
Automotive

# Automotive Market and Industry Update

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FTF-AUT-F0747



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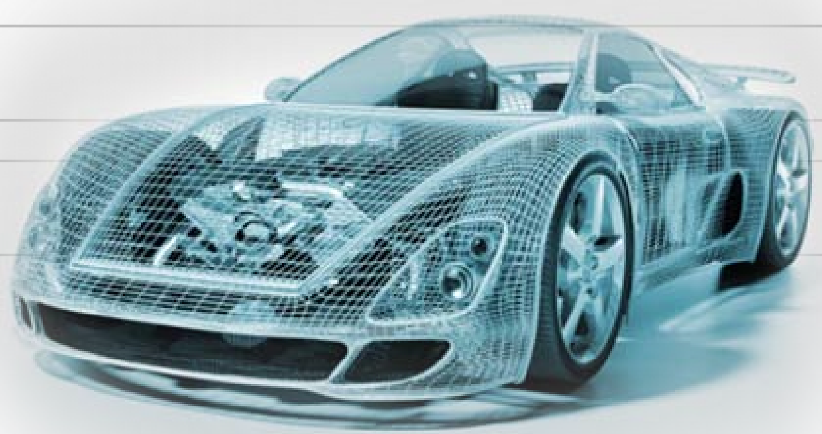
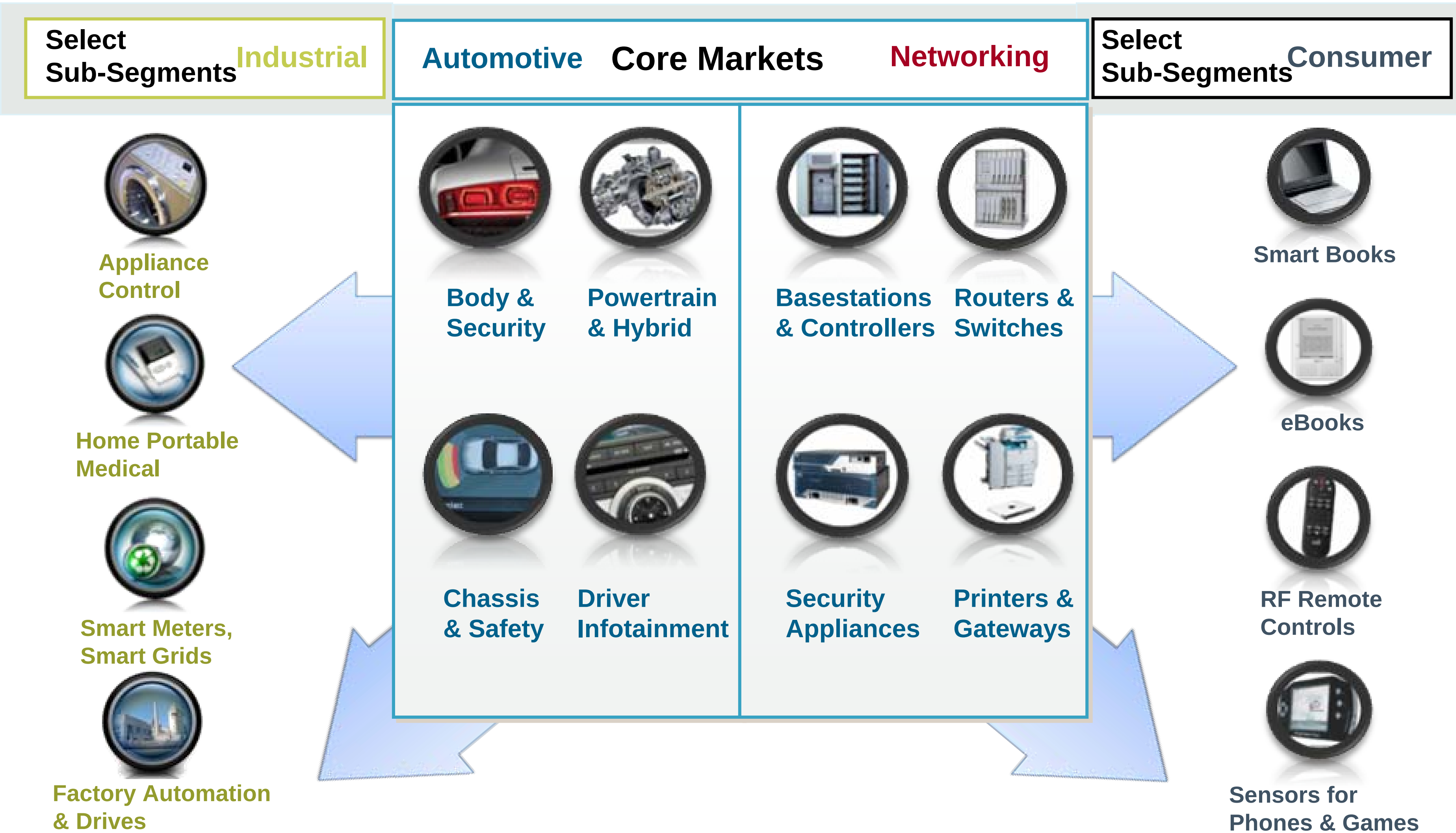
# Agenda

| | |
|---|---|
| 1 | Freescale in Automotive |
| 2 | What a Difference a Year Makes |
| 3 | Current Market Trends |
| 4 | Segment Trends:  Body, Chassis/Safety, Powertrain, Driver Information |
| 5 | What Does the Future Hold? |
| 6 | Conclusion |



# Freescale Product Portfolio



# Automotive Market: Driving Technology Confluence

## Automotive

- Safety
- Fuel Economy and Emissions
- Comfort/Entertainment

### Networking

- Wireless everywhere
- Broadband expansion
- Ubiquitous Connectivity

### Consumer

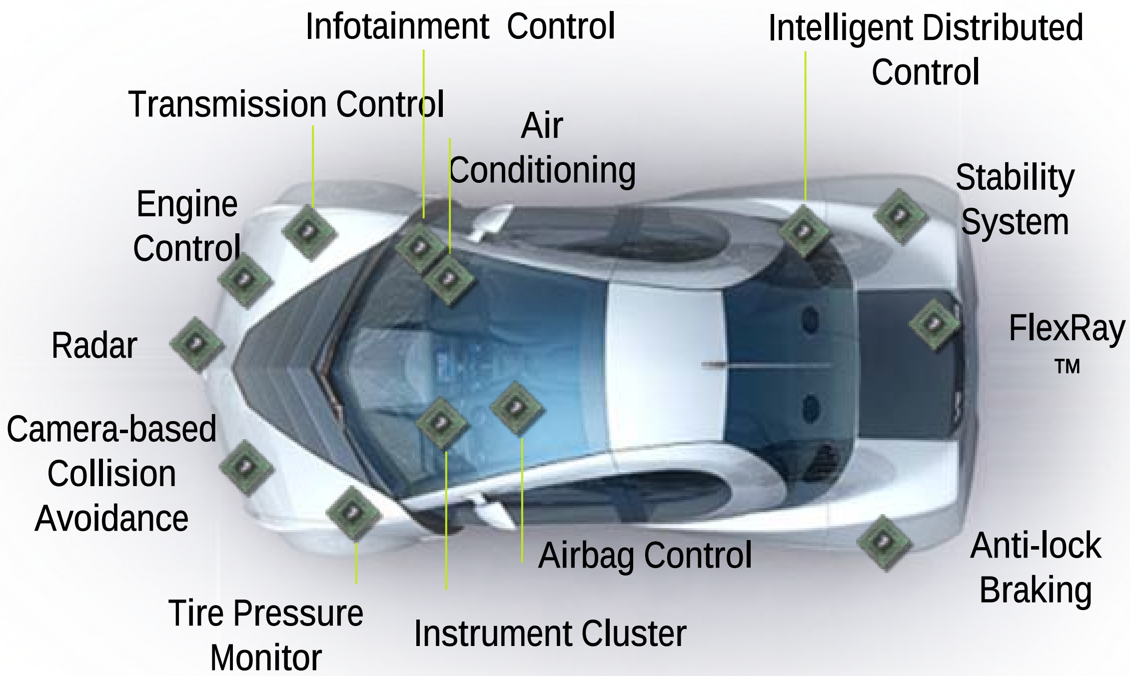
- Health
- Energy Management
- Home Entertainment

### Industrial

- Connectivity
- Medical/TeleHealth
- Smart Grid/Building Control

Going Green Health & Safety Net Effect

Technology That Changes the World




No.2 in total auto ICs

No.1 in auto microcontrollers

No.2 in MEMS sensors

# Freescale Automotive–Today's Innovation

Chevy Camaro
MCF5251
PDIM

Mercedes S Class
MPC5200
Night Vision

Lincoln MKS
S12
Body Control

Chevy Malibu
MCP5200
OnStar

Cadillac CTS
MPC5566
Direct Injection

Aston Martin DB9
Sensors
Airbag

BMW X5
MPC5567 & S12X
Dynamic Drive

Toyota Prius
DBUS
Master/Slave Airbag

Dayun
S12
Fuel Injection

Peugeot 407
MPC561
ECU

BMW 7-Series
MPC5567
Body Gateway

Honda Stepwagon
Pictus MCU & Ocotillo
Sensor Airbag

Ford Fiesta
S12XHZ
Cluster

Chery A516
S12
HVAC, Powertrain

Opel Corsa
Sensors
Airbag

Ford Fusion
i.MX31
Sync

Mazda Alexa (3)
SPC5565
Start/Stop System

Ducati 696
S12 & Pressure Sensor
ECU

BYD F3
MCU
Body, Cluster

Ford F150
SPQ1035
eSwitch Body

Note: Representative only. All of these products have multiple Freescale devices in many applications.

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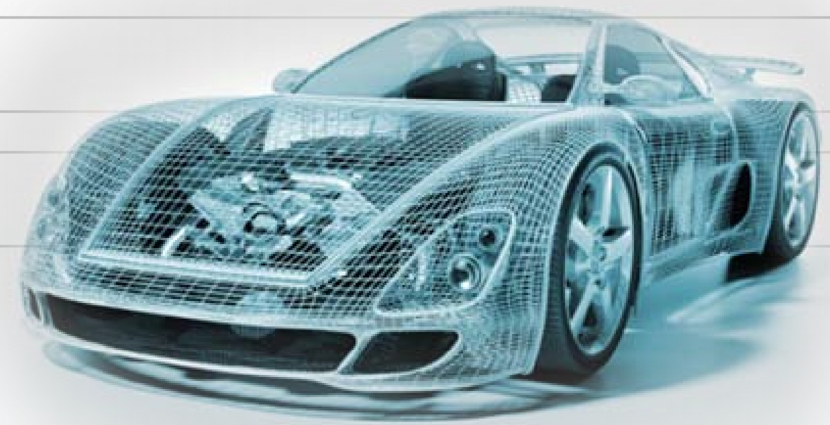



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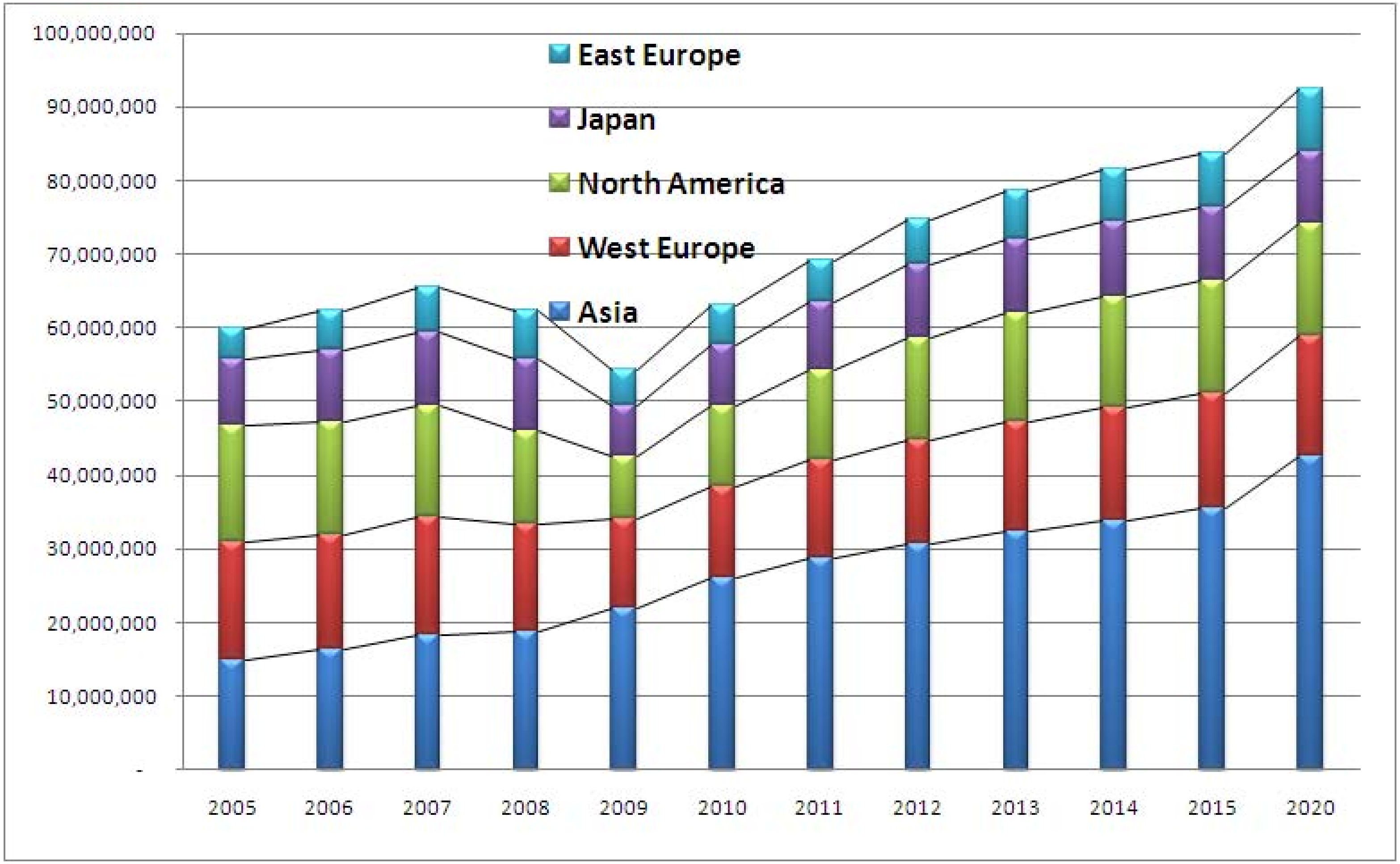
# Global Auto Production Forecast
(includes light trucks)

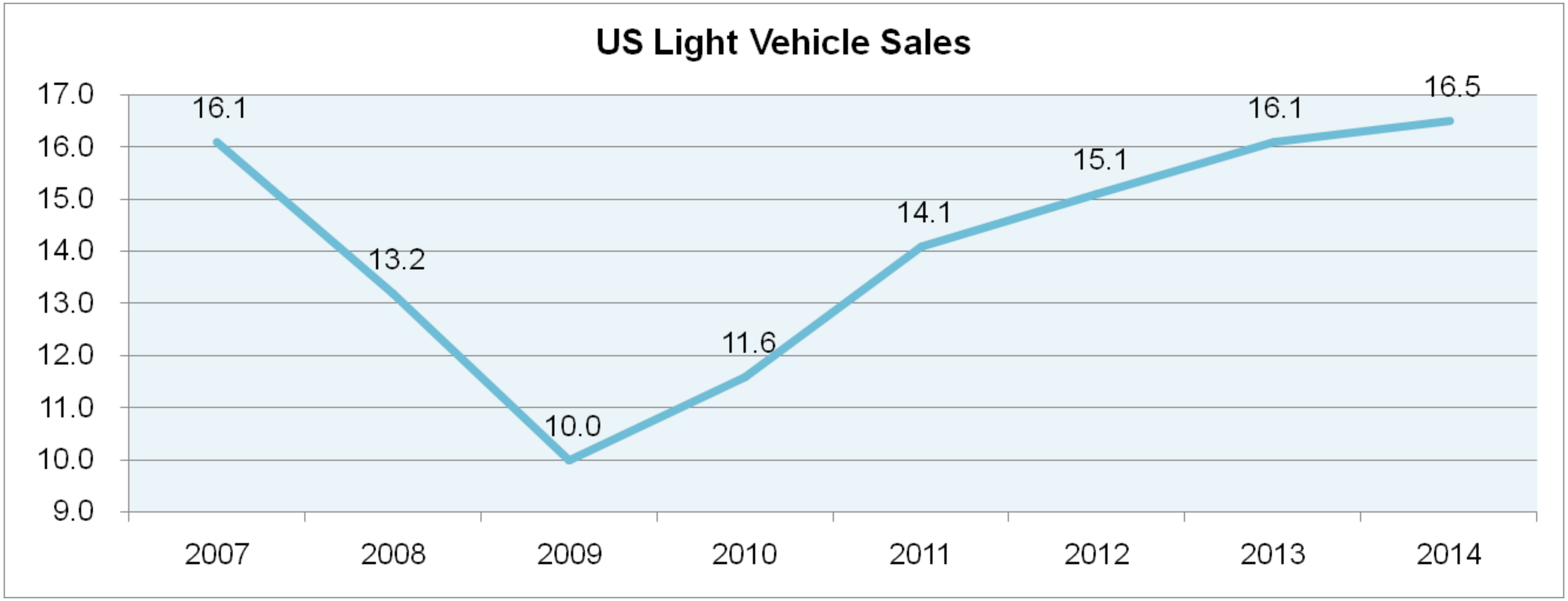
What a difference two years makes




*Global Insight April 2010*

# US Automotive Status

- Scrappage rate ~13MU / year
- Industry break even ~10-11MU but not healthy until ~12MU+
- Auto industry employment +15K in 2010, +100K per year 2011-13



# What's Important in Today's Automotive Market?

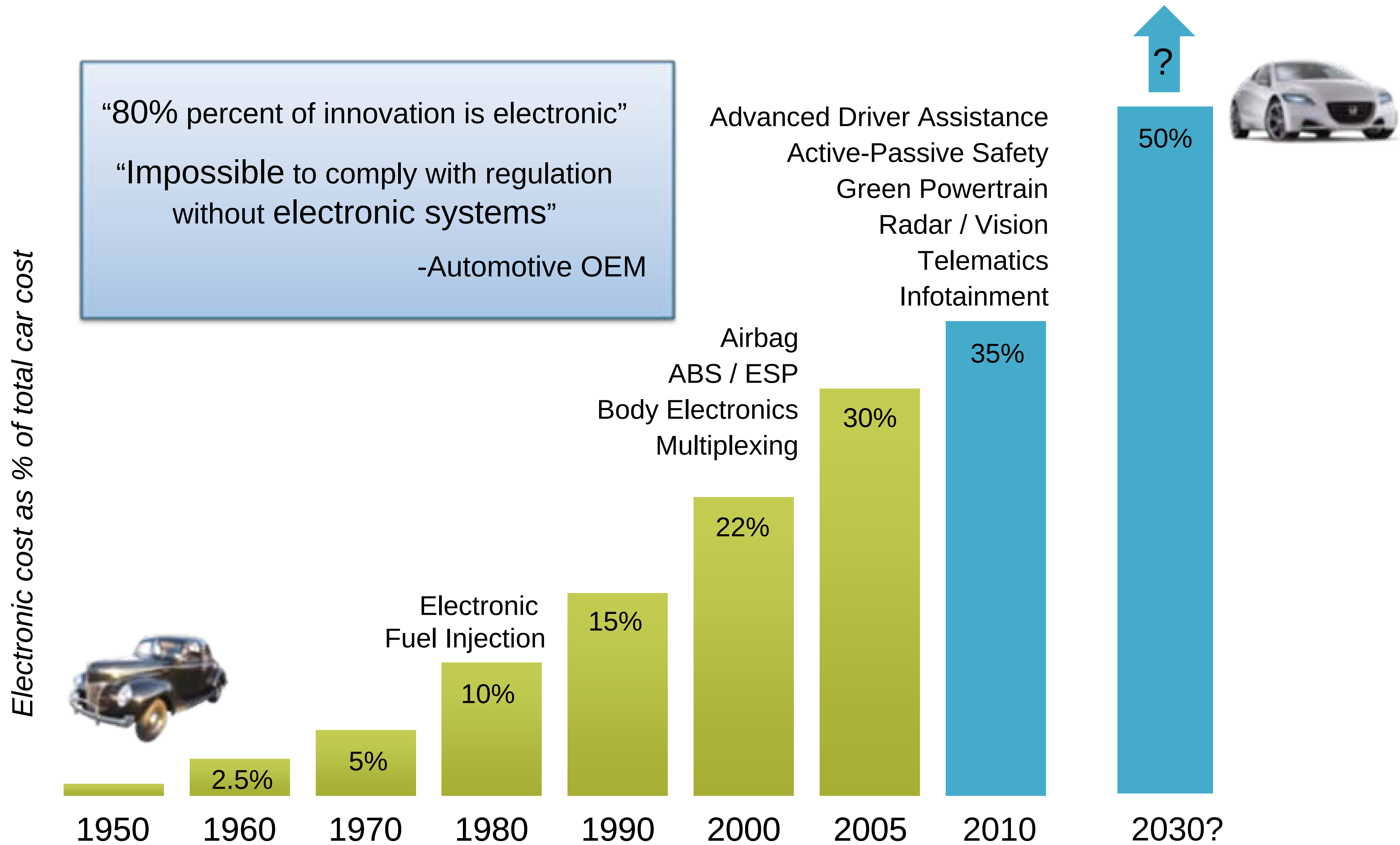
- **Fun**
  - Performance
  - Traffic
  - Driver assistance
- **Safe**
  - Accident avoidance
  - Occupant protection
  - Reliability
- **Sustainable**
  - Low impact on the environment
  - Production, use and recycle

# Automotive Electronic Content Growth

"80% percent of innovation is electronic"

"Impossible to comply with regulation without electronic systems"

-Automotive OEM



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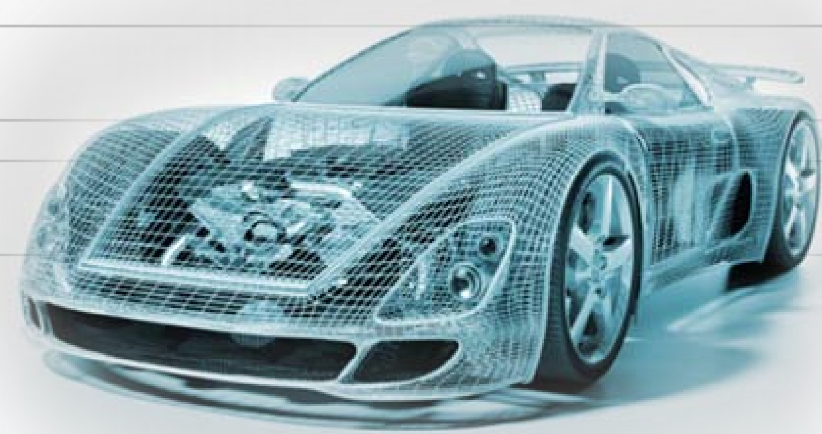


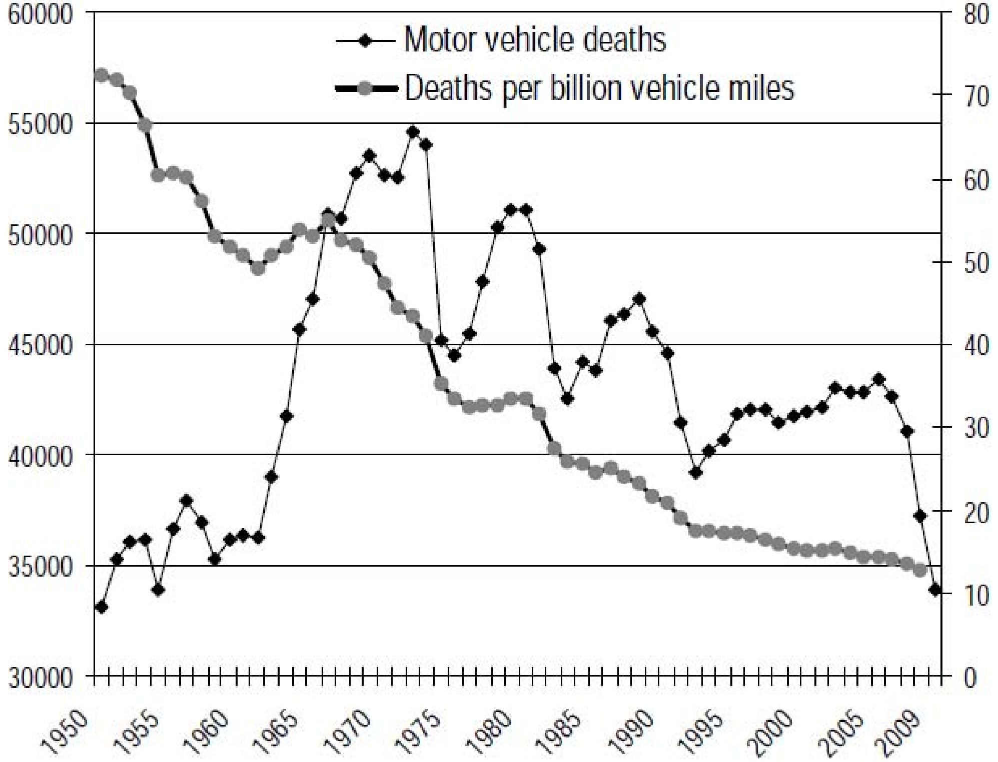
# Electronics – the Source of Improved Safety

More Cars

Higher Speeds

Higher Density

Fewer Deaths




Data: Insurance Institute for Highway Safety; iihs.org

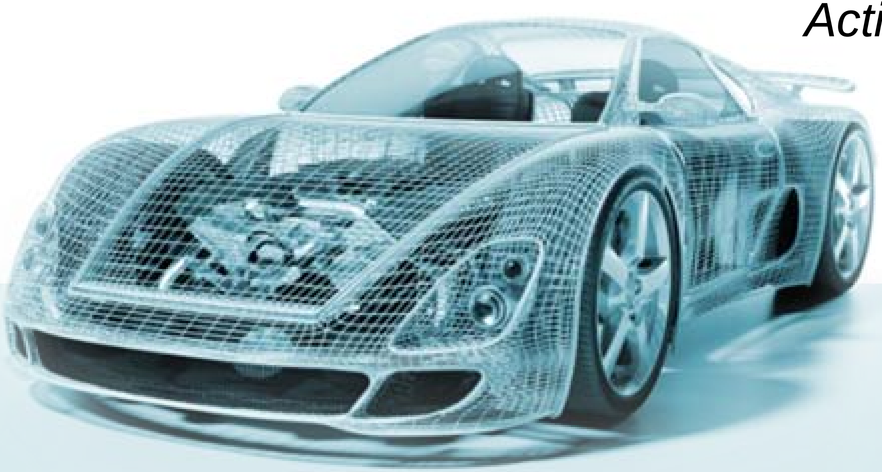
*1959 BelAire vs. 2008 Malibu*

"As more electronic sensors and computing capability are incorporated into modern vehicles, the vehicle manufactures now have the technology to enhance safety in a way that was impossible a decade ago. We believe that many of these technologies can detect and compensate for driver errors such as inattention, drowsiness, or driver misjudgment."

***Ronald Medford***

*Acting Deputy Administrator, NHTSA*

*May 2009*



*"A car with a sense of survival"*

CNET review of 2011 Infiniti EX

# Common Errors of Older and Younger Drivers

## ▶ Most Common Errors of Older Drivers

| | | | |
|---|---|---|---|
| • Scans side to side | 86% | ← | *Lane Departure Warning* |
| • Scans to rear/head check | 84% | ← | *Blind Spot Detection* |
| • Centers car in lane | 49% | ← | *Lane Departure Warning* |
| • Safe following distance | 57% | ← | *Front Collision Warning, Brake Assist* |
| • Backup up | 69% | ← | *Parking Aid, Camera/Radar* |
| • Lane changes | 86% | ← | *Lane Departure Warning, Blind Spot Detection* |
| • Speed regulation | 62% | ← | *ICC, Front Collision Warning* |

## ▶ Most Common Errors of Younger Drivers

| | | |
|---|---|---|
| • Distracted driving | ← | *Intelligent Control, DIS* |
| • Speeding | ← | *Intelligent Control, DIS* |
| • Following too closely | ← | *Front Collision Warning, Brake Assist* |
| • Driving drowsy | ← | *Driver Monitoring Systems* |

AAA Foundation for Traffic Safety
% scoring fair or poor on given item

- Occupant vs Vehicle Factors: What's more important?
  - DFSS – factor analysis 135 frontal crashes cases

| Variable | #1 Influential | #2 influential |
|---|---|---|
| Clavicle | Sex + Model Yr. | Weight |
| All Thoracic | Age | Weight |
| Upper abdomen | L4 density | Age |
| Lower abdomen | Sex + L4 density | Model Year |
| All spine injury | Pretensioner | Pret + Sex |
| Thoracic Skeletal + Clavicle | Age | Sex |
| Th. Org & Vessel + Upp | Delta V + Wt | Delta V |
| Sum of Skeletal Injury | Age | Sex |
| Sum of Organ Injury | L4 density | Weight |

  - Occupant factor most influential for **8 of 9** injury outcome measures and second most influential in **7 of 9**.
- Cars must adapt safety systems based on human factors
- Adoption of EDR and Telematics can provide estimates of injuries to emergency personnel *before* they arrive at a crash

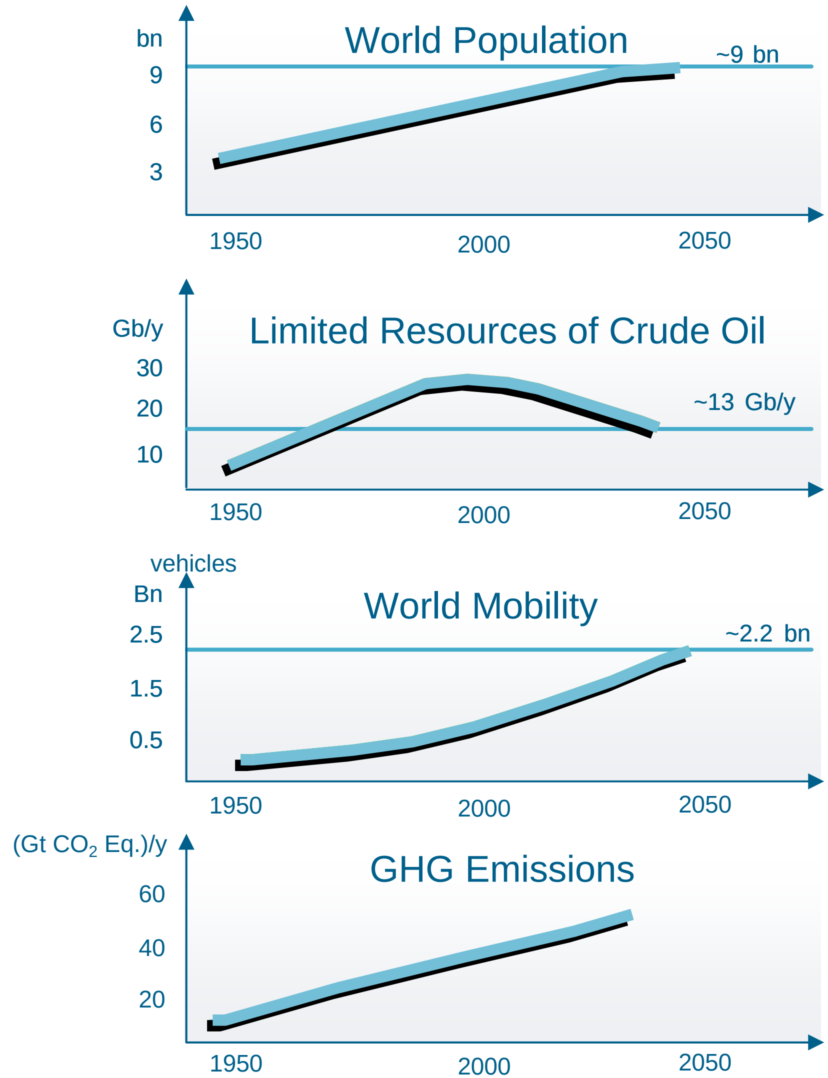
# Collision Warning and Avoidance

- Lane departure warning/prevention systems could prevent/mitigate up to 483,000 crashes per year, including 87,000 non-fatal injury and 10,345 fatal crashes
- Forward collision warning/mitigation systems could potentially prevent or reduce the severity of 2.3 million crashes in the United States each year, including 1.4 million front-to-rear crashes.
  - These improvements could prevent up to 210,000 non-fatal injury crashes and 7,166 fatal crashes each year.
- Blind spot detection/warning and emergency brake assist could prevent 457,000 and 417,000 crashes per year, respectively.
- One second of notification can eliminate 90% of front end collisions

Source: Insurance Institute for Highway Safety

# Issues: Fundamentally the Same

- Increasing world wide population
- Increasing energy usage and shortage of oil
- Increasing World Mobility
- Too much Greenhouse Gas emissions



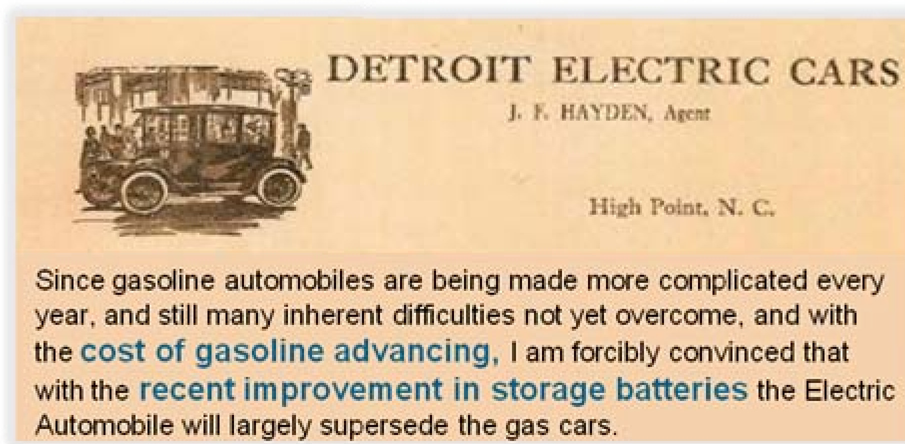
# Electric Car Concept

What’s changed
Government Regulations
and Incentives

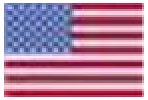
## New Idea?

**Ferdinand Porsc**, an employee of **Jacob Lohner & Co.** in Vienna, Austria developed a **drive system** based on fitting an **electric motor** to each front wheel without transmissions (hub mounted).

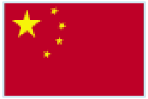

Vehicles of this type were known as **Lohner-Porsches** and were sold in 1898-1906.

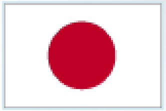
# Global Regulations Drive Innovation and Content



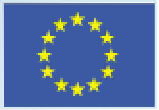
The new CAFE standards must **achieve by 2016 a combined average** fuel-economy standard of 35.5 mpg—39 mpg for cars and 30 mpg for light trucks and SUVs—a **40 percent improvement** over current standards.



Emission standards are being adopted in China by the State Environmental Protection Administration (SEPA). Chinese standards are **based on European regulations**. Focus investment area-HEV and Fuel Cell.



Japan' emissions standards in 2009 with further limits about NOx and PM  to a level in-between the US 2010 and Euro 5 requirements.



**Euro 6 standards** effective from fall  2014, with a target to reach 95g $CO_2$ by 2020

# EV/PHEV Business Dimensions

## Infrastructure & Power Requirements

- Charging infrastructure
  - @ Home
  - @ Public areas
  - @ Work
- Normal & Rapid charge options

## Product Development

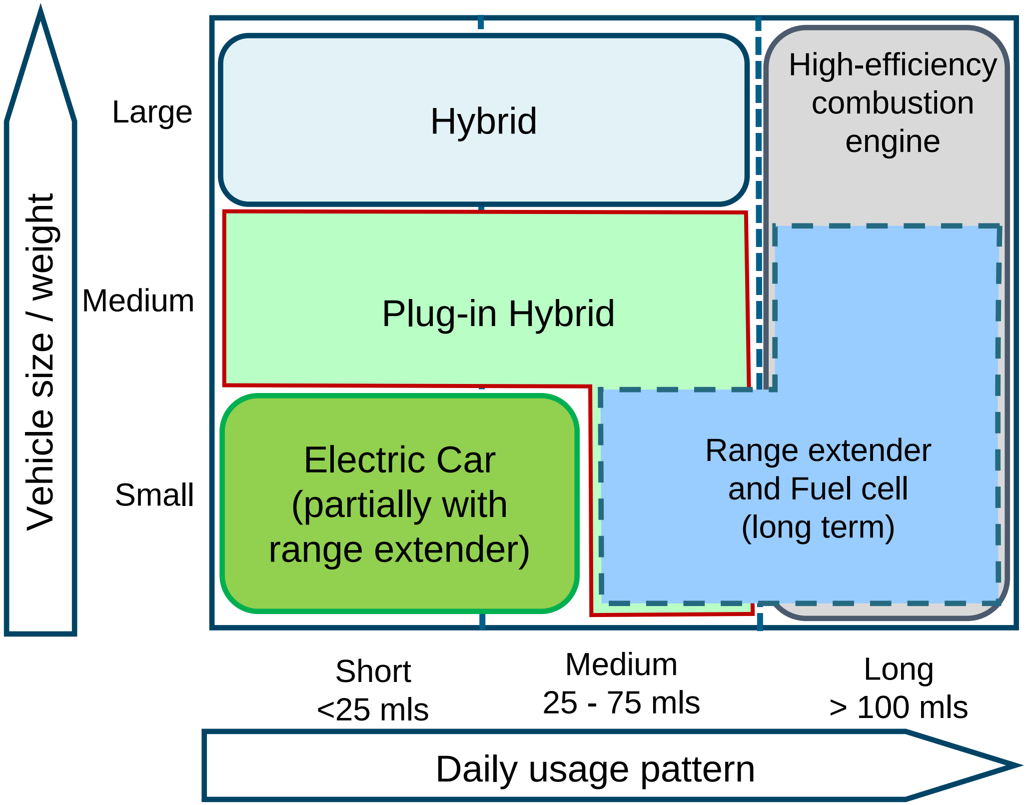
- Powertrain technology
- Chassis & body technology
- Energy storage technology
- High performance @ reasonable cost

## Business Model Innovations

- Alliance of OEM & key component suppliers
- Linkage between Government policy, Energy suppliers, Key technology innovators critical for success
- Taxes

# Powertrain Innovation Vectors

- Influences
  - **Location:** 80% of Americans drive <50 miles, 70% of Europeans drive < 25miles
  - **Application**: EV / Hybrid for city, high efficiency combustion engines for highway/commercial
  - **Cost**: Upfront cost tolerance vs. life cycle consumer benefits




*Source: Bain*

*WSJ: Electric cars Fall Short in Mini Test, “most significant effect on range is interior temperature” 6/3/10*

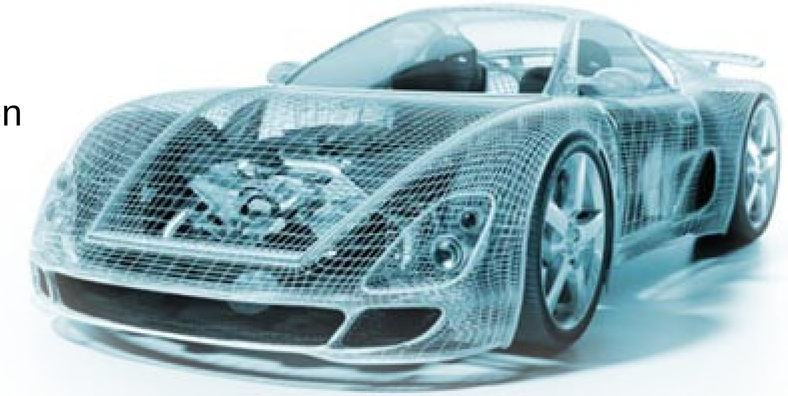
# Efficiency Requires Improvements in Many Areas

## Prediction

- Driver behavior
- Route topology
- Weather
- Managed Infrastructure

## Powertrain

- Hi Precision/Direct Injection
- Single/Multiple Turbo
- Improved Transmissions
- Start/Stop
- Mild/Full Hybrid
- EV



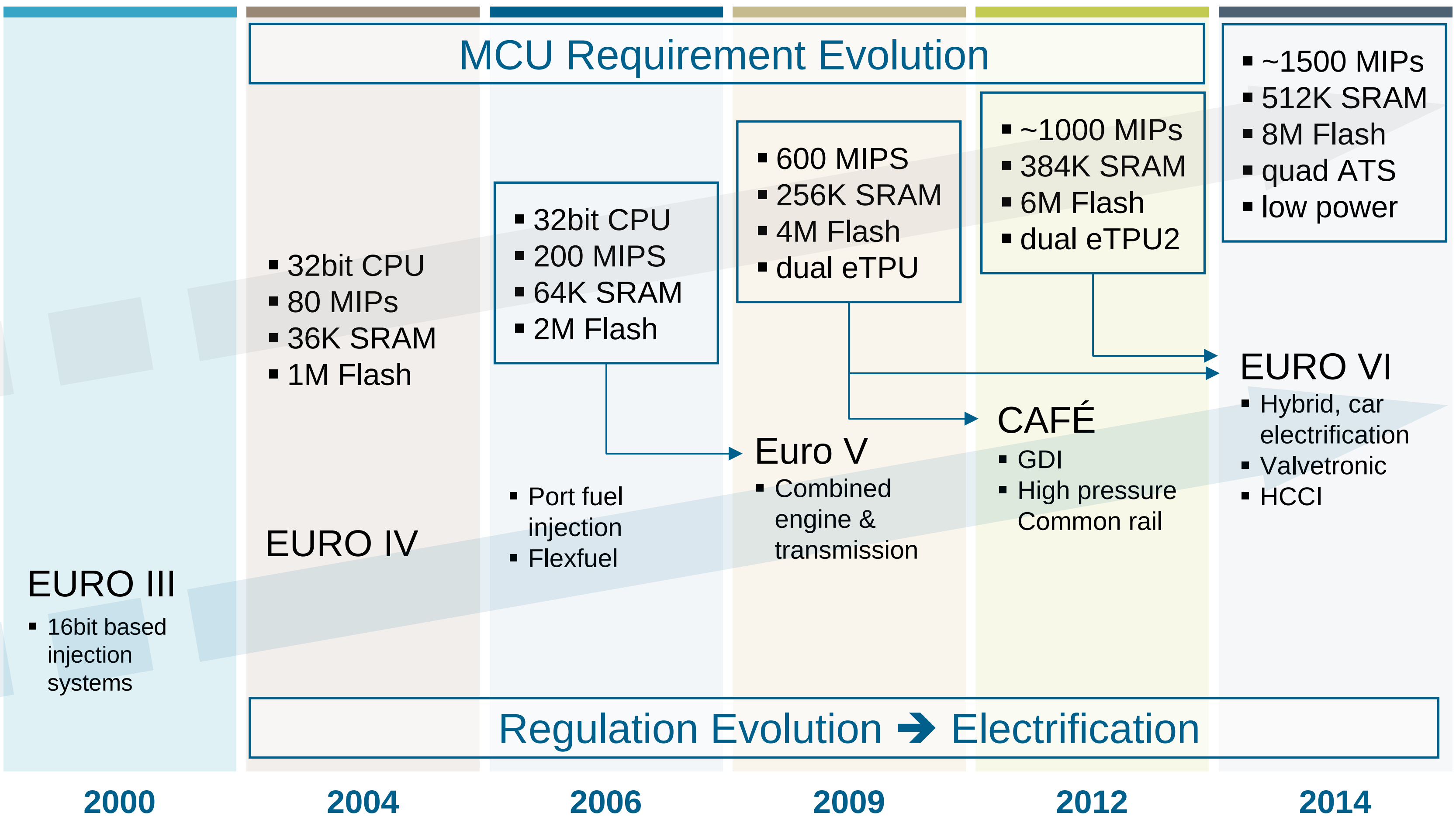
## Resistance

- Rolling Resistance
- Light Weight Materials
- Cable harnesses
- Reduced Hydraulics
- Increased Electrification
- Active Aerodynamics

## Energy Sources

- Bio Diesel
- Gasoline
- Natural Gas
- Alternative Fuels
- Hydrogen
- Electric

# Legislation Drives MCU Powertrain



# Instrument Clusters

## Critical Branding and Differentiation Point



# Information Explosion or Driver Overload?

Eco-driving

Display & Management of Hybrid/Electric Vehicle Battery Charging

Advanced Speech Recogntion for destination entry and music search

“Skinnable” User Interface

Traffic Sign Recognition

Location-based Services

Digital Radio & Traffic Information

Connectivity to portable device and WAN

Night Vision Camera

User Interface for Car system control

Diagnostics and remote support

Manage Connection to Smart Meter for battery charging

Map Data as sensor to Powertrain

Panoramic Parking assist camera

Applications downloaded from “Apps Store”

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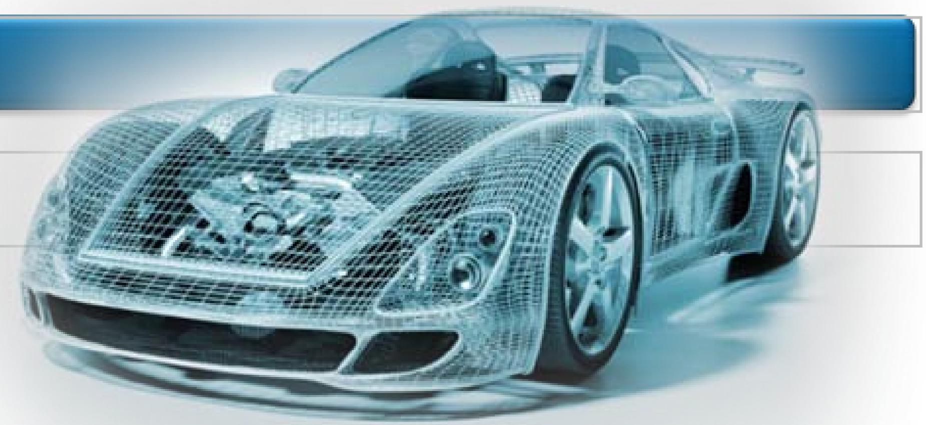
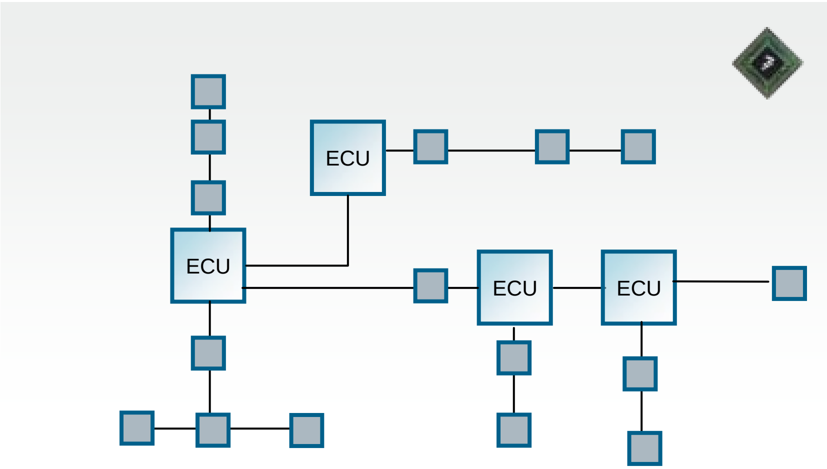


# Future Architecture Challenges

- **Power**
  - Customers requesting 50% reduction in power over existing architecture while increasing complexity
- **Performance**
  - Customers requesting up to x5 performance over existing architecture
- **Functional Safety**
  - Compliance to IEC61508 and ISO26262 standards
- **Lower Cost of Ownership**
  - Lower ASPs!!!
  - Reduced development costs
  - Faster time to market

# Future Vehicle Architectural Trends

## Today

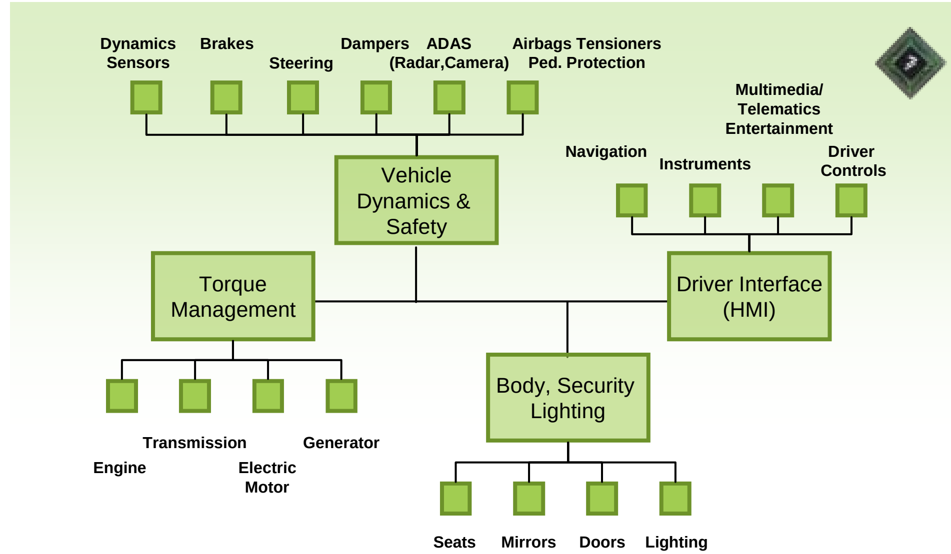



### Distributed Electronic Control Units

*One ECU per mechanical function- Connected by multiple CAN and LIN interfaces*

- Number of ECUs increases with the addition of features and vehicle options.
  - High systems and software complexity.
  - Difficult integration

## Future




### Distributed Computing

*Major computing nodes on a high performance network organized by “domains” which control “zones”*

- High performance multi-core domain controllers with guaranteed safety and security of operation.
- Lower performance but highly integrated Zones with direct actuator control.
- Standardized software and OS to ease integration

# Prediction is a Critical Component

- Energy Management with Prediction
  - Topology
  - Traffic Conditions
  - Weather / Temperature
  - Traffic Signals / State
  - Hybrid Energy Usage

All constantly transmitted
to the car's
Energy Management System

# Aging Population

- Improved Navigation
  - Intelligent / Safe routing
  - Out of Area notification
- Driver Capability and Skill
  - Alertness
  - Safety event reporting
    - Lane departure
    - Over/Under speed limit
- Medical Condition Awareness
  - Automatic notification
  - Autonomous operation in medical emergency
  - Integrated medical sensing

    *Diagnostic Steering Wheel*

# Personal Freedom vs. Efficiency

## ▶ Daily Commute Scenario

- Submitted daily commute plan
- Trip logistics transmitted to the car from central auto management
- Departure time
- Routing and speed
- Parking slot

## ▶ Issues

- Ad-Hoc driving
- Biology breaks
- Essence of personal transportation

# Advanced Infrastructure and Telematics

- Extension of your ‘Virtual Self’
  - Car Configuration
  - Personal and Business Content
  - Real time interaction with the outside world
  - Personal Privacy?

# Western Hemisphere vs. BRIC

| Criteria | Unit | USA | EU27 | Japan | Total or Avg. | Brazil | Russia | India | China | Total or Avg. | Ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Population | Mil hab | 307 | 491 | 127 | 925 | 198 | 140 | 1166 | 1338 | 2842 | 3.07 |
| GDP per capita | US$ | $47,000 | $33,400 | $34,200 | $38,024 | $10,100 | $15,800 | $2,800 | $6,000 | $5456 | 0.14 |
| Land area | Mil sq km | 9.1 | 4.3 | 0.374 | 13.774 | 8.4 | 16.9 | 2.9 | 9.3 | 37.5 | 2.72 |
| Total road | '000s of km | 6465 | 5454 | 1196 | 13115 | 1751 | 933 | 3316 | 1930 | 7930 | 0.60 |
| Car park | Mio of cars | 240 | 250 | 61 | 551 | 24 | 38 | 13 | 37 | 111 | 0.20 |
| Car density | # cars per 1000 hab. | 782 | 509 | 480 | 596 | 123 | 268 | 11 | 27 | 39 | 0.07 |
| Car density | # cars per km of road | 37 | 46 | 51 | 42 | 14 | 40 | 4 | 19 | 14 | 0.33 |

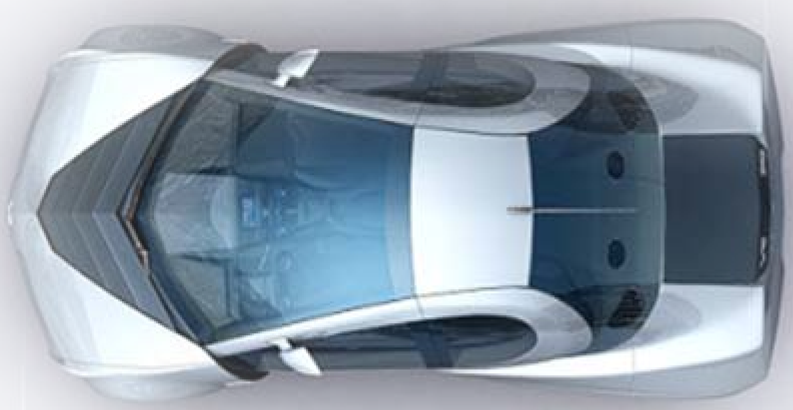
Developed Infrastructure for Transportation Management will be Critical

Source: US Central Intelligence Agency – CIA, world fact book

# Smart Highways Tomorrow: Vehicle – Road Network

- Sensor / Radar / Camera networks
- Vehicle – Road / Vehicle – Vehicle Communications
- Automated driving
- Predictive safety
- Platoon: Increased traffic density at higher speeds

# Prediction – Critical Factor in Next Generation Transportation



Safety – milliseconds save lives, collision avoidance, post crash

Efficiency – routing, navigation, consumption

Driver Information – driver decisions

# Our Common Goals

# ZERO

- Emissions
- Fatalities
- Defects

Electronics are imperative to balancing increasing individual transportation and reducing fuel cost, emissions and casualties.

Consumer awareness, legislation and competitive differentiation join forces driving automotive electronics



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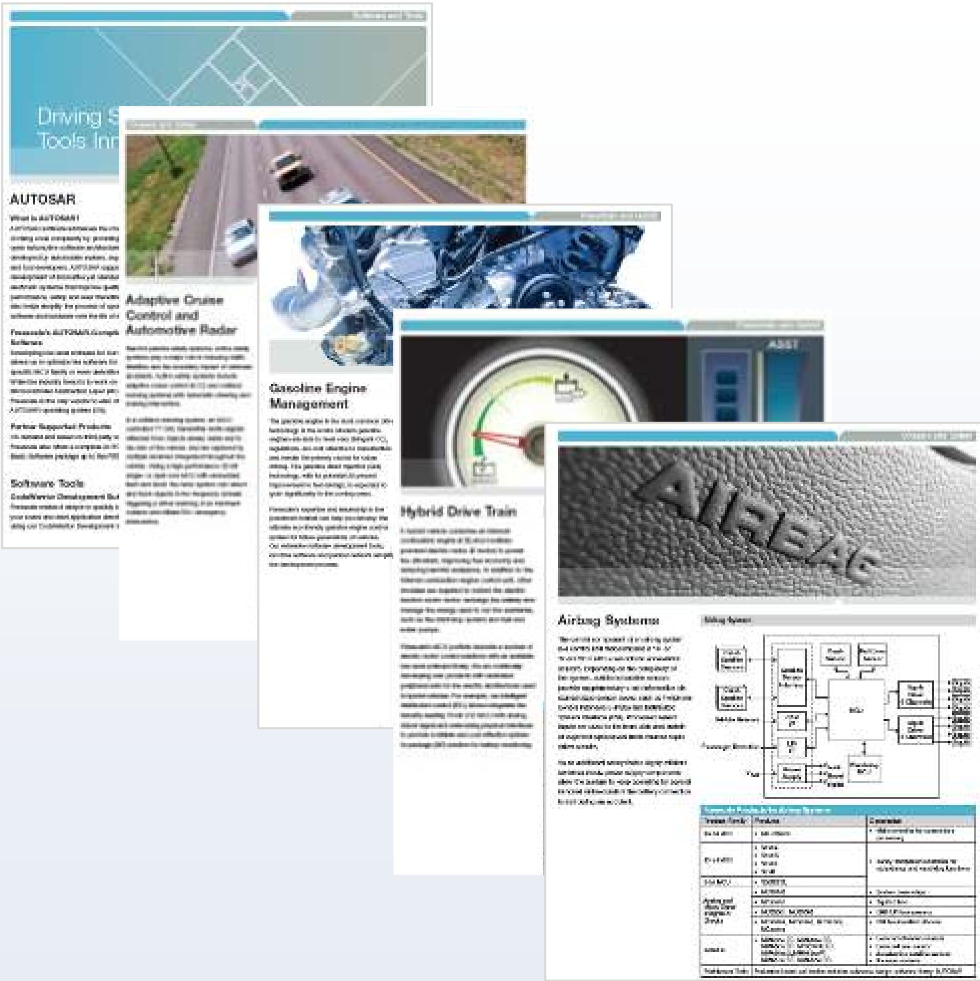
# Automotive Solutions: Helping you with System Solutions





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