Capturing the Big Bang: Event Data Recorders in Cars

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It's a common scenario: a car traveling straight through an intersection crashes into a car making a left turn. When interviewed after the accident, the shaken driver of the left-turning car claims that the other vehicle was far enough away for a safe turn and must have been speeding. For the forensic engineer asked to shed light on this kind of case, a new investigative tool is available: the air bag system's "black box" or event data recorder (EDR).

The EDR is integral to the airbag control module, a small silver box usually located under the car's front seat or center console. Until 2000, only vehicle or auto manufacturers could access and decode the information stored in these EDRs. Now, with a laptop and a specialized vehicle interface called the Vetronix Crash Data Retrieval System, investigators can download event data from a large number of vehicles, including most 1996 and newer General Motors vehicles (Chevrolet, Pontiac, Cadillac, Saturn, GMC, Buick, and Oldsmobile), select 2001 and newer Ford vehicles (including Mercury and Lincoln), and some Isuzu and Saab vehicles. This list is updated frequently, and another major manufacturer is expected to join by the end of the year.

The specific information recorded by an EDR varies with vehicle and model years. In general, it includes information about the severity of the collision and the behavior of the airbag and seatbelt system. Some 1999 and most 2000 and newer model year GM airbag control modules also record up to five seconds of pre-crash information that can include vehicle speed, braking, throttle, and engine revolutions per minute data. Some of the newest vehicles also record data such as steering wheel angle, lateral accelerations, and cruise control settings. This information is relevant to a number of typical accident reconstruction issues, as summarized in the table.

Accident Reconstruction and EDR Data

Issues	Crash Data
Liability and fraud	• Pre-crash vehicle speed, brake status, percent of throttle and steering wheel angle
Airbag performance	• Airbag status at impact and deployment timing details • Impact severity
Injury	• Impact severity
Seat belt	• Seat belt use and pretensioner deployment details • Impact severity

How EDRs Can Help

EDR data can make the difference in resolving key issues of causation and fault. For example, EDR data retrieved after an intersection collision established that one of the vehicles had been traveling nearly twice the speed limit about five seconds before the crash. Further calculations demonstrated that the collision could have been avoided if the vehicle had been traveling at a more reasonable speed. As a result, the speeding driver was found primarily liable for the crash. The EDR information was crucial to this investigation because, although the driver had braked heavily, the antilock brake system in his car prevented skid marks (a traditional source of evidence of speed) from appearing on the road. The EDR provided the only evidence of excessive speed.

In another case, event data downloaded from a sport utility vehicle after it hit a telephone pole indicated that the driver pushed the gas pedal to the floor for about three seconds and accelerated to more than 60 miles per hour (mph) before impact. This data supported witness reports that the vehicle was racing another vehicle before the crash. In addition, the event data indicated that the driver was not wearing his seatbelt at the time of the crash, which helped to explain the severity of his injuries.

The use of EDR data is not restricted to high speed collisions. Event data from a car that rear-ended a stationary van in a parking lot revealed that both vehicles experienced a speed change of 2.4 mph during the collision. Because the speed change experienced during a collision is an indicator of impact severity, this finding was useful for a biomechanical engineer who had been asked to assess the likelihood of soft tissue injury to the van occupants.

The use of electronic event data is becoming more commonplace in courts across North America. The data has been accepted in cases in at least 17 states, in several federal cases, and by at least three appellate courts. Our company has conducted a large number of tests to measure the accuracy of the data recorded by EDRs. The results of these tests, published in several papers by the Society of Automotive Engineers, have been employed to support the use of recorded event data in analyzing real-life crashes and have been used in successful *Frye* and *Daubert* hearings.

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Practical Considerations

There are issues with respect to ownership of the data recorded by EDRs. Since 2004, six states have passed bills specifically addressing EDRs and the use of their data. Fourteen other states have pending legislation. Lawyers and their experts must remain current with these laws to ascertain whether a download can be legally performed. Obtaining written permission from the vehicle owner before performing a download is recommended.

While event data can be a source of useful information, there are, of course, limitations. First, not all collisions generate data. Most airbag systems are designed to detect and respond to frontal collisions, not rear or lateral impacts. Therefore, a frontal impact force is typically required to generate crash data in the airbag module.

Second, event data may have a finite life. If the airbags were deployed during a collision, the event data will be stored permanently and cannot be overwritten or erased. However, if the airbags were not fired, the data can be overwritten by a subsequent event or erased with continued use of the vehicle. To avoid the potential loss of relevant EDR data, it is essential to promptly and thoroughly investigate collisions in which event data may have been recorded.

Third, in some circumstances the crash data cannot be relied upon. For example, if power to the airbag module was interrupted during a collision, some of the data may not be saved properly. A close inspection of the data is required to ensure that the recorded event data is valid. Examining the event circumstances is often required to ensure that factors such as wheel spin or skidding have not affected the crash data.

The EDRs in many modern vehicles can supplement engineering reconstruction of collisions. In some cases, recorded crash data will provide insights that traditional engineering methods cannot. In others, crash data can be used to corroborate traditional engineering reconstructions. Certainly, with more EDR-equipped vehicles on the road every day, understanding the strengths and weaknesses of the crash data they can provide is becoming increasingly important.

Jonathan Lawrence and David King are professional engineers with MEA Forensic Engineers & Scientists, which specializes in technical investigations of motor vehicle collisions, personal injury, property and premises, and product liability. They have investigated over 5,000 motor vehicle accidents since 1984 and have testified as expert witnesses numerous times. Lawrence and King also have been certified by Vetronix to download and interpret crash data.

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David King is responsible for technical investigations, primarily those involving motor vehicle accident investigation and reconstruction.

Mr. King has been involved in over 3000 technical investigations since joining MEA in 1984. Cases have included crash data recorder download and interpretation, severity assessment, collision sequence, occupant kinematics, seat belt use and effectiveness, vehicle speed analysis, and visibility.

Areas of Specialization:

- Accident Reconstruction
- Low Speed Collision Research
- Airbags & Restraints
- PC-Crash Analysis

Professional Affiliations:

MEA professionals are members of various professional organizations and are certified through the California State Bar and the California Department of Insurance to provide Continuing Education courses. A current listing can be found on our website at www.meaforensic.com.

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