CAR Management Briefing Seminars

August 6\textsuperscript{th}-9\textsuperscript{th}, 2012

Deliverable B2

August 15\textsuperscript{th}, 2012

Submitted to:
Michigan Department of Transportation
425 W. Ottawa, P.O. Box 30050
Lansing, MI 48909

Submitted by:
Center for Automotive Research
3005 Boardwalk, Suite 200
Ann Arbor, MI 48108
Monday 1:00 PM – 4:30 PM

With the federally-funded Connected Vehicle Safety Pilot well underway, both public and private sectors are moving ever closer to the National Highway Traffic Safety Administration’s 2013 date for announcing its regulatory intent regarding vehicle-to-vehicle (V2V) active safety. For the first time in a coordinated effort—through “driver clinics”—the safety pilot already has exposed connected vehicle safety technology to members of the general driving population. In addition, through its model deployment component, the safety pilot soon will be gathering significant data on the performance of V2V safety systems from thousands of vehicles and drivers.

Despite this clear progress, calls to regulate against the potential for driver distraction from connected vehicle technology have continued, especially for those technologies that use cellular networks. For example, a 2011 National Transportation Safety Board report called for outright bans on the use of nearly all such technology in moving vehicles. Furthermore, in early 2012, NHTSA published its Visual-Manual NHTSA Driver Distraction Guidelines for In-Vehicle Electronic Devices. Thus, even as 2013 fast approaches, many challenges remain to be addressed. This session will examine the prospects for overcoming these challenges and enabling both public and private sector business models to proliferate.

Chair:
Richard Wallace, Director
Transportation Systems Analysis

Speakers:
James Wang, Deputy General Director of Mechanical and Systems Research Laboratories
Industrial Technology Research Institute

Kirk Steudle, P.E., State Transportation Director
Michigan Department of Transportation

Tim Johnson, Director, Crash Avoidance and Electronic Controls Research
National Highway Traffic Safety Administration

Marios Zenios, Head of Connectivity and Infotainment
Chrysler Group LLC

Frank Welth, General Manager Connected Services, Product Marketing and Strategy
Volkswagen Group of America, Inc.

Roger Berg, Vice President, Wireless Technologies, North America Research Lab
DENSO International America, Inc.

Tim Yerdon, Global Director, Innovation- Design, R&D
Visteon Corporation

Kevin Link, Senior Vice President
Hughes Telematics, Inc.
2012 CAR Management Briefing Seminars

Maximizing Momentum

August 6–9, 2012
Grand Traverse Resort & Spa, Traverse City, Michigan USA
Connected Vehicles at the Crossroads

Monday, August 6, 2012
Connected Vehicles at the Crossroads

CHAIR:

Richard Wallace
Director
Transportation Systems Analysis
Center for Automotive Research
Highlights Since Last Year

• USDOT Vehicle-to-Vehicle Safety Pilot
  – Driver clinics completed in six locations, including Brooklyn, MI (at Michigan International Speedway)
  – Field test about to go live in Ann Arbor (more to come from our speakers)

• 2014 ITS World Congress
  – ITS Michigan and others making progress in preparing for Detroit to be the host city
  – 2012 version to be held in Vienna in October

• Connected and Autonomous
  – Progress made on bring these two technologies together
Connected Vehicles at the Crossroads

James Wang
Deputy General Director
Mechanical and Systems Research Laboratories
Industrial Technology Research Institute
Connected Vehicles at the Crossroads

Kirk Steudle, P.E.
State Transportation Director
Michigan Department of Transportation
Connected Vehicles at the Crossroads

Tim Johnson
Director
Crash Avoidance and Electronic Controls Research
National Highway Traffic Safety Administration
Connected Vehicles at the Crossroads

Marios Zenios
Head of Connectivity and Infotainment
Chrysler Group LLC
Connected Vehicles at the Crossroads

Frank Weith
General Manager Connected Services
Product Marketing and Strategy
Volkswagen Group of America, Inc.
Connected Vehicles at the Crossroads

Roger Berg
Vice President
Wireless Technologies
North America Research Lab
DENSO International America, Inc.
Connected Vehicles at the Crossroads

Tim Yerdon
Global Director
Innovation & Design
Visteon Corporation
Connected Vehicles at the Crossroads

Kevin Link
Senior Vice President
Hughes Telematics, Inc.
Connected Vehicles at the Crossroads

CHAIR
Richard Wallace – Center for Automotive Research

PANEL
Kirk Steudle, P.E. – Michigan Department of Transportation
Tim Johnson – National Highway Traffic Safety Administration
Marios Zenios – Chrysler Group LLC
Frank Weith – Volkswagen Group of America, Inc.
Roger Berg – DENSO International America, Inc.
Tim Yerdon – Visteon Corporation
Kevin Link – Hughes Telematics, Inc.
The State of the Connected Vehicle

Management Briefing Seminar
August 6, 2012

Kirk T. Steudle, P.E.
Director
Michigan Department of Transportation
Ongoing Initiatives

- DUAP (Data Use and Analysis Program)
- VIDAS (Vehicle Information Data Acquisition System)
- Slippery Roads
- Road Weather Management

Fixed Environmental Sensor Station

Mobile Weather Platform

visibility
precipitation rate
precipitation type
air temperature
date-time
pavement temperature
surface status
visibility
precipitation rate
precipitation type
air temperature
speed
ABS actuation
traction control actuation
accelerometry
surface status
pavement temperature
I-94 Truck Parking

- I-94 from Indiana state line to Marshall (I-69)
- Federal grant through FHWA Truck Parking Facilities Program
- Monitors public and private truck facilities
- In addition to the value to the freight industry and truck drivers
- Real-world, sustainable deployment of to ensure safety of commercial vehicle operators
  - Infrastructure and vehicle-based
Program Research

- Ethical and Legal Issues Relating to Government Agencies and Intelligent Transportation Systems Data
- Public Perception of Connected Vehicles
Partnering

- Michigan Connected Vehicle Working Group
  - www.michigan.gov/cv
- Test Bed
- Cooperative Transportation Systems Pooled Fund Study
- Safety Pilot
- MIS
Autonomous Vehicles

- Survey
- Enable manufacturers ability to test / pilot driverless vehicles
Looking Forward
Providing the highest quality integrated transportation services for economic benefit and improved quality of life.
Enhancing Safety Through Connected Vehicle Technology

Car Management Briefing Seminar, August 6, 2012

Tim Johnson
Director, Office of Crash Avoidance and Electronic Controls Research
National Highway Traffic Safety Administration
The Problem!

**Safety**
- 32,310 highway deaths in 2011
- 6,000,000+ crashes/year
- Leading cause of death for ages 4 - 34

**Mobility**
- 4.8 billion hours of travel delay*
- $101 billion - cost of urban congestion

**Environment**
- 1.9 billion gallons of wasted fuel

* Texas Transportation Institute; 2011 Urban Mobility Report
Potential “Connected” Solutions

- Normal Driving
  - Automated Vehicles (DSRC, Cellular)

- Near Crash/ Crash Imminent
  - Connected Vehicles/V2V (DSRC)

- Crash
  - Crash Timeline

- Post Crash
  - Advanced ACN (Cellular)
Connected Vehicle Safety Program Partners and Contractors

Vehicle Manufacturers
- BMW
- GM
- VOLVO
- HONDA
- DAIMLER
- Toyota North America
- CHRYSLER
- VOLPE
- KIA MOTORS
- HYUNDAI
- TOYOTA
- NISSAN
- Mercedes-Benz
- Ford
- Freightliner
- Volkswagen
- Kia

USDOT
- U.S. Department of Transportation
- NHTSA
- VOLPE
- FTA

Academia
- NHTSA
- UGPTI
- UMTRI
- The University of Iowa
- George Mason University
- Montana State University
- PATH
- CVPC
- Texas Transportation Institute

Public Agencies
- MDOT (Michigan Department of Transportation)
- VDOT (Virginia Department of Transportation)
- ADOT (Arizona Department of Transportation)
- NYSDOT
- Oak Ridge National Laboratory
- MCDOT
- Caltrans

Industry
- noblis
- Booz Allen Hamilton
- Telcordia
- SiloSmashers
- Econolite
- Cambridge Systematics
- Siemens
- Kapsch
- Delcan
- DGE Inc.
- Delphi Automotive Systems
- Meritor
- WABCO
- ITRI
- Cohda Wireless

Associations/Standards Developers
- ATR
- ITE
- IEEE
- APTA
- ITS America
- SAE International
- CVSA
- MacroSys
- Battelle
- ITRI
- Industrial Technology Research Institute
Connected Vehicle Technology has the potential to address about 80% of vehicle crashes involving unimpaired drivers.

Potential for Vehicle-to-Vehicle (DSRC) Communication to Address Real World Crashes

- **Rear-End**: 28%
- **Off Roadway**: 23%
- **Lane Change**: 9%
- **Crossing Paths**: 25%
- **Other (e.g. Pedestrian, Head-On)**
- **Intersection crash avoidance**
- **Lane Change/Blind Spot Detection**
- **Forward Crash Warning**
- **Emergency Brake Light Warning**
- **Enhanced Automatic Braking (future)**

Crosscutting: Stability Control Loss Warning

Do Not Pass Warning Vehicle-to-Pedestrian (future)
Connected Vehicle (DSRC) Technology for Safety

- **What it is**
  - WiFi radio technology (5.9 GHz) adapted for high speed environments
  - Inexpensive to produce in quantity

- **How the technology works**
  - Generates/receives messages at 10 times/second
    - Basic Safety Message (vehicle size, position, speed, heading, acceleration, brake system status)
  - Operating range of 300 meters

- **Benefits of the technology over in-vehicle sensor only systems**
  - Addresses More Crash Scenarios → Increased performance
  - Reduced Cost
  - Less False Alarms - communication around vehicles and blind intersections
Vehicle communication technology (DSRC) augments (or potentially replaces) onboard sensors (radars, camera, etc.) to form a comprehensive safety zone around a vehicle.
Fully Connected Transportation

Vehicles “talk” to each other exchanging information such as vehicle size, position, speed, heading, lateral/longitudinal acceleration, yaw rate, throttle position, brake status, steering angle, wiper status, turn signal status, enabling safety and mobility applications.
## US DOT V2V Program

<table>
<thead>
<tr>
<th>Track</th>
<th>Objectives</th>
<th>Lead</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – Crash Scenarios</td>
<td>Develop a comprehensive Pre-Crash Scenario Framework for both light vehicles and heavy trucks.</td>
<td>NHTSA</td>
</tr>
<tr>
<td>2 – Interoperability</td>
<td>Ensure that V2V safety systems can successfully function across equipped vehicles regardless of make/model.</td>
<td>NHTSA</td>
</tr>
<tr>
<td>3 – Benefits Assessment</td>
<td>Benefits assessments for V2V safety applications</td>
<td>NHTSA</td>
</tr>
<tr>
<td>4 – Application Development</td>
<td>Develop applications for benefits assessment</td>
<td>NHTSA</td>
</tr>
<tr>
<td>5 – Human Factors/Driver Issues</td>
<td>Assess driver issues and develop effective driver-vehicle interfaces</td>
<td>NHTSA</td>
</tr>
<tr>
<td>6 – Policy</td>
<td>Develop policy recommendation to support V2V deployment.</td>
<td>NHTSA/RITA</td>
</tr>
<tr>
<td>7 -Commercial Vehicles</td>
<td>Identify and coordinate the commercial vehicle component of V2V safety applications.</td>
<td>NHTSA/FMCSA</td>
</tr>
<tr>
<td>8 – Transit Vehicles</td>
<td>Identify and coordinate the transit vehicle component of V2V safety applications.</td>
<td>FTA</td>
</tr>
</tbody>
</table>
Safety Pilot Model Deployment

Kickoff Soon!

Ann Arbor, MI

August 21, 2012
Safety Pilot Deployment Site

Key Site Elements:
- 75 miles of instrumented roadway
  - 29 roadside units
- ~3000 vehicles
  - Cars, trucks, buses
  - Integrated, aftermarket, and retrofit
- 1 year of data collection

Also:
- Exercising security options
- Vetting device certification process
User Acceptance -- Driver Clinics

- 6 locations across the U.S. - began in August 2011
- 100 drivers per location
- Experienced crash warnings
  - Forward Crash Warning
  - Emergency Brake Light
  - Blind Spot Warning
  - Lane Change Warning
  - Intersection Assist
  - Do Not Pass Warning
- Feedback from drivers was overwhelmingly positive
  - ~90% of drivers expressed desire for such a system
Safety Pilot Model Deployment

- Major road test and real world implementation involving:
  - Approximately 3000 vehicles
  - Multiple vehicle & device types
  - Roadside infrastructure

- Also to test:
  - Prototype security mechanisms
  - Device certification processes
Additional Systems Enhanced or Enabled by Connectivity (wireless communication)

- Automated Vehicles

- Advanced Automatic Collision Notification (AACN)
Automated Vehicles

- Automation should be focused first on safety!
- Opportunity for enhancing safety
  - Over 90 percent of crashes involve some type of driver error!
- Automated driving concepts will likely need wireless communication technology
- NHTSA/US DOT research initiating
Concept

- Cellular-based system transmits onboard sensor data used in predicting crash severity and probability of severe injury

Areas of expected benefits

- Faster emergency response given earlier notification and knowledge of crash location
- Improved pre-hospital response/care and hospital dispatch decisions given knowledge of crash severity/injury probability
Positive Future For Connectivity

- DSRC technology rapidly maturing, several applications already developed and demonstrated
- NHTSA Decision on V2V (DSRC) in 2013 for Light Vehicles, 2014 decision for heavy vehicles
- Additional technologies and systems emerging using connectivity
  - Automated vehicles
  - AACN
Connected Vehicles at the Crossroads

Intelligent Mobility in Taiwan

James H. Wang
Secretary General
Taiwan Automotive Research Consortium (TARC)
Deputy General Director
Mechanical & Systems Research Laboratories, Industrial Technology Research Institute (ITRI)
e-mail: jhywang@itri.org.tw
Intelligent Mobility in Taiwan

- Connected Transportation System
- Electrical and Traditional Vehicles
- Personal Mobility
- Innovative Technologies
- Taiwan as Ideal Demo Site and e-Supplier
- Collaboration and Partnership with USA
A highly connected transportation system in Taiwan
from mass transit to personal mobility

Highway ETC
(electronic toll collection)

High speed rail
• Total: 345 km
• Max speed: 300kph

Ownership
Vehicle per thousand persons
• Car: 299
• Motorcycle: 653

Vehicle density
• 166 cars per 1km road
• 410 scooters per 1 km²

Registered vehicle
• 7.09 millions cars
• 15.17 millions scooters

subway
• Taipei & Kaohsiung
• Total: 152.7 km
**Challenges**
Transportation efficiency, safety and emission issues caused by:
- High vehicle density
- Vehicle mix
- Urban mobility model

**Needs**
- Safe
  - Safety & security
  - Toward zero accidents
- Clean
  - Efficiency & eco
  - Reduce emission
- Smart
  - Comfort & convenience
  - Provide diverse services

**Solutions**
- Wireless connectivity
- Intelligent cooperative systems
- Vehicle electrification
- OAM&P control technologies
- HMI in vehicular environment
The indigenous vehicle

- Safety and comfort systems
- Green vehicle by electrification

- Land Departure Warning System
- Night vision

- MPV EV+
- Eagle View
- WAVE/DSRC

- Blind Spot Monitoring system
- Think+ Car PC
- OAM&P for IVs

OAM&P: Operation Administration Maintenance & Provisioning
Innovation technologies
shaping the future vehicle

Fire wall in nano scale to prevent internal short for Li ion battery

Flexible Speaker with low power consumption, light weight, free shape & size

A cost-effective, highly stable and resistant to infrared radiant heat, environmentally-friendly.

A light weight, high torque density thin motor
Test bed and pilot projects
intelligent and electric vehicle

• Taiwan as a field trial and realization site of advanced vehicle systems and services
• Supported by well-established S&T Infrastructure, industry cluster, and joint-development of R&D organizations
Test bed and pilot projects
vehicle communication and service

Field trial projects

- Smart Bus
- iTAXI
- Smart Parking
- Pedestrian indoor navigation

Multi LBS Services
Dynamic Connection information
Security Surveillance
Lifestyle info

Smart Bus
iTAXI
Smart Parking
Partner of US DOT’s test and trial

- Crash avoidance metric partners vehicle-to-vehicle communications interoperability test  [ USDOT, GM, Ford, ... 2010.07.24 ~2011.06.03 ]
- US DOT Connected Vehicle Safety Pilot HIA (Here I Am) project (2010.09.23 ~2011.05.26)
- US DOT Connected Vehicle Safety Pilot RSE (Road Side Equipment) project (4/28)
- US DOT Test Bed HIA Set-up project (2011.07.06~2011.11.16)
Final Remarks

• The highly urbanized and mixed transportation system in Taiwan presents challenges and opportunities for clean, safe and smart mobility.

• Through collaboration and innovation, many advanced technologies and viable solutions are implemented in various pilot projects.

• We invite you to visit us and be our partners in R&D, Product Dev, and Demo programs.

Contact James Wang at jhywang@itri.org.tw
Frank C. Weith
General Manager, Connected Services
VWoA Connected Services, VW Product
Marketing and Strategy
GLOBAL RESEARCH AND DEVELOPMENT PROGRAM

Worldwide Collaboration

- Knowledge network
- Teamwork of experts worldwide
- Driving innovations
- Comparison of concepts
- Best solutions in car
FUTURE CHALLENGE: INTELLIGENT AND EFFICIENT MOBILITY SOLUTIONS

- Urbanisation
- Increasing traffic load
- Seamless mobility

- Individual customer requirements
- Income polarisation
- Demographic change

- Society

- Increasing vehicle number
- Legal requirements
- New markets

- Energy
- Climate change
- CO₂
- Peak of oil

- Mobility

- Safety
ULTIMATE GOAL:
AUTONOMOUS DRIVING (CORE TECHNOLOGIES)

Driver Assistance Systems

Connected Car

Human Machine Interface

eMobility Development
DRIVER ASSISTANCE SYSTEMS
THE DRIVER AS UNCERTAINTY FACTOR CAUSES OF FATAL ACCIDENTS

Causes of Fatal Accidents

- Mental factors: 38%
- Incorrect decisions: 46%
- Unexpected Behaviour: 11%
- Technology: 5%

- Causes:
  - Sleep: 0%
  - Distraction: 5%
  - Medical reasons: 10%
  - Car in front: 15%
  - Vehicle dynamics: 20%
  - Sudden decision: 25%
  - Lane-Keeping: 30%
  - Parked car: 35%
  - Pedestrians/animals: 40%
  - Accident: 45%
  - Other: 50%
  - Technology: 55%
INCREASING NEED FOR SAFETY AND MEET CUSTOMER DEMANDS

Supporting the driver when he/she is in need of assistance

Under-challenging the driver
- Simple, monotonous driving tasks
- E.g. long distance trips, traffic jams

Over-challenging the driver
- Complex driving tasks
- E.g. entering a motorway, turning at intersections etc.

Autopilot
- Under defined conditions
- Specific situations
- Selected road sections only

Safety Angel
- Information
- Warning
- Assistance
- Up to automatic accident avoidance

How good/flawless is the driver?
Complexity of driving task
Need for support
BUILDING BLOCKS OF TECHNOLOGIES

Driving at the limits of physics

- Vehicle dynamics
- Track coordination

“Golf 53”

Driving in unknown terrain

- Recognition of environment
- Locating
- Trajectory

“Stanley”

Driving according to traffic regulations

- Driving strategy
- Complex environment

“Junior”

- Expanding the horizon
- Predict danger

“Car to X”

- Drifting algorithm
- High speed

“Intelligent Car”

“Pikes Peak TTS”

- Vehicle dynamics
- Track coordination

“Junior”
AUTONOMOUS DRIVING: INTEGRATION OF THE BUILDING BLOCKS (2010)

“Pikes Peak TTS”

• Driving strategy
• Complex environment
• Vehicle dynamics
• Track coordination
• Drifting algorithm
• High speed
• Recognition of environment
• Locating
• Trajectory
CONNECTED CAR
CONNECTIVITY VISION – HETEROGENEOUS NETWORKS
CONNECTIVITY DRIVER – IMPROVING TRAFFIC SAFETY

Safety and Security / Emergency Response

In-car warning from infrastructure (V2I)

Poor visibility (V2V)

Navigation / Alternate Routes
CONNECTIVITY DRIVER – INTEGRATION OF ONLINE SERVICES

Traffic Information
Fuel Prices
Time Tables
Restaurants and Hotels
Tourist Information
Current Events

Right Information, Right Time to make the Right Decision
Integrated Solution:

- Driver Assist Systems could enhance passenger safety at or near the incident sight
- Traffic Incidents could be fed directly into Streaming Traffic data to improve accuracy
- Very short latency (<50ms) for allowing quicker responses
CONNECTIVITY ENABLER – CAR-TO-INFRASTRUCTURE (V2I) FUTURE APPLICATION

Integrated Solution:

- Driver Assist Systems could enhance passenger safety by responding to infrastructure
- Eliminate running of Red Lights, no Turn on Red, Stop signs, etc…
VEHICLE CONNECTIVITY CHALLENGES

- Political Discussions
- Legal Limitations
- Business Case
- Implementation Scenario
- Standards
- Data Safety
- Data Security
- Data Keeper
V2X ROLE OUT CHALLENGES – POLICY ISSUES

• Surveillance Society – “Big Brother”
• Vehicle as an Open Platform and Vehicle Data Access
• State/Local Jurisdictions Rule on DSRC
• DSRC by Google or Verizon
• V2V-Only Mandate

Concerns relating to:
• Privacy / Security
• Governance and Rules
• Customer Acceptance
• Liability
• IP (Intellectual Property)
• Business Strategy
**V2X CRITICAL ELEMENTS FOR DEFINING SUCCESS**

**Driver Assessment Clinics**
- Gage Customer Acceptance in live driving scenarios
- Record GPS/DSRC performance in various driving environments
- Over 700 Naive Drivers in 6 US cities evaluated

**Model Deployment**
- Nearly 3000 V2V capable vehicles:
  - 64 Integrated + Aftermarket Safety + Vehicle Awareness Devices
- Develop Minimum Performance Standards

**Advanced Application Development**
- Characterize V2V capabilities
  - Forward Collision Avoidance (V2V+Radar vs. V2V Only)
  - Influence Test Procedures
  - Intersection Movement Assist*

**Interoperability**
- DSRC Communication Channel Congestion Control (200+ Movable Units)
- Scalability Testing
- Security Credential Management System Development
** This group/program was formerly known as Intellidrive

USDOT: United States Department of Transportation  
FHWA: Federal Highways Administration  
NHTSA: National Highway Traffic Safety Administration  
CAMP: Crash Avoidance Metrics Partnership  
RITA: Research and Innovative Technology Administration
THE CONNECTED CAR IN A CONNECTED WORLD
HUMAN MACHINE INTERFACE
HMI INFOTAINMENT EVOLUTION – WHO’S THE COMPETITION?

HMI Driving Innovative In-Vehicle Solutions

Increase Safety By:
• Integrating Content
• Integrating Features
  – Voice
  – Touch pad
• Reducing Distraction

VOLKSWAGEN GROUP OF AMERICA
## Golf blue-e-motion

### Vehicle Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle weight</td>
<td>1545 kg*</td>
</tr>
<tr>
<td>* 205 kg more than Golf Blue Motion TDI with DSG</td>
<td></td>
</tr>
<tr>
<td>Dimensions L/ B/ H</td>
<td>4199/ 1786/ 1480 mm</td>
</tr>
<tr>
<td>Gearbox</td>
<td>EQ 210 (1-Gang-Getriebe)</td>
</tr>
<tr>
<td>Maximum speed</td>
<td>135 km/h</td>
</tr>
<tr>
<td>Acceleration (0-100)</td>
<td>11,8 s</td>
</tr>
<tr>
<td>elektr. Driving range</td>
<td>up to 150 kilometer</td>
</tr>
</tbody>
</table>

### Power Train

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-motor</td>
<td>85 kW / 115 PS</td>
</tr>
<tr>
<td>battery</td>
<td>26,5 kWh (Li-Ion)</td>
</tr>
<tr>
<td>voltage</td>
<td>324 V</td>
</tr>
<tr>
<td>torque</td>
<td>270 Nm</td>
</tr>
</tbody>
</table>

Seamless Integration of Connectivity is Critical for BEVs
THE CAR OF THE FUTURE...

..... learns to see
vision technology

..... is connected
wireless, mobile communication

..... interfaces to you
speech and graphics

...seamlessly integrated systems
...continuously evolving towards Autonomy
Thank you for your attention!
Connected Vehicles: Driving the User Experience

Timothy J. Yerdon
Innovation | Design | R&D
Agenda

• Visteon today

• Why the world of automotive is changing

• Designing for the user experience

• Questions to consider for the future
**Visteon Today**

<table>
<thead>
<tr>
<th>Visteon Overview</th>
<th>Product Line Portfolio</th>
<th>2011 Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Leading provider of value-added components/systems to a broad range of global vehicle manufacturers</td>
<td><strong>Climate</strong></td>
<td>$4.0 Billion</td>
</tr>
<tr>
<td>• Employees:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 22,000 consolidated</td>
<td><strong>Electronics</strong></td>
<td>$1.3 Billion</td>
</tr>
<tr>
<td>- 37,000 including joint ventures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 120 facilities in 28 countries*</td>
<td><strong>Interiors</strong></td>
<td>$2.3 Billion</td>
</tr>
<tr>
<td>• 2011 revenue:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- $8.1 billion consolidated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- $12.0 billion including joint ventures and discontinued operations</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Includes joint ventures.*
Visteon’s Competitive Advantage

Presence in Emerging Markets

Automotive Intellect

Talented People

Effective Cost Controls

Solid Customer Base

Strong Supplier Partnerships

Leading Quality Metrics

Focused Product Strategy

Leading Innovative Technologies

Joint Venture Relationships

Global Footprint

A Strong Global Presence
Connected Vehicle Collaboration Partners

[Logos of various partners including the Department of Transportation, NXP, Savari, UMTRI, CohdaWireless, University of Virginia, Visteon, PATH, and ITRI]
Agenda

• Visteon today

• Why the world of automotive is changing

• Designing for the user experience

• Questions to consider for the future
A Changing Society: Megatrends

- Individualization
- Female Shift
- Health & Well-Being
- New Ecology
- Connectivity

- Silver Revolution
- Globalization
- Education
- New Work
- Mobility

Source: Visteon Corporate Innovation & Zukunftsinstitut
Deciphering the Trends: What’s Important for Automotive?

- **Connectivity** is not just for electronics….it’s a lifestyle!

- “Smart Mobility”
  - Time and energy management
  - CAFE regulations = weight / CO₂ reductions
  - Different vehicle use cases = zipcar, Car2Go, OnStar, vehicle / ride sharing
  - Seamless connectivity = infotainment, V2X communications, traffic and parking management
  - Autonomous and semi-autonomous driving
Agenda

- Visteon today
- Why the world of automotive is changing
- Designing for the user experience
- Questions to consider for the future
Why do we need to consider the user experience?

Companies that focused on the customer experience, OUTPERFORMED the S&P 500, by 10 to 1.

– BusinessWeek
Focus on Upstream Customer Engagement

Product Development Phases

Planning
- Product Definition

Development
- Design Prototype
- Test

Manufacturing
- Process Engineering

Production

Market
- Product Launch, End User

Leveraging the Visteon Tool Kit

Consumer INPUT

Consumer Insight
Visteon Tool Kit

CRAFTSMANSHIP
Prioritization and prediction of product elements and design execution

EXPERIENTIAL PRODUCT MODEL
Consumer-defined attributes captures the ideal user experience

FUTURE WEB
An innovation process to visualize the future

CONSUMERS
Identifying their motivating factors to develop products which exceed expectations

USABILITY
Creating a more intuitive experience for drivers and their vehicle’s electronics

VEHICLES AND SEGMENTS
Understanding the elements which ignite passion and desire for a particular vehicle
Product Model: My Ideal Electronics Experience

**ACCESSIBLE**
All the information I need during my drive is right in front of me. I don't have to search for anything.

**PERSONAL**
My gauges, controls, and displays are designed to fit my specific needs.

**SAFE**
I'm not distracted; I'm focused on the road. I have information about my car - everything is in working order. In an emergency, I am connected to people and information I need.

**ACCURATE**
I know that my gauges and controls do what they are supposed to do.

**SIMPLE**
The controls and displays are easy to figure out. I know what they are and what they do.

**ENGAGING**
My electronics, controls, and displays grab my attention - I want to touch and interact with them.

- **Organized**
  All in one place, grouped together

- **At-a-glance**
  Easy to read and see, digital

- **At my fingertips**
  Within easy reach, handy like voice activation or touch screen

- **Responsive**
  Confirmation/feedback that "something happened"

- **Precise**
  Information is current, real time, digital

- **Effective**
  Reliable, it works

- **Fun**
  Colorful, different shapes

- **Unique**
  Unexpected design elements

- **Comfortable**
  Feels good in my hand, easy on my eyes

- **Compatible**
  Works with my devices

- **Connected**
  Constant access to people, information, entertainment

- **Customizable**
  I want to choose the information I receive, how it looks and sounds

- **Straightforward**
  Know what it is and what it does

- **Effortless**
  Limited number of steps, e.g. one touch or one click
<table>
<thead>
<tr>
<th>Key Questions to Consider</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>safe:</strong></td>
<td>Are users able to interact with the system while driving?</td>
</tr>
<tr>
<td><strong>simple:</strong></td>
<td>Are users able to understand the system’s display and content organization?</td>
</tr>
<tr>
<td><strong>accessible:</strong></td>
<td>Are users able to easily interact with the system’s functionality?</td>
</tr>
<tr>
<td><strong>accurate:</strong></td>
<td>Does the system provide understandable feedback and behave according to users’ expectations?</td>
</tr>
<tr>
<td><strong>personal:</strong></td>
<td>Are users able to easily customize options and integrate external devices?</td>
</tr>
<tr>
<td><strong>engaging:</strong></td>
<td>Are users intrigued by the system and is it intuitive?</td>
</tr>
</tbody>
</table>
Vision. Translated.

- Bringing real-world answers to conceptual questions
- Making quality tangible
- Finding and deploying the right technology