



## **Autonomous Vehicle Backgrounder**

Contact: **David Giroux, 1-800-637-4161**

Autonomous vehicle technology has been in the news quite a bit lately, as various companies—from traditional automobile manufacturers to firms in the high-tech arena—have conducted tests on a range of prototype vehicles. A number of misconceptions exist about autonomous vehicles and different opinions exist on the future of this technology on American highways.

### **Commercial Autonomous Vehicles Do Not Equal Driverless Vehicles**

In terms of on-highway commercial trucks, it is incorrect to refer to a vehicle in autonomous mode as a driverless truck. In fact, the technology being developed as part of the Freightliner Inspiration Truck requires that a qualified truck driver with a valid commercial driver's license is in the cab and at the controls. The driver is an important part of the system and essential to take control of the truck in certain highway situations, as well as on local roads and in docking the truck to make pickups and deliveries.

### **Autonomous Commercial Trucks Offer Many Advantages**

Autonomous vehicle technology in commercial vehicles can increase fuel efficiency, improve highway safety, reduce traffic congestion and cut greenhouse gas emissions. Daimler Trucks estimates that autonomous driving can reduce fuel consumption by up to 5 percent. This data is supported by a recent Frost & Sullivan study that said a long-haul autonomous heavy-duty truck would save an average of 7 percent in fuel consumption, while regional-haul trucks would reduce fuel consumption by 4 percent. Frost & Sullivan also found that autonomous commercial trucks would reduce maintenance costs for trucking companies. These savings result from reduced component strain because of more uniformed traffic flow. Because of advanced connectivity, there would be anticipatory diagnostic and maintenance work through software updates conveniently transferred while on route. Because autonomous vehicles are more connected, they can be programmed to pick routes around congested areas. This can also help reduce congestion on highways, along with emissions.

## **There Are Different Levels of Autonomous Technology**

According to the National Highway Traffic Safety Administration, there are five levels of autonomous vehicles:

- **No Automation (Level 0):** The driver is in complete control of braking, steering, throttle and power at all times.
- **Function-Specific Automation (Level 1):** One or more specific control functions, such as electronic stability control or vehicle-assisted braking, operate automatically.
- **Combined-Function Automation (Level 2):** At least two primary control operations, designed to work in unison to relieve the driver of control of those functions, operate autonomously. These combined functions might include adaptive cruise control in combination with lane centering.
- **Limited Self-Driving Automation (Level 3):** Vehicles at this level enable the driver to cede full control of all safety-critical functions under certain traffic or environmental conditions. The vehicle monitors changes in those conditions requiring transition back to driver control. The driver is expected to be available for occasional control, but with sufficiently comfortable transition time.
- **Full Self-Driving Automation (Level 4):** The vehicle is designed to perform all safety-critical driving functions and monitor roadway conditions for an entire trip. Such a design anticipates that the driver will provide destination or navigation input, but is not expected to be available for control at any time during the trip. This includes both occupied and unoccupied vehicles.

## **Autonomous Vehicle Technology Is Here Today**

The fact is that many commercial trucks and passenger vehicles already operate on public roads today using Level 1 function-specific automation and some Level 2 functionality deployed to enhance safety. In terms of today's roads, Daimler Trucks North America believes that certain Level 2 and Level 3 autonomous vehicle technology is best suited for on-highway applications for long-haul commercial trucks. The Freightliner Inspiration Truck will still require a trained driver and will not operate in autonomous mode once it leaves highway conditions, such as when it makes local deliveries.

## **Rules for Autonomous Trucks**

Daimler Trucks North America believes that federal and state laws and regulations of both commercial and passenger vehicles are important to maintain the safety of highways and roads. The autonomous vehicle systems that are being developed are showing improvements not only when it comes to safety, but also in reducing fuel costs, alleviating traffic congestion and improving the environment. When it comes to some of the advancements being made in technology that are part of the Freightliner Inspiration Truck, our hope is that governments will look closely at regulations that, if updated to match advancements in technology, will help foster and advance these important benefits.

## **Truck Drivers and the Autonomous Vehicle**

Truck drivers will still be required for important tasks behind the wheel of the Freightliner Inspiration Truck. But the autonomous vehicle systems can help reduce driving stress, cut the amount of monotonous time periods on long trips, and have a positive effect on driver health. By improving the quality of life of truck drivers, autonomous vehicle technology may also help reduce the driver shortage by improving driver turnover and attracting new people who previously may not have considered a career as a truck driver. Drivers will be able to perform other important business tasks while traveling, making it easier for drivers to be both transport managers and drivers. These activities while driving autonomously can lead to better alertness during monotonous long-haul trips.

## **Autonomous Vehicles and Public Perceptions**

Like any new technology, there will be a period of time during which people will become familiar with the advantages and start to adopt the systems they find useful. With autonomous vehicles in the commercial trucking segment, this is going to be an evolutionary process, not a sudden revolution. In fact, if you look at some of the advanced safety and fuel savings technologies already in place on modern Class 8 trucks, this evolution has already started. Consumers are being exposed to the advantages of autonomous vehicle technology in the cars they drive and we expect that they will not only accept, but start to demand, some of the safety features in commercial trucks. Ultimately a number of factors will be at play determining when autonomous vehicle technology for commercial trucks will start to penetrate the market. Government regulations will need to set guidelines for the technology. The availability of proven autonomous vehicle systems at a cost that provides an 18- to 24-month customer payback will be an important factor. And autonomous vehicles will need to gain social acceptance with fleets, owner-operators, society and insurance carriers. We believe the demonstration of the Freightliner Inspiration Truck is a major step in starting the conversation about the advantages of autonomous vehicles for moving freight and toward developing the technology for market introduction.

The benefits that freight haulers and society overall are likely to experience include:

- Road safety is increased by the intelligent networking of the assistance systems.
- Fuel consumption is reduced due to more uniform traffic flow and powertrain optimization.
- Vehicle component strain is reduced as a result of the more uniform traffic flow.
- Maintenance and repair costs are reduced because of less component strain and fewer accidents.
- Transport logistics are more efficient due to predictive route planning.
- Driver stress is reduced in monotonous driving situations.
- Drivers can optimize time with the ability to take over dispatching tasks while on the road.

- The entire transportation sector's reputation is improved by increased safety, efficiency, reliability and environmental performance.

### **The Technology in the Freightliner Inspiration Truck**

Daimler Trucks North America has been developing the various technology sub-systems needed for autonomous vehicle operation for more than 20 years. The Freightliner Inspiration Truck equipped with the Highway Pilot sensors and computer hardware is based upon a series production Freightliner Cascadia® Evolution, fully certified to meet all U.S. Federal Motor Vehicle Safety Standards. The Highway Pilot links together a sophisticated set of camera technology and radar systems with lane stability, collision avoidance, speed control, braking, steering and other monitoring systems. This combination creates a Level 3 autonomous vehicle operating system that can perform safely under a range of highway driving conditions, from maintaining legal highway speeds to stopping and starting in heavy traffic.

Like any Class 8 truck, drivers must have a commercial driver's license and be available to guarantee the safe operation of the vehicle according to traffic conditions. In the Freightliner Inspiration Truck, the driver makes the decision on when to engage the Highway Pilot system once the vehicle has safely entered the highway. The driver must assess the system performance, and intervene accordingly whenever appropriate. Highway Pilot informs the driver visually on its current status and also accepts commands from the driver. The driver can override the system at all times.

A radar unit in the center area of the Freightliner Inspiration Truck front bumper scans the road ahead at long and short range. The long-range radar, with a range of 820 feet, looks far and narrow to see vehicles ahead. The short-range radar, with a range of 230 feet, looks wider to see vehicles that might cut in front of the truck. The front radar unit is the basis for the Adaptive Cruise Control and Emergency Braking Assist already available today in the Detroit Assurance™ safety system. The area ahead of the truck is also scanned by a stereo camera. The camera recognizes lane markings and communicates to the Highway Pilot steering gear for autonomous lane guidance.

While the Cascadia Evolution currently utilizes Adaptive Cruise Control, the Inspiration Truck is equipped with Adaptive Cruise Control PLUS. ACC+ combines the abilities of active cruise and distance control in combination with the ability of the vehicle to stop and go without driver intervention. Simply, the Inspiration Truck can control distance and speed in a range of 0 mph up to the maximum vehicle speed. The Adaptive Cruise Control PLUS system that is part of the Freightliner Inspiration Truck has the standard hardware and software in some series production vehicles, such as the Mercedes Benz Actros. However it has modified software specific to the AV driving application.

## **Autonomous Vehicle Leadership**

If you look at essential technology deployed today in both commercial and passenger vehicles that will become key components in future autonomous vehicles, Daimler—through its Mercedes-Benz, Freightliner Trucks and Detroit brands—is leading the way. Other companies are contributing in terms of demonstrating the technological feasibility and increasing public awareness of the topic. However, no other company has the combined strengths and leadership in both the commercial truck and passenger vehicle categories to have a full understanding of how to best integrate autonomous vehicles into today’s highways. When it comes to commercial vehicles, no other system in the world has the type of sensor and camera technology that enables the Freightliner Inspiration Truck to operate—all the way from initial acceleration up to the speed limit for trucks. Freightliner Trucks has achieved a much higher degree of automation with a more advanced product.

The Freightliner Inspiration Truck promises to unlock autonomous vehicle advancements that reduce accidents, improve fuel consumption, cut highway congestion, enhance driver experience, improve connectivity, and safeguard the environment. The Freightliner Inspiration Truck illustrates Daimler Trucks North America’s commitment to customer value through consistent investment in the latest technology and delivery of the best commercial trucks on today’s roads. Some of the core autonomous vehicle systems in the Freightliner Inspiration Truck are already successfully deployed in the current Freightliner Cascadia Evolution.

## **Freightliner Inspiration Truck Design**

### **Exterior**

The hood is designed to eliminate the cowl. To open, it slides forward and then can be tilted. The door panels are shaped to match the hood styling. The side fairings are newly designed to match the hood and wheel fairings. The wheel fairings are also new, aerodynamic and aggressively styled.

### **Lighting**

The exterior lights are new. The marker, identification and grill lights will be blue when in autonomous mode and white or amber when in normal operation. The headlights were styled to match the hood design.

### **Interior**

Bench seats were created for the ride and drive event. Halo lighting was created in the sleeper compartment to provide ambiance. The instrumentation is a high resolution 12.3-inch display.