"Black Box" Technology and Its Implications to the Auto Insurance Industry

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When the term "black box" is used, often times the first thing that comes to mind is an aircraft's flight data recorder. These devices are the focus of aircraft crash investigations because their recovery provides tremendous insight into what factors contributed to the cause of the mishap. Today there are numerous "black box" technologies that can also provide auto crash investigators, insurance companies and legal counsel with significant information about what happened in a car crash. These technologies can include aftermarket solutions that may include global positioning system (GPS) capabilities and video capture, as well as the storage of crash data. These technologies also include original equipment manufacturers (OEM) solutions. All of these "black box" solutions are also referred to as event data recorders or EDR technologies. For the purposes of this article, the terms EDR and "black box" will be used interchangeably.

This article will focus on EDR technologies that are available as original equipment to private passenger automobiles, trucks, vans and SUVs. This is because OEM technologies have significant advantages to the auto insurance industry over after-market solutions. These include: 1) the significant cost and coordination of each installation of the technology is avoided; 2) unique or customized tracking systems to recognize equipped vehicles are not required; 3) OEM technologies have critical mass in the marketplace; and 4) OEM technologies have an established track record as valid, acceptable evidence in litigated matters.

As original equipment, the EDR is the vehicle's sensing and diagnostic module (SDM) for later model General Motors (GM) vehicles, the restraint control module (RCM) for recent Ford Motor Company (Ford) vehicles or other similar devices that control deployment of occupant protection systems. During a crash event, these systems will "wake up" or become activated and if the system determines that a crash is severe enough to warrant airbag deployment, the airbag will be discharged. Depending on the make and model of the vehicle, various elements of pre-crash and post-crash data may be stored

and subsequently harvested for analysis of what actually happened during the accident event.

Experimental EDR technologies were developed with limited capabilities as early as 1974*1*. In the 1994 model year, EDR technologies became available in select GM models*2*. Apparent early uses of the data obtained from these technologies were for accident investigations related to research initiatives and, subsequently, product performance and liability claims. As such, OEM EDR technology has a significant history of providing admissible evidence in litigated matters.

National Highway Traffic Safety Administration (NHTSA) officials have indicated that almost every vehicle with an airbag system has some type of crash recorder although the data collected varies widely*3*. However, this EDR information is oftentimes only accessible by hardware and software that is proprietary to the automobile manufacturer. In these instances, access to this information requires the manufacturer's involvement. Because of the coordination required and a manufacturer's disinterest in participating in a large number of individual insurance claims, requested involvement of manufacturers is only warranted in the most severe matters.

Notwithstanding, there are many reasons why OEM EDR technology is now a common and cost-effective source of crash information for claim evaluation for the insurance industry. These reasons include the following:

1. EDR information provides valuable insight into a claim investigation and evaluation.
2. Desktop technology exists to enable laypersons to quickly and easily analyze and interpret EDR information and assess its implications.
3. Crash data can be easily retrieved from a large number of private passenger autos, trucks, vans and SUVs using a single, commercially available hardware platform without manufacturer involvement.
4. Clarification has emerged regarding the ownership of "black box" data and related legal risks.
5. The Internet provides a pipeline to transmit "black box" data instantaneously to a desired user for immediate analysis.

Without any one of these developments, EDR technology might only be a viable solution for insurance claims with high financial exposure. However, because each of these components now exists, a complete solution is available that offers the potential to transform how the insurance industry evaluates and adjudicates claims. This article will explore each of these developments in more detail.

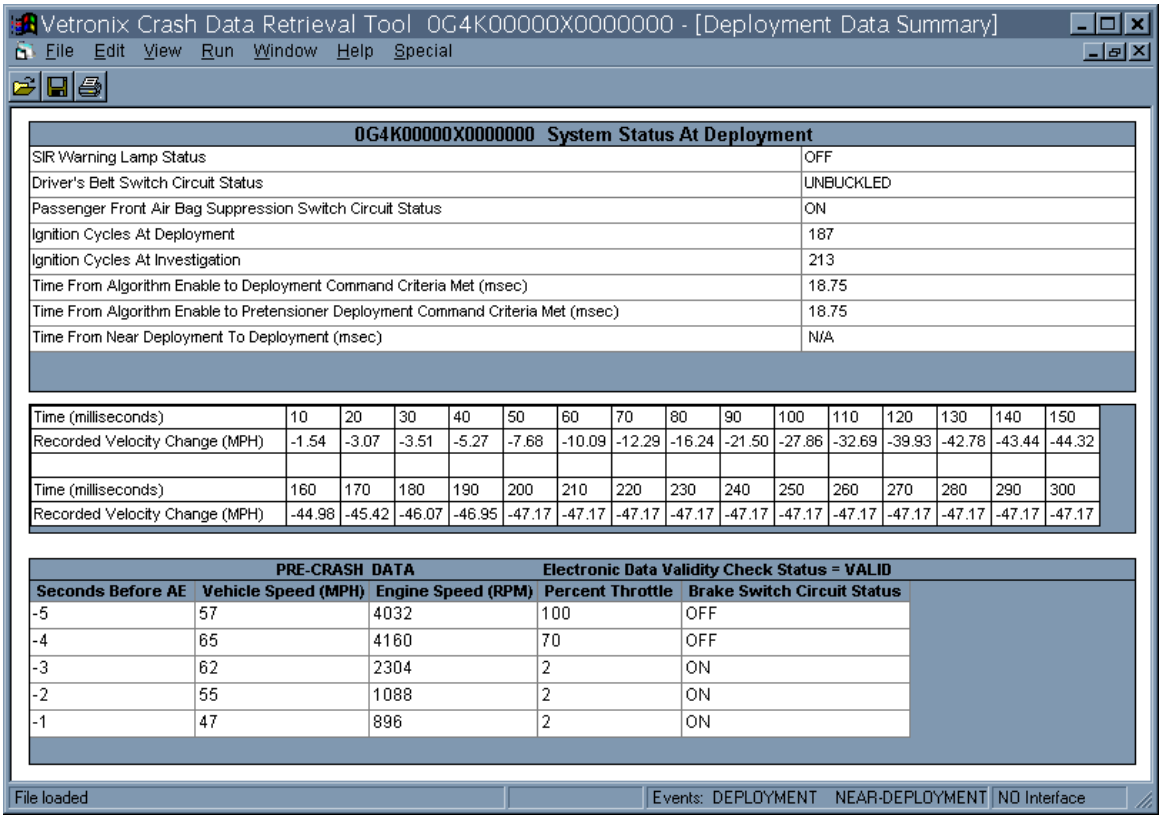
EDR Information

GM is the first manufacturer to allow the general public to access and retrieve EDR information using the Vetronix Crash Data Retrieval (CDR) System. By the first quarter of 2002, Ford will follow suit with several of its more popular models. Because of the

limited public experience with Ford EDR information, the functionality of GM EDR system features will be the focus of this article unless otherwise noted. Figure 1 provides a summary of the data that can be downloaded from an OEM EDR on select GM models. Notable information contained in this summary includes the following:

1. Status of driver seatbelt usage at the time of the accident. Although this indicator can be positive when the seatbelt harness is fastened, but not around the occupant, this information could be relevant to comparative or contributory negligence determinations when seatbelt use is at issue.
2. Vehicle ignition cycle count at the time of accident, and in select models, the count when the "black box" data was downloaded. Although current EDR technology does not capture the date of the accident, ignition cycle counts (i.e., the number of times the ignition switch has been turned on and off) give an indication of the amount of usage a vehicle experiences after an accident but before the data is harvested.
3. Longitudinal or forward post crash vehicle velocity changes (or Delta V data), in mph, at 10 millisecond increments for the first 150 to 300 milliseconds after a collision. This is crash pulse information that defines the severity of the collision not only in magnitude, but also in duration.
4. Pre-crash information regarding vehicle speed (mph), engine speed (rpm), percent throttle and braking status (i.e., on or off) at one second intervals for five seconds prior to impact.

Figure 1



Based on changing airbag system architectures or components, some GM models will have EDR systems that record either pre-crash or post-crash data, while other models will collect both.

As previously noted, during the first quarter of 2002, the Vetronix CDR System will be able to harvest data from select Ford models. Although pre-crash data will not be initially harvestable from these models, the information available will include, but not be limited to, the following:

- Longitudinal Delta-V data,
- Lateral Delta-V data,
- Driver seat belt status, and
- Passenger seat belt status.

In certain cases, when external factors are linked to the harvested data, insight into accident causation can be gleaned. If the data shown in Figure 1 was collected from an intersection collision, for example, the information might be suggestive of a driver attempting to accelerate through an intersection before the traffic light turned red and deciding at the last moment to abort the attempt but failing to stop the vehicle prior to the collision. This scenario can be inferred because the "black box" data shows that the vehicle was in fact accelerating approximately four seconds prior to the collision and that braking did not occur until approximately three seconds prior to the collision.

Clearly, EDR information provides objective and definitive information regarding various time, speed and distance factors as they relate to the cause of an accident. Such information is critical for accurate liability determinations.

Analysis Technology and Processes

Injury Sciences of San Antonio, Texas offers a product named WrExpert. WrExpert is an engineering-based claims evaluation technology that provides users insight into accident and injury causation. This web-based technology can also import "black box" data harvested by the Vetronix CDR System and provide greater insight into not only what happened to the vehicle from which the "black box" data was harvested, but also provide insight into what happened to the other vehicle and its occupants.

WrExpert is a complementary technology to EDR systems since EDR technology: 1) has sensitivities to non-frontal collisions that must be carefully evaluated; 2) cannot derive point and angle of impact (i.e., impact configuration); and 3) cannot independently assess accident implications to the other vehicles and their occupants. For these reasons, "black box" data will continue to be an important supplemental source of information in the investigation of a claim. Traditional sources of information used to evaluate claims such as collision repair estimates and vehicle photographs will continue to be important to an investigation and analysis of a collision. WrExpert contains databases with information on over 28,000 private passenger autos, pickups, vans and SUVs. These specifications include physical dimensions, mass attributes, and crash test data/performance. With this

information and a vehicle's collision repair estimate and damage photographs, WrExpert can determine impact severity to both vehicles involved in a two car collision, injury potential to each vehicle's occupants as well as supplement accident causation analyses with point and angle of impact assessments. These analyses can be performed either with or without "black box" data. The addition of "black box" data, however, enhances the fidelity of an evaluation. Additionally, these complementary technologies facilitate a liability determination based on the objective data documented in the repair process and recorded by the vehicle during the accident event. Consequently, time related to attempting to reconcile disparate statements among witnesses and accident participants is minimized or avoided.

WrExpert can also be used to identify data inconsistencies that may be captured by an EDR system, such as inaccurate pre-crash speeds related to skidding or other scenarios involving loss of traction. Since WrExpert employs numerous analysis methodologies and its algorithms must always satisfy the laws of physics, data inconsistencies can be quickly identified.

Data Availability

The CDR System currently offered by Vetronix Corp. is capable of downloading crash data from GM auto, pickup, van, and SUV models dating back to 1996. The next releases of this system, scheduled for the first and second quarters of 2002, will also harvest data from select 1994 and 1995 GM models as well as introduce harvesting capabilities from the following Ford models:

- 2000-2001 Taurus and Mercury Sable,
- 2001 Crown Victoria and Mercury Grand Marquis,
- 2001 Windstar, and
- 2001 Lincoln Towncar.

These Ford models will be harvestable using the same CDR hardware platform. This platform requires only a software update and the addition of several connecting cables for those EDR systems possessing different onboard hardware.

With the addition of these Ford models and earlier year GM models, approximately 15 percent of all private passenger vehicles on the road will have harvestable "black box" information. Furthermore, because of the significant market share held by GM and Ford, the percentage of vehicles on the road with EDR systems harvestable by the Vetronix CDR System is expected to increase by 2-3 percentage points with each new model year without the addition of any other manufacturers or new Ford models. This means there is about a 30 percent chance that at least one vehicle in an accident involving two passenger vehicles will have an EDR that can be harvested by the Vetronix CDR System. Accordingly, this percentage is expected to increase 4 to 6 percentage points with each new model year. Practically, however, previously described EDR technology sensitivities and limitations will preclude the utility of this data in many accident configurations and

circumstances. Consequently, potential accident harvesting rates at or above 30 percent will not be experienced for several years.

It is important to note that EDR information is harvestable even when the airbag does not deploy in a collision. For example, in GM systems, when the airbag system is "awakened" during a collision (or sometimes in severe braking maneuvers) and the system determines the event is not severe enough to warrant air bag deployment, the event is referred to as a near-deployment event. In near-deployment events, the data recorded is temporarily stored for 250 ignition cycle counts (or approximately sixty days of normal use). Should a vehicle be involved in another near-deployment event before a previous near-deployment event is cleared, the most severe event is stored. Should a collision be severe enough to warrant the deployment of an airbag (a deployment event) the data is permanently stored and cannot be overwritten. This technology is also capable of recording two impacts in an accident sequence if at least one of the impacts is severe enough to deploy the airbag.

When considering these features in light of claims processes, the following observations are made:

1. EDR information is valuable to more than high severity, high exposure cases. It is harvestable in the frequent, minor-type collisions and is very helpful in resolving "low impact" type claims. Since this data is time-sensitive, early recognition and execution of harvesting opportunities will be critical in the claims process.
2. Should a question arise as to whether the data harvested is applicable to the accident in question because of a claim of a subsequent collision, the data storage method insures that the worst-case event is being evaluated. In the assessment of injury claims, this worst-case data gives the claimant every benefit of the doubt.
3. When an airbag deploys in an accident, the module storing the data must be replaced. These modules should be identified and treated as relevant evidence in the investigation and evaluation of an accident. Accordingly, process revisions to the salvage and storage of these parts in the collision repair process should be considered.

Data Retrieval

Data retrieval is a very straightforward process that can be accomplished in 5 to 10 minutes if the vehicle is not structurally compromised in a fashion that makes the harvesting portals inaccessible. Training for data retrieval only (but not data interpretation) can be easily accomplished in an hour. As shown in figure 2, the Vetronix CDR System is connected to a PC on which proprietary Vetronix software is loaded. Figure 3 illustrates the steps required to physically harvest the data. Once the Vetronix software is activated on the PC, the Vetronix CDR System is plugged into one of two available ports on the vehicle. One port is the diagnostic link connector or OBD II port found under the dashboard as shown in figure 3a. This port is universal across all vehicles sold in the U.S. since 1996 and data can be harvested from this port using a standard cable. Should this port be compromised, the data can be harvested directly from the module storing the data (i.e., the SDM in GM vehicles) using a cable compatible with the storage module as shown in figure 3b. At the present time, there are 5 different cables required to harvest information from the unique storage modules in all harvestable GM vehicles as well as the Ford vehicles to be added.

Figure 2

Figure 3a

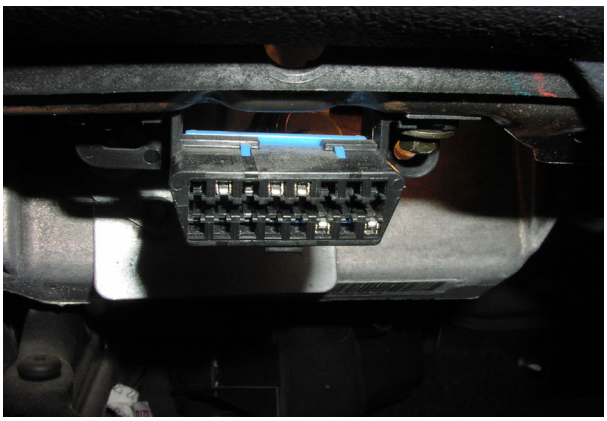


Figure 3b

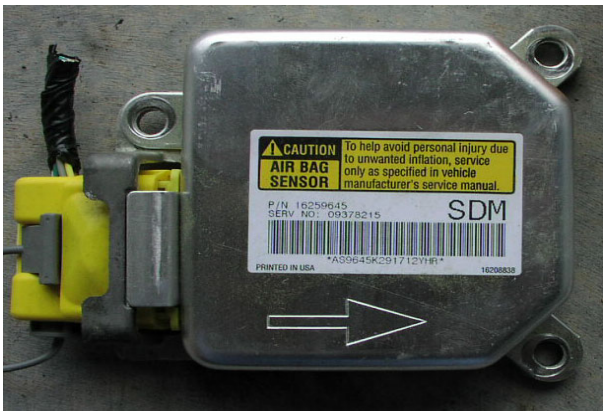


Fig. 3a above, the diagnostic link connector

Fig. 3b to the upper and lower right, the SDM typically found under the driver's seat

Once the cable connections are made, the harvester of the information enters their name, the case or claim number, the date the information was harvested, the date of the accident and the vehicle identification number (VIN). Once this data is entered, the collection process is activated from the PC by the harvester and the data is downloaded to the PC on its designated storage medium. The filename of the downloaded information is the VIN.

To harvest information from an EDR system, the vehicle need not have power. In these cases the Vetronix CDR System can be powered from another vehicle using its cigarette lighter adapter or from traditional power outlets in a shop environment. With alternative power sources, the SDM can be removed from the vehicle and stored for subsequent harvesting of data. If a vehicle has a functioning power supply, "black box" information can be downloaded using its own power.

The harvesting of "black box" data by the Vetronix CDR System does not erase the information in the data storage module but will advance the ignition cycle count recorded for the harvesting event. In other words, the same "black box" information related to an accident event can be harvested multiple times by parties with different interests, unless ignition cycle count limits are exceeded by the harvesting activity for stored near-

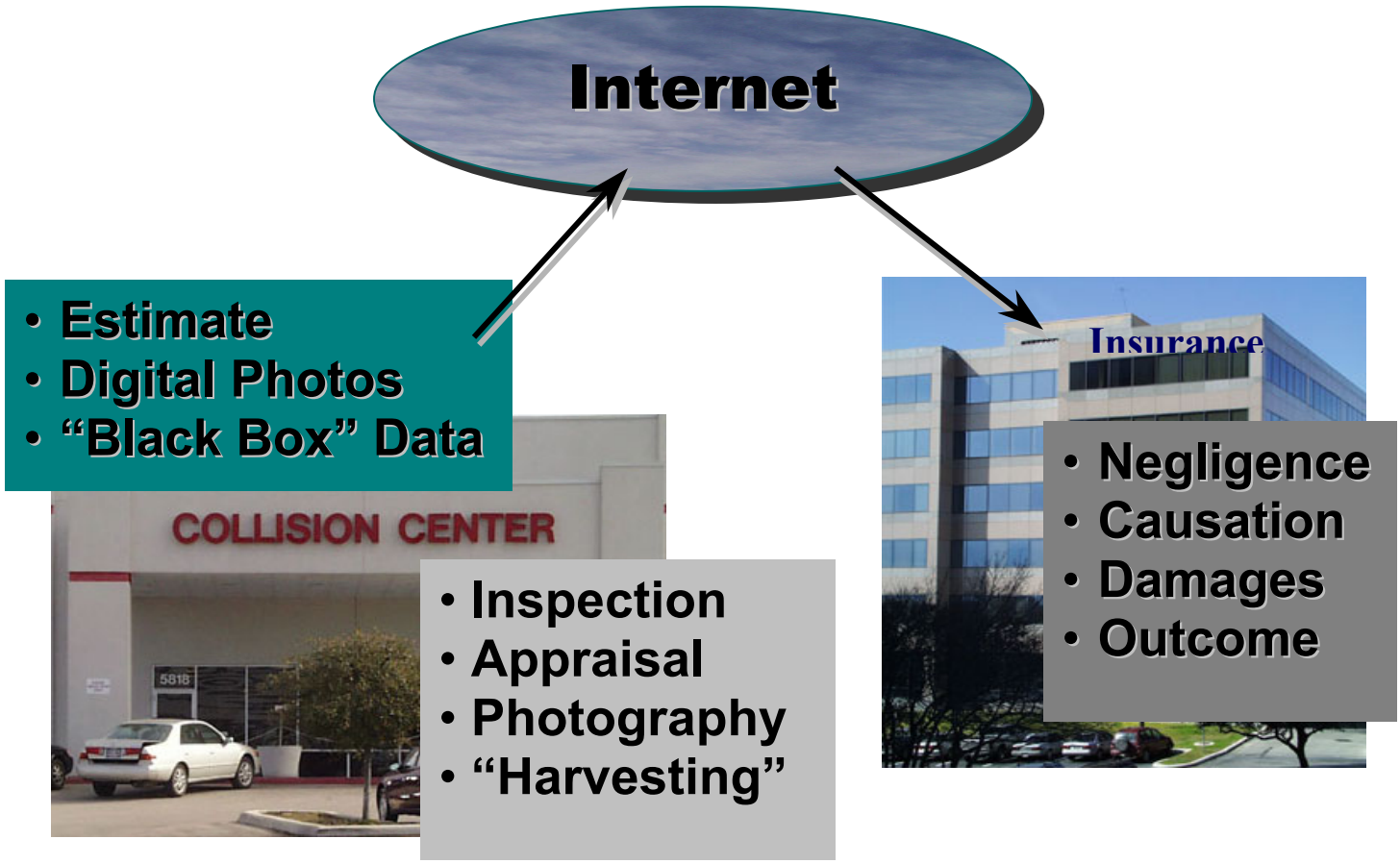
deployment data. Since the data is objective, favors no party and has well documented rates of accuracy*4,5,6*, it can eliminate costly debates over various aspects of an accident event.

Potential harvesters of "black box' data include researchers, forensic experts and investigators, law enforcement personnel, attorneys, government agencies, insurance company personnel, independent adjusters/appraisers, auto repair facility personnel and airbag service and installation companies.

As shown in Figure 4, the insurance industry has a tremendous opportunity to leverage existing inspections of vehicles during the collision repair process and use these opportunities to harvest EDR information while the vehicle is photographed and a repair estimate is written. If accomplished during these processes, the information becomes available early in the evaluation of a claim. Some insurance organizations have already deployed the Vetronix CDR System to many of their participating direct repair facilities so "black box" data can be routinely harvested.

Figure 4

New Way to Leverage Collision Repair Process



Should a matter be litigated, the chain of evidence as it relates to the harvesting of information will become important regardless of the individual or organization harvesting the information. For this reason, care should be taken to preserve the "black box" evidence collected and to ensure against potential spoliation issues.

Data Ownership

The emerging consensus regarding the ownership of "black box" data is that the owner of the vehicle owns the "black box" data. This position is held by NHTSA*7* and has been espoused by privacy advocates. A representative of the Center for Economic Justice in Austin, Texas has observed that vehicle owner privacy rights to "black box" data would depend on exactly what is being recorded. If the "black box" records only vehicle speed, seatbelt use, braking activity, and changes in acceleration, consumers likely do not have any privacy rights to that data. However, if "black boxes" are recording driving patterns – such as where and when a motorist drives – privacy becomes a concern. It was further observed that the owner of the vehicle owns the data within the "black box" and if the insurance company asked for it, the vehicle owner would probably have a duty to turn it over to them"*8*.

The duty alluded to comes from typical contractual relationships between an insurance company and its insured. Specifically, an insured is contractually bound to cooperate with an insurance company's investigation of an accident in order to receive insurance benefits. While accessibility to "black box" information is probably not specifically written into the policy language, the duty to provide relevant information to an accident event and its cause is generally addressed. This duty is critical to the prevalent use of EDR systems. This is because Newtonian physics enables one to glean insights into third party claims from the insured's "black box" information. Consequently, an insurance company is able to obtain objective insight into an accident event from an insured's EDR, using tools such as WrExpert, without having to pursue EDR information from third parties who have no duty to disclose the data.

Under the framework that the owner of the vehicle owns the data, the following structure for data ownership has been proposed*9*:

1. If the vehicle is owned by mass transit or common carrier, the regulatory agency governing that carrier owns the data.
2. If the vehicle is in a commercial fleet, the owner of the fleet owns the data.
3. If the vehicle is used for commercial purposes by an independent owner-operator the independent owner-operator owns the data.
4. If the vehicle is a personal vehicle, the owner of the personal vehicle owns the data.

Under this ownership construct, a legal framework has also been outlined. First, "black box" data is privileged in a civil proceeding and the privilege may be waived by the

owner of the privilege. Secondly, the data is protected in a criminal proceeding under the Fifth Amendment and these protections can only be waived by the accused*10*.

Public perceptions of "black box" information provide additional insight into the potential accessibility and utility of EDR systems. Recent household surveys by the Insurance Research Council indicate that the public is generally in favor of using EDR systems to facilitate the investigation of an accident and determine fault. Conversely, the surveys indicate that the public is opposed to using GPS and EDR systems to monitor mileage and driving habits for the determination of insurance rates*11*.

Given the substantial benefits that can be derived from EDR systems (see the section describing related benefits), specific contractual provisions, and perhaps incentives (e.g., waived deductibles, reduced rates), may be placed in insurance policy language. This would provide opportunities to clarify exactly how the data will be collected and used in the investigation and evaluation of an accident and any potential civil proceedings that might ensue. Until such time, existing public perceptions, constructs of data ownership and emerging legal frameworks suggest that a conservative approach to the collection of this data is warranted. Such an approach would involve disclosure of the information to be harvested to the vehicle owner and subsequently obtaining the vehicle owner's permission via a release. In essence, protocols to obtaining this data would be similar to those employed to obtain an individual's medical record.

Data Transmission

Once "black box" data is harvested, the next step is to analyze the data and its implications. In those circumstances where the harvester of the information will also be analyzing the data, no data transmission is required. In these situations, chain of custody issues related to the data, if any, are minimal. Only data and harvesting integrity can be questioned. Because expert harvesting and analysis is cost prohibitive on a large-scale basis, an alternative solution has been developed by Injury Sciences to address these issues.

Injury Sciences offers a secure web site to which harvested "black box" data can be uploaded and maintained without exposure to corruption or subsequent alteration. The unique features of this web site include: 1) transmission of original hexadecimal data retrieved from the EDR System to prevent the possibility of data tampering, 2) administrative data capture to document chain of custody, and 3) accessibility of the data in an unalterable form only by authorized personnel. Using the previously described WrExpert technology and Injury Sciences' web site, "black box" data can be harvested in Florida, uploaded and subsequently analyzed in California in the same business day.

Benefit

Near-term benefit to the insurance industry will be primarily in the areas of casualty claim evaluations and liability determinations. Specifically, in conjunction with other technologies such as WrExpert, the following factors related to injury causation can be assessed with EDR information:

- Impact severity,
- Restraint system utilization,
- Injury mechanisms, and
- Injury severity.

Additionally, the following factors relevant to an accident causation and liability determination analysis can be assessed, also with the use of complementary technologies:

- Point of impact,
- Angle of impact,
- Pre-impact speeds, and
- Pre-impact breaking times and distances.

Studies conducted by Injury Sciences over nearly two dozen different insurance carriers have shown that the use of technical or science-based analyses regarding injury causation (without "black box" data) early in the evaluation of a casualty claim reduces loss costs related to opportunistic claiming by 30 to 70 percent across casualty claim populations nearing 40 percent of a carrier's inventory. Additionally, these studies have shown that claims benefiting from this information resolve quicker with less overall effort and, consequently, expense. Clearly, "black box" data can augment these results and add demonstrable benefit in the areas of liability determination. As an example, only a few modest reductions (i.e., 10 to 20 percent) in loss costs because of comparative/contributory negligence issues in just a few policy limit claims will justify investment in these analysis technologies for even the largest organizations.

The reasons why significant reductions in loss costs are recognized involve several fundamental principles in claims. These are:

1. Those with the best and most relevant information and those best prepared are in the strongest position.
2. Consistency and accuracy improves overall results.
3. Less time and activity means less cost.

These analysis capabilities also will enhance fraud detection by Special Investigation Units in insurance companies and law enforcement personnel by helping to identify staged accidents and other fraudulent claims. It is also an excellent tool to supplement low impact programs.

Longer-term, EDR technology may enhance a carrier's pricing strategies as they accumulate data which demonstrate that third party casualty claim costs are lowered for those insureds that drive vehicles with harvestable "black box" information. Claim costs should be further reduced because numerous studies have shown that EDR technologies have reduced crash rates and costs*12*. Alternatively, should data begin to demonstrate that for the same severity of impacts, certain vehicles have greater repair costs, pricing can be adjusted accordingly based on this real world crash test data. Currently, the primary, but limited source of this information is the Insurance Institute for Highway Safety.

Summary

Harvestable "black box" data will only become more commonplace. In the recent past, NHTSA has been twice petitioned to make EDR technology required in all new passenger vehicles. Both petitions were declined because of the voluntary movement of the industry to this goal*13*.

With the current critical mass of vehicles on the road today with harvestable information, the inevitable growth of these vehicle populations and the suite of complementary products and tools available, "black box" technologies posture the auto insurance industry to profoundly improve its claims processes and decisions, reduce loss costs and develop information bases for operational and strategic decision-making that were previously unimaginable. To this end, the ultimately successful solutions and strategies will require responsible, accurate and consistent capture, interpretation and utilization of this data. Lastly, as the auto insurance industry embraces this technology, the public will begin to think of autos, rather than aircraft, when the term "black box" is used.

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