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## **DENSO's Resonance Cockpit Connects Cars, People and Society**

*–DENSO's future vision of safe and seamless connectivity–*

**DETROIT** - Technology has truly changed the way we connect with people, cars and even society in general. And it's continuously reshaping how the automotive industry needs to integrate technology into the vehicle. Yes, people want to be connected. But, for the auto industry, the challenge is how to seamlessly enable connectivity while ensuring safety.

Global auto supplier DENSO is working to bring the latest new technologies driver's *want*, and will soon *expect*, into the vehicle – but doing so with an emphasis on improving safe driving and mitigating driver distraction. Enter Resonance 2020, a vehicle cockpit display designed to illustrate DENSO's vision of how people, cars and society will safely and seamlessly connect in the future. DENSO's Resonance uses technologies that are here today, like active safety "sensing" technology (millimeter-wave radar, sensors, etc.) and vehicle-to-vehicle and vehicle-to-infrastructure (V2X) communication technologies. Combining these technologies gives the vehicle a 360 -degree situational awareness of the roadway.

To keep drivers' eyes on the road and hands on the wheel, Resonance uses voice recognition technology that allows drivers to verbalize requests, like changing the temperature or radio station. Also, the cockpit has head-up display technology that places critical information on a windshield display in the driver's natural line of sight. All of these technologies work together in a way that improves the individual components and creates a coordinated system that resonates with the driver.

### **DENSO's HMI Manager**

DENSO, in collaboration with two top U.S. universities, has been working on a driver distraction measurement tool that can quantitatively measure a driver's cognitive workload. DENSO's Resonance features a \*behind-the-scenes Human Machine Interface (HMI) Manager that measures driver workload using the driver's biometric readings. This, along with other vehicle input from the active sensors and V2X communications devices, allows the HMI Manager to decide what action it should take to keep the driver safe. Based on the driver's workload, the HMI Manager provides information the drivers need/want in the most appropriate display, such as the navigation screen, cluster or head-up, at the suitable time.

Resonance 2020 embodies the three following features that help keep drivers safely and seamlessly connected:

### **1. Active Safety Assist: Improves 360-degree situational awareness**

Using active safety technology and V2X communications, DENSO's Resonance helps keep vehicle occupants safe by improving the driver's 360-degree situational awareness outside the vehicle. Together, these technologies can assess the real-time risk of a potential crash with another vehicle or with an obstacle/animal/pedestrian in the roadway. The HMI Manager gives the driver an early crash detection warning, such as a steering wheel vibration. And, if the driver is not able to react in time, the car can take control of the steering or braking to avoid a potential collision.

### **2. Smart Go System for more convenient driving**

Connecting the vehicle to roadway infrastructure and information service centers can shave time from the daily grind. DENSO's Smart Go System gives the driver real-time road conditions and traffic updates. The system is designed to ease roadway congestion and help the driver avoid high traffic areas. The Smart Go System will provide the information in the safest way possible by either voicing or showing information in the head-up display while the car is in motion. Depending on the driving situation, information can appear in the car navigation screen and/or the instrument cluster display.

### **3. Personalized Info Guide gives driver's information they want and expect**

DENSO's Personalized Info Guide connects the vehicle's HMI Manager with the driver's PC and/or smartphone. The system then sends the content to a secure information server that analyzes the driver's personal preferences. How it works:

- The driver can voice information requests
- The HMI Manager will pull information from the server that is tailored to the driver's personal preferences
- The information will either be voiced or safely displayed to the driver

For example, the system can help the driver find a preferred type of restaurant or store when driving in new places.

As consumer electronics continue to change the way we do things, DENSO will continue to develop in-vehicle technologies that connect people, cars and society, while also helping to improve everyday safe driving.

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**\*Please note:** For demonstration purposes, DENSO has made the technology visible on the cockpit display. In a real driving environment, this would be a behind-the-scenes technology assistant.