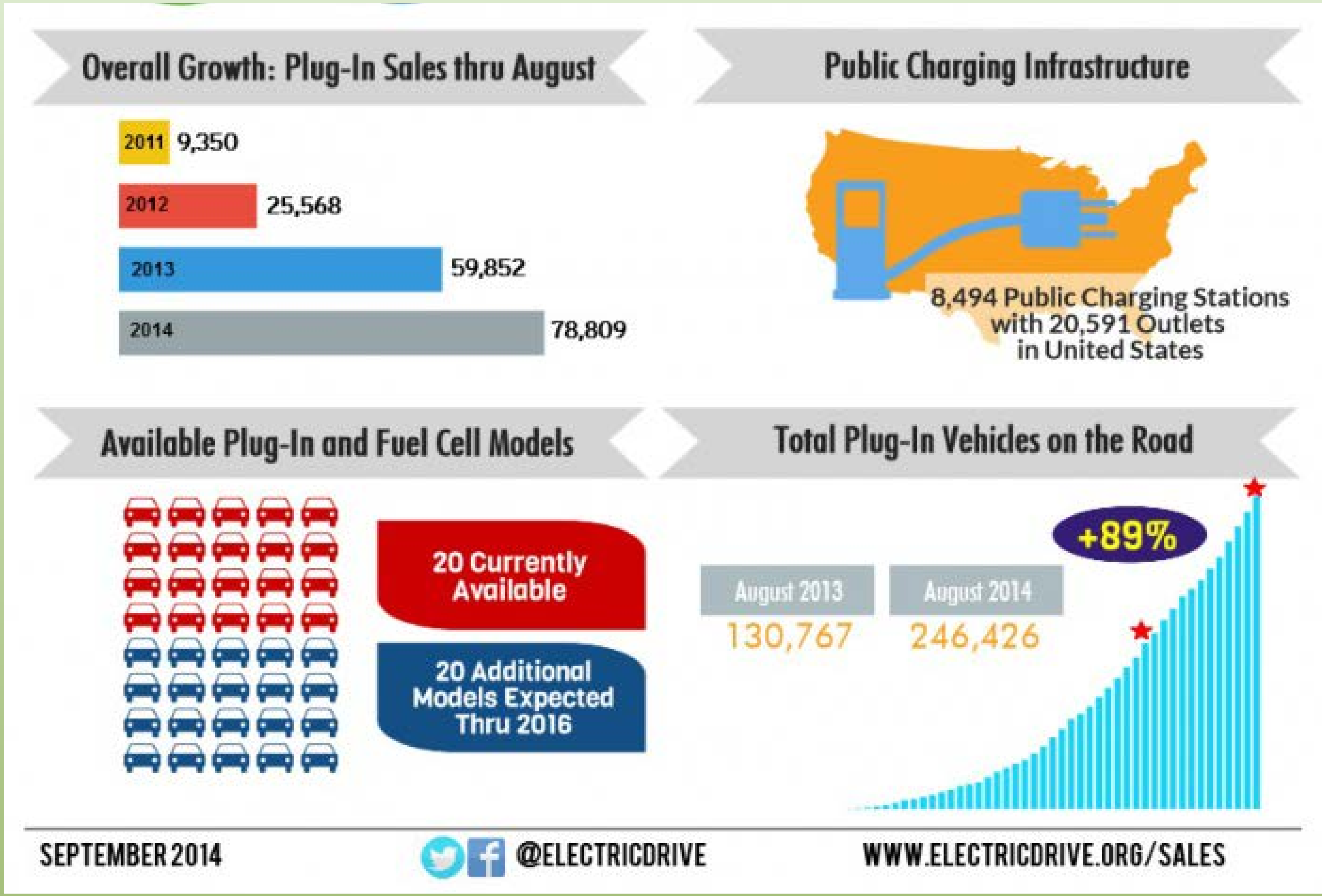
Hybrid Sales Plateaued for Now at 3% Market Share



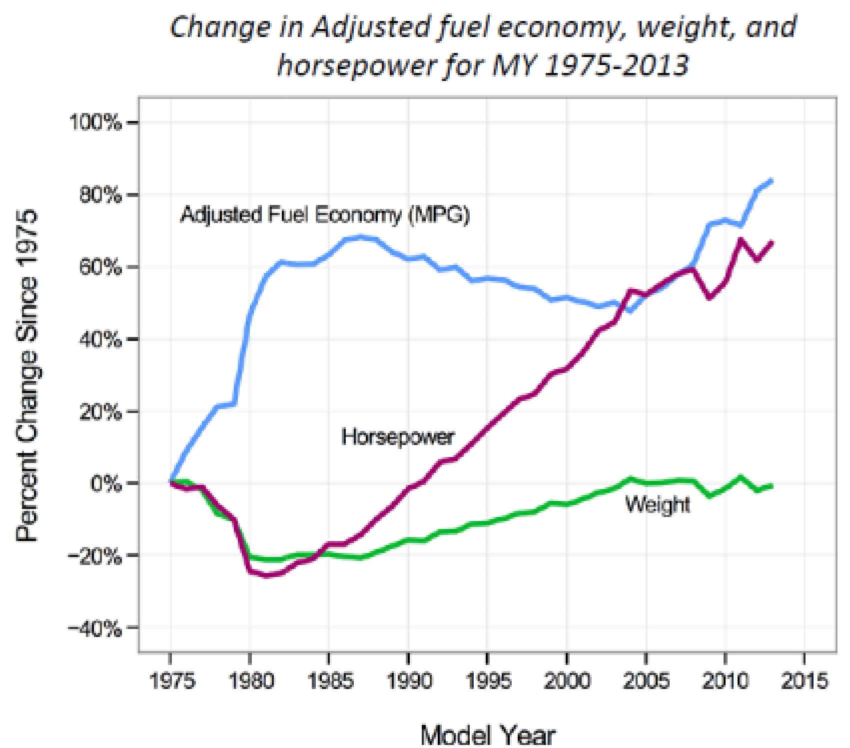
US Plug-In Vehicle Sales Continue to Grow



Plug-In Vehicles *Accumulate* on the Road

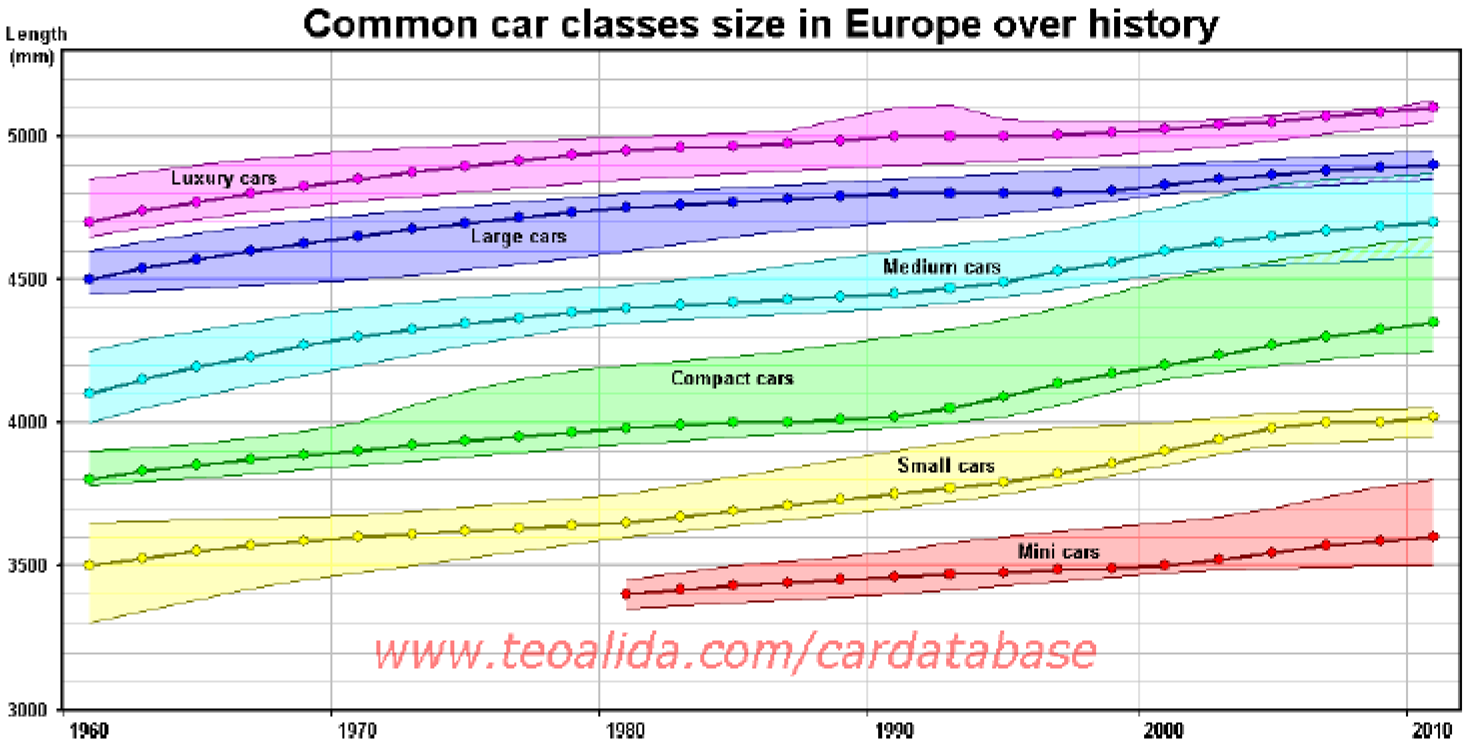


History of Vehicle Mass, Power, and Fuel Economy



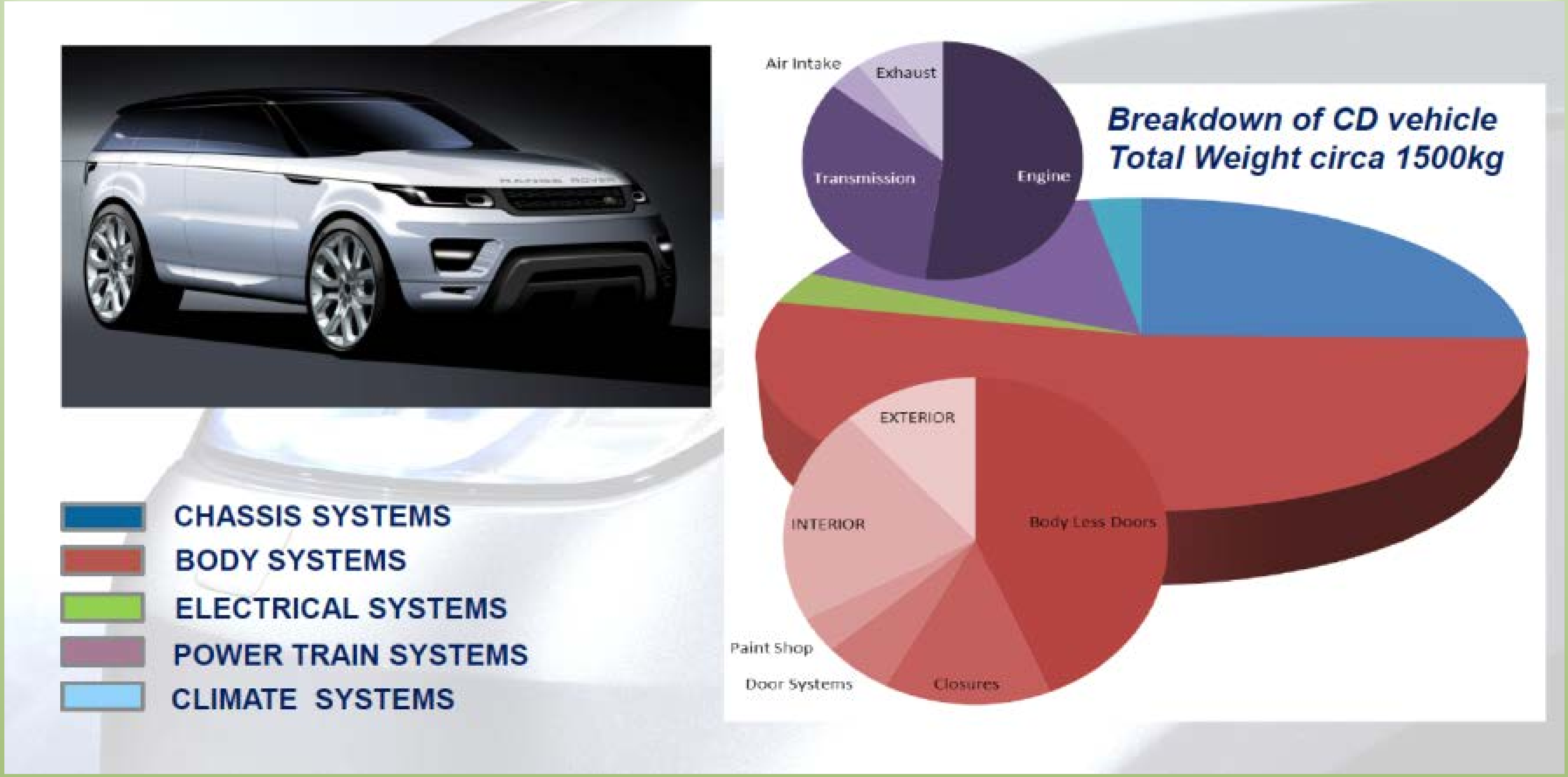
[Green Car Congress, Dec 2013]

Trend of Historical Vehicle Size Increases (Europe)



Example of the Old vs New Fiat 500

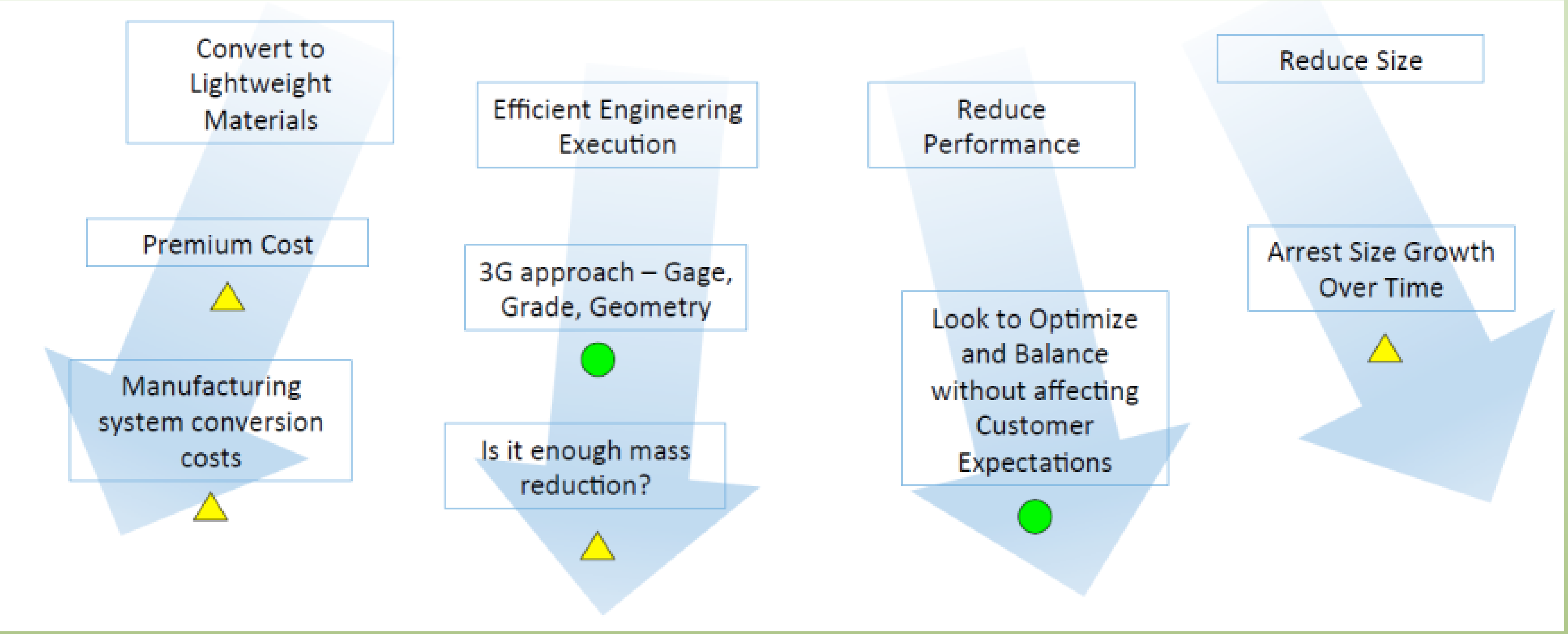
Typical Vehicle Mass Break-Down by System (Land Rover)



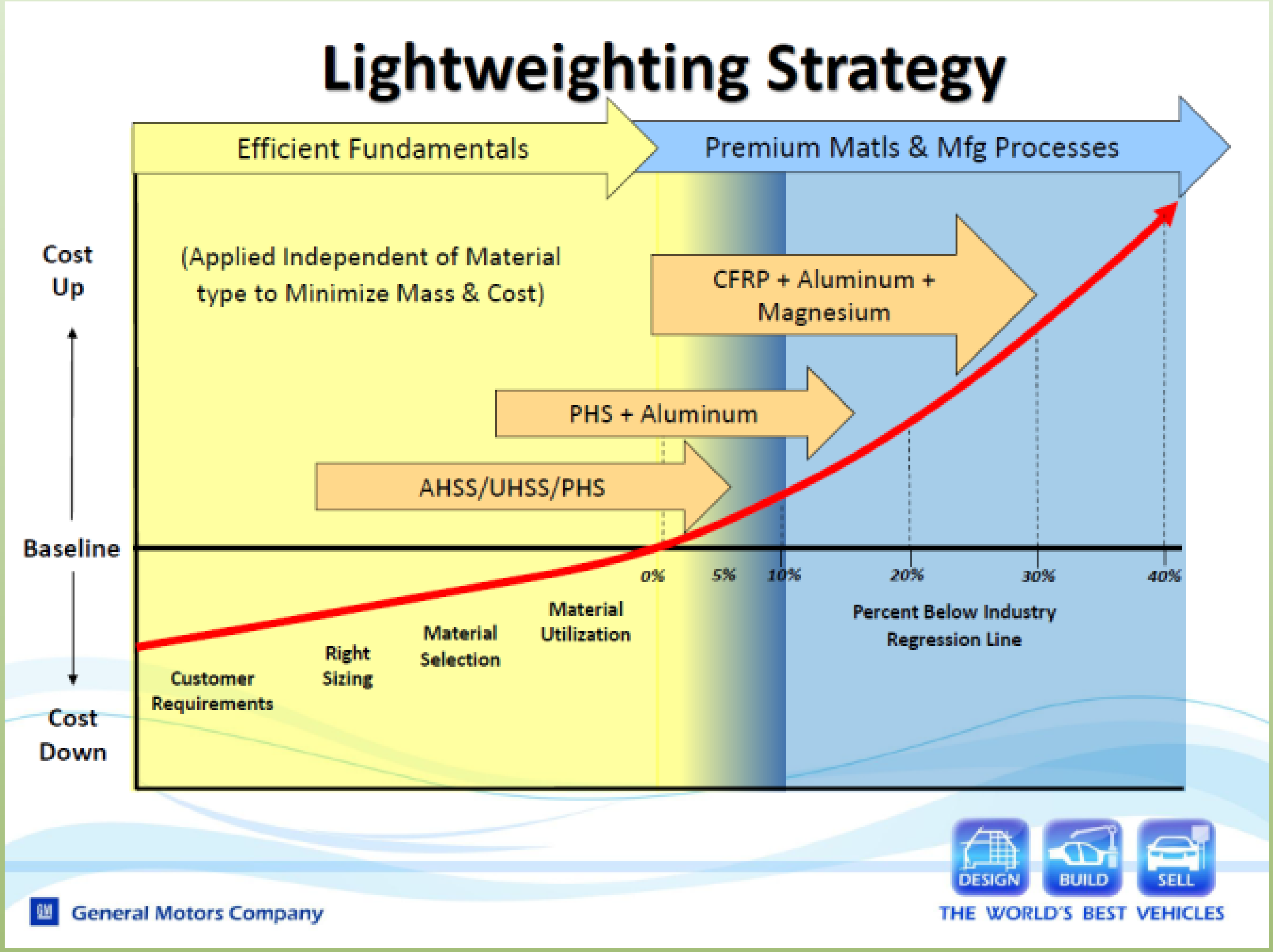
How Does Mass Reduction Achieve Fuel Economy Savings?

- Less energy required to accelerate the vehicle (F=ma)
- Less rolling resistance at speed
- Lightweighting begets lightweighting:
  - Smaller powertrains
  - Lighter chassis and brake components
  - Smaller gas tanks
  - Smaller wheels and tires

Mass Reduction Approaches for Body Structures and Closures



Progression of Lightweighting Strategies by Cost

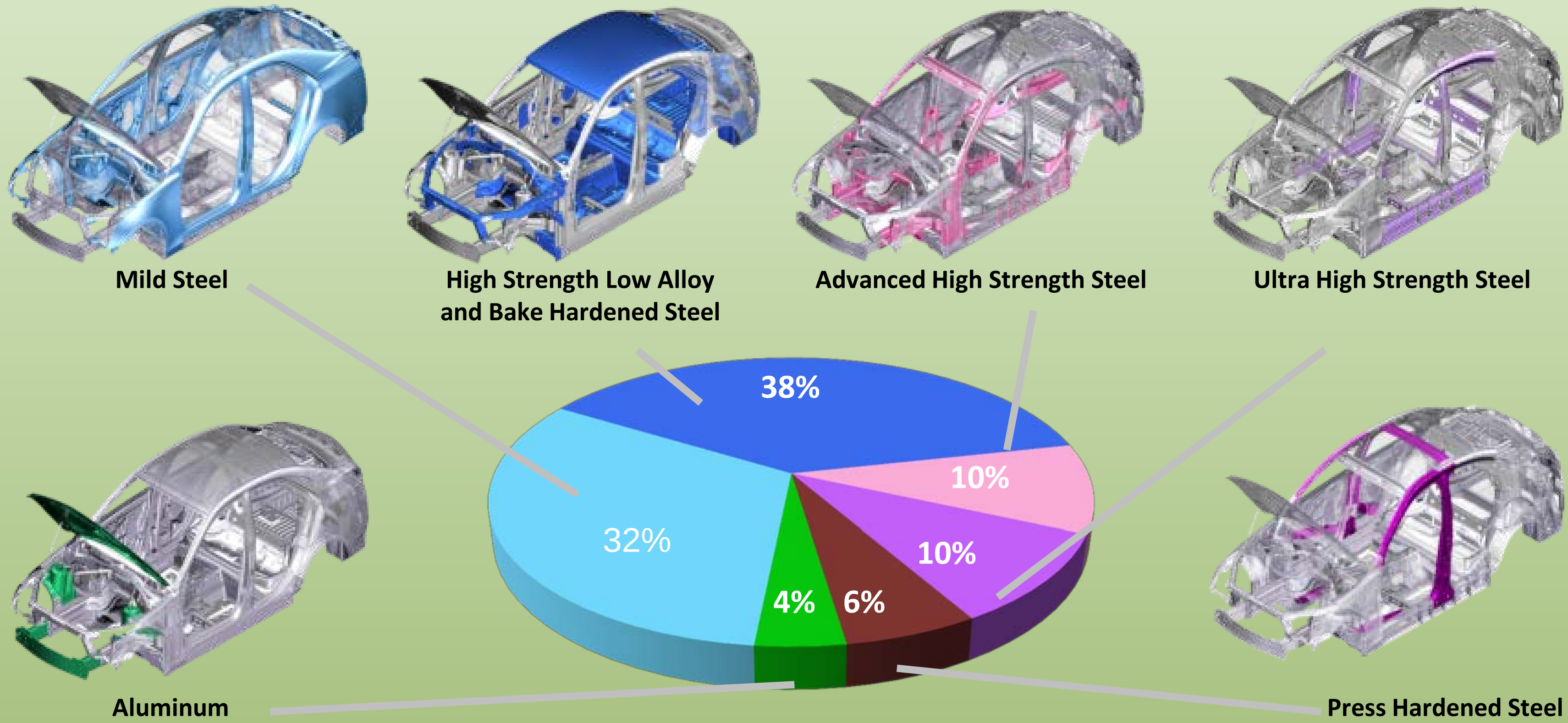


Examples of Sustained Lightweight Material Applications

- Aluminum Castings
  - Engine blocks and heads
  - Transmissions
  - Heat Exchangers
- Advanced High Strength Steels
- Aluminum Closure Panels

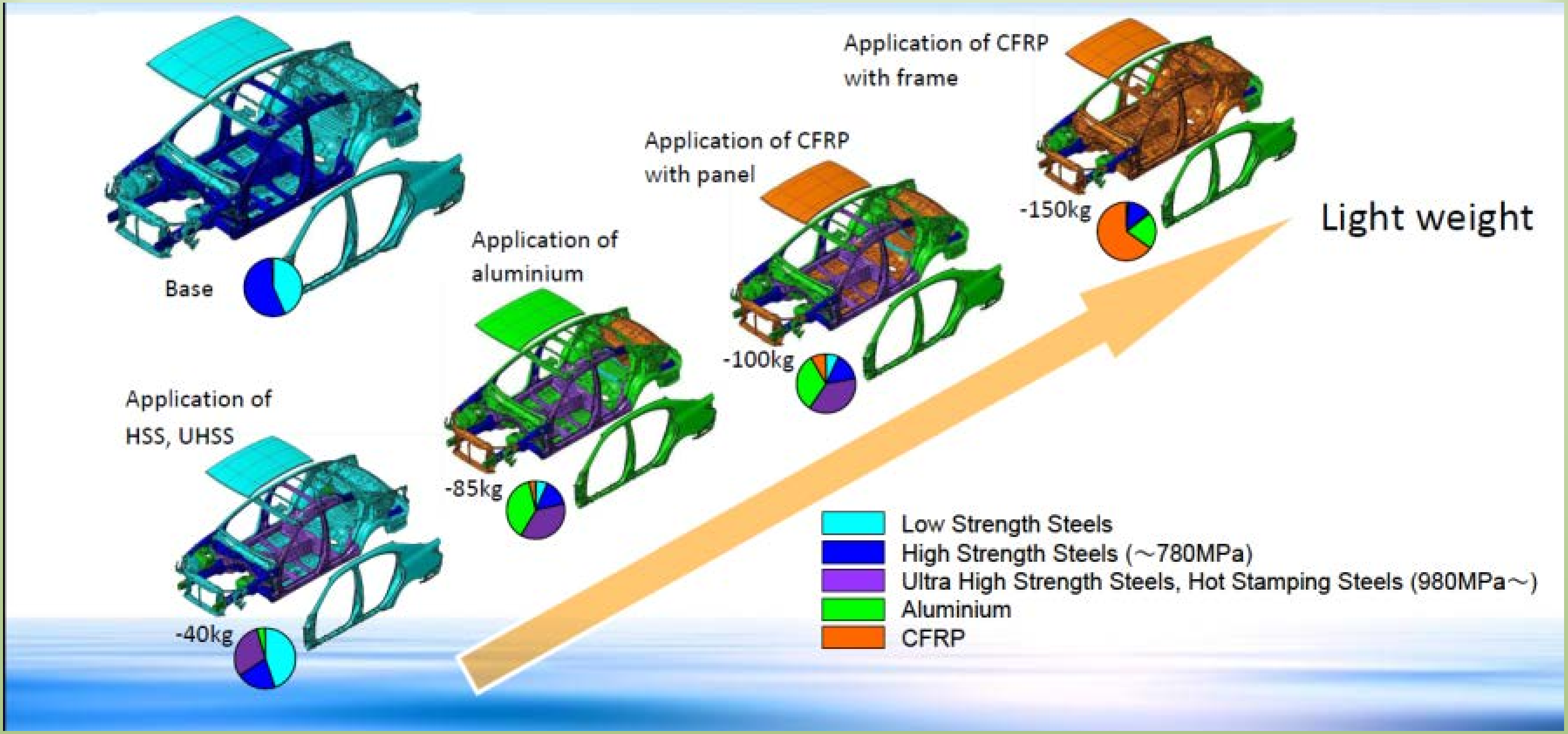
Multiple Materials In Body-In-White

- ATS Example:



Material Distribution as a Percent of BIW Mass

Toyota’s View of Lightweighting Technologies



Assembles of Advanced and Multiple Materials Complicate Joining

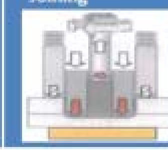
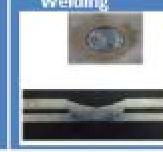
6. Multiple material

TOYOTA

Joining technology

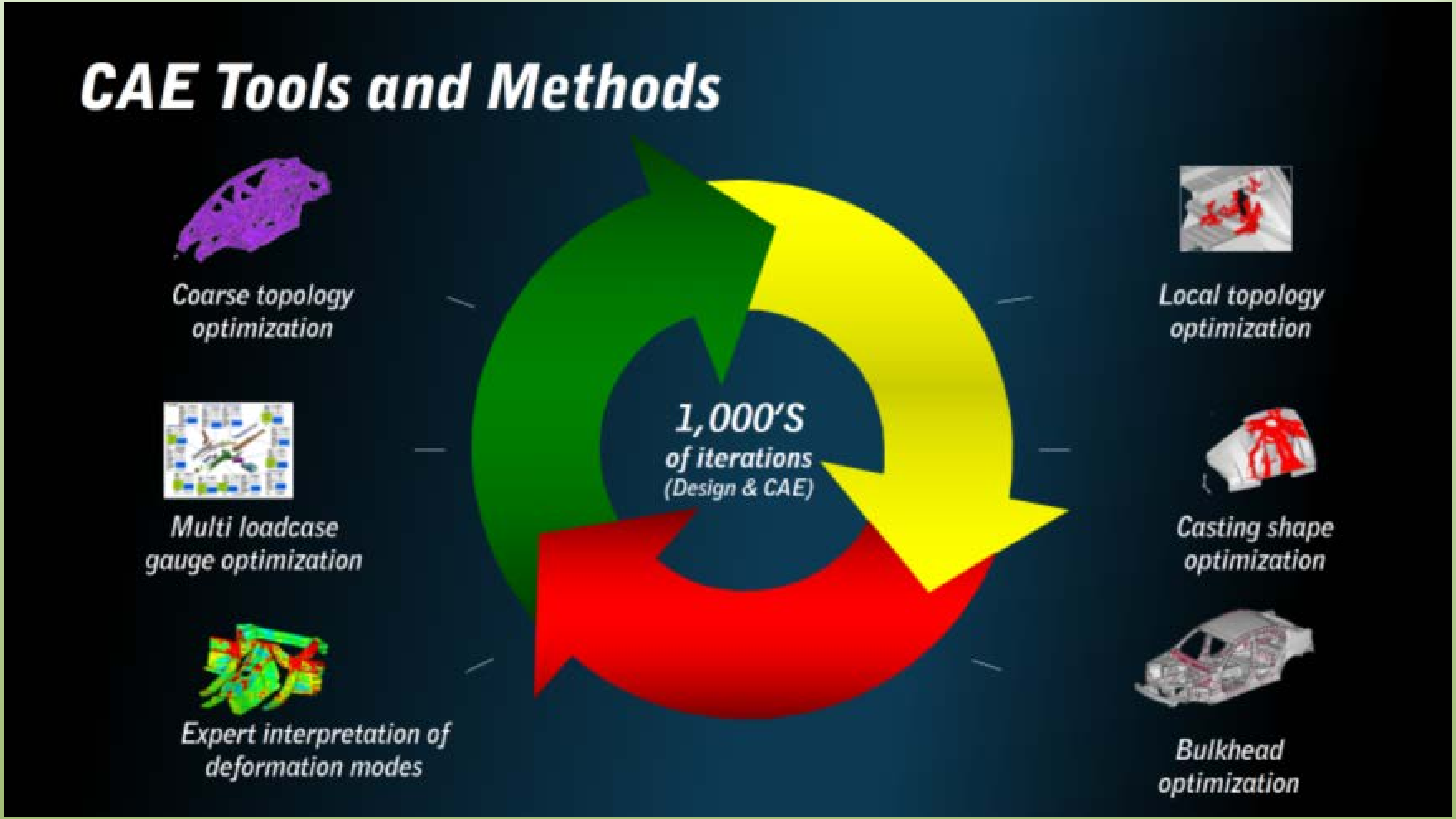
○=Candidates to use/develop in Toyota

LSS: Low Strength Steels
HSS: High Strength Steels （～780MPa）
USS: Ultra High Strength Steels , Hot Stamping Steels (980MPa～)
AL ： Aluminum

Combination of materials	SPR Self Piercing Rivet 	FDS Flow Drill Screw 	FSW Friction Stir Welding	FSJ Friction Spot Joining 	LSW Laser Screw Welding 	adhesive	・・・
Steel x Steel					○	○	
AL x AL	○	○	○		○	○	
Steel (LSS,HSS) x AL	○	○	○	○		○	
Steel(UHSS) x AL			○	○		○	
AL x CFRP(Random)	○			○		○	
Steel (UHSS) xCFRP(Random)	○			○		○	
CFRP x CFRP	○			○		○	
:							

Develop the most suitable Joining technologies for each material combination and each location

Enabling Computer-aided Engineering (CAE) Can Limit Materials Choices

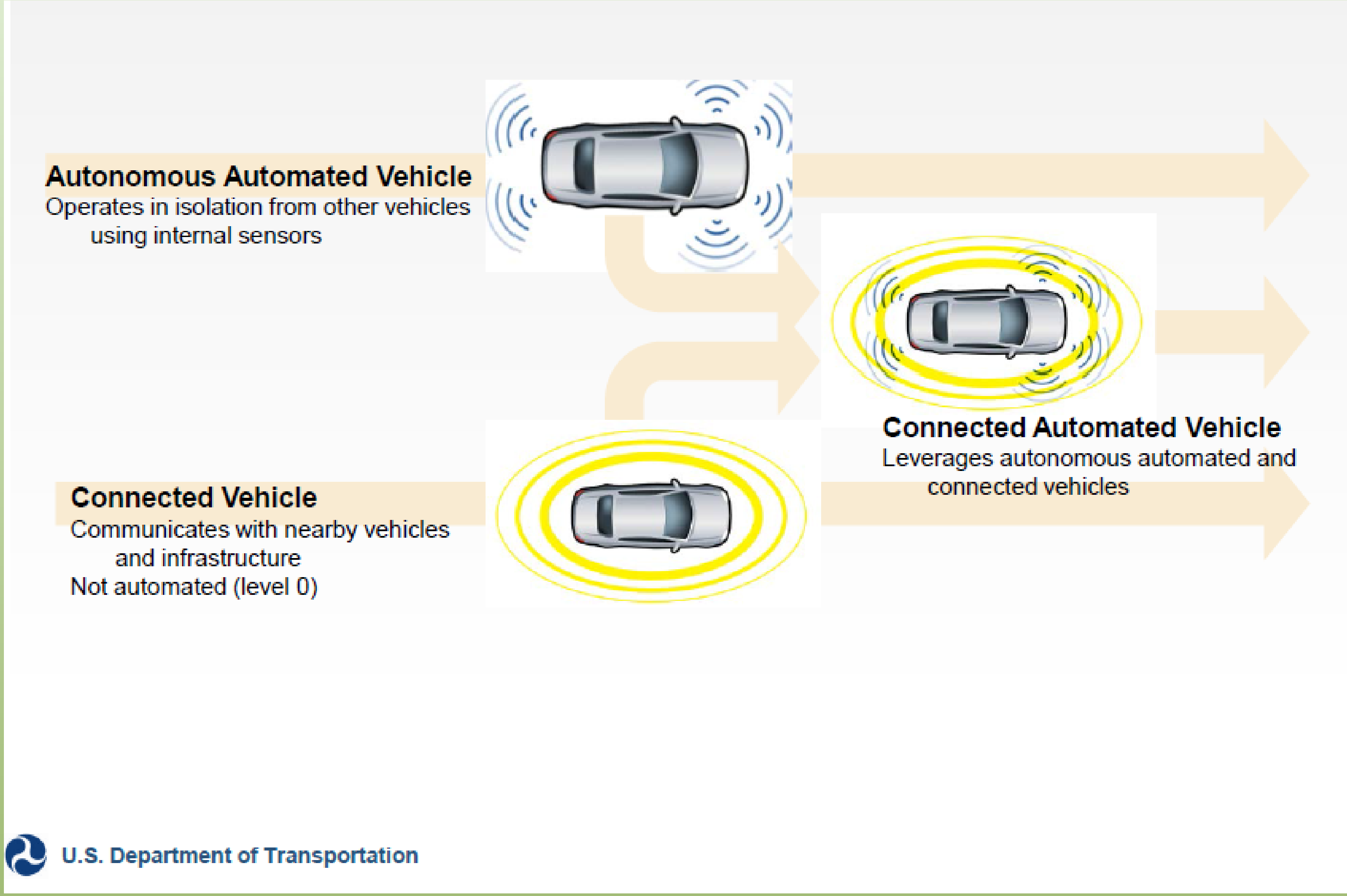


Typical Worker Skills Required in the Field of Lightweight Vehicles

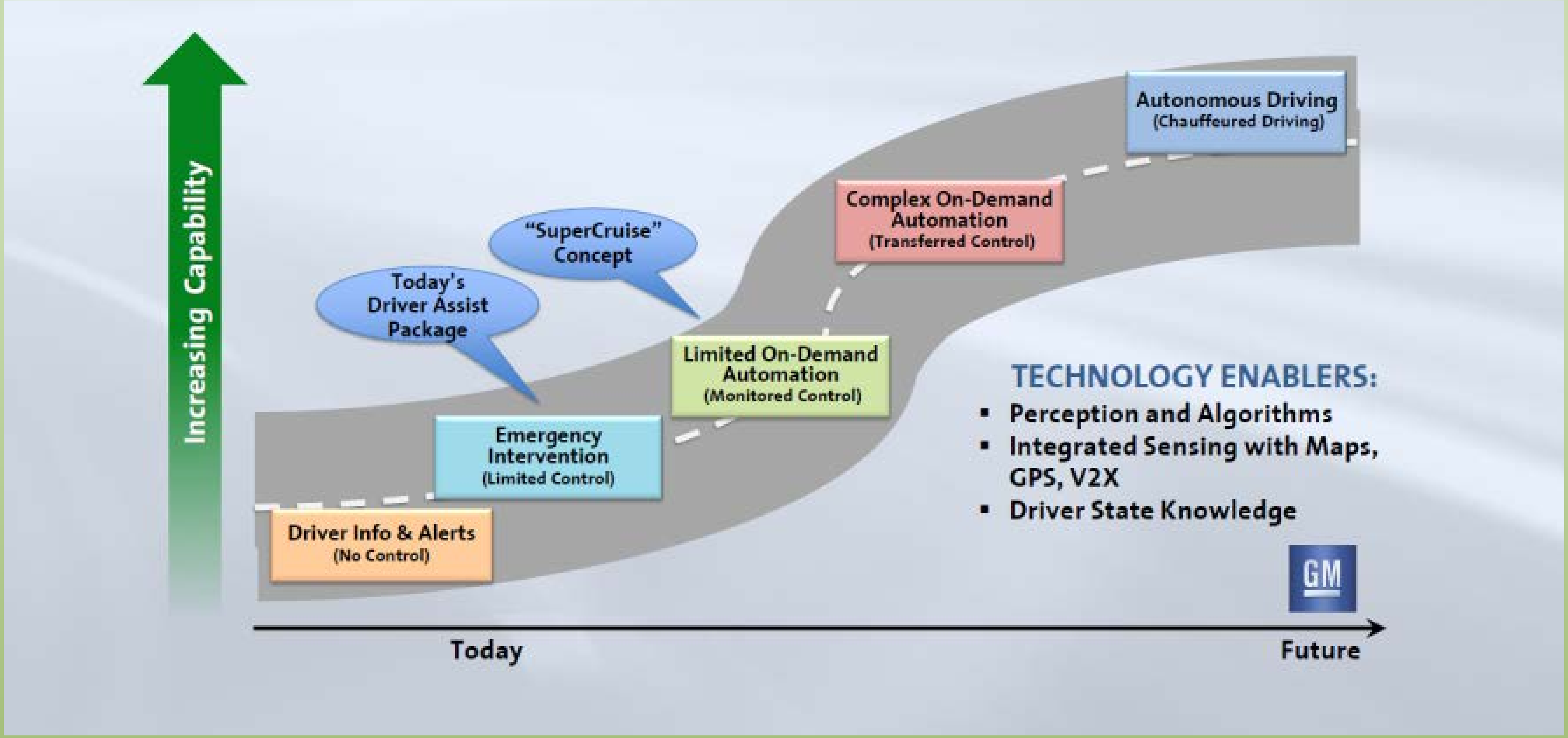
- Designers
  - Understanding of automotive materials properties for design including strength, stiffness, formability, joining methods, reparability, and recycling.
  - Familiarity with proven, sustainable automotive material choices
  - Understanding of systems engineering, CAE modeling , and manufacturing systems
- Technicians
  - Knowledge of how and when to repair many different automotive materials
  - Ability to assess and repair many different types of automotive joints and complex assemblies
  - Familiarity with how to identify and sort materials for reprocessing

Ford Takes a Leap: the New 2015 All Aluminum F150 Pickup Body

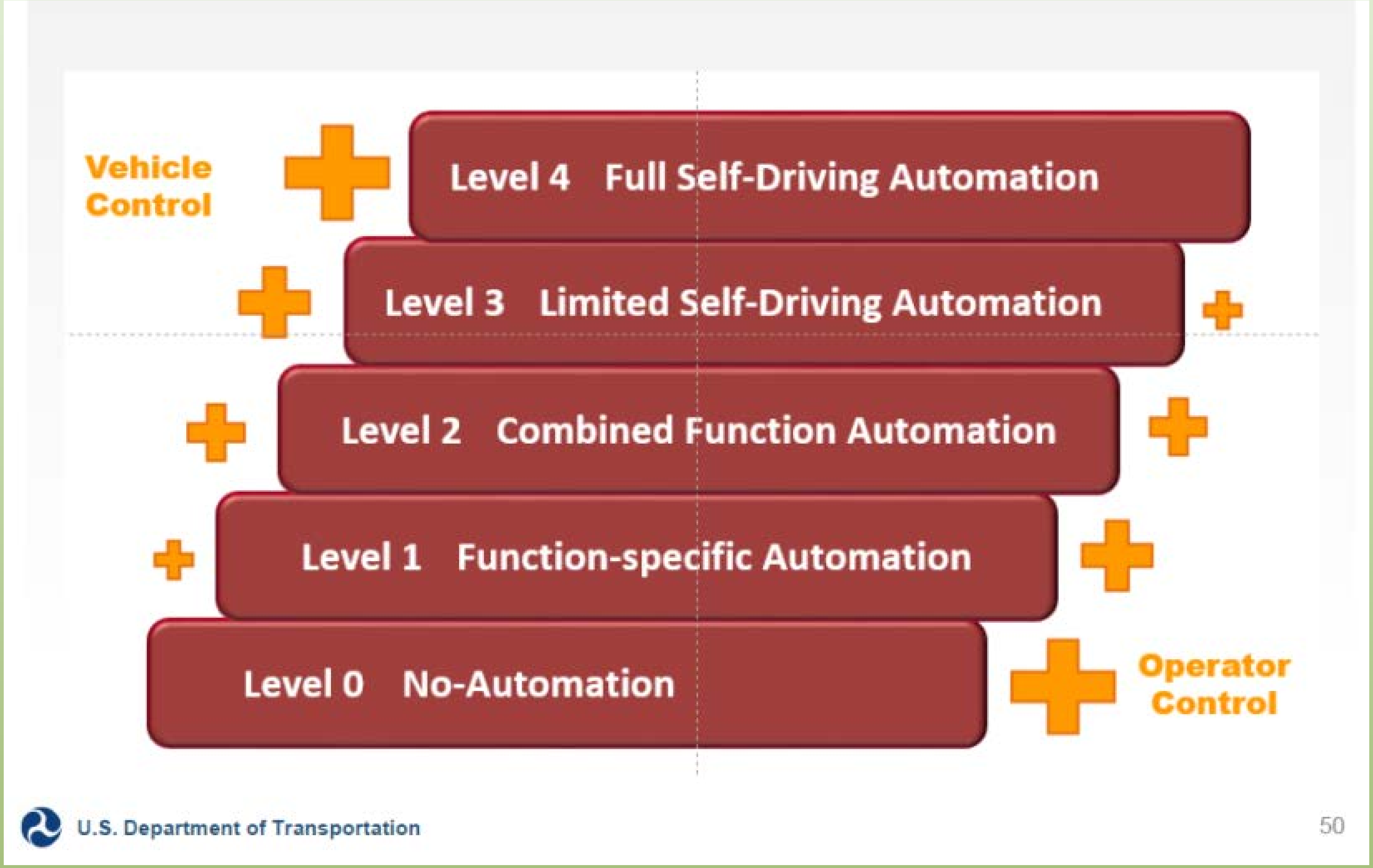
Automated and Connected Vehicles



GM's Road to Automated Driving

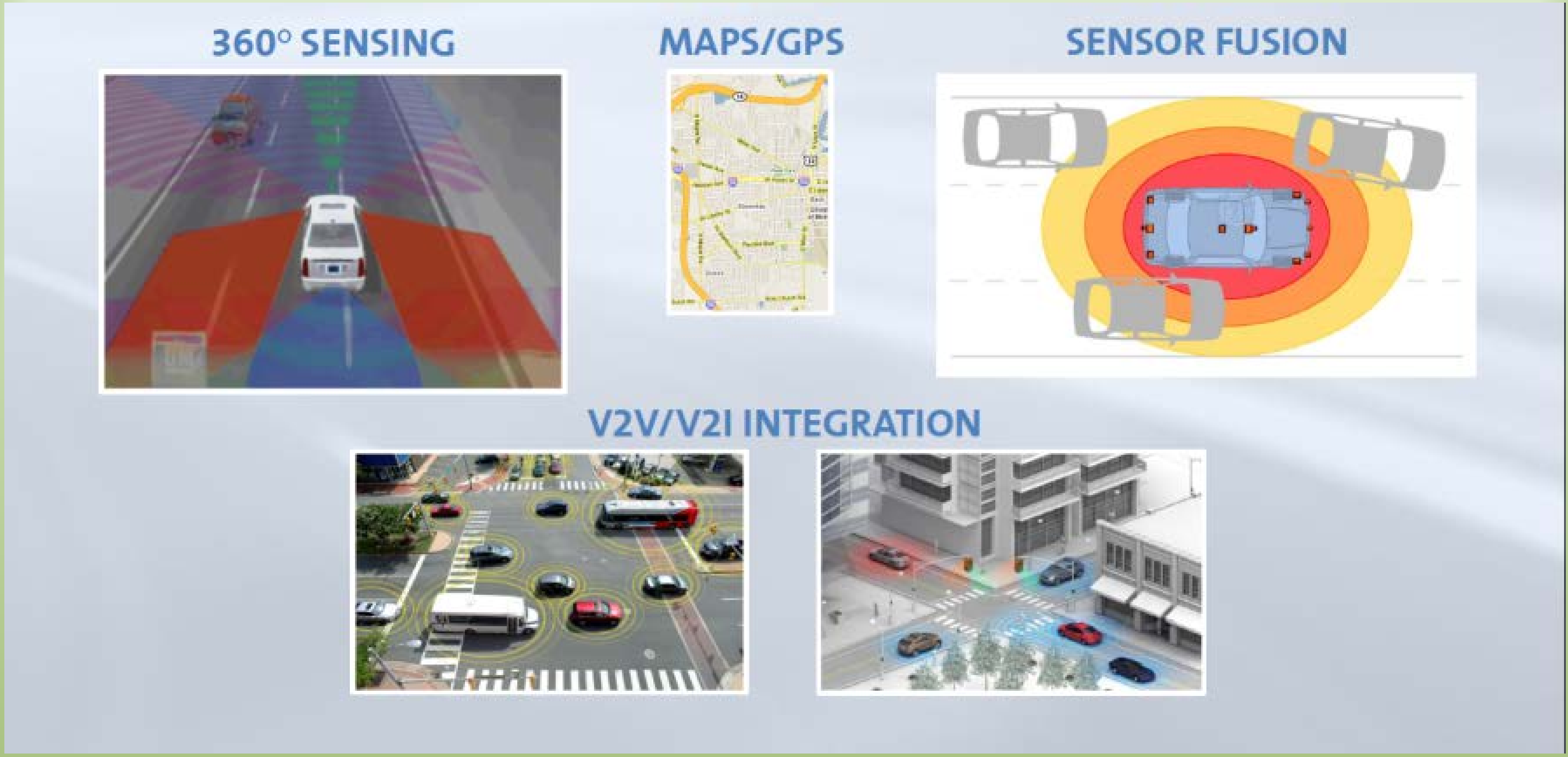


NHTSA's Levels of Automation



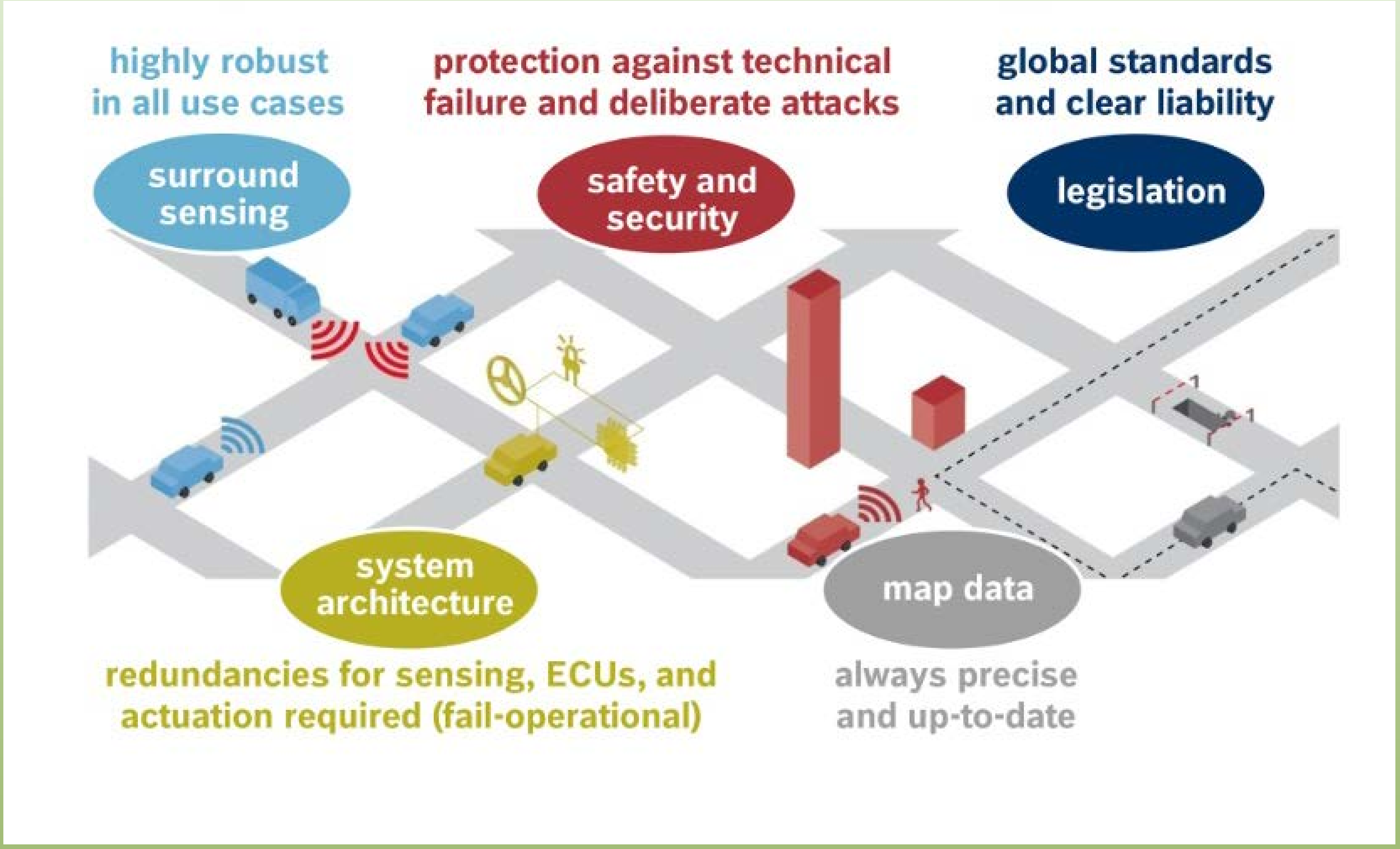
The Environment of the Connected Automated Vehicle

Integrated Systems Approach to Vehicle Automation



Coming application: 2017 Cadillac “Super Cruise”

The Complexity of Automated Driving



Typical Worker Skills Required in the Field of Automated Vehicles

- Working knowledge of wired and wireless protocols for vehicle-to-vehicle and vehicle-to-infrastructure communication devices
- Network programming knowledge in developing automation scripts
- Configuring and operating wired and wireless switches, routers, firewalls, and security systems
- Fluency in software such as Windows, Linex, VPN, SFTP/FTP, etc.
- Ability to conduct interoperability testing for automotive communication systems

Poll

When do you think fully autonomous (self-driving) vehicles will be introduced?

A. 2020
B. 2025
C. 2030
D. Never

Webinar Roadmap

- Setting the Stage
  - Who we are (Center For Advanced Automotive Technology)
  - Recap of Webinar of April 17, 2014
- Highlights of CAAT Annual Conference of May 2, 2014
- Updated Industry Needs in Advanced Automotive Technology
  - Continuing in Vehicle Electrification
  - Expanded in Vehicle Lightweighting
  - Expanded in Automated and Connected Vehicles
- New Seed Funding Opportunities
- Where We Go from Here

CAAT Seed Funding

- Funding available on a first come, first serve basis for educational institutions to develop or adapt materials:
  - From modules and artifacts to courses and complete curricula
  - Equipment not to exceed 20% of funding request
- CAAT and its partners will identify priority development needs

Focus of CAAT Curriculum Development and Dissemination

Automotive Systems and Subsystems	**Pre-production** Research⇨*Design*⇨ Development⇨Testing	**Production** Tooling⇨Manufacturing⇨ Assembly⇨Operations	**Post-Production** Service⇨Reuse⇨Recycle
HEV/EV Vehicle Systems	**X**		**X**
– Energy Storage	x	**X**	**X**
– Motors, Controls, and Components	x		x
Advanced Engine Systems	**X**	x	**X**
Alternate Fuel Propulsion Systems	**X**	x	**X**
Light-weighting and materials	**X**		**X**
Connected & Automated Vehicles	**X**	x	**X**

Note: ***Italicized*** areas are new **X:** primary focus x: secondary focus

CAAT Seed Funding Process

- Submit funding request using Proposal Template posted online
- Proposal reviewed and approved by CAAT
- Contract issued with key milestones for:
  - Deliverables
  - Payments
  - Reports

Summary of CAAT Seed Funding Projects

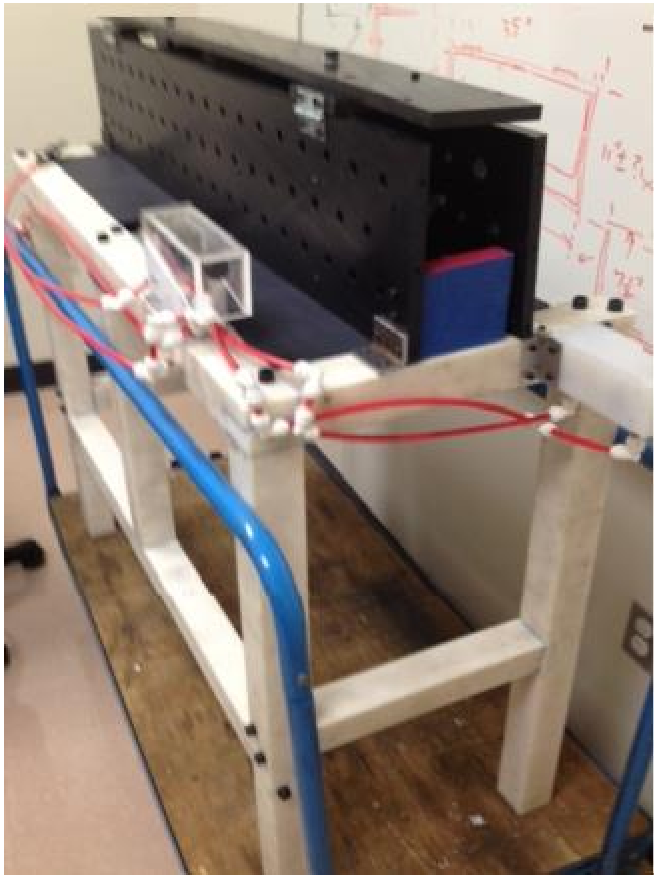
Institution	Title	Contract Date	Completion date	Amount	Status	Contact
Lawrence Technological University	Hybrid-based modules for two mechatronics courses	5/12/2011	11/7/2011	$22,278	Completed	Vladimir Vantsevich vantsevi@uab.edu
Lewis and Clark CC	Modified ASE certification courses to include hybrid/EV impacts	6/1/2011	11/7/2011	$27,540	Completed	Christopher Reynolds cereynolds@lc.edu
Grand Rapids CC	Curriculum for battery manufacturing job training	6/1/2011	5/22/2012	$8,403	Completed	Julie Parks jparks@grcc.edu
Lansing CC	Hybrid and EV overview modules for technician workforce and general public	2/8/2012	7/26/2012	$13,180	Completed	Glenys Warner warnerg@lcc.edu
Grand Valley State University	Modules for Li-ion battery reclamation technology	5/8/2012	3/31/2013	$25,000	Completed	Charlie Standridge standric@gvsu.edu
Ivy Tech CC	Course module on integrating EV charging stations to "Off Grid" energy center	5/14/2013	5/1/2014 (Targeted)	$22,299	Progress report submitted 11/2013	Susan J Ely sely3@ivytech.edu
Kent Intermediate School District	Project-based module for HS based on design, build, test and competition of an EV	11/4/2013	7/31/2014 (Targeted)	$16,000	1st report and 2nd payment due 4/30/2014	Angela Morris AngelaMorris@kentisd.org
Utica Community Schools	Middle school CTE bridge course based on design and build of an EV	3/10/2014	11/30/2014 (Targeted)	$22.000	Project initiated	Shannon Williams shannon.williams@UticaK12 .org
Wayne State University	Course module for technicians and engineers on the analysis and control of electric motors	2/13/2014	1/31/2015 (Targeted)	$16,122	Project initiated	Wen Chen wchenc@wayne.edu
University of Alabama at Birmingham	Course for technicians and engineers in Energy Efficiency of HEVs and EVs, Labs	5/1/2014 (Estimated)	1/31/2015 (Estimated	$25,000 (Proposed)	Awaiting final proposal from UAB	Vladimir Vantsevich vantsevi@uab.edu

Presenter

Charlie Standridge
Assistant Dean of the College of Engineering and Computing
Grand Valley State University

Educational Modules Concerning Processes for Remanufacturing, Repurposing and Recycling of Batteries:
A Partnership between Grand Valley State University and Muskegon Community College

The Partnership Approach



- Muskegon Community College provides
  - Curriculum development
  - Technical course assessment
- GVSU provides
  - Graduate student
  - Grant co-ordination
  - General education course assessment

Grand Valley State University

Muskegon Community College

The Module Approach

- Course materials that can be adapted to many courses and contexts
  - Overview, context, perspective
  - Electrical topics
  - Safety topics
  - Mechanical / chemical topics
- Active learning exercises

Grand Valley State University

Muskegon Community College

The Proposal / Reporting Process

- Proposal is short & straightforward
  - Objectives
  - The work plan
  - Testing
  - Staffing
  - Budget
  - Deliverables
- Reporting
  - Follows proposal outline

Grand Valley State University

Muskegon Community College

The Results

- At Muskegon CC
  - A new course in *Battery Chemistry*
  - The existing course *Intro to Hybrid's and Alternative Fuels*
- At GVSU
  - The Global Issues course: *Renewable Energy Systems: Structure, Policy and Analysis*
- Muskegon CC – GVSU relationship buiding

Grand Valley State University

Muskegon Community College

The Future

- At Northwestern Michigan CC
  - Shared previous work
  - Under consideration: Additional modules for Hybrid Electric Vehicle class

GRAND VALLEY STATE UNIVERSITY

Muskegon Community College

Presenter

Shannon Williams
Career & Technical Education Teacher Leader
Utica Community Schools

EXPLORATORY DESIGN & ENGINEERING II

Utica Community Schools

Grades 7-9
Prerequisite EDE I

Presentation by:
Shannon Williams
CTE Teacher Leader

EXPLORATORY DESIGN & ENGINEERING I

- Implemented 2013-14
- Student Enrollment:
  - 2013-14 = 795 students
  - 2014-15 = 984 students
- Course Content
  - Engineering
  - Mechanical Design
  - Architecture
  - CAPSTONE Career Exploration
- Course Delivery
  - Board drafting/design
  - CAD drafting/design
  - Projects
    - Design, build, test, reimagine

EXPLORATORY DESIGN & ENGINEERING II

- Implementation 2014-15
- .5 Credits
- Grades 7-9
- Prerequisite EDE I
- Student Enrollment
  - 2014-15 = 268
- Course Content
  - Electronics 101
  - Mini Projects/Sources of Power
  - Capstone - Build an Electric Vehicle

COURSE CONTENT EXPANDED

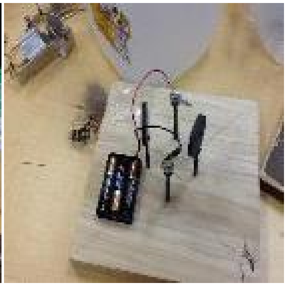
- Review & Intro
  - Drawing/Reading Schematics associated with electronics
  - Basic drafting symbols

Timeline:
Estimated 7 weeks

- Electronics 101
  - Bread Board
  - Resistor Color Code
  - OHM law and basic circuits
  - Parallel Circuit
  - Diode Action
  - Electromagnetism
  - Capacitance
  - Transistor Switch
  - Variable Switch
  - Variable Resistor LED Dimmer
  - DC Motor Experiment
  - Transistor Oscillator

COURSE CONTENT EXPANDED

- Mini Projects/Sources of Power
  - Motor – Magnet
  - Battery/Voltage
  - Solar Power


Timeline:
Estimated 6 weeks

- Capstone/Electric Vehicle
  - Design an electric vehicle
  - Market your vehicle
    - Trade show
  - Race
  - Evaluate results/Retool (distance)
  - Race
  - Evaluate results/Retool (pulling weight)
  - Race

Timeline:
Estimated 5 weeks

DEVELOPMENT TIMELINE

- December
  - Planning team met
- February – April
  - Course Development
    - Shannon Williams
    - Scott Spry
    - Andy Davis
    - Jason Thoel
- April 15th, 2014 - Professional Development
  - Introduction of Course to IX teachers (15 teachers)
  - WIN, Chrysler, CAAT, Wayne State University, MISD
- May
  - IVD Competition (6 teachers)
- June
  - 2 Day Summer Workshop (14 teachers)

EXPLORATORY DESIGN & ENGINEERING II

- Course Content
  - Electronics 101
  - Mini Projects/Sources of Power
    - 3 Units
  - Capstone - Build an Electric Vehicle
    - One original build
    - Tradeshow
    - Two addition competitions after retool

Soft Skills Missing in Job Candidates
Communication – Listening & Speaking Skills
Critical & Analytical Thinking
Adaptability & Flexibility
Initiative
Problem Solving & Decision Making

ELECTRICAL ENGINEERS

Exploratory Design & Engineering II

Curriculum at a Glance

Estimated Time Allocations

1 Week	Introduction to class. Policies and procedures. How to draw and read schematics associated with electronics Review of basic drafting skills associated with new symbols How to use a bread board – 1 day Lesson #1 - Resistor Color Code – 2 days	Recommended at beginning of course
1 Week	Lesson #2 - OHM' law and the basic electronic circuit – 2 days Lesson #3 - Parallel Circuit – 2 days Lesson #4 - Diode Action – 1 day	
1 Week	Lesson #5 - Light Emitting Diodes – 1 day Lesson #6 - Electromagnetism – 2 days Lesson #7 - Capacitance – 2 days	These lessons can occur in any order that makes sense for your schedule. For instance, if the class is running 1st semester you may want to move the Solar Unit to the third week of school.
1 Week	Lesson #8 - Transistor Switch – 2 days Lesson #9 - Variable Resistor LED Dimmer – 2 days	
1 Week	Lesson #10 - DC Motor Experiment – 2 days Lesson #11 - Transistor Oscillator – 2 days	
2 Weeks	Students choose 6 circuits past Lesson #11 to build on their own.	
2 Weeks	Battery Unit • Timeline – 2 days • Presentation – 3 days • Lemon Project – 2 days • Potato Project – 2 days	
2 Weeks	Motor Unit • Introductory PowerPoint with activities – 2 or 3 days • Teacher Demo-simple motor – 1 day • Advanced Stationary Motor – 4 days • Wind Turbine – 3 days	
2 Weeks	Solar Unit • Introductory PowerPoint with activity – 1 day • Ice Cube Meltdown – 1 day • Funnel the Sun – 2 days • Shoebox Water Heater – 3 days • Invention/Innovation Presentation – 3 days	
5 Weeks	Capstone Project Electric Vehicle • Design vehicle & begin material list • Complete design & procure materials • Build and test vehicle • Build and test vehicle / begin report • Complete challenges, class presentations and showcase	Recommended to stay at end.

The timeline above accounts for 18 weeks out of the semester. This leaves some room for individualization, school closings, and district scheduled testing.

Battery
Intro_Electronics
MicroElectric Vehicle Project
Motors
Proposal
Solar
Course_Description.docx
Curriculum_at_a_Glance.docx

Battery Assessment.docx
Day 1-2_Timeline Worksheet.docx
Day 1-2_Timeline_BatteryProject_OVERVI...
Day 3-5_Prezi Rubric.docx
Day 3-5_Prezi_BatteryProject_OVERVIEW....
Day 6-7_Lemon_BatteryProject_OVERVIE...
Day 6-7_Lemon_BatteryWorksheet.docx
Day 8-9_Potato_BatteryWorksheet.docx
Day 8-9_Potatoe_BatteryProject_OVERVIE...
Day10_Battery_Assessment.docx

Lesson #1
Lesson #2
Lesson #3
Lesson #4
Lesson #5
Lesson #6
Lesson #7
Lesson #8
Lesson #9
Lesson #10
Lesson #11
33-1AnswerKey.pdf
Answer Key.docx

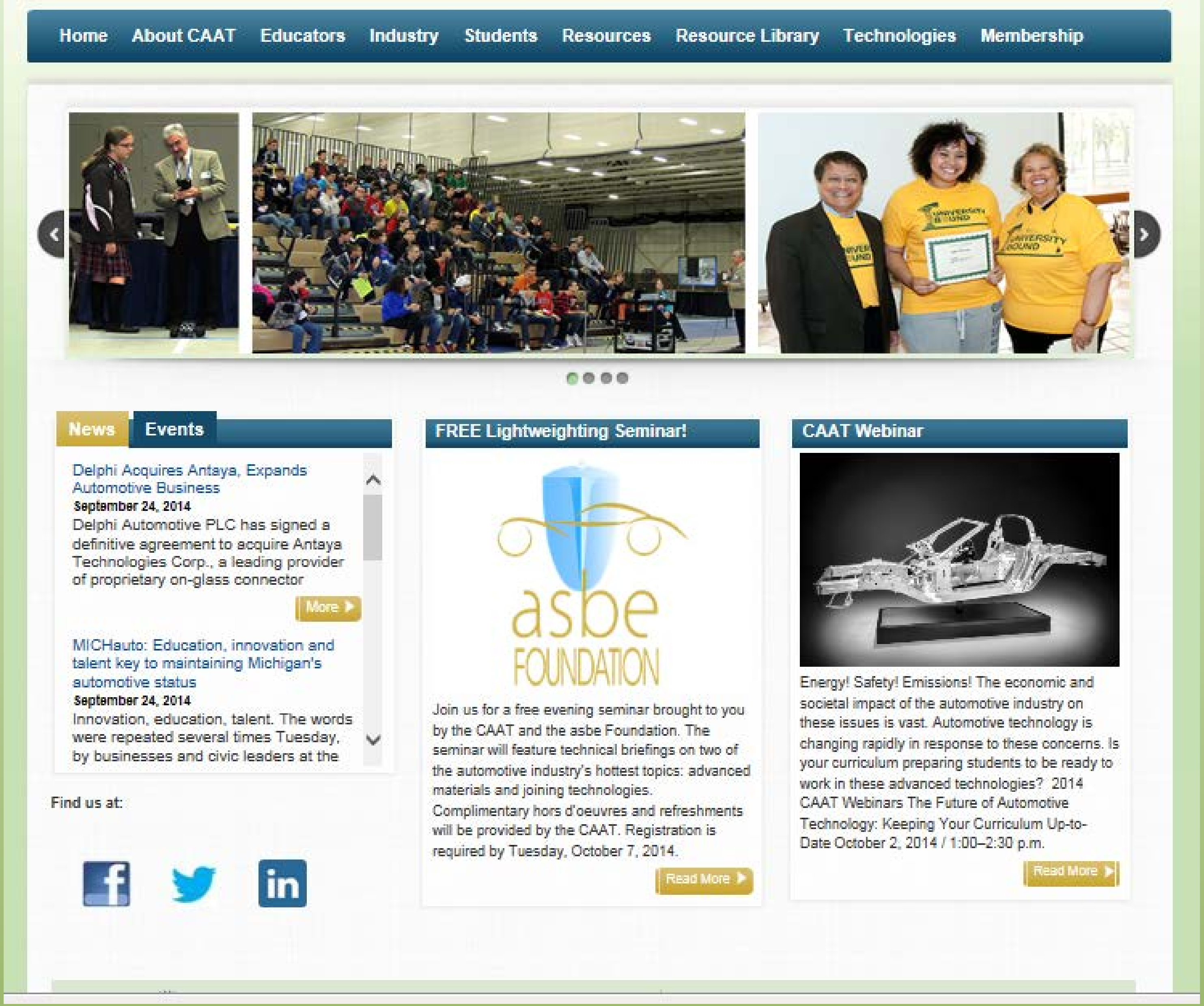
ColorCodeLab.pdf
LES1-1 Resistor Color Code Chart.xls
LES1-2 Resistor Value Worksheet.docx
LES1-3 Resistor Code Flash Cards.docx
LES1-4_TeacherTipSheet.docx
Lesson 1.docx

Pictures
MicroElectric Overview.docx
MicroElectric Project BOM.docx
MicroElectric Project Challenges.docx
MicroElectric Project Report Req.docx
MicroElectric Project Rubric.docx
MicroElectric Project.docx
MicroElectric Showcase Evaluation.docx
MicroElectric Showcase.docx

Presenter

Sherri Doherty
Assistant Director-Communications for CAAT
Macomb Community College

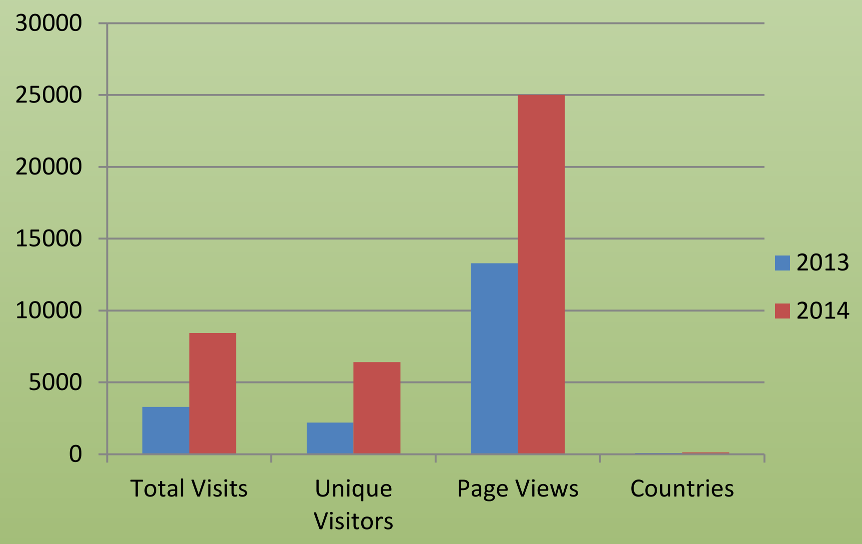
CAAT Website - www.autocaat.org



CAAT Website Growth

CAAT Website Traffic	2013	(8 Months) 2014
Total Visits	3,300	8,440
Unique Visitors	2,200	6,400
Page Views	13,300	25,000
Countries	85	120

- Nearly 300 social media followers (launched Dec, 2013)



CAAT Website – About Us

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About CAAT

- Why CAAT at Macomb Community College?
- What Does the CAAT Do?
- Partners
- Oversight
- Staff Biographies
- CAAT Conference
- CAAT Electric Vehicle Ride and Drive
- Photo Gallery
- NVC Only Access

Home > About CAAT

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About CAAT

Funded by the National Science Foundation, the Center for Advanced Automotive Technology (CAAT), located in Warren, MI, is one of 42 Advanced Technological Education Centers in the U.S. The CAAT is a partnership between Macomb Community College (Warren, Michigan) and Wayne State University (Detroit, Michigan).

The Advanced Technological Education (ATE) program prepares technicians for the high-technology workplaces that the United States needs to prosper. The National Science Foundation created the ATE program in response to the Science and Advanced Technology Act of 1992. This first Congressional mandate to the independent federal science agency emphasizes the role of community colleges, the public 2-year educational institutions that are located throughout the country, as the main providers of technician education in the U.S.

Our Mission:

- To increase the pool of automotive technicians, engineering technologists, and engineers to work with advanced propulsion vehicle systems and their components.
- Lead the way in collaboration among education, industry, government and professional associations.
- Be a regional resource for developing and disseminating advanced automotive technology education.

Our Vision:

The CAAT will be the national leader in advanced automotive technology education and industry and government collaboration to meet the expanding workforce needs of the automotive industry.

Downloads:

- CAAT Brochure
- CAAT Flyer

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CAAT Website – Educators

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Educators

- Seed Funding
  - Funded Programs
  - Apply for Seed Funding
- Professional Development
- Professional Development Opportunities
- Educational Partners
- Browse Resource Library

Home > Educators > Seed Funding > Apply for Seed Funding

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Apply for Seed Funding

The documents below describe the Seed Funding Program and include how to apply for seed funding:

- An overview of the Center for Advanced Automotive Technology (CAAT) and seed funding, Click Here
- The proposal template applicants complete and submit to the CAAT to request seed funding, Click Here
- Debarment and suspension form to be completed by seed funding recipients, Click Here
- Check list for assessing seed funding proposals, Click Here
- The process flow chart explaining the entire process beginning with applying for funding to receiving funding and submitting final products, Click Here
- For the funded project report template, Click Here
- Requirements for delivery of funded materials, Click Here
- Sample annual NSF survey to be completed by funding recipients, Click Here

If you have questions, please call the CAAT office at 586-445-7128 or by e-mail at CAAT@macomb.edu

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CAAT Website – Industry

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Industry

- CAAT Industry Advisory Council (IAC)
- Professional Development Opportunities
- Michigan Academy for Green Mobility Alliance (MAGMA)

Home > Industry > Professional Development Opportunities

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Professional Development Opportunities

The CAAT supports and funds academic, general public, and industry outreach education and professional development. This page will list the CAAT's recent and upcoming professional development efforts for industry. These may include conferences, workshops, and more. If you are interested in professional development for educators, please visit our Professional Development Opportunities page for educators.

Free Evening Seminar by the asbe Foundation and the CAAT: Lightweighting: The Implications for Automotive Design Development

asbe FOUNDATION

Wednesday, October 15th, 5:30-8:00 p.m.
Macomb Community College
Center Campus Cultural Center (Building K)
44575 Garfield Rd.
Clinton Township, MI 48038-1130

Join us for networking and technical briefings on two of the automotive industry's hottest topics: advanced materials and joining technologies.

* Complimentary hors d' oeuvres and refreshments provided by the CAAT *

Sponsored by the American Society of Body Engineers Foundation (asbe Foundation) with support from the CAAT

Agenda	
5:30-6:30 p.m.	Registration, Networking ,and Refreshments
6:30-7:40 p.m.	Presentations: • Greg Schroeder, Center for Automotive Research, "Overview of Advanced Materials and Joining Technology" • Jeff Conklin, Magna International, Inc. • Matt Zaluzec, Ford Motor Company, "25% Weight Saving Ford Fusion Project"
7:40-8:00 p.m.	Q & A

Registration is required by Tuesday, October 7, 2014. Click here for a map and directions to the Center Campus of Macomb Community College and the Cultural Center. Click here to register. If you have difficulty registering, please write contactus@asbefound.org.

Please share this announcement with anyone who might benefit from this event. Questions about this technical seminar can be directed to the CAAT at CAAT@Macomb.edu.

Upcoming CAAT Educator / Industry Activities

2015 CAAT Conference (Save the Date)

- FREE
- Friday, May 1, 2015
- MCC South Campus, Warren, MI
- Continental breakfast & lunch included

Lightweighting Seminar

- FREE
- October 15, 2014 (Evening)
- MCC Center Campus, Clinton Twp., MI
- Offered by the asbe Foundation (sponsored by CAAT)

CAAT Website – Students

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Students

- Career Pathways
- Electric Vehicle Technology Certificate Programs
- Alternative Fuels and Hybrid Electric Vehicle Courses in Michigan
- Student Activities

Home > Students > Electric Vehicle Technology Certificate Programs

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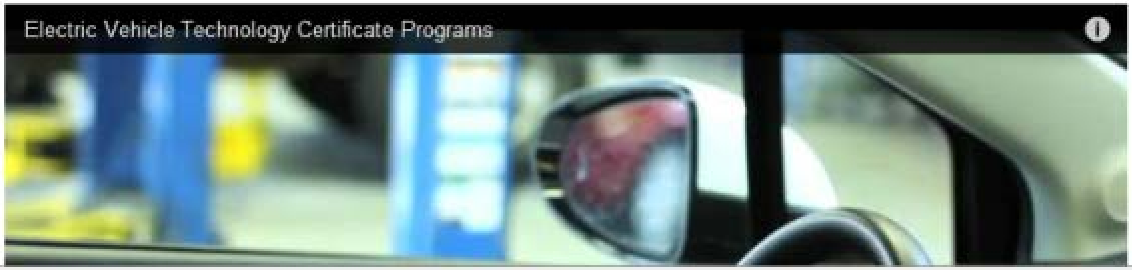
Electric Vehicle Technology Certificate Programs

Currently, there are over 2.6 million hybrid and electric vehicles on the road in the United States. In 2013, manufacturers offered 49 hybrid electric vehicles, 3 plug-in hybrid electric vehicles, and 9 fully-electric vehicles. By 2020, the world-wide electric vehicle value chain will likely be greater than $250 billion (Source: World Bank Study). Energy prices, environmental concerns and fuel economy targets are driving the demand for hybrid and electric vehicle technicians now and into the future.

The MCC EV Cohort at the Volt assembly plant in Hamtramck, MI.

Two Electric Vehicle Technology Certificate Programs, one in product development, and the other in service, prepare individuals, including unemployed and underemployed persons, with the fundamental skills and abilities for careers in these fields. These certificate programs are sequences of technical and professional courses that are industry focused and designed for workforce preparation. These courses may also apply toward other technical certificates and associate degree programs.

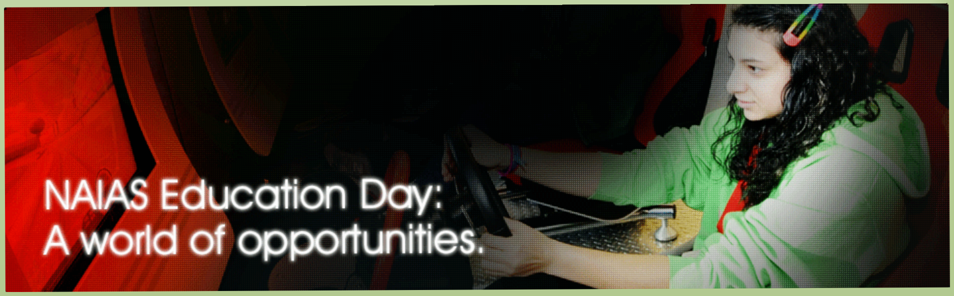


CAAT Annual Student Activities

University Bound

Auto Rama

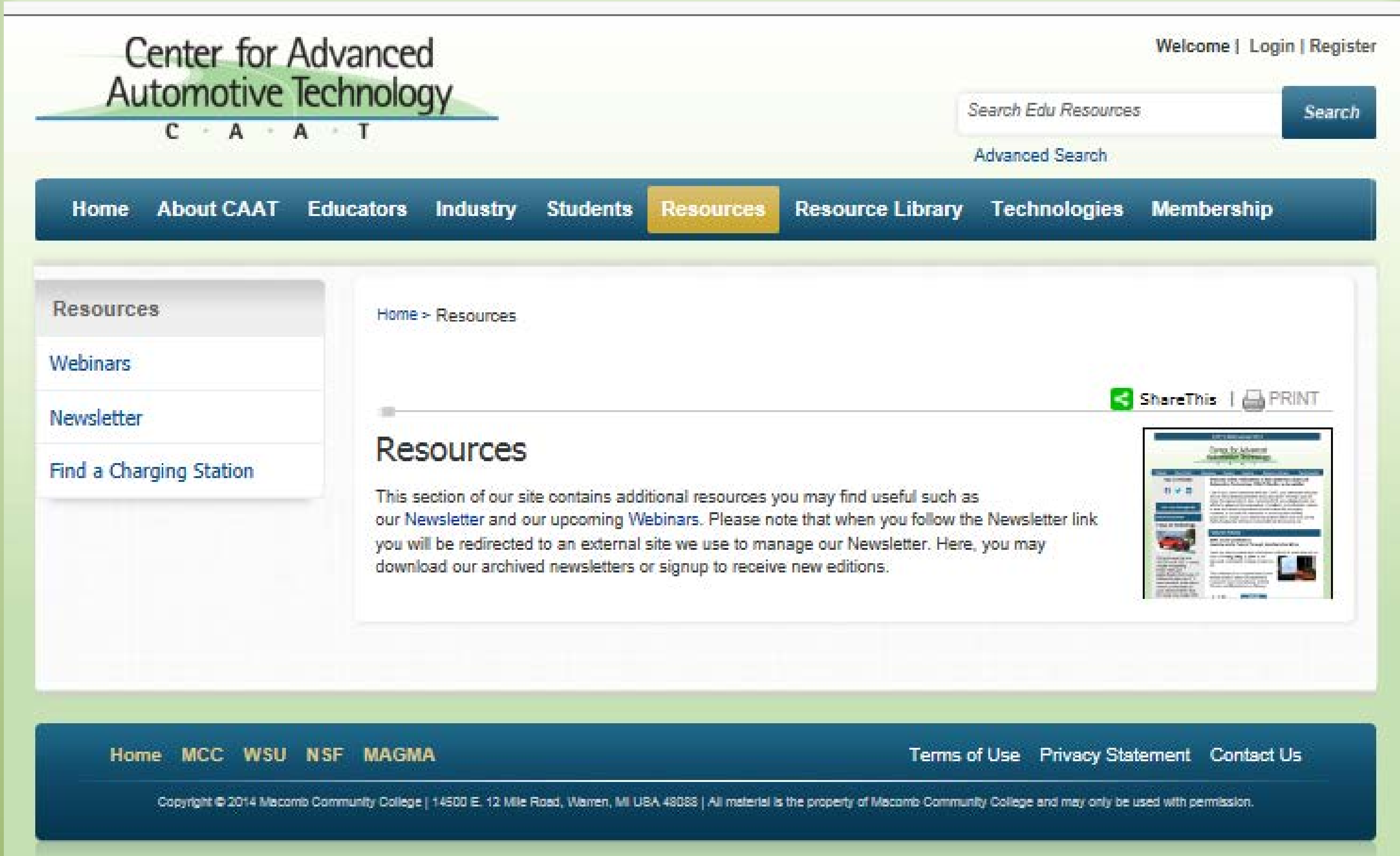
North American International Auto Show



Hybrid Electric Vehicle (HEV) Summer Academy

RET Days

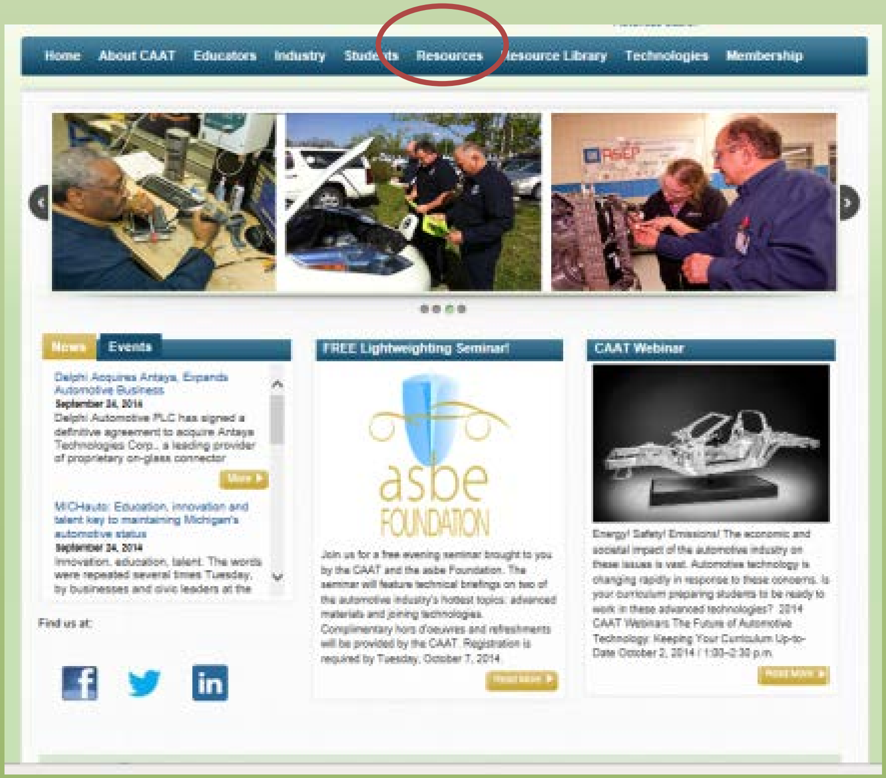
CAAT Website – Resources



CAAT Monthly Newsletter

Sign up today!

- Visit www.autocaat.org
- Click on Resources
- Click on Newsletter



CAAT Website - FREE Resource Library

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Advanced Search

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Resource Library
- Browse Resources
- Search Resources
- Submit a Resource
- Conference Resources
- Licensing, Citations, and Use of Materials

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Browse Resources

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Our library is set up to browse based on three criteria (engineering technology, education level, and audience). You can filter your results by clicking one of these fields. The number next to each field denotes the number of resources under this category. Types of resources under each category may include class activities, complete courses, curriculum, homework, labs, lesson plans, modules, presentations, studies, and reports. For a refined search of the library or the rest of the site, please use the Search Resources tab.

Engineering Technologies

Advanced Combustion Engine Technology (7)
Alternative Fuels and Lubricants (15)
Automated and Connected Vehicle Technology (9)
Energy Policy (18)
Energy Storage and Battery Technology (27)
Grid Interface (Power and Communications) (7)
Fuel Cells/Hydrogen (15)
HEV/EV System Technologies (HEV, EV, and Plug-in HEV) (49)
Integration, Networking, and Communications (8)
Materials Lightweighting (28)
Other (25)
Power Electronics (Motors, Controls, Inverters, and Converters) (23)

Education Level

Elementary School (1-5) (8)
Middle School (6-8) (10)
High School (9-12) (32)
Undergrad Students (13-14) (82)
Undergrad Students (15-16) (29)
Graduate Students (2)

Audience

CAAT Website - Technologies

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- Advanced Engine Technologies
- Alternative Fuels
- Automated and Connected Vehicles
- Batteries
- Fuel Cells
- Hybrid and Battery Electric Vehicles
- Integration, Networking, and Communications
- Materials Lightweighting
- Power Electronics
- Smart Grid

Home > Technologies > Automated and Connected Vehicles

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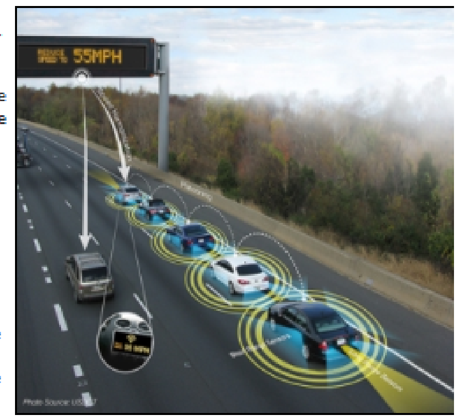
Automated and Connected Vehicles

Automated and connected vehicle technologies are becoming some of the most heavily researched automotive technologies. Currently, some automated and connected vehicle technologies are available, but are only a fraction of what will be available in the future. Although this page contains separate sections for connected and automated vehicle technologies, be aware that many of the technologies overlap. For instance, to have a fully automated vehicle, the vehicle must also be a connected vehicle.



Click the image above to view a larger version

Connected Vehicles

Source: Center for Automotive Research (CAR) Publications

Connected vehicles are vehicles that use any of a number of different communication technologies to communicate with the driver, other cars on the road (vehicle-to-vehicle [V2V]), roadside infrastructure (vehicle-to-infrastructure [V2I]), and the "Cloud." This technology can be used to not only improve vehicle safety, but also to improve vehicle efficiency and commute times. Listed below are some of the benefits of connected vehicles:

- **Crash Elimination:** Crash-free driving and improved vehicle safety could change the concept of a vehicle as we know it
- **Reduced Need for New Infrastructure:** Self-driving can reduce the need for building new infrastructure and reduce maintenance costs
- **Travel Time Dependability:** Convergence can substantially reduce uncertainty in travel times via real-time, predictive assessment of travel times on all routes

Stay Connected with the CAAT

- Visit our website at www.autocaat.org
- Sign up for our monthly newsletter
- Follow us on social media
- Plan to attend the FREE CAAT Conference on May 1, 2015
- Contact us with your seed funding project ideas!

CAAT e-Blast | February 2014

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Stay Connected

Join Our Mailing List!

Register Now to Attend the FREE 2014 CAAT Conference

This FREE conference, *You Can't See the Future in the Rearview Mirror*, will be held on Friday, May 2, 2014 at Macomb Community College's South Campus in Warren, MI. Don't miss your opportunity to learn more about the future of the automotive industry from our keynote

Michigan's Senior Automotive Advisor Visits the Center for Advanced Automotive Technology

Nigel Francis, senior automotive adviser to the state of Michigan and senior vice president, Automotive Industry Office, Michigan Economic Development Corporation, visited the CAAT earlier this month. Nigel is charged with developing, implementing, and executing a comprehensive strategic plan and road map to promote, retain, and grow the automotive industry in Michigan. He serves as the state's central connection point for automotive industry stakeholders and engages with them to drive action that supports the industry and Michigan's overall economic growth strategy.

Nigel Francis

During his visit, Mr. Francis shared with the CAAT key components of his comprehensive strategy to drive

Center for Advanced Automotive Technology

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Please take a moment to help us become better:

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Macomb Community College

Education • Enrichment • Economic Development

Discover. Connect. *Advance.*

NSF

WAYNE STATE

Thank You!

Questions?