BREAKING DOWN VEHICLE SCANNING

A LOOK AT THE WHY, HOW, TRUTHS AND MYTHS OF SCANS

LARRY MONTANEZ // Contributing Editor

Advanced electric technology: the final frontier. These are the voyages of the Starship Collision Repair. Its five-year mission: to explore strange new OEM procedures, seek out the proper, accurate and correct OEM repair information, learn that diagnosis is singularly the most important aspect of estimating and to boldly go and raise the repair education level and awareness to where no man has gone before…

Things we saw and heard mentioned in *Lost in Space*, *Star Trek*, *Battlestar Galactica*, and *Star Wars* are now becoming a reality not of space travel, but of land travel. Everyday automobiles are now acting like the space craft we watched in TV shows and movies when many of us were children. The features that used to be so far advanced and exclusive to high-end luxury vehicles can now be found as standard equipment in most of today's economical vehicles.

The electronic computer-controlled systems in vehicles are some of the most highly advanced and reliable systems we have ever seen, but they are also one of the most misunderstood in the industry. These modules or microprocessors are generally referred to as an Electronic Control Module (ECM). Like any computer component, these ECMs sometimes need updates and/or relearning; to do this, you need to first scan the system. There can be anywhere from 40 to 100 computer controls to operate, communicate and in some cases, record information about the operation of a system or systems that can be used later for diagnosis. Over the past few years, understanding how vehicle systems operate and how to diagnose them has never been more important. Adaptive Cruise/Distronic Cruise Control, Adaptive Light Control, Advanced Anti-Lock Braking Systems, Automatic Parking, Navigation System/GPS, Automotive Night Vision/Heads Up Display, Blind Spot Detection, Collision Avoidance/Pre-Crash System/Pre-Collision Assist, Crosswind Stabilization, Driver Drowsiness Detection/Driver Monitoring Systems, Electronic Brake Distribution, Emergency Driver Assistant, Electronic Stability Control, Forward Collision Warning, Glare-Free High Beam/Pixel Lighting/LED Lighting, Hill Descent Control, Intelligent Speed Adaptation, Intersection Assistant, Lane Departure Warning System, Pedestrian Protection System, Rain Sensor, Surround View System/All Around Camera, Traction Control Systems, Vehicular Communication Systems and Wrong-Way Driving Warning name a few, but still not all, of the computerized systems found in many vehicles today. I intentionally left off two important system components — Supplement Restraint System (SRS) Occupant Weight Detection Sys-

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tems (OWS) or Classification Systems (OCS), and Back-Up Camera Systems, which we will discuss later in this article.

Technicians have utilized scanners for the past 25 years to not only determine what is or is not operating properly, but also to reset or relearn systems as an alternative to going to the dealer for service. Techs rely on scanners to perform their jobs and determine the root cause of the problem by eliminating systems that are performing properly.

Some in collision repair and the insurance industry have been slow to embrace scanning vehicles (Figs. 1, 2), but that is all about to change. Mechanical diagnostic flow charts and procedures are written by the engineers based on the idea that a component failed because of longevity of use or electrical failure and not because of collision damage. Most times in service repair, an electrical component failure is either because the component ran its life or some sort of re-engineering repair is needed, which is generally very noticeable — such as an errand wire running from the fuse box to the component. But for collision repairers, the component failure is generally a direct result of a collision event. When a vehicle involved in a collision arrives at the repair facility, one of the first things the damage assessor or technician should do during the blueprinting/triage is to perform a scan of the vehicle systems.

Scanning needs to be a standard operating procedure during the initial inspection of the vehicle. Scanning will easily identify electronic system failures and inoperative components. Utilizing the OEM repair procedures, OEM Code Listing and a computer scanner, a damage assessor will be able to determine which systems are or are not operational, what systems codes are current and which are history codes, and any relearning that would be required after repairs are completed and/or damaged components are replaced.

Truth vs. myth

Before we continue, let's clarify a few points about scanning to distinguish the truth from myth.

1. If there are not lights on the dashboard, there is no reason to scan the vehicle.

FALSE. The light on the dashboard, called a Malfunction Indicator Lamp (MIL, Fig. 3), is illuminated by an ECM due to a Diagnostic Trouble Code (DTC). Most systems that fail and set a DTC will not set or illuminate an MIL on the instrument information cluster. In many collision events, the Airbag Control Module (ACM) will record a non-deployment or deployment event, and because of this a DTC many be set. In some events, the ACM may have commanded a component deployment, such as a seat belt buckle or headrest, and it is not visibly noticeable, or the ACM commanded a deployment and the airbag failed to deploy, due to some sort of failure, and an MIL was not illuminated. Without scanning, the vehicle could be repaired and then delivered to the vehicle owner without an operating SRS component.

Airbags are generally replaced near the end of the repair process, just before delivery. So if a damaged SRS component is discovered near the completion of vehicle repairs, it will delay delivery and a supplement will be required.

2. We need to use a common sense approach to scanning, similar to what was done in the early 1980s when unibody vehicles became more prevalent in vehicle designs.

FALSE. Structural diagnosis is still a misunderstood process almost 35 years after the mass influx of unitized structures. A large percentage of repair facilities still don't perform pre-measuring to determine if the vehicle has or has not sustained structural misalignment. We have been seeing an epidemic of incorrectly repaired vehicles that have structural misalignment after repairs are completed during post-repair inspections, and in many cases the vehicle must be totaled out; the cost is becoming astronomical. This is no different with pre-scanning.

Would you be comfortable with your doctor using common sense and visual analysis to determine if you have cancer or not? How many times have you experienced a common-sense diagnosis to structural damage so you repair the vehicle, send it for a wheel alignment and the tech explains that the vehicle will need an alignment because the structure is misaligned? Or you attempt to install replacement suspension components and you cannot because they will not line up with the mounting holes? How many times is a vehicle

deemed ready for delivery and then you discover MILs illuminated or a system component will not operate properly?

3. Insurers do not have to pay for clearing or resetting of DTCs that are not related to the current event.

TRUE. Insurers do not owe any payment for history DTCs, but they do have an obligation to pay for the scans to confirm or deny if the DTC is related to the current event or a non-related history issue(s). Additionally, during the repairs there can be vehicle DTCs set due to the repair process, and these DTCs would need to be cleared. In many cases, a simple remove and install (R&I) of a component will require a scan and relearning process and an additional scan to confirm the relearning is complete. An example would be blending a front door outer panel and R&I of the side view mirror assembly, if the mirror is equipped with a camera and/or lane departure sensor. The mirror would require a realignment check after it is reinstalled.

The analysis and repair processes must include a referencing of the OEM repair information to ensure the damage report is accurate, includes all required operations and materials, and that the components are replaced and repaired properly. Most of the OEMs also have systematic post-collision inspections that must be performed. To access OEM repair information you should go to the OEM website or use a third-party provider, such as ALLDATA.

Remember that a manually entered line for the cost of accessing the OEM information should be on the damage report. The costs can be a one-time fee, monthly fee or annual fee.

Evaluating vehicles in a collision

The following are procedures and operations from the Volkswagen Auto Group repair manual found online at erWinVW.com or Collision.Alldata.com.

When servicing load bearing or wheel supporting components on accident vehicles, damages to the suspension could remain undiscovered. These undiscovered damages may lead to heavy damages in continued vehicle operation. Therefore, on accident vehicles, the listed components must be checked in the described manner and sequence, independent of performing a vehicle alignment. If no deviations from the specified values were determined during the vehicle alignment, no deformations of the suspension are present.

1. Visual and functional check of the steering system

2. Visually check for deformations and cracks

3. Check for play in the tie rod joints and steering gear

4. Visually inspect for faulty boots

5. Check electric wires and hydraulic lines and hoses for chafe marks, cuts and kinks

6. Check hydraulic lines, bolted connections and the steering gear for leaks

7. Check the steering gear and lines for proper seating

8. Check the proper function through the entire steering by turning the steering wheel from stop to stop. The steering wheel must be rotary without hitching at equal force

9. Visual and functional check of the suspension

10. Check all components shown in the overviews for deformation, cracks and other damages

11. Replace damaged components

12. Perform a vehicle alignment on an approved wheel alignment stand

13. Visual and functional check of the wheels and tires

14. Balance tires, checking for cuts and impact damage on the treads and flanks.

15. Check tire inflation pressures, using the inflation pressure plate on the fuel tank flap.

16. For damage to the wheel and/or tire, the tire must be replaced. This also applies when the course of the accident and damage on the vehicle points to possible non-visible damages.

17. Tires should not be older than 6 years. When in doubt, proceed as follows: As soon as a safety risk cannot be ruled out, the tire(s) must be replaced.

Also check other vehicle systems, for example:

1. The brake system including the Anti-lock Brake System (ABS)

2. The exhaust system and passenger protection by a visual and functional check

Test values, adjustment values and notes can be found in the respective repair manual sections.

The checking of accident vehicles described here refers to the suspension and does not lay claim to the completeness of the entire vehicle.

Electronic vehicle systems

Safety-related system such as ABS/Electronic Differential Lock (EDL), Airbag, electronically regulated vehicle systems; Electro-mechanical, Electro-hydraulic steering and other driver assistance systems must be queried for fault codes using the vehicle diagnostic tester. If faults were stored in the DTC memory for the system mentioned, then these systems must be serviced according to the specifications in the repair manual. After performing repairs, check the fault stored in the DTC memory of the affected system again, to make ensure proper function.

While the vehicle is in the repair process, the vehicle will be partially disassembled and electronic components will be unplugged and as such, more DTCs could be set when moving the vehicle between departments. The damage assessor or technician will need to re-scan or perform a post-scan of the vehicle. This post-scanning will accomplish two things:

1. It will assist in determining which systems require a reset/relearn procedure, which would also include aiming of cameras and distance sensors/radars, etc.

2. It will check all systems for faults that may have occurred during the repair process.

This post-repair scanning should be performed, even if the vehicle is going to the dealer, which it should, for system checks and relearning (if necessary), so the repair facility has a record and knows which systems are classified as loss-related (direct result of the collision event), claim-related (result of the repair process) and/or unrelated (prior history codes).

Vehicle manufacturers

For the past 20-25 years, European OEMs have had advanced electronic computer-controlled systems that required scanning to diagnose and reset after repairs. About 12 years ago, when many of the European OEMs started forming their Certified Collision Repair Facility (CCRF) programs, they began including pre-scanning as part of the "inspections required after a collision" in SOPs. In the past year, the following OEMs — including some of the European OEMs with CCRF programs — have issued position statements on the importance of pre- and post-scanning their vehicles that have been involved in collision events:

- General Motors (Buick, Cadillac, Chevrolet, GMC)
- Fiat Chrysler Automobiles (FCA) (Fiat, Chrysler, Jeep, Dodge, Alfa Romeo and Maserati)
- Honda and Acura
- Mercedes-Benz, SMART and Sprinter
- Nissan and Infiniti
- Toyota, Lexus and Scion

More OEMs will be issuing similar position statements in the coming months. Position statements are an explanation of required procedures contained within the repair manual and/or for clarification about something not fully written out in the repair manual and/or an update, addition, amendment or addendum to a procedure(s).

The following are portions of OEM statements on scanning systems and requirements after a collision event — are you following these procedures in your shop?

- Vehicles, systems and components are engineered, tested and manufactured to help protect vehicle occupants. Vehicles include numerous electronic control systems, including those that operate safety and driver assist systems. Most of these systems include onboard self-diagnostics that monitor the state of health and/or rationality of input and output circuits. When monitored circuit values fall outside predetermined thresholds, DTCs may be set in one or more electronic control unit (ECU). Therefore, a preliminary diagnostic scan during the repair estimation phase is required to

determine what DTCs may be present, so proper repairs may be included.

• Use of the OEM-specific scan tools may be required due to proprietary software and trademarking of systems. These tools contain software programs that aftermarket tools may not contain and can assess whether an OEM vehicle's safety and security system contain active or stored DTCs.

• Safety and security related systems, such as antilock brakes, supplemental restraint systems (SRS), occupant restraint controller (ORC), seat belts, active head restraints, forward facing camera and radar, blind spot monitoring, and other automated electronic driver assistance systems must be tested for DTCs that could be active (current) or stored following a collision. Use of the approved vehicle diagnostic tester is necessary before and after collision repair.

• Any of the following conditions could trigger DTCs prior to or during collision repairs, which could result in improper vehicle performance:

✓ Vehicle is involved in an accident or collision, even though the damage may appear minor
✓ Vehicle has been in an accident with or without air bag deployment
✓ Voltage loss, including battery disconnects and hybrid battery disabling
✓ Significant vehicle disassembly including but not limited to bumpers, door handles, headlamps and mirrors
✓ Interior trim repair or removal
✓ Glass removal and replacement operations

• Any repairs performed without using OEM-approved parts and not following published repair guidelines and procedures may expose current or future vehicle owners and occupants to unnecessary risk.

• If faults were stored in the DTC memory for any safety or security system, then these systems must be serviced according to the repair procedures in Service Information.

• After performing repairs, recheck the system to determine if any active or stored DTCs remain; if so, take appropriate service action to ensure proper function.

• Multistage air bags with multiple initiators must be checked to determine that all squibs were used during the deployment event. Typically, all initiators are exhausted and all potentially hazardous chemicals are burned during an air bag deployment event. However, it is possible for only one initiator to be exhausted; therefore, you must always confirm that all initiators have been cycled to minimize the risk of improper handling or disposal of potentially live pyrotechnic or hazardous materials. This procedure must be performed using the approved diagnostic scan tool or at a company, such as Collision Diagnostic Services (makers of the asTech2) that scans the vehicle using OEM-approved scan tools.

Generally, there will be a listing of reassembly operations followed by the electronic scanning, sensitivity, and/or relearning operations, such as:

• Connect the battery with the ignition switched on. Pyrotechnic components could deploy after connecting the battery if they were not repaired correctly. Individuals must not be inside the vehicle when connecting the battery. Disconnect the battery ground wire with the ignition switched on. If Airbag MIL DTC indicates a fault after installation, DTC memory must be checked, deleted and checked again.

• Any repair that requires disconnection of electrical components in order to perform the repair will require a post-repair diagnostic scan to confirm if the component is reconnected properly and functioning.

• Damage that requires body parts replacement will always require a post-repair diagnostic scan.

• Some safety and driver assistive systems will require inspections, calibration, and/or aiming after collision or other body repairs.

• The applied mechanical forces encountered in a collision can damage electrical circuits and components in ways that are not easily diagnosed with visual inspection methods. Here are some other electronic control system self-diagnostic facts:

✓ The proliferation of electronic control systems has increased the number of potential DTCs beyond the point where a dashboard indicator can be installed and/or illuminated for every DTC. Dashboard indicators are intended for driver notification, not vehicle diagnostics.
✓ Therefore, the presence or absence of dashboard indicators/warning lights is not an acceptable method to determine if post-collision diagnostic scans are necessary.
✓ Many DTCs do not illuminate dashboard indicators, but an electronic control system may still operate improperly or be completely inoperative.
✓ Because of the complexities of serial data networking, dashboard indicators that do illuminate may appear unrelated to the actual vehicle problem.
✓ Some self-diagnostics require multiple failures, or other criteria such as a number of drive cycles, to be met before illuminating any indicators.
✓ Low battery voltage and/or repair procedures may inadvertently set multiple DTCs. Clear the DTCs and determine which ones reset after battery voltage is stabilized.

• When reconnecting the 12-volt battery, after collision repairs are complete, some electrical systems may not operate properly. These may include, but are not limited to the following:

✓ Navigation systems
✓ Engine idle speed learn
✓ Power window, power tailgate, moonroof, power sliding door position and/or pinch detection
✓ Keyless access and immobilizer/security systems

• Since the reset procedures vary by OEM, vehicle and system, enter the vehicle information into the OEM diagnostic tool and/or online repair and service information site, and search the keyword "reset" or "diagnostic reset." Generally, this search will retrieve a list of reset procedures required after parts replacement and/or a battery disconnect. Some reset procedures can be done without special tools. Others may require scan tool software.

• Front passenger's seat weight sensors controls passenger's front airbag operation and the passenger airbag on/off indicator based on the occupant's weight. Like any scale, weight sensors are a precision device and require checks.

• Windshield replacement for vehicles with driver-assist sensors (including rain/light sensors) located in the windshield.

• Removal and/or replacement of exterior components, bumpers, SRS sensors, parking sensors, wiring harnesses, vehicle control units, seats, or interior trim panels.

• Some OEMs offer models with one or more of the following camera- and/or radar-based driver support systems that require software-based aiming and/or calibration to ensure proper operation after certain components have been removed and/or replaced:

✓ Adaptive/Active/Distronic/Autonomous Cruise Control
✓ Collision Mitigation/Predictive/Avoidance Braking System
✓ Forward Collision Warning
✓ Lane Departure Warning/Lane Keeping Assist System
✓ Blind Spot Information/Assist
✓ Multi-View Camera System/All-Around Camera Systems

• Rearview (backup) cameras do not require any aiming procedures after removal or replacement unless the vehicle is also equipped with the Multi-View, All-Around, Guide View, Active-View, Park Assist, Auto Park System. Check with the OEM procedures.

• These procedures may require special tools and/or the OEM scanner and software to complete. Refer to the service information for specific information.

Test drives

A test drive of the vehicle is required to be performed by a technician at the repair facility, regardless if the vehicle was inspected and/or serviced at the dealer or independent mechanical repair facility, to ensure the vehicle is operating properly. Additionally, this test drive will also check for wind noise, drivability issues and check services performed by another shop.

Conclusions

As of this writing, some vehicles are now equipped with advanced adaptive LED or HID headlamps that allow one or both of the lamps to turn to provide better vision for the driver during turns. These headlamps require OEM software to align and reset after the lamps have been removed and reinstalled or replaced. Some OEMs — for example Mercedes-Benz on the 2017 E-Class (W213) — are now requiring the VIN to be imputed to the software to install into the headlamp control modules during the installation and aiming of the headlamp.

Collision repair professionals must understand the importance of checking the vehicle's computerized systems and memories, and understand who can reset these systems. Not knowing there was a problem or claiming there were no MILs present is not an excuse for not checking the vehicle systems. Many post-repair issues can be avoided by having the dealer check over the vehicle, or through just a simple scan. This would also provide some liability protection to the repair facility, as the dealer checked the computer systems and gave the facility a cleared vehicle report (invoice).

I hope this article helps the industry understand the truths and myths on vehicle scanning and the importance of having the vehicle's computerized systems checked, cleared and/or reset to ensure the vehicle operates and drives properly.

LARRY MONTANEZ is co-owner of P&L Consultants, which works with collision shops on estimating, production and proper repair procedures. He is also a certified technician for multiple OEM collision repair programs. *info@pnlestimology.com*