

FUTURE VEHICLE COMPUTER SYSTEM IN A FIVE-SCREEN WORLD



Byron Shaw

Managing Director, Advanced Technology, Silicon Valley







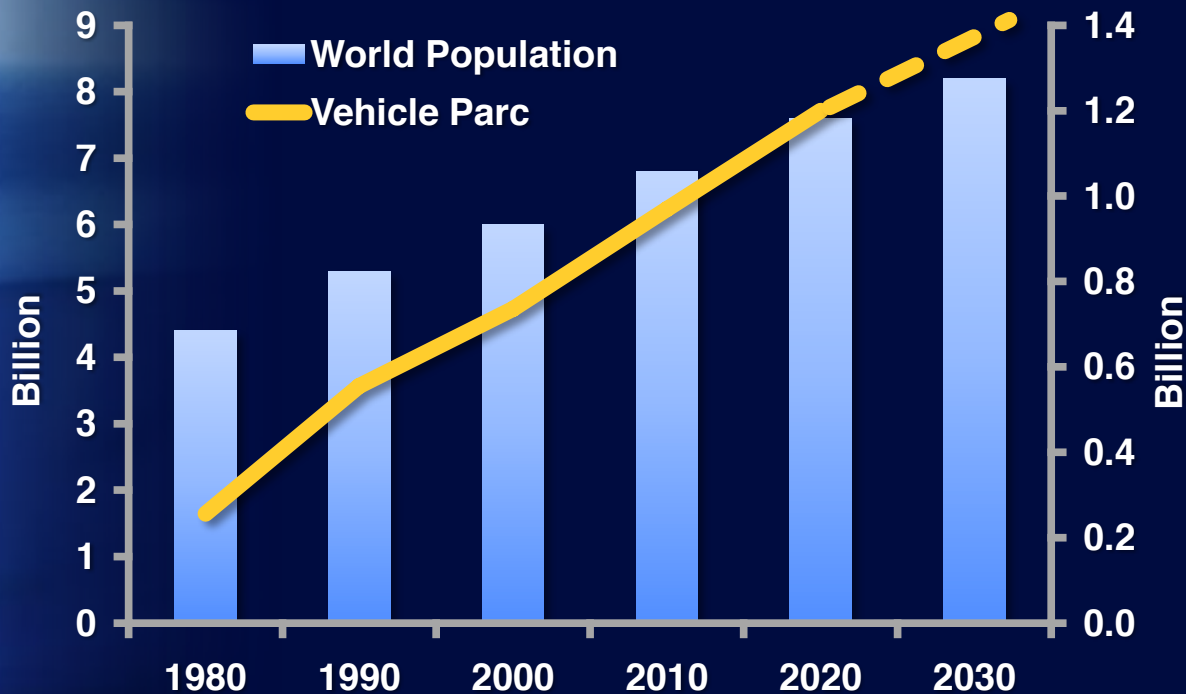


URBAN CHALLENGE: MEGACITIES

- By 2030, 60% of the world's population will live in urban areas, up from 50% today
- Within 20 years, 80% of wealth will be concentrated in cities
- As the urban population increases, traffic congestion in large metro areas will become an even bigger issue



PERSONAL MOBILITY MUST BE REINVENTED FOR THE 21st CENTURY



Technology Challenges

- Energy
- Safety
- Congestion
- Smart Materials
- Connectivity
- Manufacturing

TECHNOLOGY DRIVERS

Challenges

Stretch Goals

- | | |
|-------------------|----------------------------------|
| ■ Energy | Low-cost renewable energy |
| ■ Safety | Autonomous crashless vehicles |
| ■ Congestion | Congestion-free routing/ parking |
| ■ Smart Materials | Multi-component composites |
| ■ Connectivity | Open architecture electronics |
| ■ Manufacturing | Agile, real-time manufacturing |

CARS THAT DON'T CRASH



AND AUTONOMOUS DRIVING



CURRENTLY AVAILABLE CRASH AVOIDANCE TECHS

(2010 AND 2011 GM MODELS)

Lane Departure Warning



Cadillac DTS
Cadillac STS



Buick Lucerne

LDW w/Traffic Sign Recognition "Opel Eye"



Opel Insignia
Opel Astra

Speed/Curve Advisor



Cadillac STS
Cadillac DTS
Cadillac SRX

Rear Back-Up Video



Many Models

Electronic Stability Control



Many Models

Side Blind Zone Alert



Cadillac DTS
Cadillac STS
Cadillac Escalade



Buick Lucerne
Buick LaCrosse



GMC Yukon/
Yukon Denali



Chevrolet Tahoe/
Suburban



Adaptive Cruise Control w/Forward Collision Alert



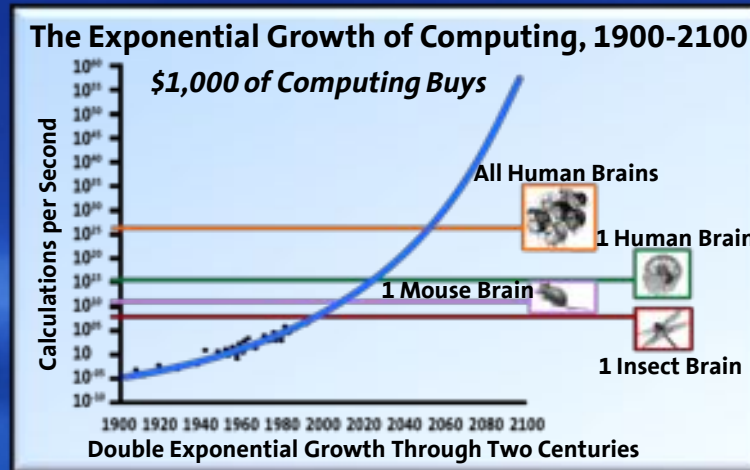
Cadillac DTS
Cadillac STS

Side Blind Zone Spotter Mirror

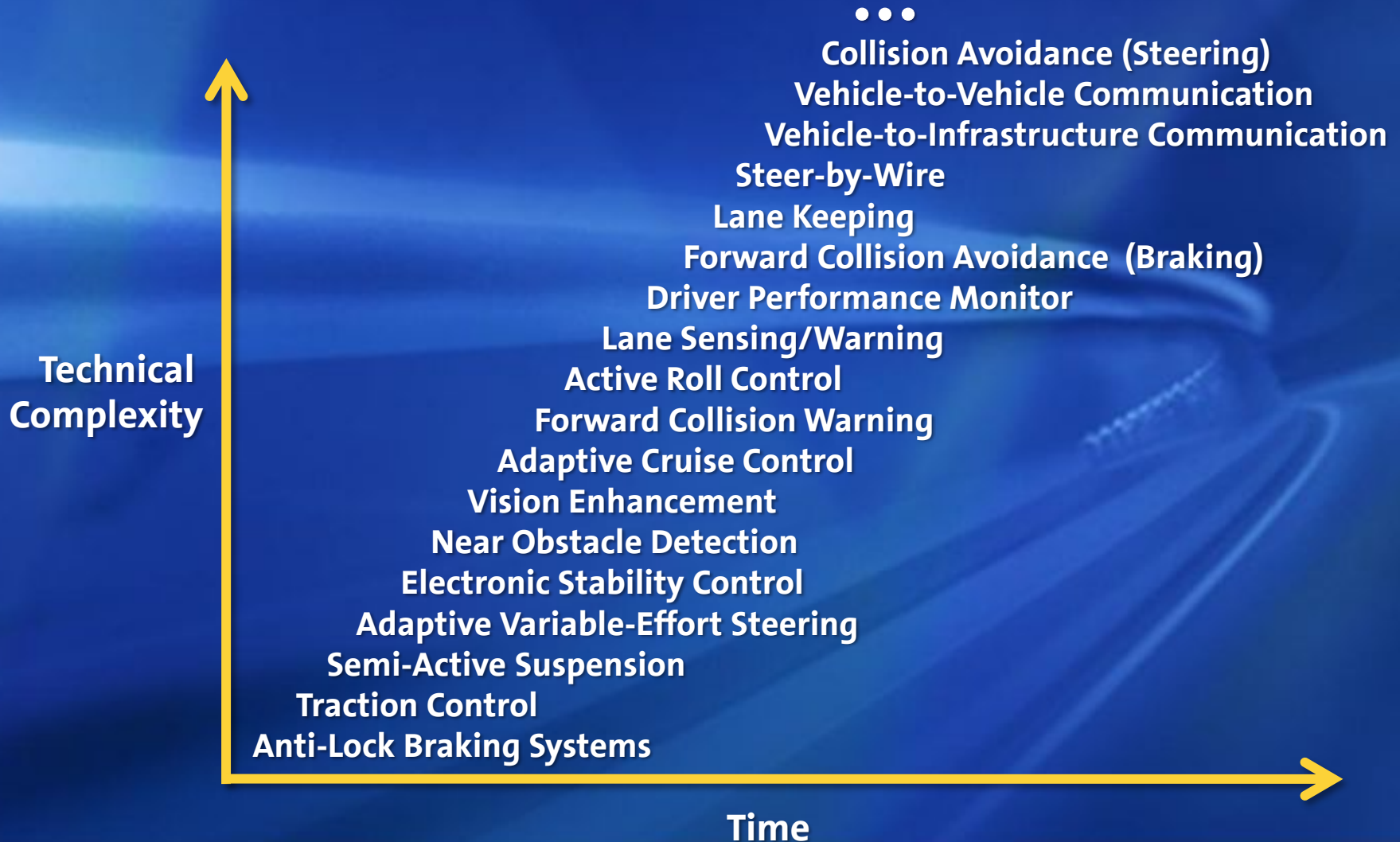


Chevrolet Traverse

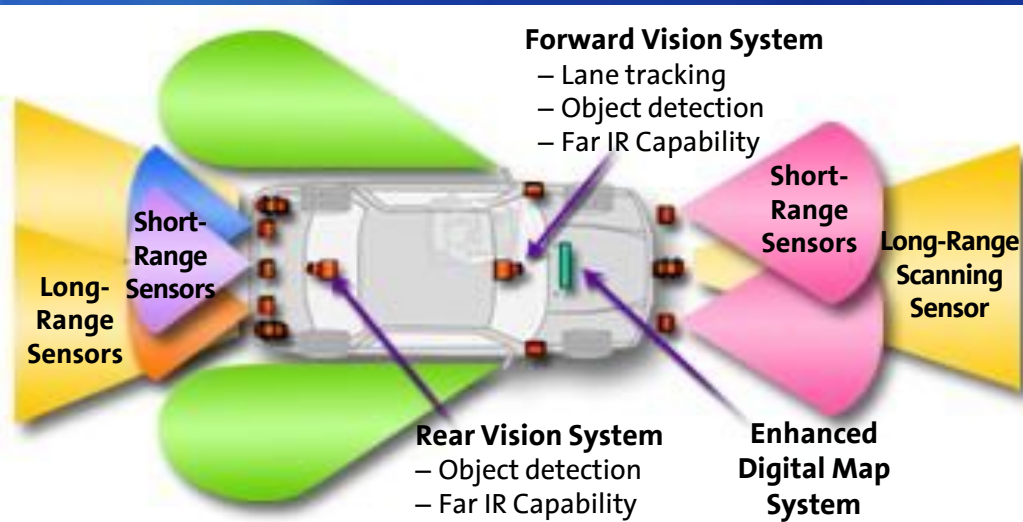
ROADMAP TO AUTONOMOUS DRIVING



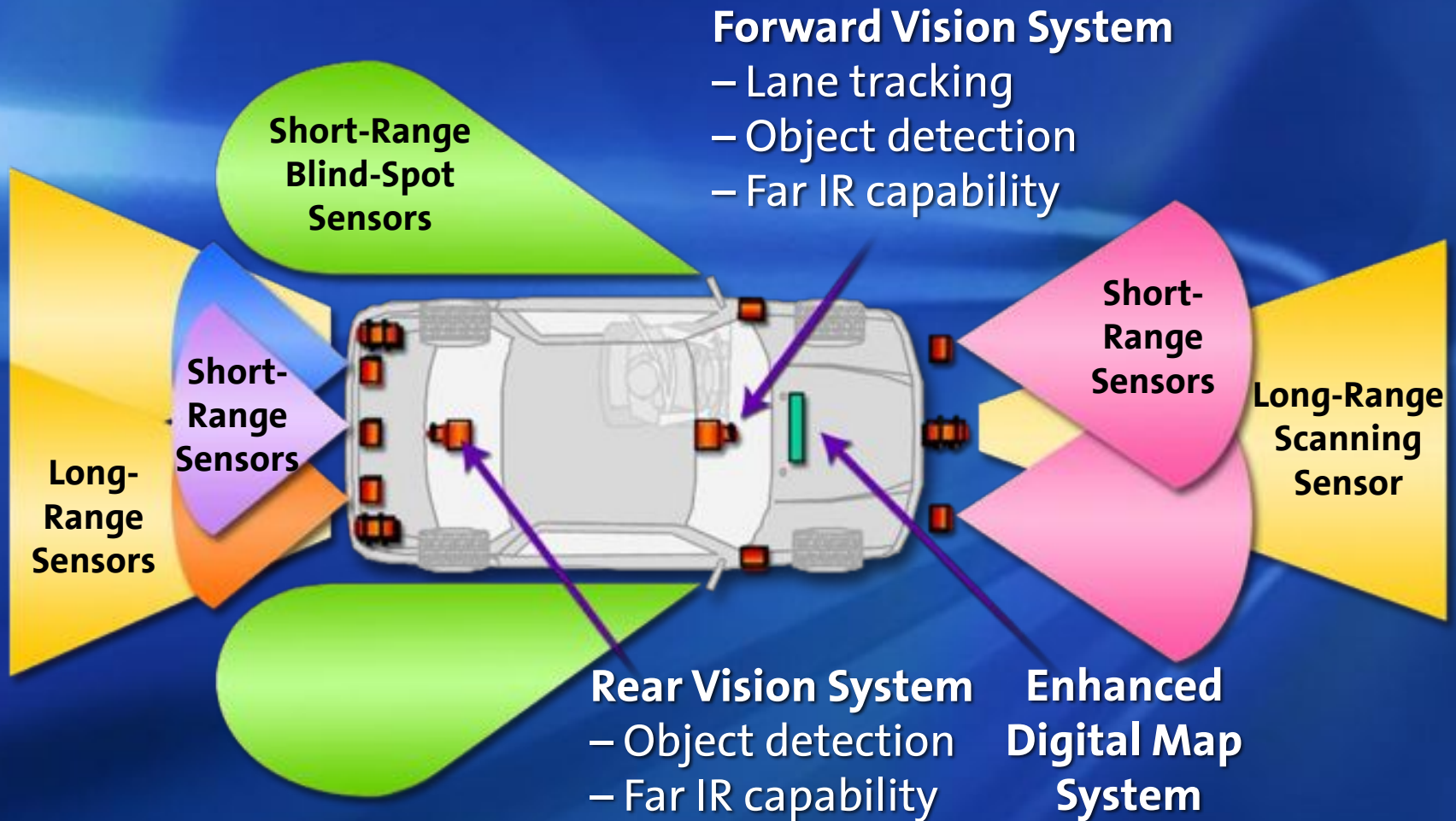
ADVANCED SAFETY TECHNOLOGY STREAM



NOVEMBER 3, 2007: “BOSS” WINS DARPA URBAN CHALLENGE!



360° SENSING CAPABILITY



TECHNOLOGY DRIVERS

Challenges

Stretch Goals

- | | |
|-------------------|----------------------------------|
| ■ Energy | Low-cost renewable energy |
| ■ Safety | Autonomous crashless vehicles |
| ■ Congestion | Congestion-free routing/ parking |
| ■ Smart Materials | Multi-component composites |
| ■ Connectivity | Open architecture electronics |
| ■ Manufacturing | Agile, real-time manufacturing |

REINVENTING PERSONAL URBAN MOBILITY: EN-V (ELECTRIC, NETWORKED VEHICLE)



EN-V AUTONOMOUS SYSTEM COMPONENTS AND FEATURES

**DSRC
antenna**



**Smart phone for
remote parking
and retrieval**



**Forward vision
sensor for object and
collision detection**



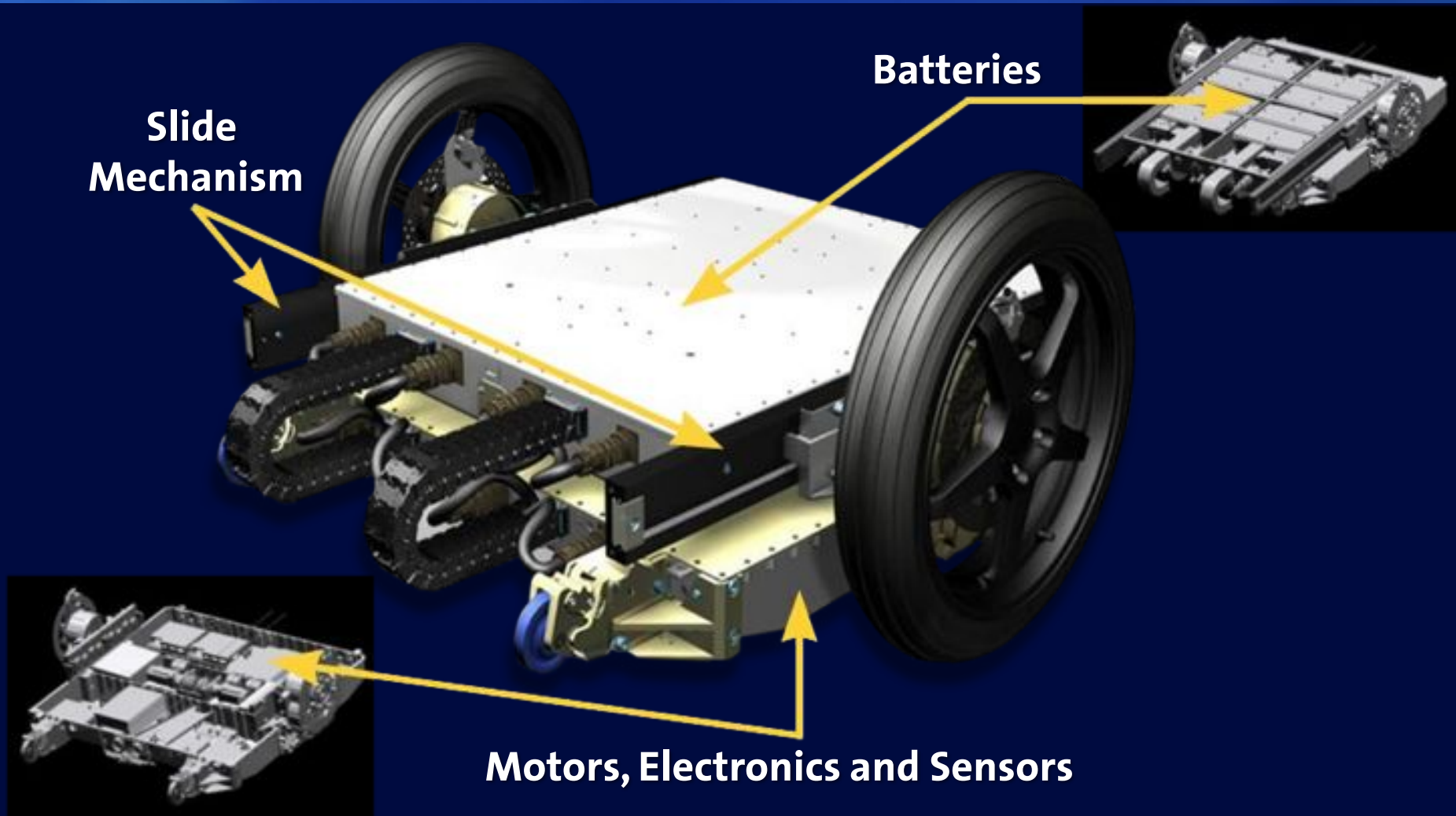
**Forward range
sensors for slow
speed object and
collision detection**



GPS antenna



BY-WIRE SKATEBOARD CONTAINS PROPULSION AND CHASSIS HARDWARE



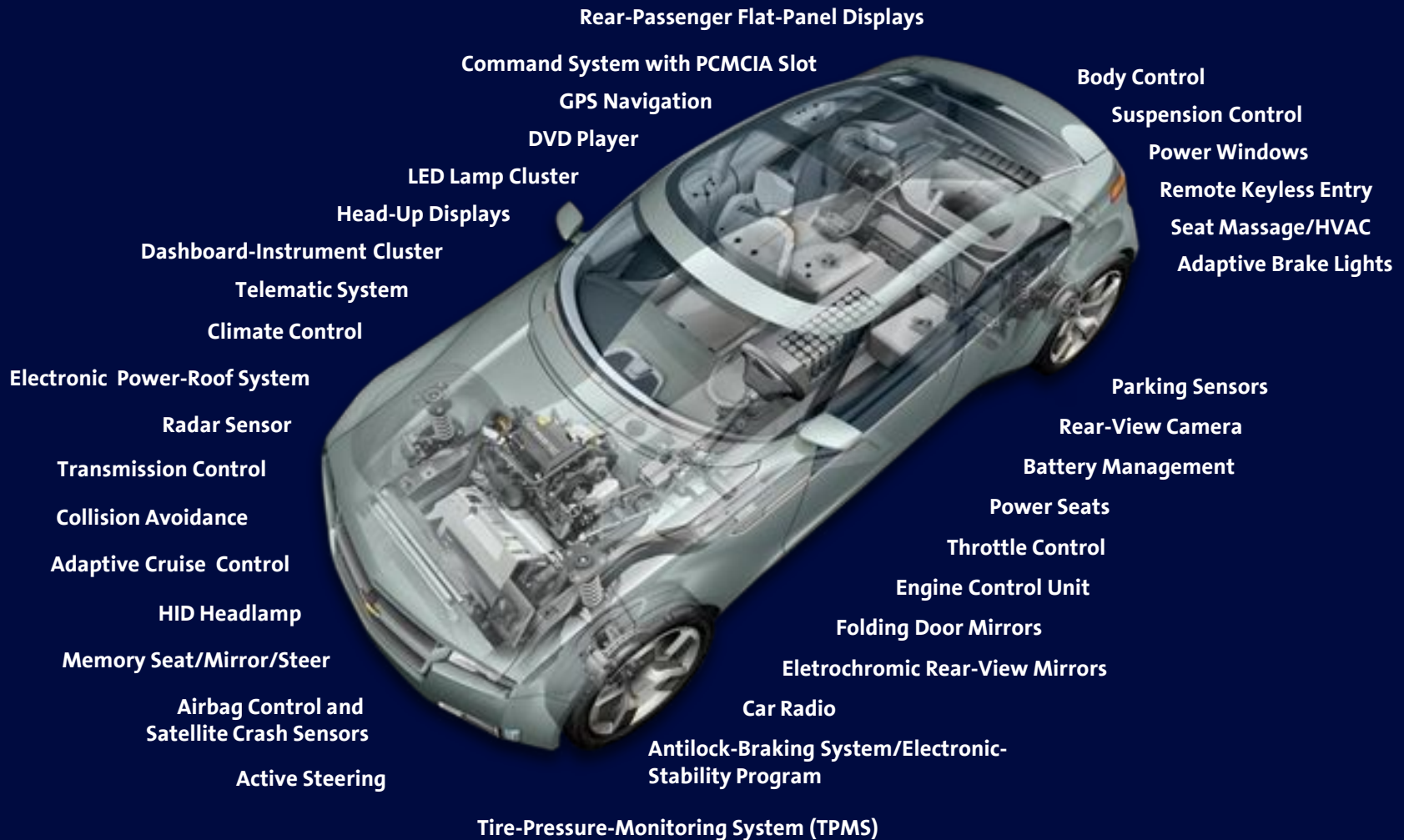
TECHNOLOGY DRIVERS

Challenges

Stretch Goals

- | | |
|-------------------|----------------------------------|
| ■ Energy | Low-cost renewable energy |
| ■ Safety | Autonomous crashless vehicles |
| ■ Congestion | Congestion-free routing/ parking |
| ■ Smart Materials | Multi-component composites |
| ■ Connectivity | Open architecture electronics |
| ■ Manufacturing | Agile, real-time manufacturing |

VEHICLE ELECTRONICS AND SENSORS



EXAMPLES OF UPCOMING FEATURES AND SERVICES

- Smartphone interface
- Rear Seat Entertainment with mobile digital Satellite TV
- Advanced Navigation with camera view (Augmented Reality)
- Wireless charging
- GM-specific Apps
- Software Defined Radio
- Ubiquitous connectivity
- Full Cloud connectivity

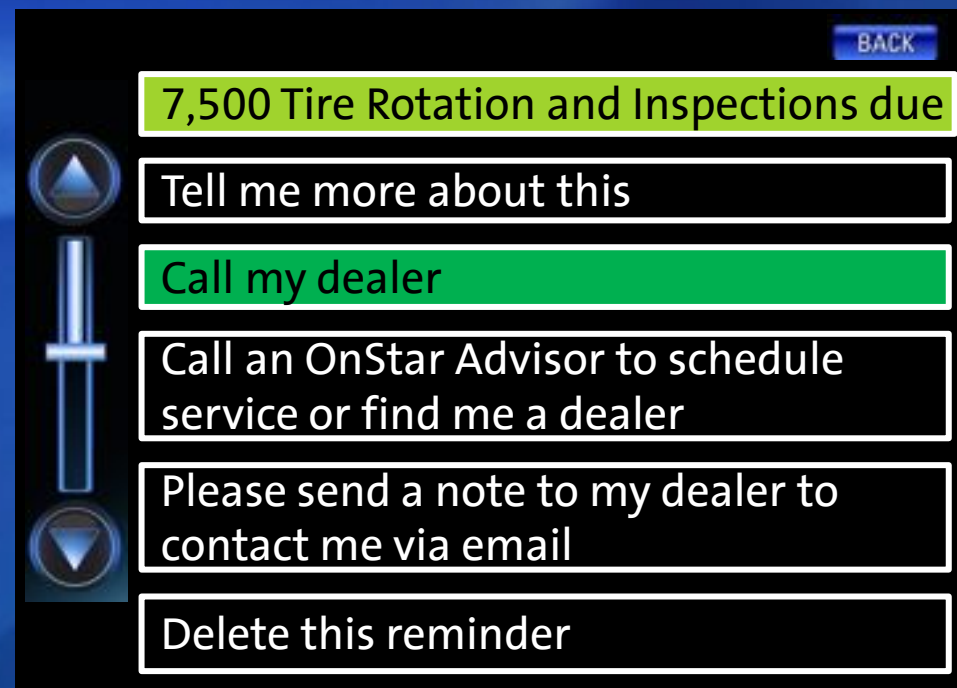


EXAMPLES OF UPCOMING FEATURES AND SERVICES

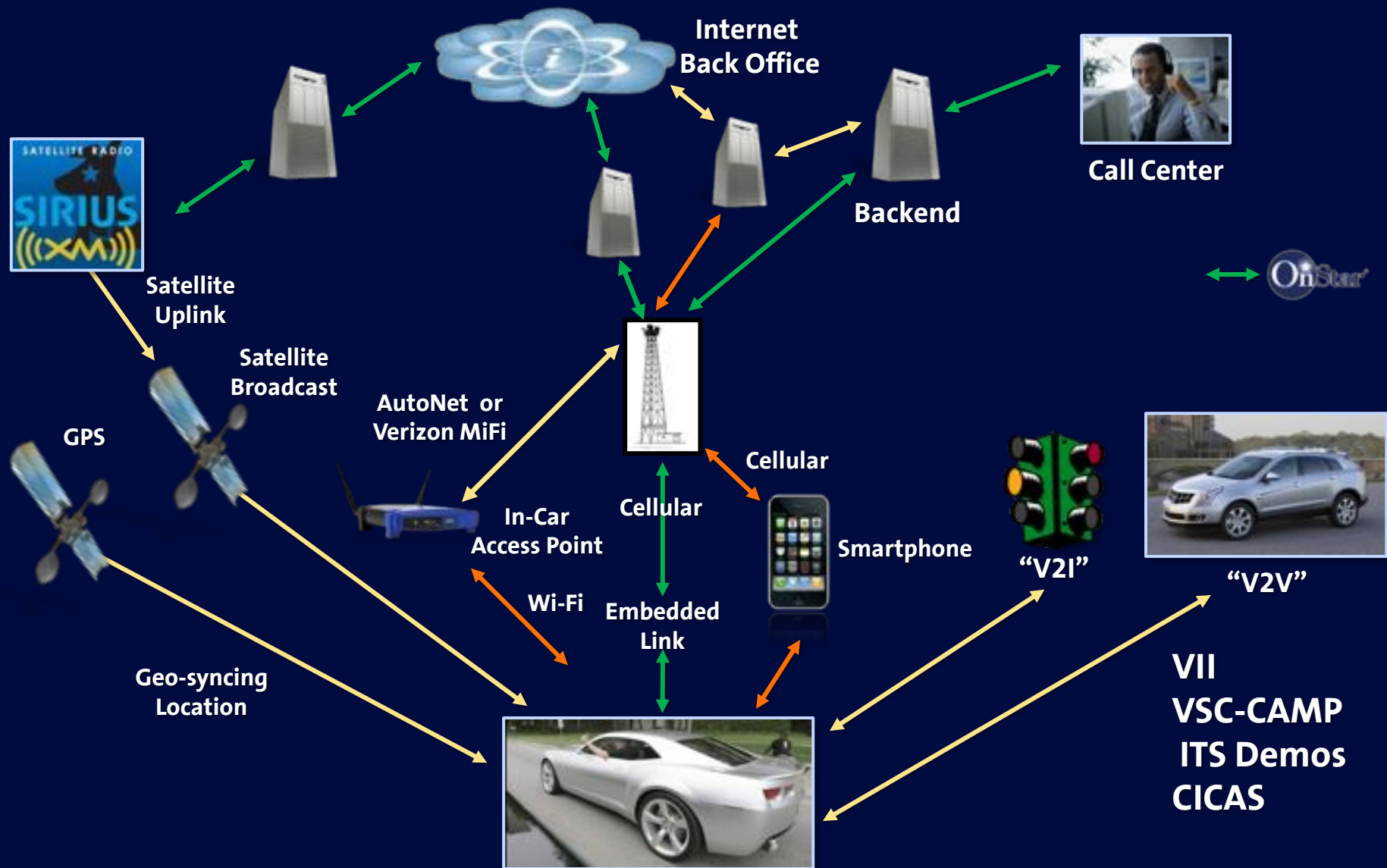
Advanced Navigation with Augmented Reality



On-board Real-time Diagnostics



VEHICLE IS PART OF A “CONNECTED” ECO-SYSTEM



SMART PHONE MOBILE APPS



CONSUMER ELECTRONICS IS DRIVING MANY OF TODAY'S IN-VEHICLE "CONNECTIVITY" FEATURES

iPhone and App Eco-system



Personal Media



Pervasive GPS



Social Networking

twitter

facebook.

myspace®
a place for friends

ANY TIME
ANY CONTENT
ANY WHERE



Mobile Data Plan

LG

NOKIA
Connecting People

Sony Ericsson

Pandora
Interactive Studio

palm



Personal Navigation

MAGELLAN

dash

NAVIGON

GARMIN

miio
explore more

tomtom

EXAMPLES OF GROWING FEATURES AND SERVICES

EXISTING

(Primarily Vehicle Centric)

Safety & Security

Diagnostic Services

Customer Care

**Navigation
Traffic & Weather**

**Personal Device
Connectivity**

NEW

(Primarily Consumer Centric)

**Personalized
Location Based
Services (LBS)**

**Personal Device
Connectivity**

**Smart Phone Apps
for EV**

Eco Navigation

**Social
Networking**

EMERGING

**Content Download
from Cloud**

Advanced Prognostics

Mobile Commerce

**V2I
Application**

**EV Smart Grid
Connectivity
with V2G**

CURRENT DNA

Energized by
Petroleum

Powered Mechanically by
Internal Combustion Engine

Controlled
Mechanically

Stand-alone

Totally Dependence
on the Driver

Vehicle Sized for Max
Use – People and Cargo



NEW DNA

Energized by Biofuels,
Electricity, and Hydrogen

Powered Electrically by
Electric Motors

Controlled
Electronically

“Connected”

Semi/Full Autonomous
Driving

Vehicle Tailored to
Specific Use

NEW VEHICLE DNA

GM Hy-wire
Fuel Cell / By-wire
Concept Vehicle



Chevrolet Volt
Electric Vehicle
with Extended Range



EN-V
Electric, Networked
Urban Mobility Concept

General Motors – Joint Ventures

