Connected and Automated Vehicles and the Cybersecurity Threat

—*How the Industry is Responding*

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Innovation for the Real World

Agenda

- Delphi Overview
- The Road Toward Automated Driving
- Why Cybersecurity Matters?
- What Needs To Be Addressed?
- Delphi’s Approach

Delphi's Global Team – At the center of technology innovation

19,000
engineers and scientists

$17B
2014 revenue

126
manufacturing sites
15
major global technical centers

$1.7 B
in Research & Development

160,000
people in
32
countries

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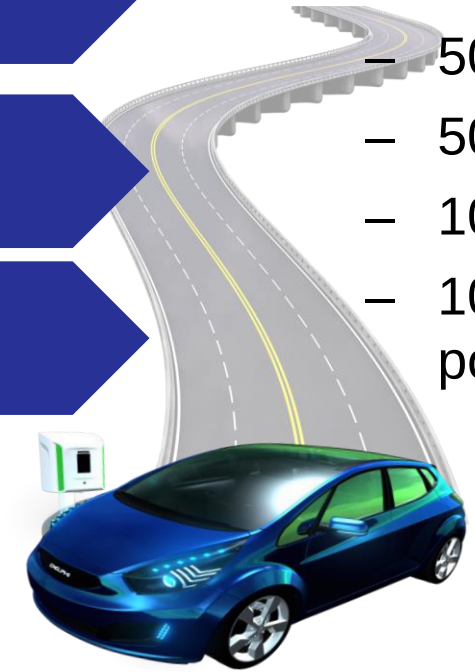
Delphi – Changing the way transportation is delivered

In the next 10 years:

- 50% more vehicles on the road
- Stricter fuel economy regulations @ 54.5 MPG by 2025
- Automated driving reality



And, Delphi technologies are creating a world with:

- 50% fewer accidents
- 50% less emissions
- 100% better fuel economy
- 1000% more computational power in the vehicle

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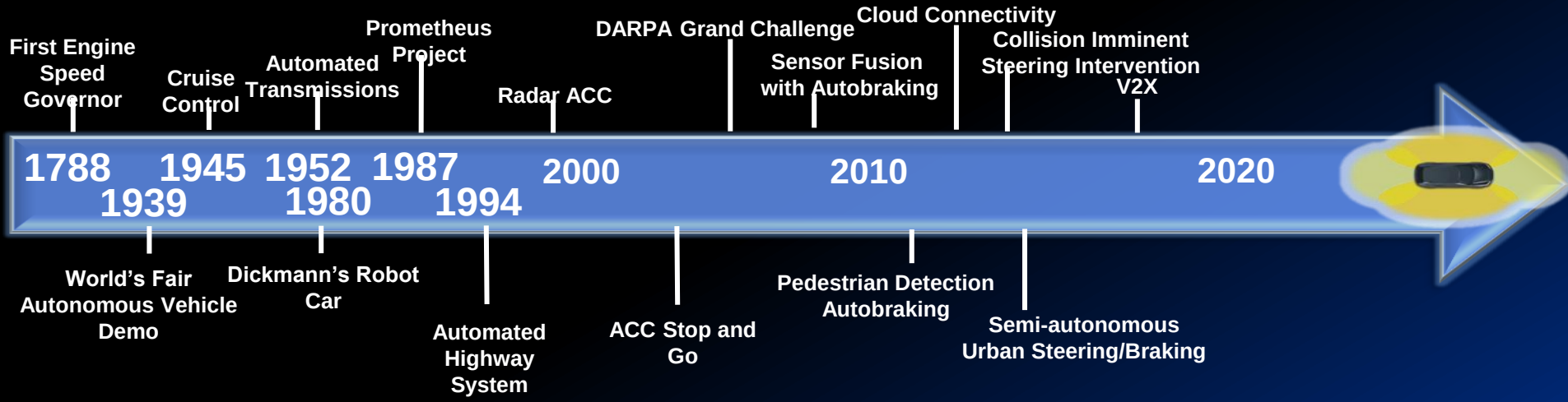
The Road Toward Automated Driving



- Sensing technology and electronic controls have been in development for decades, forming the building blocks of autonomous driving

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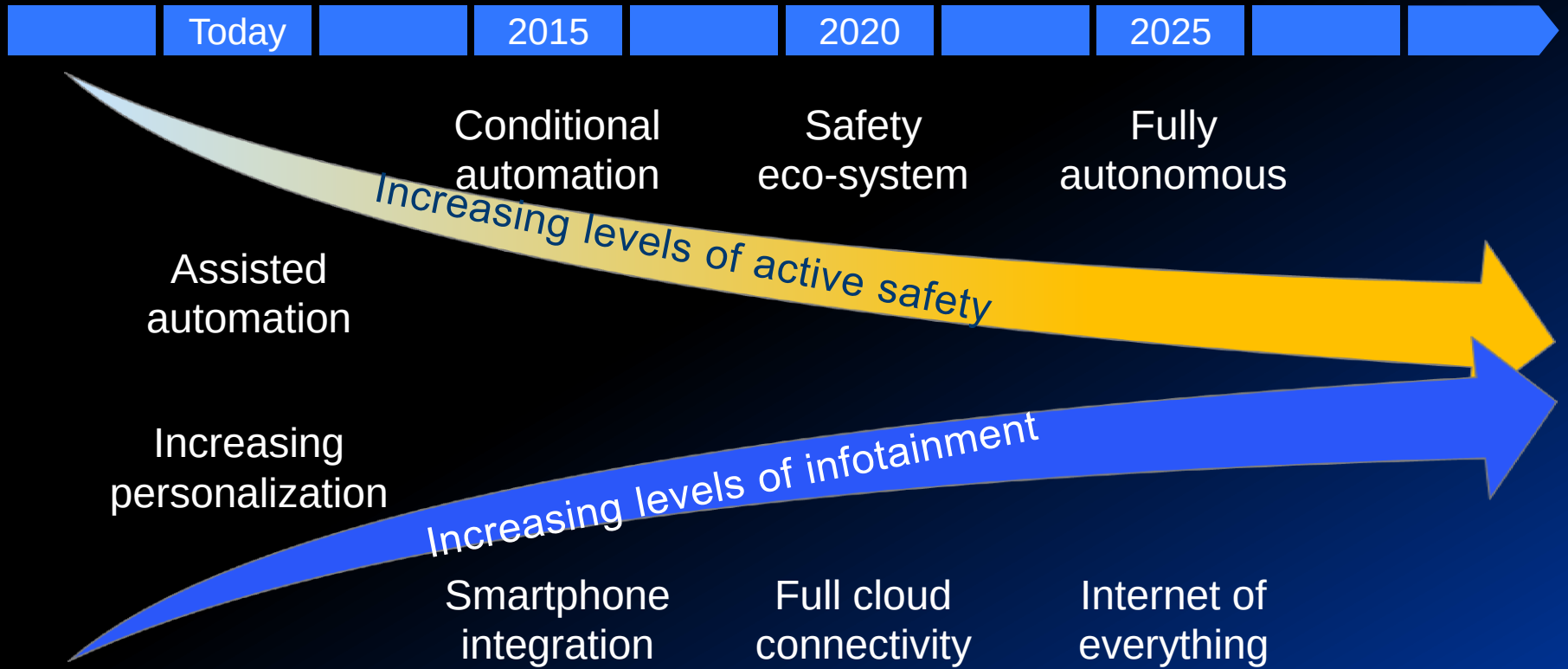
What's next? Convergence of technologies



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Why Cybersecurity Matters?

Malicious cyber activity could generate costs comparable to car crashes, piracy, pilferage, or drug trafficking

Putting Malicious Cyber Activity in Context			
CRIMINAL ACTION	**ESTIMATED COST**	**PERCENT OF GDP**	**SOURCE**
GLOBAL			
Piracy	$1 billion to $16 billion	0.008% to 0.02%	IMB
Drug Trafficking	$600 billion	5%	UNODC
Global cyber activity	$300 billion to $1 trillion	0.4% to 1.4%	Various
US ONLY			
Car Crashes	$99 billion to $168 billion	0.7% to 1.2%	CDC, AAA
Pilferage	$70 billion to $280 billion	0.5% to 2%	NRF
US- cyber activity	$24 billion to $120 billion	0.2% to 0.8%	Various

Source: “The Economic Impact of Cybercrime and Cyber Espionage” Mc Afee Center for Strategic and International Studies July 2013

Why Cybersecurity Matters

- On December 2, 2013, Senator Edward J. Markey [D – MA] sent letters to 20 major automobile manufacturers requesting information about how consumers are protected from cyber attack or unwarranted violations of privacy
  - Letters sent to Volvo, Volkswagen, Toyota, Tesla, Subaru, Porsche, Nissan, Mitsubishi, Mercedes Benz, Mazda, Lamborghini, Jaguar, Hyundai, Honda, GM, Ford, Chrysler, BMW, Audi, and Aston Martin
- 2014: Data security is the name of the game across all industries
  - April: the "Heartbleed" flaw was made public (1/2-million servers exposed; 50 million Android phones vulnerable)
  - June: AT&T confirmed insider data breach occurred in April
  - July: JP Morgan revealed data breach affected 76 million households and 7 small businesses
  - August: celebrity photo hack
  - November: Sony Pictures Entertainment hack
  - December: More than 4.6 million North American Snapchat users' phone numbers and usernames leaked online
- 2015: Health insurer Anthem hit by hackers. Breach gets away with names, social security numbers of customers, employees.

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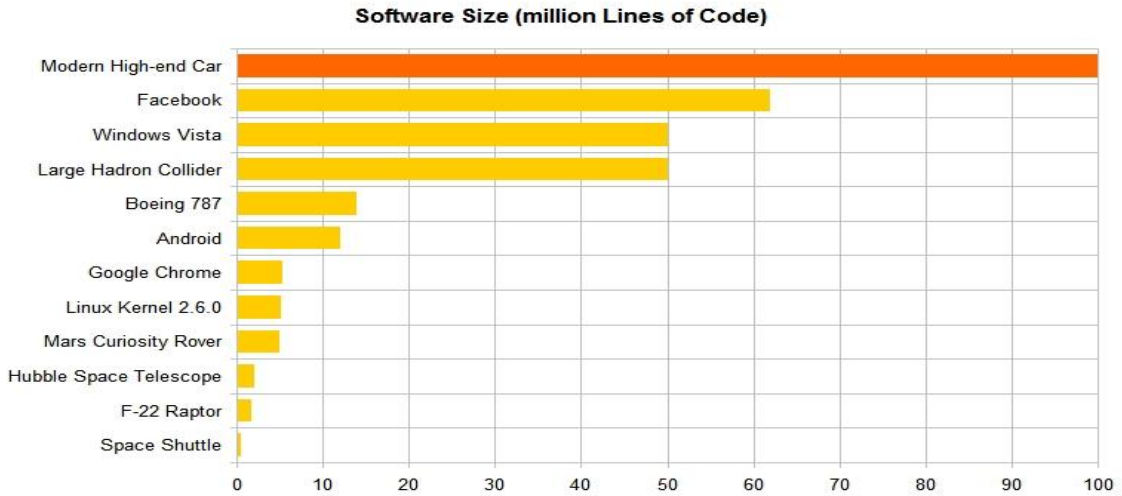
Why Cybersecurity Matters?

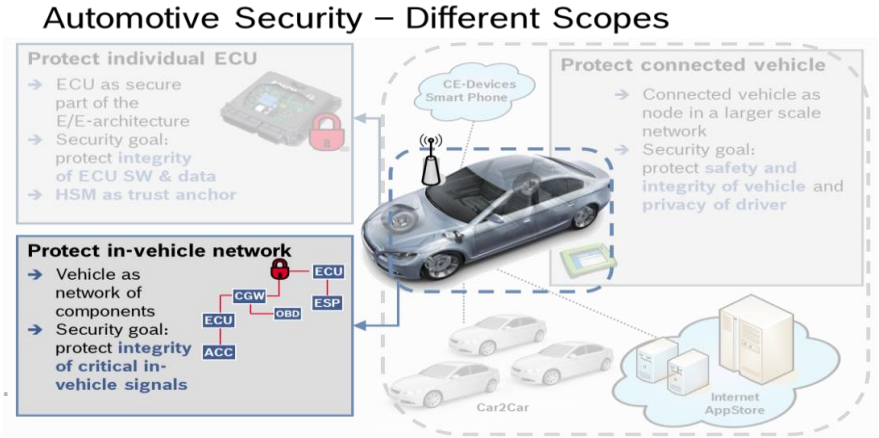
- Even low-end cars have embedded more than 30-50 so-called Electronic Control Units (ECUs) that talk over Controller Area Networks (CANs).
- Modern high-end car features around 100 million lines of code, and this number is planned to grow to 200-300 millions in the near future with the advents of Connected Vehicle and Automated Driving
- A F-22 fighter jet is less than 2 million, a Boeing 787 is around 14 million and even a cumbersome operating system such as Windows Vista is “only” 50 million.



Sources: (1) Information is Beautiful http://www.informationisbeautiful.net/visualizations/million-lines-of-code/
(2) Andrea Busnelli – June 26, 2014 https://www.linkedin.com/pulse/20140626152045-3625632-car-software-100m-lines-of-code-and-counting

What Needs To Be Addressed?

- **Scope of Problem(s)**
  - Prevention of taking control of in-vehicle electronic systems via wireless or wired means.
- **Related Areas**
  - Security of mobile media information such as copyrighted video and audio being used in the car.
  - Security of in-vehicle parameters such as engine calibrations, odometer, etc.
  - Accuracy and validity of in-vehicle parameters such as vehicle speed. Will involve Functional Safety ISO 26262.
  - Integrity of emissions-control systems
  - Detection of counterfeit ECUs.
- **Heightened Threats**
  - Most of today's vehicle networks were not intended to be secure
  - Personal Device Integration
  - Telematics
  - Cloud Access
  - V2X
  - Automated Driving



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What Needs To Be Addressed?

Automotive Initiatives

- Cyber security is a global concern and is a real and growing threat for the automotive industry
- Like other industries, the automotive industry would benefit from a concerted, industry-wide approach
- SAE is proposing a shared, secure and common platform for the automotive industry to communicate, analyze, exchange, and share information on imminent cyber security threats
- SAE International, through its Industry Technologies Consortia, is assembling a global consortia of major automotive manufacturers to define the need, scope and operational requirements
- The Alliance of Automobile Manufacturers and the Association of Global Automakers are spearheading the formation of an ISAC (Auto-ISAC) to help share information about cyber threats.

Source: SAE International, “CYBER SECURITY & THE AUTOMOTIVE INDUSTRY”, 2014 SAE World Congress

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Delphi's Approach

- Designs are secure
- Products are manufactured reliably
- Vehicles need to operate safely
- Integrity of the people in the system
- Delphi is developing standards for: Embedded controller (ECU), Cloud computing platforms, IT infrastructure, Network operations, Encryption, Device connection, Anomaly detection, Intrusion prevention
- We are working with a number of national and international organizations to ensure a coordinated approach.
- Internally, we have a dedicated team of engineers, IT professionals and attorneys to provide the necessary oversight in the area of cyber security and connected vehicles from supply to delivery and aftermarket

Source: SAE International, "CYBER SECURITY & THE AUTOMOTIVE INDUSTRY", 2014 SAE World Congress

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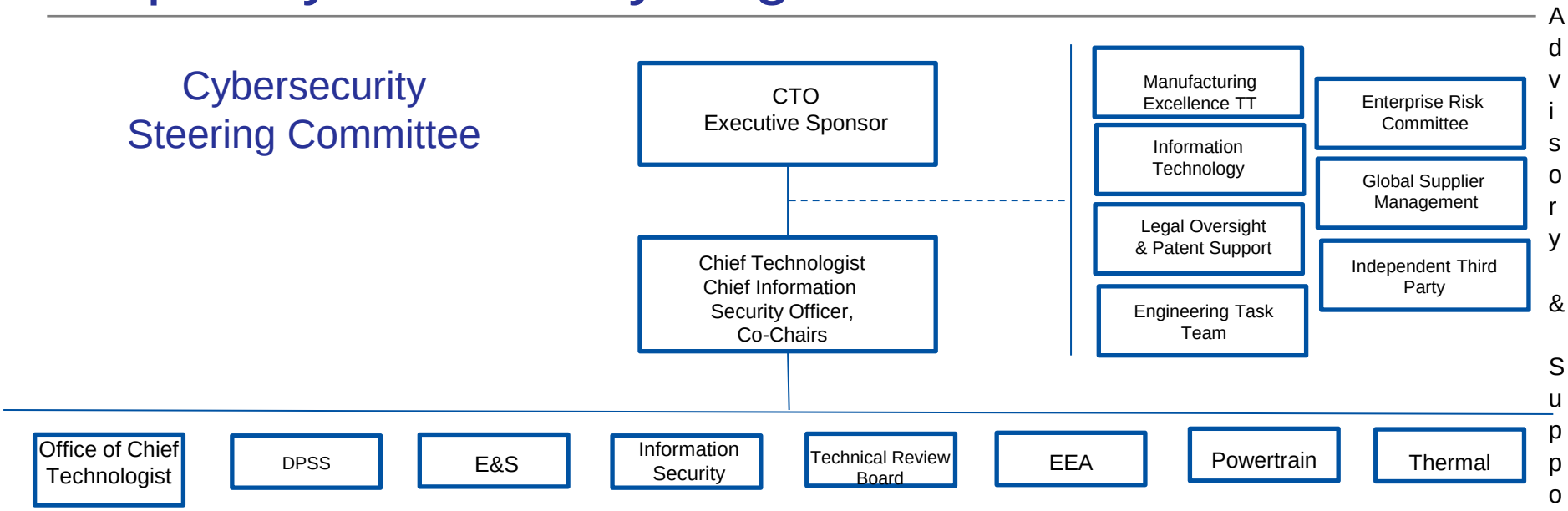
Delphi Cybersecurity Organization



Vehicle Cybersecurity Steering Committee Charter

To enable a safe and secure vehicle experience through the identification and mitigation of cybersecurity risks.

Vehicle Cybersecurity Mission Statement

Enhance Delphi's reputation as a leader in the development of safe and secure vehicle systems by providing awareness and training, adopting standards and implementing procedures. The team will engage with standards-setting bodies, government groups, academic institutions, and leading industry organizations.

Connected and Automated Vehicles and the Cybersecurity Threat

How Industry is Responding

- Data security is the name of the game across all industries
- The economic impact of cybercrime may reach $100 billion annually
- Connected and Automated Vehicles technology heightens the cybersecurity challenges for the Automotive Industry
  - Humongous tasks to be planned and executed!
  - Cross-industry collaboration
- Solid foundations to build upon for turning the challenges into business opportunities for Safe and Secure Connected Vehicles
  - SAE's Initiative
  - Auto-ISAC
  - Battelle's CyberAuto Challenge

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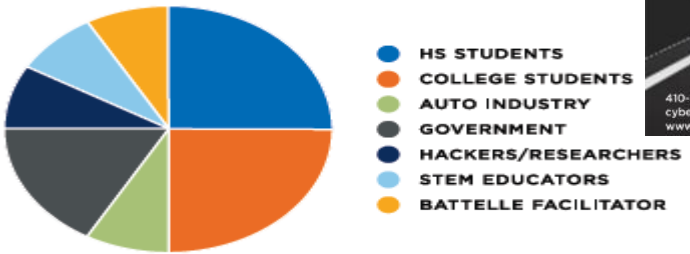
What Needs To Be Addressed?

SAE International to Join Battelle CyberAuto Challenge

- July 13-17, 2015 at 5725 Delphi Drive, Troy, MI
- Practicum based challenge week
  - Real current model full-feature cars
  - Real equipment
  - Real communication protocols
  - Real industry/government experts
  - Ethical “White Hat” hackers
- Value Proposition:
  - Cooperative relationships building
  - Bottom-up learning
  - Interns/employees recruitment



Source: Battelle

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Recommended Industry Approach

- Designs are secure
- Products are manufactured reliably
- Vehicles need to operate safely
- Integrity of the people in the system