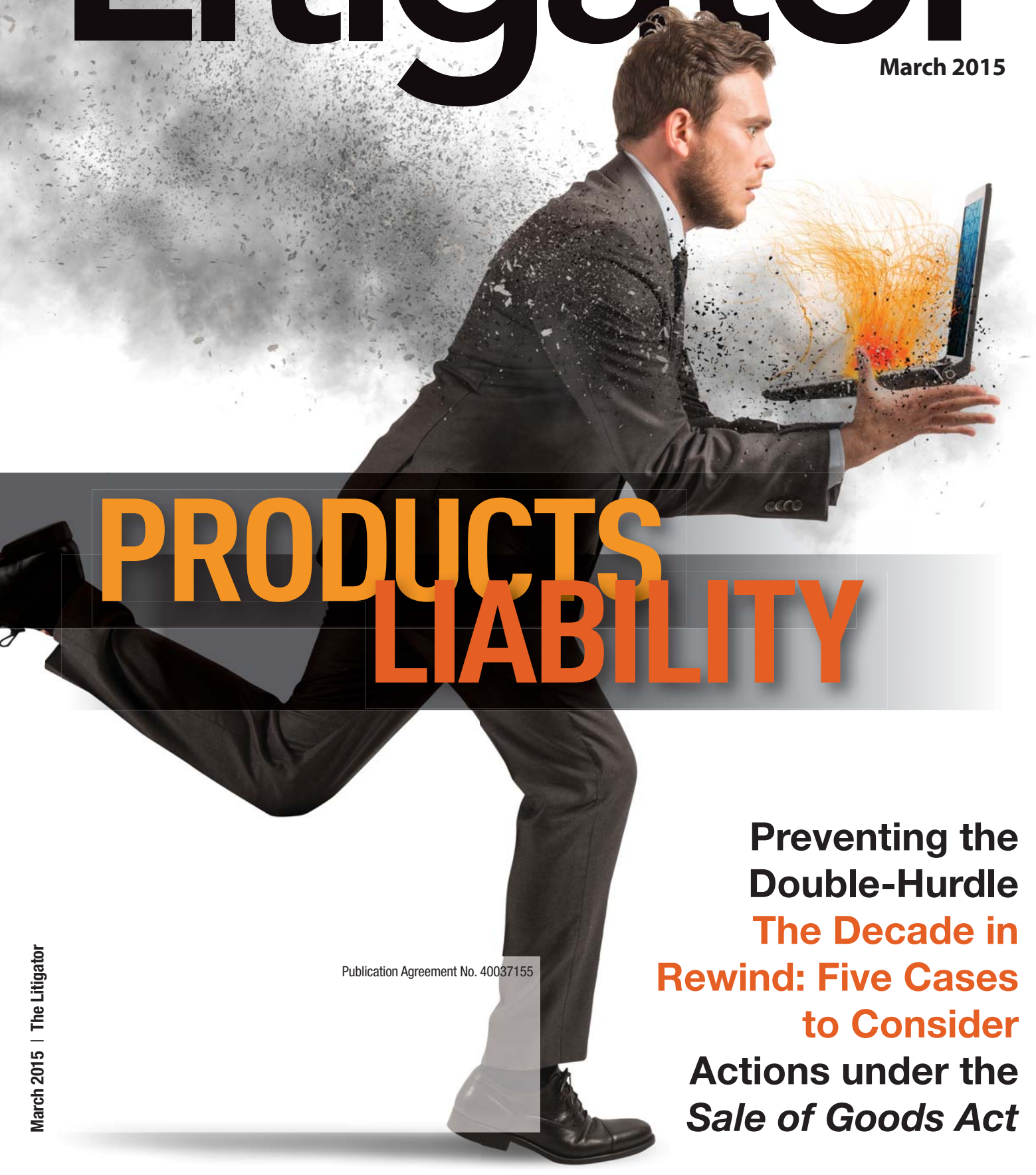
OTLA Ontario Trial Lawyers Association

The Litigator

March 2015



PRODUCTS LIABILITY

Publication Agreement No. 40037155

Preventing the Double-Hurdle

The Decade in Rewind: Five Cases to Consider

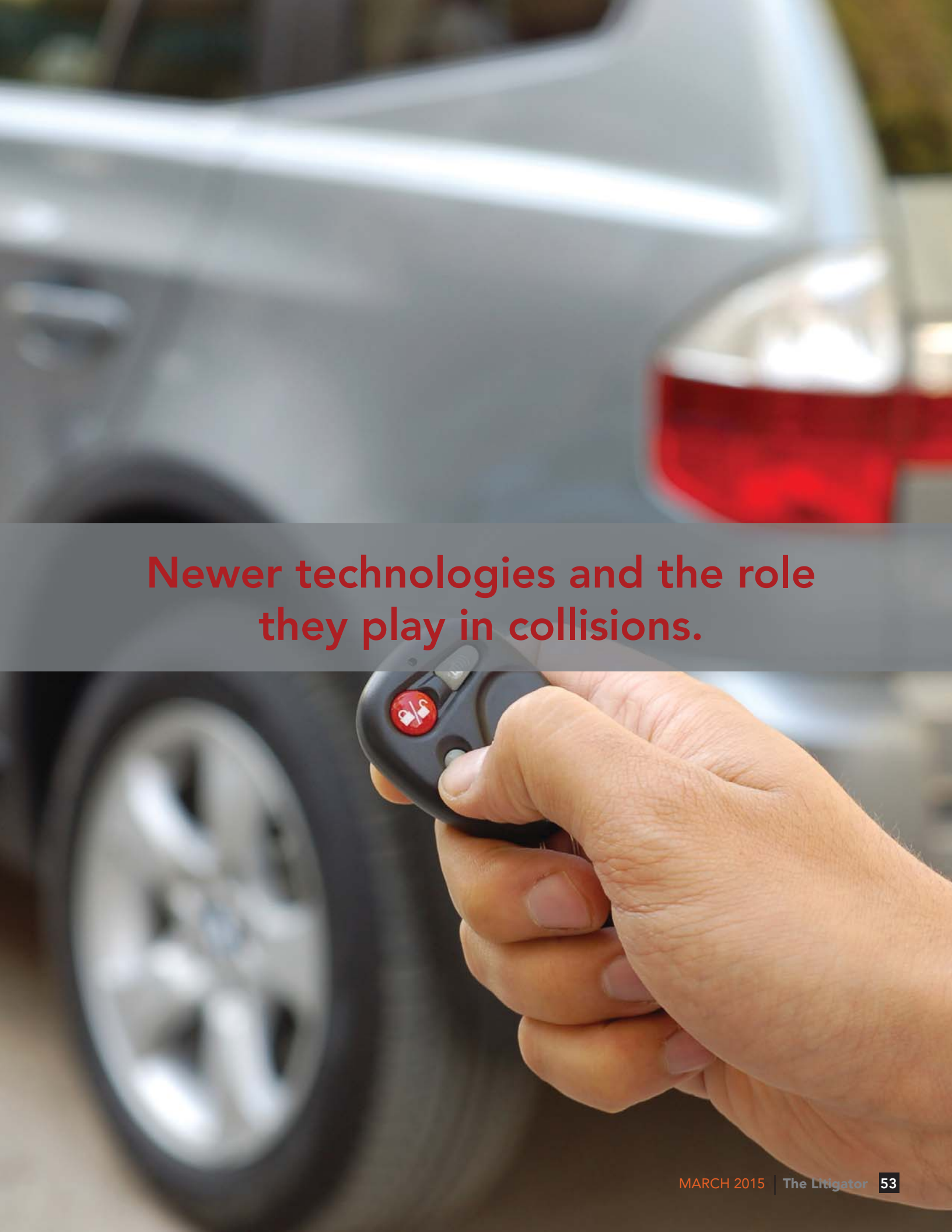
Actions under the *Sale of Goods Act*

BY MARK PAQUETTE AND DAVID PORTER

Investigating Automotive Product DEFECTS

Similar to cellular phones and other electronics, automobiles have seen an astonishing rate of technological development over the past few decades. As with any new technology, this development can result in gains in performance and safety, but can also result in occasional defects. Unfortunately, these defects can at times be a causal factor in collisions or personal injuries. This article reviews some of these newer technologies and the role they can play in collisions, and discusses how the data stored in vehicle electronics (specifically airbags) can assist in the detection of defects in relation to these technologies.

Statistically speaking, automotive defects resulting in collision are rare. According to a study published by the National Highway Traffic Safety Administration in 2008,[1] less than 7% of collisions had a "vehicle-related factor." The majority of these were tire/wheel related, and only 0.6% and 0.2% had a braking system or steering deficiency, respectively. As these numbers would also include excessive wear and lack of servicing, for example worn out



Newer technologies and the role they play in collisions.

tires, we are left with the conclusion that an automotive product defect causing a collision is a very uncommon occurrence. Nonetheless, defects do occur, as evidenced by the recalls that have been issued in recent years in relation to some new technologies.

In many cases the new technologies implemented by automotive manufacturers have resulted in the migrating from the traditional mechanical components to electronically controlled devices for systems such as throttle, steering and airbag.

Drive-by-Wire (Throttle) Technology

The traditional throttle system, linking the accelerator pedal to the engine throttle, consisted of mechanical components (such as a cable and actuators). Over the past decade, several manufacturers have replaced this mechanical system with a 'drive-by-wire' system, which has replaced the mechanical components with an entirely electronic system. Now, the only components linking the accelerator pedal to the engine are electrical wires and components which translate the pedal application by the driver into the desired throttle application at the engine. A drive-by-wire system has numerous advantages, including weight reduction and elimination of mechanical components, but they require electrical power to function properly.

Occasionally, a driver may claim that he/she experienced an unwanted acceleration event prior to a collision, meaning that the vehicle was accelerating even though the driver was not stepping on the accelerator pedal. When investigating such an allegation, a visual inspection of the vehicle would

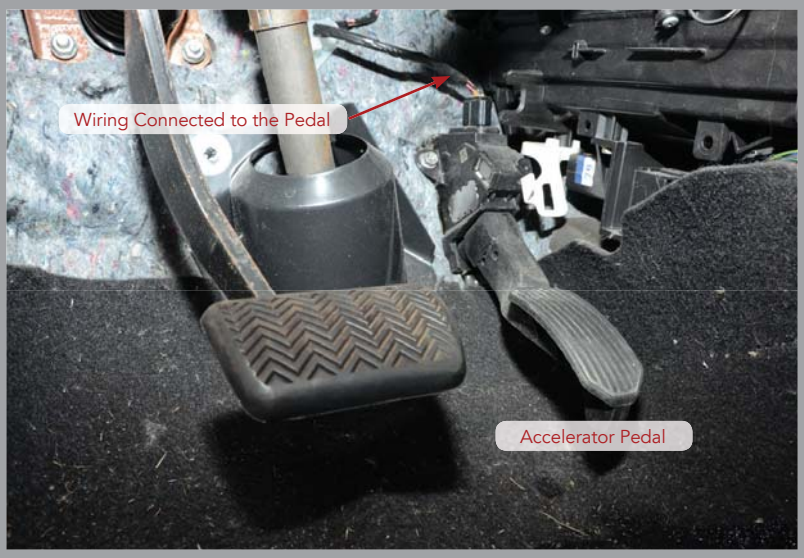


Figure 1 - Example of a drive-by-wire accelerator pedal

FORTUNATELY, technological development has provided a powerful new tool for investigation of alleged mechanical defects: the Event Data Recorder (EDR), often referred to as the 'Black Box' (even though it is almost always silver).

not allow for a complete assessment of any defects if the vehicle is equipped with drive-by-wire technology. Unless the vehicle's engine can be started, which is often not possible due to collision damage, then an investigator is left with only a visual examination of some of the components, such as a floor mat and the pedal itself. Confirmation of the actual function or condition of the system is therefore problematic.

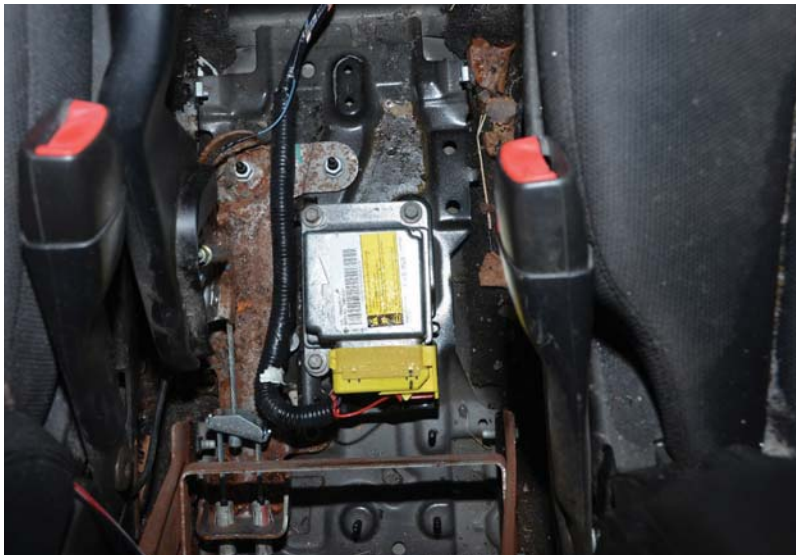


Figure 2 – View of the Airbag Control Module in a 2006 Pontiac Torrent

Electric Power Steering

For several decades, automobiles and light passenger vehicles have been equipped with a power steering assist system which reduces the amount of force that the driver must apply to the steering wheel in order to control the vehicle. Traditionally, the power steering system has consisted of a pump driven by the vehicle's engine that forces fluid through the steering rack. This pump is activated by the driver turning the steering wheel, which reduces the amount of effort the driver needs to apply to turn the wheels. In newer vehicles, manufacturers have started replacing this mechanical pump with an electric power steering system, which consists of an electrical motor that provides similar assistance in reducing the force needed to rotate the steering wheel. One major advantage of an electric power steering system is an improvement in fuel economy due to a smaller load on the vehicle's engine.

Airbag Technology

With regards to safety innovations, airbags have greatly increased the odds of survival and decreased the potential for serious injury in the majority of collisions. Airbag technology has developed extensively since its introduction, from originally only providing a frontal airbag for the front occupants, to modern automobiles being equipped with side impact torso airbags, curtain airbags, and occasionally even knee bolster airbags for increased occupant protection. Another significant development has been the occupant detection system for the front passenger seat. When airbags were first introduced, it was quickly realized that a small child located in the front passenger seat could be badly hurt by airbag deployment; conversely, an adult occupant in the front passenger seat benefited from the airbag deployment. When this hazard was recognized, automotive manufacturers installed a switch on the dash to allow for the front passenger airbag to be manually activated or deactivated by using the vehicle key. Since this required the driver to remember to switch the airbag on or off depending on the occupant (adult/child) in the front passenger seat, this solution was only as effective as the memory of the driver. To eliminate the dependency on this manual activation/deactivation, a system was developed which incorporated a seat weight sensor located within the front passenger seat. This occupant detection system is able to deactivate the airbag if the weight of the individual corresponds to that of a child.

The Event Data Recorder (EDR)

While the above technologies provide a variety of advantages in automobile design, it is also more difficult to verify that these technologies are functioning properly, due to the nature of the related components. Fortunately, technological development has provided a powerful new tool for investigation of alleged mechanical defects: the Event Data Recorder (EDR), often referred to as the 'Black Box' (even though it is almost always silver).

The supplemental restraint system (primarily the airbags) is controlled by

an airbag control module that, while powered, is continuously monitoring for sudden acceleration or deceleration of the vehicle. When a certain threshold level is met, the system will 'wake up,' and very quickly (often within less than 40 milliseconds) decide if the collision event is of sufficient severity to deploy one or several of the airbags. If the event is too minor, the system will simply return to its monitoring state.

An EDR is a component of the airbag control module that will capture and lock data associated with the 'waking up' event that it has experienced. EDRs are not present in all vehicles, meaning that any given vehicle may not have the capability to record data from a collision. However, some vehicles, particularly General Motors vehicles, have had an EDR since the mid-90s. Recently, changes to legislative requirements in the United States have resulted in a greatly expanded list of the makes and models of vehicles that contain an EDR such that the vast majority of new vehicles sold in Canada are now equipped with an EDR.

There are two different types of data that can be downloaded from an EDR. The first is pre-collision data, meaning data collected by the EDR before the actual collision. Typically, this type of data will include the vehicle speed, brake application, throttle application, and occasionally steering wheel angle or other variables such as outside temperature. Secondly, an EDR may have collision-related data, consisting of the system status, such as seatbelt use and airbag deployment times, and collision severity parameters. The data retrievable from an EDR varies considerably by make and model year. Of note, data may be stored even if there was no airbag deployment.

Pre-Crash Data

Parameter	-5 sec	-4 sec	-3 sec	-2 sec	-1 sec
Vehicle Speed (MPH)	73	73	72	72	0
Engine Speed (RPM)	2496	2496	2496	2496	0
Percent Throttle	Invalid	Invalid	Invalid	Invalid	Invalid
Accelerator Pedal Position (percent)	Invalid	Invalid	Invalid	Invalid	Invalid

FIGURE 3 – EDR pre-impact data showing a power interruption between 2 and 1 seconds prior to the collision

How can EDRs help with auto defect investigations?

The data contained in an EDR allows the investigator to paint a picture of what the driver was doing in the seconds leading up to the collision. This data can then be compared to the data that is expected if the vehicle did experience the alleged defect.

Sudden Power Loss

Recently, a recall was issued by General Motors for a wide range of models due to a concern with the ignition switch. While driving, the vehicle key could suddenly rotate out of the 'run' position on the ignition. This would result in the engine shutting down, causing an immediate loss of power steering and disabling other systems. Also, this meant there was a loss of electrical power to several systems, including the airbags, which may no longer deploy regardless of the collision severity.

If this type of defect is alleged by a vehicle operator to have caused a collision, an investigator may see evidence of this in the EDR pre-crash data. As an example, Figure 3 above is a section of pre-impact data which has an indication of this type of condition.

This data is sampled at one second intervals, and these times are in reference to the collision event. For example, the data at "-5 sec" refers to five seconds before the collision, and so on. This data indicates that the vehicle speed went from 72 miles per hour (116 km/h) to zero between data points -2 and -1 seconds prior to the collision. It is impossible for a vehicle to decelerate this quickly; similarly, the engine RPM drops from 2496 to zero in the same period of time. This is a clear indication that the engine shut off at some point between -2 and -1 seconds before the collision occurred.

Therefore, the information recorded by this EDR would be consistent with a driver reporting a sudden loss of vehicle power. It is important to note that there are several reasons why a vehicle could lose power, and an examination of the vehicle would be required to determine the most likely cause.

Unintended Acceleration

In recent years, there have been several well-publicized allegations and subsequent investigations into unintended accelerations occurring in Toyota vehicles. As is the case for most new vehicles, these vehicles were equipped with a drive-by-wire system.

As discussed above, assessing the function and/or condition of a vehicle equipped with a drive-by-wire system can be difficult or impossible through

Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle	Brake Switch Circuit Status
-5	12	4023	100	OFF
-4	24	4992	100	OFF
-3	32	6144	100	OFF
-2	44	4352	100	OFF
-1	39	4160	1	OFF

FIGURE 4 – EDR pre-impact data, showing no braking before the collision

a visual examination. Fortunately, EDR data can once again be of assistance in uncovering what occurred in the seconds prior to such an event. The EDR information can clearly contradict or support an allegation of a vehicle defect, as the examples below demonstrate.

Example 1

A driver indicates that he/she was stepping on the brake pedal firmly, yet the vehicle accelerated out of control, resulting in a collision. The pre-impact data retrieved from the vehicle's EDR in figure 4 above indicates the following.

The EDR data indicates that at no point from 5 seconds before the collision were the brakes applied. Conversely, the throttle is showing 100% application from -5 to -2 seconds prior to the collision. This data therefore indicates that the driver was not braking at all; further, the driver was likely pressing the wrong pedal (stepping on the accelerator rather than the brake pedal).

Example 2 –

In this example a driver reports that despite applying the brakes continuously, the vehicle continued to accelerate, resulting in a collision. EDR data retrieved from the vehicle is shown to the right in figure 5.

In this case, brake application data, which goes back to 8 seconds before the collision, shows that the driver was applying the brakes over all of the data points (except one), yet the EDR data also shows a constant throttle application over the 5 seconds before the impact. As it is unusual for a driver to apply two pedals at once, this may be an indication of a defect. However, a full vehicle examination would be required to complete the investigation; for example, a common cause of both pedals being applied at the same time is a stuck accelerator pedal caused by the presence of a floor mat that is too thick for the vehicle.

Airbag System Failure

The recent recall by airbag manufacturer Takata (which resulted in 10 automakers recalling almost 8 million automobiles for the potential of metal shards being projected toward an occupant in the event of a deployment) demonstrates that there can even be problems with the components of the airbag system. While this type of problem cannot always be identified by the data stored in the EDR, the data can at times point to the issue when compared with the rest of the information obtained from an investigation. One example of this type of issue is the

Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle
-5	34	3072	40
-4	32	3008	40
-3	34	3008	40
-2	38	3328	40
-1	35	3136	40

Seconds Before AE	Brake Switch Circuit Status
-8	ON
-7	ON
-6	ON
-5	ON
-4	ON
-3	OFF
-2	ON
-1	ON

FIGURE 5 – EDR pre-impact data, showing simultaneous braking and throttle application

failure of the occupant protection system.

As discussed above, the front passenger seat occupant detection system can disable the airbag deployment if a child is present in that position, yet still enable the airbag deployment when an adult is seated there. The potential is then present for the system to fail to deploy an airbag when one could have protected an adult in the front passenger seat.

There are a number of reasons why the sensor might misinterpret the presence of an adult as being a child; however, if this does occur, the EDR data will show the presence of a child, as in the example below:

Passenger Classi cation Status at Event Enable	Small Occupant Classi cation Type #2

FIGURE 6 – EDR small occupant (child) classi cation

If the person that was seated in the front passenger position was in fact a large adult, it would be expected that the EDR data would show something to reflect this, such as below, where the "AM50" indicates a 50th percentile adult male:

Occupancy Status, Passenger	AM50

FIGURE 7 – EDR adult male classi cation

Such an error might occur if the occupant was positioned such that their body weight was not resting on the seat, but it may also point to some problem or defect with the seat sensor system.

What Can You, as the Legal Advisor, Do to Assist with a Defect Investigation?

If you have reason to suspect an automotive defect resulted in a collision or a personal injury, the most important step to take is evidence preservation. Too often, a vehicle will be destroyed before a thorough examination can be conducted; even if the EDR data is available, without an actual vehicle examination, any findings are typically

speculative and based on several assumptions. For example, although the EDR could show signs of a power loss, as in the example above, without a vehicle examination the cause of this may be hard to determine. Furthermore, there is a proliferation of other systems on the vehicle that can store data in relation to the operation of that vehicle, including in the key fob in some vehicles. Ensuring that all of the available information is preserved is the first step in being able to establish if a defect was present.

In addition, if a recurring problem was being experienced by the vehicle driver, records from any service work done prior to the collision can shed a light on any repairs done or parts replaced that would have modified the vehicle from its original condition.

Summary

The constant technological developments in the automotive field present new challenges when investigating automotive defects, because a failed technology might leave no evidence of a problem. Fortunately, Event Data Recorders can provide valuable information when trying to determine what exactly happened just before and during the collision event. As with most investigations, evidence preservation is key to being able to fully investigate not only if a defect did occur, but what caused it and why. Since vehicle technologies are becoming ever more complex and hard to assess, the use and availability of on-board electronic data in the detection of a vehicle defect will continue to increase.

Mark Paquette *is a professional engineer with Giffin Koerth in Toronto, Ont.*

David Porter *is a professional engineer with Giffin Koerth in Toronto, Ont.*

NOTES

[1] National Motor Vehicle Crash Causation Survey, Report to Congress, U.S. Department of Transportation, National Highway Traffic Safety Administration, July 2008.