



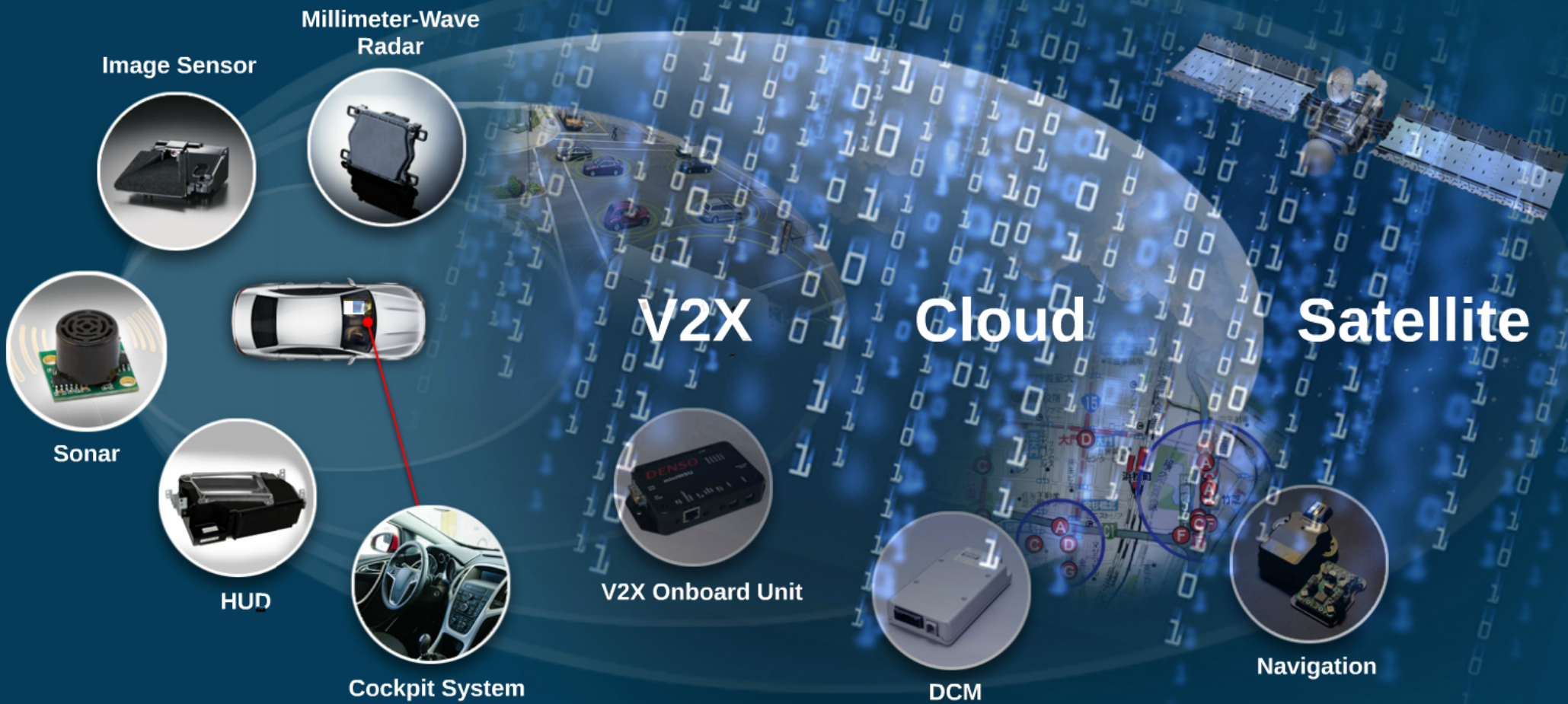
# *DENSO*

## **Connected Vehicles and Automated Vehicles** Driving Forward Fast

**Justin McBride**  
Elevate Lab  
DENSO International America, Inc.

August 4, 2014

# The Environment of the Connected Vehicle





# WIRELESS IMPLANTABLE MEDICAL DEVICES



**The Driver's**  
Physical Condition  
Stress Level  
Habits  
Mood

fitbit

3.8

36:18 10'13"

Exercise Frequency

8:25 54:18 6:34

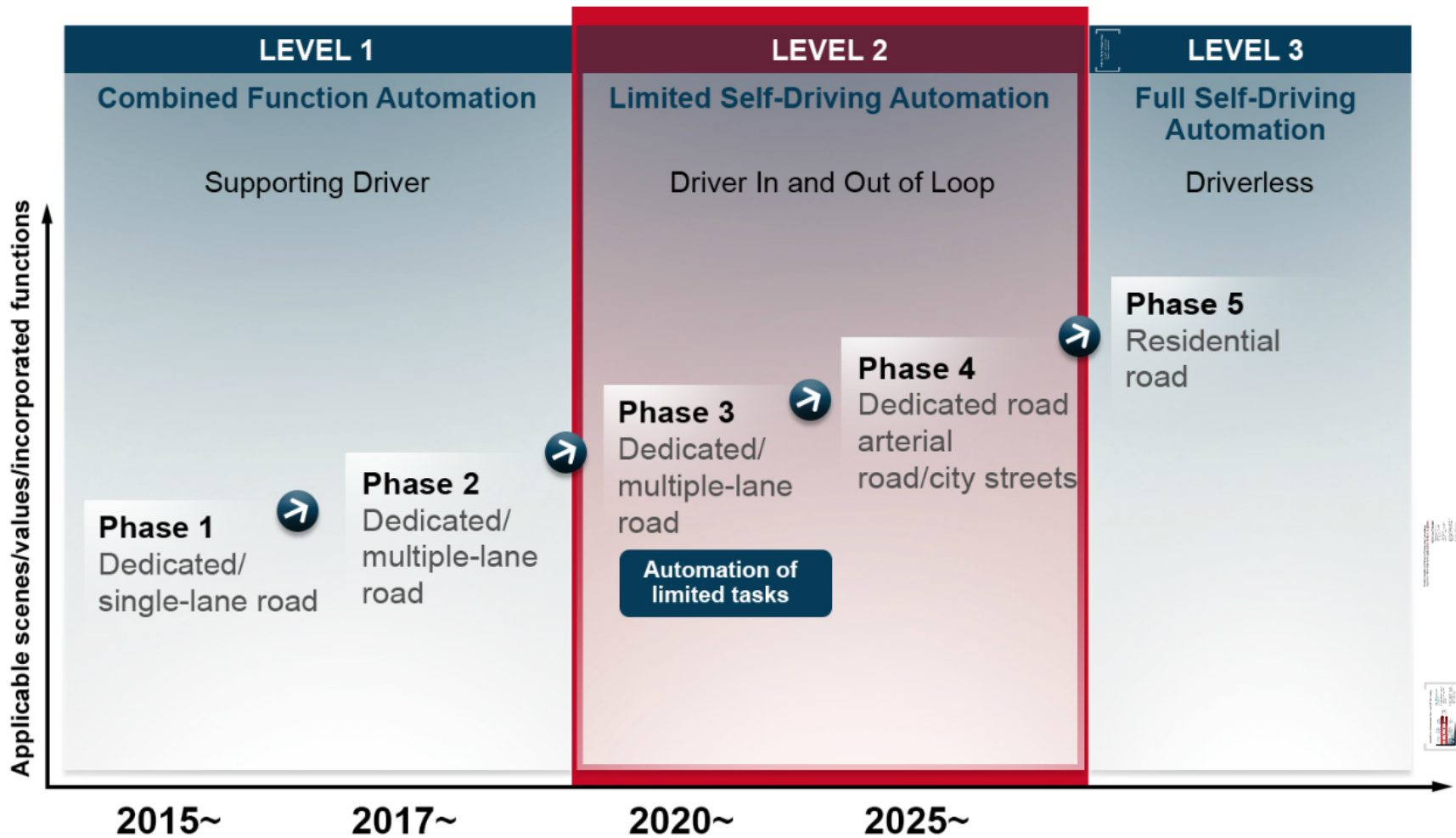


HUD



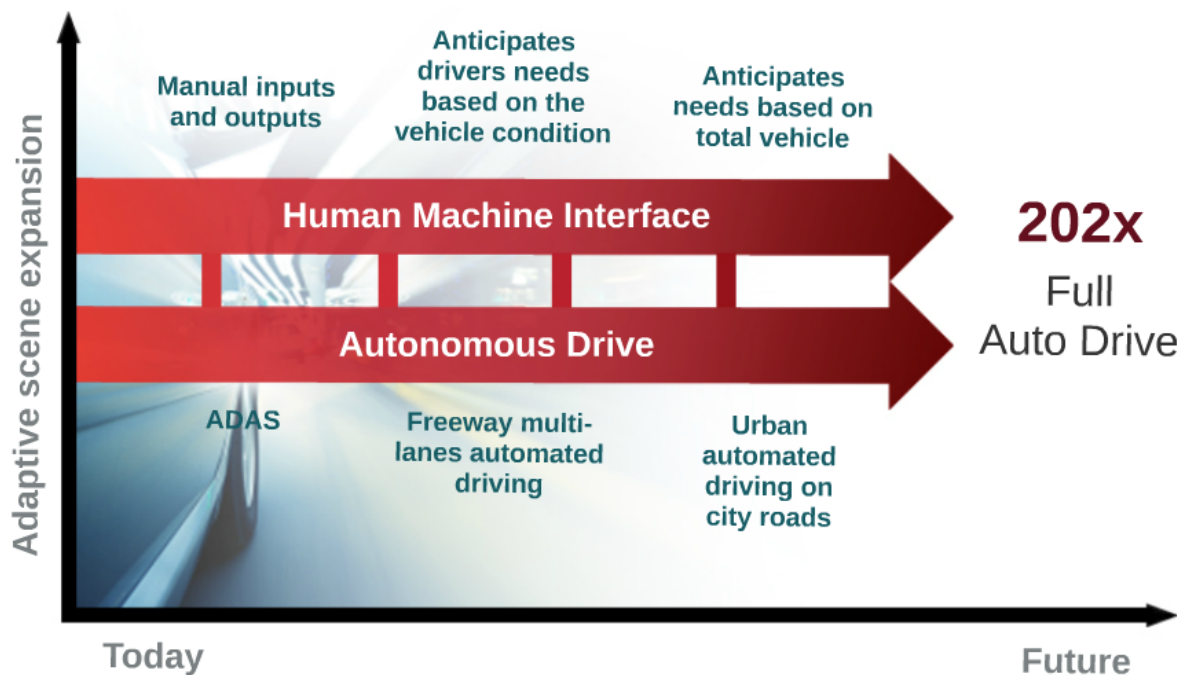
Cockpit System

# Phases of Autonomous Drive





# Parallels of Autonomous Drive and HMI Technology

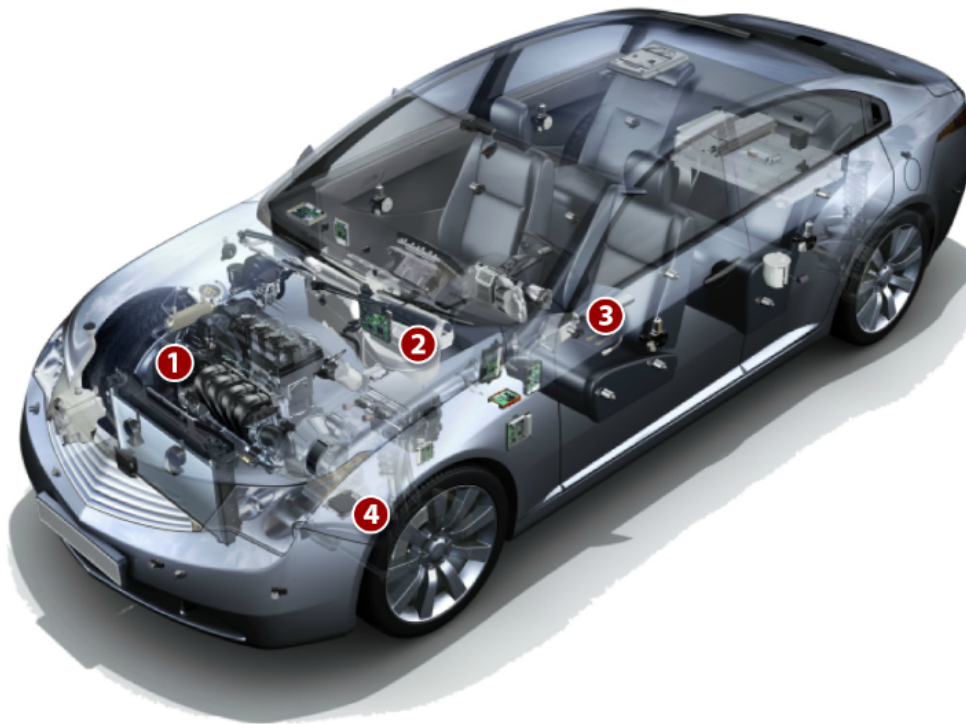


## Our HMI Approach is Holistic

1. Must safely manage all info coming into vehicle
2. Must safely manage when driver comes in and out of loop

# **DENSO**

Global Supplier of Advanced Automotive Technology,  
Systems and Components with **\$39.8 Billion in Sales**



## **Systems Provider**

- 1 Powertrain Control System**  
Engine management system, Gasoline direct injection, Hybrid components, Starter, Alternator, etc.
- 2 Thermal Systems**  
Heating Ventilation Air Conditioning (HVAC), Compressor, Heat exchangers, Battery thermal management, etc.
- 3 Information & Communication Systems**  
Instrument Cluster, Head-up Display, Human Machine Interface technologies, Horn, Keyless entry, Wireless phone charger, etc.
- 4 Driving Control & Safety Systems**  
Passive safety technologies, Airbag sensing system, Active safety technologies, Traction control system, Antilock braking system, etc.



# DENSO's Long-term Plan 2025



## Preserve the Planet

Significantly Improve fuel economy, reduce CO2 emission and reduce overall energy consumption



## Protecting Lives

Greatly increase safety and security on and off the road  
Strive for zero accidents

# The Evolution of The Driver





According to Henry Leavitt Ellsworth  
Commissioner of U.S. Patents, 1843

**EVERYTHING**  
that can be  
**INVENTED**  
**has been**  
**INVENTED**

# The Sad Truth

Every **55** SECONDS  
one U.S. teen  
is injured in a  
**CAR ACCIDENT**

By 2020,  
the world **population** is on course to reach **7.7**  
billion people

And **vehicle ownership**  
is forecasted to reach



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They project that annual traffic accidents will claim  
**2 million precious lives.**

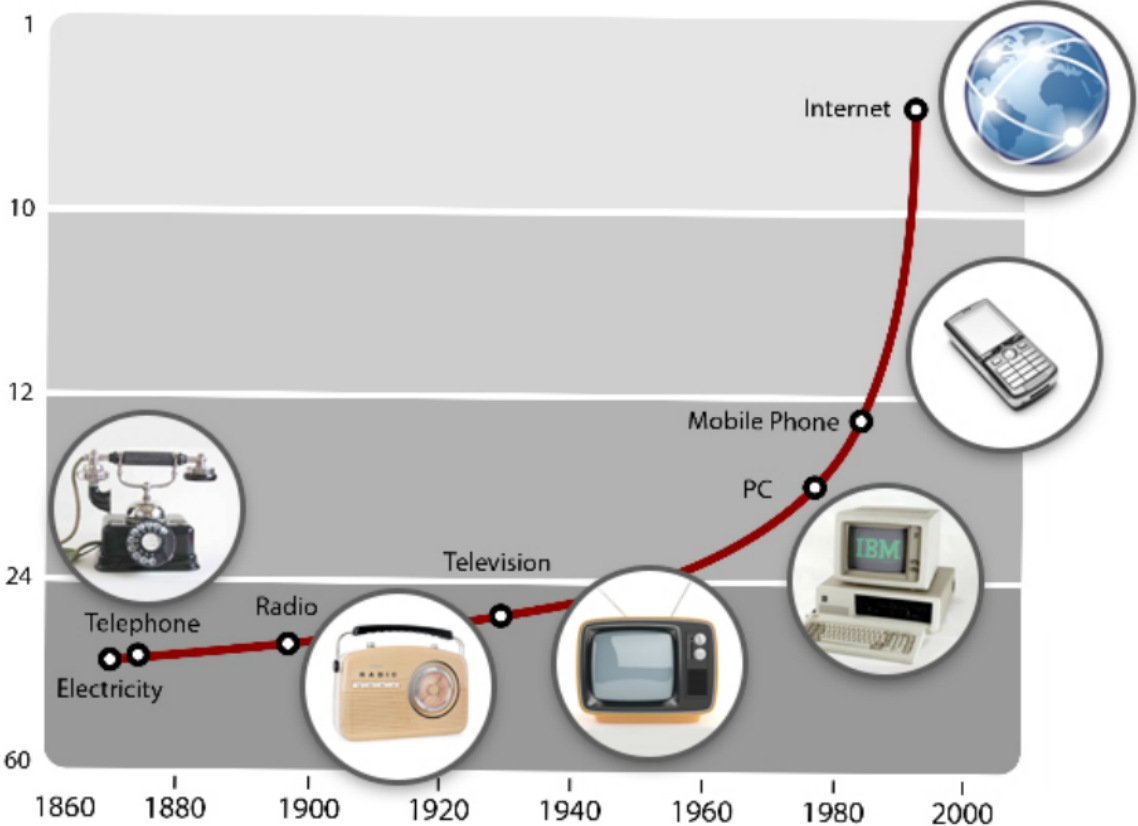
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Some say technology is part of the  
**problem**

We believe technology can be  
part of the **solution**

# Key Point in History Where it is About Finding the Right Combinations of Technologies





**ELEVATE**  
**LAB**

***DENSO created Elevate Lab,  
an industry-unique mix of Engineers, Designers,  
and Researchers who take a **holistic approach** to  
solve some of the industry's **BIGGEST** issues.***

# Driver Workload



## **DENSO's HMI Lab**

GOAL: To anticipate drivers needs



# Understanding Driver Workload

Establishing a common methodology to objectively measure driver workload



Improving HMI Design



Supporting Driver

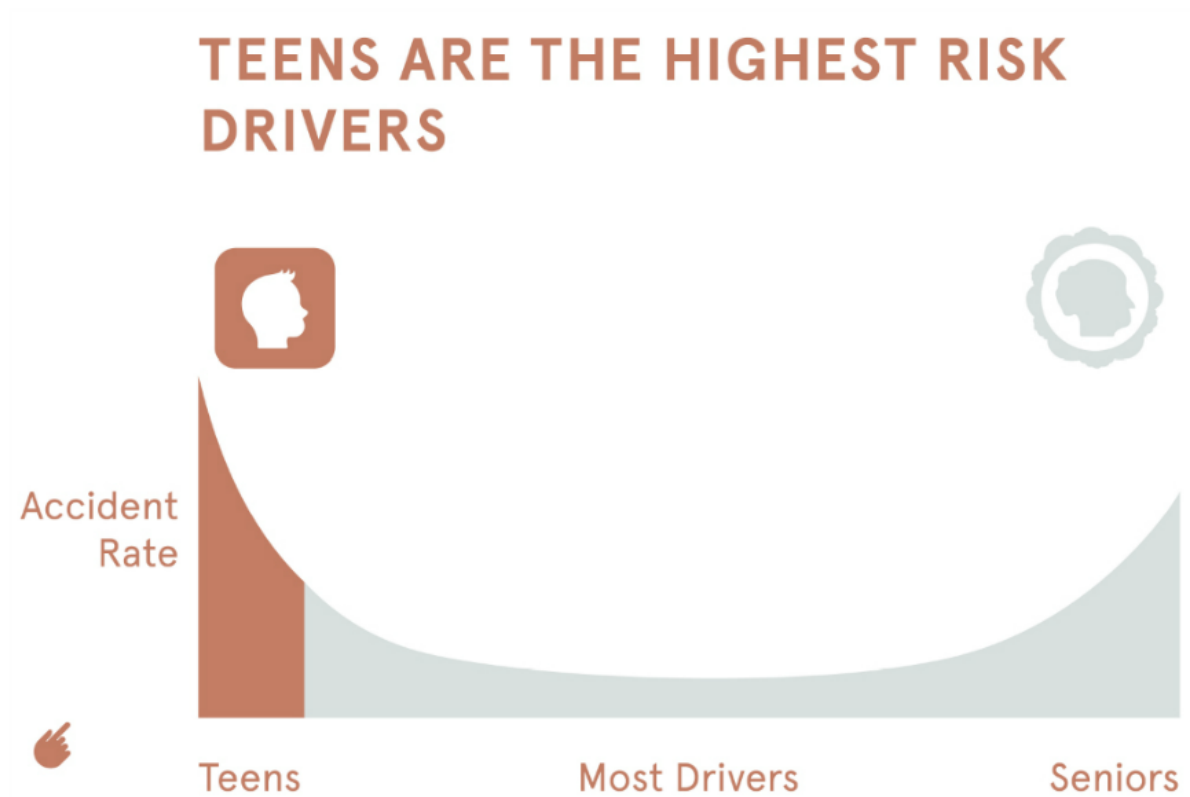


\* still in development

360° situational awareness using technology to understand environment inside and outside of vehicle

# Let's Look at Teen Drivers

They are the most **CONNECTED** and most **DANGEROUS**



# Industry Challenge

**DENSO, MIT AgeLab and Touchstone Evaluations**  
Established a New Consortium to Study Driver Distraction

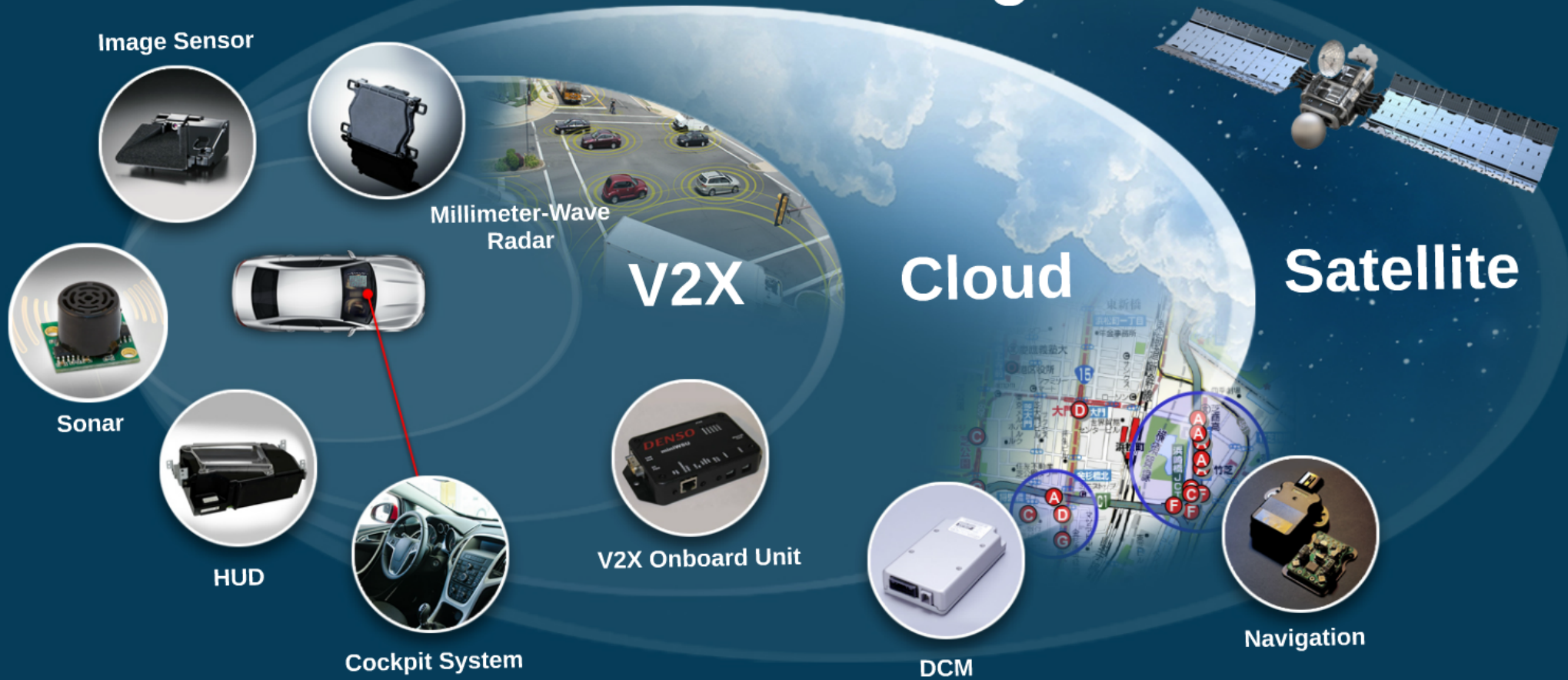
**Initial members**

Honda R&D, Subaru Research & Development, and  
Jaguar Land Rover





# Connectivity and Driverless Vehicles Present Challenges



## **Technology can and will be The Solution**

But it's not until we objectively understand the driver that we can truly reach full autonomous driving.



Thank you.