UNDERSTANDING ADVANCED SYSTEMS AND REPAIRS

DRIVER ASSISTANCE AND SAFETY SYSTEMS OFFER MANY BENEFITS FOR DRIVERS, BUT CAN COMPLICATE REPAIRS IF YOU DON'T FOLLOW OEM PROCEDURES

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The future of the automobile will be much like what many of us saw in *Demolition Man*. For those who haven't seen the movie, it was released in October 1993 and takes place in 2032 —15 years from now. It features self-driving vehicles with interactive on-board communication with the driver. Systems are voice activated, including tire changes and back-up and side cameras; there is touch electronic dash instrumentation, collision avoidance systems, communication with other vehicles and, in case of a collision, the vehicle instantaneously fills with foam for occupant protection. We all — kind of — know where we are right now with technological advances in vehicles, don't we? Let's take a look at what we really mean by advancements and some currently available driver assistance systems.

Key fobs and automatic interval maintenance

One key for him; one key for her. Press the unlock button or just grab the door handle and the vehicle knows which person is entering the vehicle. The seat, steering wheel, mirrors, radio stations and even the accelerator and brake pedals adjust to your settings based on the memory pre-set in the key fob the last time it was in the vehicle. Accelerator levels, shift points and driving habits control interval maintenance recommendations, which means your spouse's vehicle may need an oil change every 8,000 miles, while your vehicle, an identical one, would require an oil change every 3,500 miles. This ensures the vehicle is maintained to provide proper performance for years of reliability.

Adaptive Cruise Control

These systems regulate the speed you set and then sensors, radar or cameras check the interval to the vehicle ahead by automatically accelerating and braking in a speed range of roughly 0 to 100 mph — although Audi and Mercedes-Benz claim upwards of 150 mph. Auto or Adaptive Cruise Control (ACC) uses radar sensors or cameras installed in the front of the vehicle, bumper, grille or front windshield to read the objects in front of the vehicle. Generally, the sonar or radar waves are sent out and signal back once they bounce off an object. The field of view is generally 30 to 40 degrees and about 500 to 800 feet. Sensor control units process the signal readings and detect vehicles or objects ahead. On higher-end sport and luxury vehicles, the controls adjust for sport to comfort or soft-ride settings. On some of the newer and more advanced systems, there is a Stop & Go traffic feature that allows the ACC to actually start and stop automatically. The system slows the car to a stop

PHOTOS: AUDI, FORD, MERCEDES-BENZ

— at traffic lights, for example — and it will automatically move again, following the vehicle ahead. During longer stops, the system will make the driver "tap" the accelerator or the control lever or button on the column or steering wheel. During this process, the system checks the image data supplied by video cameras and sensors consistently to ensure safety. These systems can detect possible dangers, such as pedestrians crossing the road at the last minute. Additionally, the parking system's sensors provide detailed information of vehicles and objects nearby, just prior to moving or during low-speed maneuvers.

These ACCs with Stop & Go function constantly receive information from other driver assistance systems. There can be data coming in from 20 to 30 other control units, continuously analyzing the vehicle's surroundings. This expanse of data enables the system to recognize multiple different scenarios and predicatively support the driver and act accordingly if the driver does not. Many of these systems utilize information provided by the GPS/navigation system; this data allows the vehicle systems to know the selected route, and it can then predict and compute curves or even traffic and accidents.

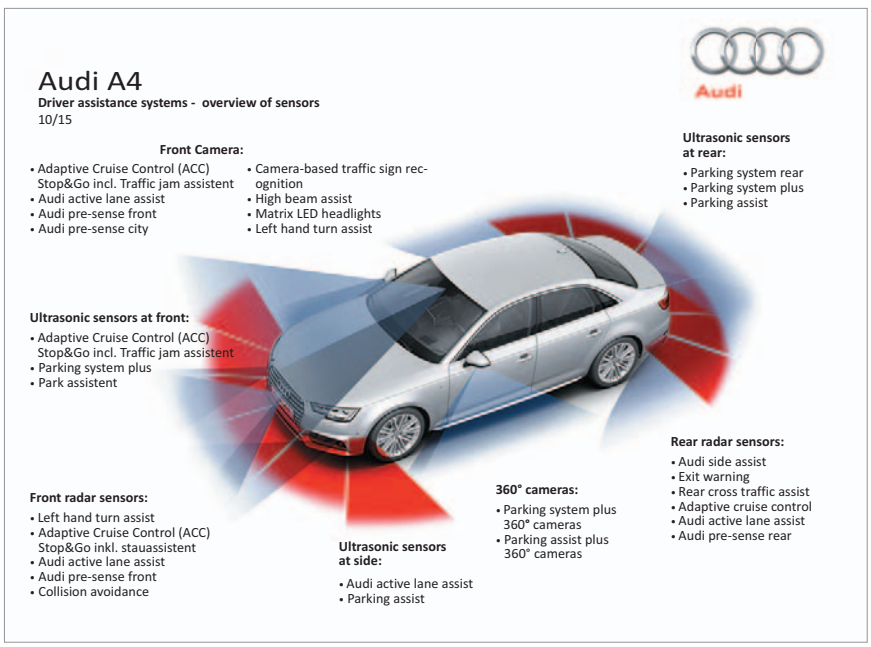
Many of these ACC systems are so smart and knowledgeable that they are able to act autonomously in most situations, such as quickly passing a car turning in an urban road to changing lanes when another vehicle is merging on the highway. Each manufacturer offers ACC in a number of different versions, including without Stop & Go function, depending on the model series and packages. So when repairing these vehicles, make sure you reference the OEM procedures for aiming and realigning or re-aiming these sensors and cameras.

Lane Assist or Lane Keep

Most of these Lane Assist Systems utilize an electromechanical power steering system, along with a camera mounted in the rear-view mirror, outside side-view mirrors or attached to the front windshield to detect the lane markings and even roadway signage. These cameras can deliver multiple high-definition images to the computer controls and those images are viewed as algorithms that allow the system to determine appropriate action, if necessary. Generally the navigation software assists in detecting the lane markings and the route the vehicle is traveling. For example, if your vehicle approaches a lane line or marker without the turn signal being activated, the system helps the driver to steer back into the lane by intervening and gently easing the vehicle back on track using the electromechanical steering. Older systems had an audible sound, a vibration in the seat or even both warnings. On wider lanes, where the vehicle can drift considerably prior to breaching the lane line, the driver would be alerted by a seat or steering wheel vibration, if necessary. Some systems provide color images for the system to differentiate between yellow lane lines in construction zones and white lane lines. Again, it is imperative to refer to the OEM procedures for replacement of the system components, even if you just remove them for replacement of the component they are affixed to. This information will be in the mechanical or electronic sections of the repair manual, not in the body repair area.

Side Assist with Lane Departure

Some systems offered by OEMs, like Audi and Mercedes-Benz, include a lane change assistant. This system monitors the traffic behind the vehicle and warns the driver as necessary prior to critical lane changes. It is like blind-spot warning on steroids. The system becomes active when a defined speed is reached and usually uses radar sensors mounted in the rear of the vehicle, bumper or rear body panel and some information is provided by the parking sensors. When another vehicle is detected in the critical zone, such as riding in the blind spot or approaching rapidly from the rear, information is sent and the system will acti-



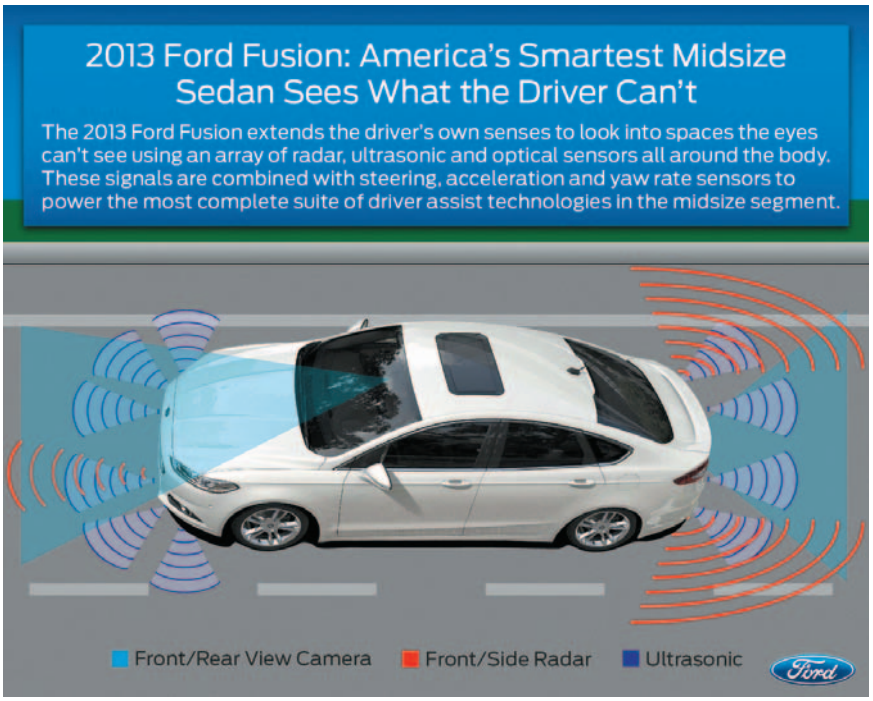
vate once a threshold has been breached. Generally, a yellow LED indicator lights up dimly in the housing of the driver's exterior mirror, without disturbing the driver. The driver sees it only when looking directly into the mirror. If the driver activates the turn signal to change lanes, the indicator becomes brighter and flashes multiple times. This signal or warning is clearly perceptible and the optical signal is directed at the driver.

Night Vision Assistant

Night vision systems work by utilizing a thermal imaging camera located at the front of the vehicle. The camera is protected by a window that is cleaned by a separate nozzle and heated when cold. The camera reacts to the heat radiated by objects in the recorded scene, then a computer transforms the information into black and white images that are displayed on the instrument panel or windshield. These systems use what is called far infrared technology, and can look up to 1,000 feet ahead. This is far beyond the range of the HID or LED high beams, and the IR camera is affected — or blinded — by headlights and similar light sources approaching from the opposite direction. Most importantly, this system concentrates on that which is most important: people. Regardless if the person is visible to the human eye, they are conspicuously bright in the image due the heat they give off, whereas the cooler surroundings appear dark. Detected humans are highlighted with a yellow marking on the display. If the control unit predicts a hazard because a person is walking on the road close to the vehicle, the person is marked in red and a warning sounds. A warning also appears in the head-up display, similar to a back-up camera and parking aid warnings.

Park Assist or Parking Aid

A variety of different parking systems use ultrasound, acoustic and optical signals, or a rear-view camera in which images are displayed on the monitor, usually in



the radio control screen or a pop-up screen. When reversing into a parking space, Park Assist lets the driver know the surroundings with a visual of the rear of the vehicle, the rear and one side or an all-around (overhead view) camera display. Some systems perform all the necessary steering movements for both parallel and end-on parking spaces. The system locates a parking space using side-mounted ultrasound sensors that scan the parking spaces on the side of the road in two dimensions while driving at moderate speed. A notification appears in the display when the system finds a suitable spot. If the driver chooses to park in that parking space, all they need to do is stop and put the vehicle into reverse, then the Park Assist activates and performs all necessary steering movements with the aid of the electromechanical steering, sensors and cameras. The driver may have to accelerate, shift gears and brake or some systems will automatically perform the entire process. As with any parking aid or assist, visual and audible signals provide support and warning. The system provides similar assistance when leaving parking spaces. Generally, the all-around or surround-view camera systems use four small cameras mounted in the grille, rear deck lid, hatch/liftgate or tailgate and in the housings of the side mirrors. The surround-view camera increases safety not only when maneuvering, but also in narrow parking spaces during exits.

Pre-Safe, Pre-Sense Accident Predictive Safety System

The Pre-Safe Systems vary from OEM to OEM, but these systems basically operate on the same data information. The system analyzes the information from multiple sensors. For example, when the brake pressure and ABS sensors signal a maximum brake application and/or skidding is reported by the Electronic Stability Control Program (ESP), the Pre-Safe control unit intervenes. Depending on the situation it will activate some, most or all of the following:

1. Illuminate the hazard warning lights.
2. Begin to close all side windows and the sunroof (providing there is no obstruction, such as an arm, which is sensed by a inferred beam).
3. The seatbelts will begin to tighten by tensioning the slack to hold the occupants in place. This tensioning process, which is reversible, is triggered by small electric motors. If an accident does not occur, the belts are released again.
4. The seats may adjust to position the occupants for optimal safety for airbag deployment.
5. The suspension may stiffen.
6. The steering may stiffen (become more responsive).

These newer Pre-Safe systems also use the data from the Adaptive Cruise Control, Lane Departure, Blind Spot and even the Stop & Go Function systems. The Pre-Safe systems utilize the front sensors that monitor the traffic in front of the vehicle and use this data to pre-

ACTIVE PARK ASSIST uses two ultrasonic sensors and electric power-assisted steering to help drivers parallel park. The sensors measure the gap between two vehicles to determine if there is enough room for the Ford F-150. After confirming the F-150 can fit, the truck automatically steers into the space, while the driver operates the accelerator and brake pedals.

dict potential collision hazards. Some systems have multiple warning levels for the operator. The first level may be an audible sound and flashing lamp; the second may be a vibration of the steering wheel or a jerk caused by brief braking. If the driver applies the brake or removes their foot from the accelerator pedal, then the systems stand down; but if not, then the system applies the brakes automatically, which would be the third level. Additionally, while the partial braking is applied and the vehicle is slowed, the windows and sunroof begin to close, the hazard warning lights are illuminated and the the seat belts will begin to tension. Level four would activate just prior to the impact, where the maximum braking is applied and the seat belts are pulled fully taut, while the seats may be repositioned. This is all done to mitigate the injuries and consequences of the collision event. Some OEM models incorporate an additional function to protect against impending rear-end collision events. This newer function can often prevent rear-collision events entirely by automatically increasing the speed of the vehicle. In cases, where there is no room in front to speed up, this system will significantly reduce the applied-impact forces by closing the windows and sunroof, tensioning the seat belts and repositioning the seats. The structural design of the seats and headrests is an important element of safety, especially in the case of a rear-end collision. Typically, these types of accidents occur at traffic lights or during stop-and-go traffic at lower speeds. In these types of collision events, the seat back is accelerated to between 5 mph to 15 mph within a tenth of a second. The integral head restraint system, which seems to be standard in every vehicle now (mechanical pendulum or passive deplorable type) activates to prevent or lessen whiplash injuries. Again, refer to the OEM procedures in the mechanical and electronic sections of the repair manual.

PHOTO: GM

THE CHEVY CRUZE demonstrates vehicle-to-pedestrian crash avoidance technology that can detect pedestrians in the path of the vehicle.

As you can see, there are a multitude of systems in vehicles to protect the occupants. It is vitally important to read the repair manual during each and every repair. Shops, technicians and insurance personnel must also understand the importance of not only pre-repair scanning and post-repair scan diagnostics, but also pre-measuring the vehicle, as the mounting areas for sensors on the structure could have been displaced, which could render a sensor inoperative. Keep in mind — most of this information is not in the body repair section of the manual and is in the mechanical and/or electronic sections.

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