CAR “BLACK BOXES”
MYTHS, REALITIES & FRAUD FIGHTING

W. R. “RUSTY” HAIGHT
SCOTT BAKER

Collision Safety Institute (2002-)
- TEEX, Texas A&M, staff
  - 1990-2001
- NUCPS, instructor/contractor
  - Recent chapter on “CDR”

1285+ crash tests
- 1025 in the car (5/16)
- 170 air bag deployments
- Top “speed:” 53.8mph (86.5km/h)
- Top delta-V: -26mph (-42km/h)

Guinness World Record
- “Most Human Subject Crash Tests”
  - 1999-present

San Diego Police Dept.
- Accident Investigation Bureau to 1984

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"BLACK BOX?"
WHAT ARE WE REALLY TALKING ABOUT HERE?

- Flight Data Recorder vs Event Data Recorder
  - Is there really a difference?

- Flight Data Recorder (FDR)
  - Always recording aircraft flight data

- Event Data Recorder (EDR)
  - Not a stand alone device
  - May record data in passenger cars, light trucks and SUVs

IRONICALLY...

- In the recent tragic fatal crash involving a private plane and a Nissan Sentra...
  - ...Guess which one of the involved vehicles had crash data?

- And neither had a "black box..." ...but the Nissan had an EDR
WORDS MEAN THINGS

- The Airbag Control Module (ACM) is a safety systems control module first, and then may, if the conditions are right, have the potential to record data to an Event Data Recorder (EDR) subcomponent
- An ACM may also be called an Electronic Control Unit (ECU)

- The Event Data Recorder (EDR) is a subcomponent, a part, of an Airbag Control Module (ACM) which may record information after a crash or other physical occurrence if the conditions are right

WHERE DOES THE NAME “EDR” COME FROM?

- Title 49, CFR Part 563
  - CFR: Code of Federal Regulations
  - NHTSA: National Highway Traffic Safety Administration

  “… Event data recorder (EDR) means a device or function in a vehicle that records the vehicle’s dynamic time-series data during the time period just prior to a crash event (e.g., vehicle speed vs. time) or during a crash event (e.g., delta-V vs. time), intended for retrieval after the crash event.
  - For the purposes of this definition, the event data do not include audio and video data. …”
SO, WHAT IS “CDR?”

- CDR is the acronym for the Bosch Crash Data Retrieval® (CDR) Tool
  - It does NOT stand for “crash data recorder”
- The Crash Data Retrieval® Tool is a system of components which retrieves event/crash data which may be recorded in the EDR subcomponent of certain passenger cars, light trucks and SUVs

---

“MAY BE RECORDED?”

1. Crash occurs & data MAY be recorded to the EDR function
2. Does the vehicle have an airbag system?
   - Y: Proceed to next step
   - N: There is no data to retrieve
3. Does the veh/module have an EDR capability??
   - Y: Proceed to next step
   - N: There is no data to retrieve
4. Was the “physical event” the type req’d for recording?
   - Y: Proceed to next step
   - N: There is no data to retrieve
5. Was there power at the module to record some data?
   - Y: Using the CDR Tool, one should be able to retrieve useful data
   - N: There is no data to retrieve

Not all steps are applicable to all situations or module types.
THE REAL POTENTIAL

- Despite some potential for there not being data in a given vehicle, there are currently **more than 150 million** registered vehicles on the road in North America with available data.
- Covering more than **17 vehicle manufacturers** over model years from **1994-2017!!**

MAY NOT OR WILL NOT RECORD...?

- **EDR Rule #1:** the systems may not record data for a number of reasons BUT they **never record data** when the car’s been parked with the **key off**

When the key is turned from the “run” position, one of the car’s main computers tells all the others to **shut down** – that includes the airbag control module. When it’s shut down, it **can’t “see” an event and won’t record data**
CAR “BLACK BOXES”
- MYTHS, REALITIES & FRAUD FIGHTING

MYTH VS REALITY

**MYTH**
- I’m going to “download the CDR”
  - Heard as a vendor’s proposal for retrieving data from an insured’s or claimant’s vehicle
  - From a claimant’s attorney wanting access to a car

**REALITY**
- False
  - EDR Rule #2: There is no “CDR” to download
    - “CDR” is an acronym for the proper name of a tool/system
  - The statement gives us good insight into the vendor or lawyer’s actual knowledge or understanding of the technology…
MYTH VS REALITY

MYTH
• “I’ve heard about that CDR (EDR, “black box”) stuff, it’s something required by Federal law, right?”
  • “Every car has this thing, right?”

REALITY
• False
  • 49CFR563 is a regulation not a law and it does not require a manufacturer to have an “EDR” capable device
  • Not “every car” (not even every car with an airbag) has an EDR function and not all systems work the same across all manufacturers

49CFR563.2 - PURPOSE

563.2 - Purpose
• “The purpose of this part is to help ensure that EDRs record, in a readily usable manner, data valuable for effective crash investigations and for analysis of safety equipment performance (e.g., advanced restraint systems). These data will help provide a better understanding of the circumstances in which crashes and injuries occur and will lead to safer vehicle designs.”
49CFR563 – DATA ELEMENTS

- 563.6 Requirements for vehicles.
  - "Each vehicle equipped with an EDR must meet the requirements specified in §563.7 for data elements, §563.8 for data format, §563.9 for data capture, §563.10 for crash test performance and survivability, and §563.11 for information in owner's manual."

- 563.7 Data elements.
  - "(a) Data elements required for all vehicles. Each vehicle equipped with an EDR must record all of the data elements listed in Table I, during the interval/time and at the sample rate specified in that table."

49CFR563.7 TABLE I: REQUIRED DATA ELEMENTS

- Crash severity
  - Longitudinal delta-V
  - Maximum longitudinal delta-V
  - Time to the maximum longitudinal delta-V

- Pre-crash data for up to about 5 seconds before the event
  - Vehicle speed
  - Engine throttle percentage of full (or accelerator pedal percentage of full)
  - Service brake "on" or "off"
  - Driver seat belt buckled or unbuckled

- Event relativity
  - Whether or not there was a single or two connected events
  - The time between events if there were 2
  - Ignition cycle count at the time of the crash and at the download

- Airbag system operation
  - Air bag warning lamp on or off
  - How long it took to deploy the driver’s and right front passenger’s airbags
  - An indication of whether or not the event record was completely recorded in the EDR after the crash
THERE MAY ALSO BE
“CONDITIONAL ELEMENTS”

- Crash severity
  - Lateral delta-V

- Pre-crash data for up to about 5 seconds before the event
  - Engine RPM
  - Roll angle
  - ABS activity
  - Steering input
  - Right front passenger seat belt buckled or unbuckled
  - Some indication of the presence or approximate “size” of the right front passenger
    - Sometimes even information about the driver

“DELTA-V?”

- Many are familiar with the term from “low speed” crashes
  - “LIST” and “MIST” claims often focus on estimates or sometimes outright guesses related to delta-V and that to injury potential

- Delta-V is a measure of the crash severity
  - Severity is not based on impact speed
  - EDR data objectively reports delta-V
  - It tells us how bad the crash was for the occupants and how – in what direction - the impact acted on the car and occupants

- Delta-V isn’t about how fast you’re going, it’s about the sudden stop at the end
“DELTA-V?”

- From a crash test, what would you estimate the crash severity to be?
- Remember, *crash severity is not impact speed*, it’s delta-V

Data from the car on the left which was stopped at impact

```
<table>
<thead>
<tr>
<th>Time (ms)</th>
<th>Longitudinal Delta-V (MPH/km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>-0.1 (0.2)</td>
</tr>
<tr>
<td>20</td>
<td>-0.1 (0.2)</td>
</tr>
<tr>
<td>50</td>
<td>-0.1 (0.2)</td>
</tr>
<tr>
<td>60</td>
<td>-0.1 (0.2)</td>
</tr>
<tr>
<td>90</td>
<td>-0.1 (0.2)</td>
</tr>
</tbody>
</table>
```

Data from this car which was stopped at impact

```
<table>
<thead>
<tr>
<th>Time (ms)</th>
<th>Delta-V, Longitudinal (MPH/km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0 (0.0)</td>
</tr>
<tr>
<td>2</td>
<td>0.0 (0.0)</td>
</tr>
<tr>
<td>4</td>
<td>0.0 (0.0)</td>
</tr>
<tr>
<td>6</td>
<td>0.0 (0.0)</td>
</tr>
<tr>
<td>90</td>
<td>5.0 (8.0)</td>
</tr>
<tr>
<td>100</td>
<td>5.0 (8.0)</td>
</tr>
</tbody>
</table>
```
ACTIVE HEAD RESTRAINTS AND HOW MUCH DAMAGE?

Data from this car, which was stopped at impact, indicates it received a 5mph delta-V.

WITNESS ... EXPERT? OR BOTH?

- Compare the damage profiles of the two cars
- Can you estimate the delta-V for each?
- Can you estimate the impact/closing speed?
CROWN VIC 8
WITH THE GREEN ROOF

PCM EDR Data (1)

<table>
<thead>
<tr>
<th>Buffer Address (Hex)</th>
<th>Relative Time (calc.) (Seconds)</th>
<th>Restraint Deployment Signal (Received / Not Received)</th>
<th>Speed, Vehicle Indicated (MPH [km/h])</th>
<th>Accelerator Pedal % Full (%)</th>
<th>Engine Throttle % Full (%)</th>
<th>Brake Switch (On / Off)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAX000171F</td>
<td>1/2 (42)</td>
<td>NR Received</td>
<td>61 (98)</td>
<td>91</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>EAX000290</td>
<td>Not Received</td>
<td>28 (45)</td>
<td>97</td>
<td>98.5</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>EAX000210</td>
<td>Not Received</td>
<td>28 (45)</td>
<td>67.5</td>
<td>98.5</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>EAX000220</td>
<td>Not Received</td>
<td>28 (45)</td>
<td>86.5</td>
<td>98.5</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>EAX000230</td>
<td>Not Received</td>
<td>28 (45)</td>
<td>89.5</td>
<td>98.5</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>EAX000240</td>
<td>Not Received</td>
<td>28 (45)</td>
<td>89.5</td>
<td>98.5</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>EAX000240</td>
<td>Not Received</td>
<td>28 (45)</td>
<td>89.5</td>
<td>98.5</td>
<td>98</td>
<td>98</td>
</tr>
</tbody>
</table>

CROWN VIC 9
THE ALL WHITE CAR

<table>
<thead>
<tr>
<th>Buffer Address (Hex)</th>
<th>Relative Time (calc.) (Seconds)</th>
<th>Restraint Deployment Signal (Received / Not Received)</th>
<th>Speed, Vehicle Indicated (MPH [km/h])</th>
<th>Accelerator Pedal % Full (%)</th>
<th>Engine Throttle % Full (%)</th>
<th>Brake Switch (On / Off)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAX000640</td>
<td>NR Not Received</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Off</td>
</tr>
<tr>
<td>EAX000640</td>
<td>NR Not Received</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Off</td>
</tr>
<tr>
<td>EAX000640</td>
<td>NR Not Received</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Off</td>
</tr>
<tr>
<td>EAX000640</td>
<td>NR Not Received</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Off</td>
</tr>
<tr>
<td>EAX000640</td>
<td>NR Not Received</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Off</td>
</tr>
<tr>
<td>EAX000640</td>
<td>NR Not Received</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Off</td>
</tr>
<tr>
<td>EAX000640</td>
<td>NR Not Received</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Off</td>
</tr>
</tbody>
</table>

Notes:
1. EDR data represents specific instances where the system recorded data.
2. NR denotes data not recorded.
3. Values indicate typical speeds and pedal positions at the time of data recording.
MYTH VS REALITY

MYTH
• There is only data for a short time before and/or after “an event”

Either...
• It doesn’t remain in the vehicle for long
• There’s not enough recorded data to be useful or

REALITY
• Maybe...
• The data isn’t simply erased after a certain number of days
  • On older GM systems it can be erased by the module after a certain number of ignition cycles
• Usually about 5 seconds of various data elements captured before a crash
  • And up to 0.3 seconds of the crash severity

Pre-Crash Data (Most Recent Event - Table 1 of 5)
(The most recent sampled values are recorded prior to the event)
MYTH VS REALITY

**MYTH**
- I can’t “connect” the data to my crash/event
  - “That ignition cycle thing is really vague”
  - There’s no date or time stamp

**REALITY**
- Maybe…
  - Using ignition cycles requires a certain amount of skill and sometimes some *additional investigation or analysis*
  - But there are other resources for some vehicles…

CONNECTING THE DATA TO THE EVENT

- Most recent model vehicles report *ignition cycles*
- GM systems have been reporting ignition cycles since the 90’s

<table>
<thead>
<tr>
<th>System Status At Non-Deployment</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIR Warning Lamp Status</td>
</tr>
<tr>
<td>Driver’s Belt Switch Circuit Status</td>
</tr>
<tr>
<td>Passenger SIR Suppression Switch Circuit Status (if equipped)</td>
</tr>
<tr>
<td>Ignition Cycles At Non-Deployment</td>
</tr>
<tr>
<td>Ignition Cycles At Investigation</td>
</tr>
<tr>
<td>Algorithm Enable to Maximum EDM Recorded Velocity Change (insec)</td>
</tr>
<tr>
<td>Maximum EDM Recorded Velocity Change (MPH)</td>
</tr>
<tr>
<td>A Deployment was Commanded Prior to this Event</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>System Status At Non-Deployment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ignition Cycles At Investigation</td>
</tr>
<tr>
<td>SIR Warning Lamp Status</td>
</tr>
<tr>
<td>SIR Warning Lamp ON/OFF Time (seconds)</td>
</tr>
<tr>
<td>Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously</td>
</tr>
<tr>
<td>Ignition Cycles At Event</td>
</tr>
</tbody>
</table>

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CONNECTING THE DATA TO THE EVENT

- Most recent model vehicles report *ignition cycles*
- Some vehicles also report the *odometer reading* at the event
- Some vehicles may report a *lifetime operation time*

### System Status at Event (1st Prior Event)

<table>
<thead>
<tr>
<th>System Status</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete File Recorded</td>
<td>Yes</td>
</tr>
<tr>
<td>Event Record Status - Delta-V, Longitudinal</td>
<td>Complete</td>
</tr>
<tr>
<td>Event Record Status - Delta-V, Lateral</td>
<td>Complete</td>
</tr>
<tr>
<td>Event Number</td>
<td>1</td>
</tr>
<tr>
<td>Total Number of Events</td>
<td>2</td>
</tr>
<tr>
<td>Time from Event 1 to 2 (sec)</td>
<td>0.0</td>
</tr>
<tr>
<td>Multi-event, Number of Events</td>
<td>1</td>
</tr>
<tr>
<td>Odometer Recorded at Event (miles [km])</td>
<td>2083 (3352)</td>
</tr>
<tr>
<td>Operation System Time at Event (seconds)</td>
<td>234945</td>
</tr>
<tr>
<td>Ignition Cycles, Crash</td>
<td>292</td>
</tr>
</tbody>
</table>

### System Status At 1 second

<table>
<thead>
<tr>
<th>System Status</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission Range (if Equipped)</td>
<td>Invalid</td>
</tr>
<tr>
<td>Transmission Selector Position (if Equipped)</td>
<td>Invalid</td>
</tr>
<tr>
<td>Traction Control System Active (if Equipped)</td>
<td>Invalid</td>
</tr>
<tr>
<td>Service Engine Soon (Non-Emission Related Lamp)</td>
<td>OFF</td>
</tr>
<tr>
<td>Service Vehicle Soon Lamp</td>
<td>OFF</td>
</tr>
<tr>
<td>Outside Air Temperature (degrees F)</td>
<td>72</td>
</tr>
</tbody>
</table>

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HIT WHILE PARKED, UNATTENDED...OVERNIGHT?

- Imagine the claimant's surprise after you show them the data and the day's (and night's) weather report.

System Status At 1 second

- Transmission Range (if Equipped)
- Transmission Selector Position (if Equipped)
- Traction Control System Active (if Equipped)
- Service Engine Soon (Non-Emission Related) Lamp
- Service Vehicle Soon Lamp
- Outside Air Temperature (degrees F)

CONNECTING THE DATA TO THE EVENT

- Most recent model vehicles report ignition cycles
- Some vehicles may report the odometer reading at the event
- Some vehicles might even report the date of an event
  - From the vehicle's clock...so it might not be set "right"
  - Or a parameter listed may not be available on that vehicle.
CONNECTING THE DATA TO THE EVENT

- Most recent model vehicles report ignition cycles
- Some vehicles may report the odometer reading at the event
- Some vehicles might even report the date and time of an event
  - From the vehicle’s clock…so it might not be set “right”

System Status at Event (Record 1, Most Recent)

| Event Counter at Event (Counts) | 1 |
| Event Type | Frontal |
| Multi-Event, Number of Events | 1, Event |
| Time from Previous Event to Current Event (msec) | 0.0 |
| Vehicle Clock, Date and Time at Event (YYYY-MM-DD, HH:MM:SS) | 2015-07-06, 00:09:00 |
| Vehicle Mileage (km) | 60 |
| Operating Time (min) | 287 |
| Ignition Cycle at Event (Cycles) | 107 |
| Ignition Cycle at Download (Cycles) | 108 |

MYTH VS REALITY

MYTH
- The “EDR” always records data, “24/7”
  - Constantly monitoring where I go, where I’ve been, and who is in the car with me

REALITY
- False
  - May or may not record data after an “event”
  - Does not identify a driver or occupants
  - Does not track car by GPS or some other locator system
WHO IS IN THE CAR WITH THE DRIVER?

- Some systems are relatively clearer, reporting the approximate minimum weight of the right front occupant.

### Pre-Crash Data, 1 S

<table>
<thead>
<tr>
<th>Recording Status, Pre-Crash/On</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time from Pre-Crash to TRG (ms)</td>
<td>100</td>
</tr>
<tr>
<td>Buckle Switch, Left Seat</td>
<td>Buckled</td>
</tr>
<tr>
<td>Buckle Switch, Right Seat</td>
<td>Buckled</td>
</tr>
<tr>
<td>Occupancy Status, Passenger</td>
<td>AM50</td>
</tr>
<tr>
<td>Seat Position, Driver</td>
<td>Rearward</td>
</tr>
<tr>
<td>Shift Position</td>
<td>Drive</td>
</tr>
</tbody>
</table>

50th percentile “adult male crash dummy” is about 170lbs or greater (FMVSS208)

WHO IS IN THE CAR WITH THE DRIVER?

- Some systems are relatively clear in terms of reporting the approximate “size” of the right front occupant.

### Right RFR Front Row ICCS Curtain Loop

<table>
<thead>
<tr>
<th>Driver Belt Switch Circuit Status</th>
<th>Buckled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger Belt Switch Circuit Status</td>
<td>Not Buckled</td>
</tr>
<tr>
<td>Passenger Seat Occupancy Status</td>
<td>Empty</td>
</tr>
<tr>
<td>Passenger Classification Status</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Passenger Air Bag ON Indicator Status</td>
<td>Off</td>
</tr>
<tr>
<td>Passenger Air Bag OFF Indicator Status</td>
<td>On</td>
</tr>
<tr>
<td>Low Tire Pressure Warning Lamp</td>
<td>Off</td>
</tr>
<tr>
<td>SIR Warning Lamp Status</td>
<td>Off</td>
</tr>
<tr>
<td>SIR Warning Lamp ON/OFF Timing</td>
<td>355320</td>
</tr>
</tbody>
</table>

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WHO’S IN THE CAR?

- Some systems are pretty detailed

Pre-Crash Data -1 Sec

<table>
<thead>
<tr>
<th>Safety Belt Status, Driver</th>
<th>Belted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seat Track Position Switch Status, Driver</td>
<td>Not Foremost (Middle/Rear)</td>
</tr>
<tr>
<td>Occupant Position Classification, Driver</td>
<td>Not Foremost (Middle/Rear)</td>
</tr>
<tr>
<td>Air Bag Warning Lamp (On/Off)</td>
<td>Invalid Data</td>
</tr>
<tr>
<td>Air Bag Suppression Switch Status, Front Passenger</td>
<td>Data Not Available</td>
</tr>
<tr>
<td>Safety Belt Status, Front Passenger</td>
<td>Not Belted</td>
</tr>
<tr>
<td>Seat Track Position Switch Status, Foremost, Front Passenger</td>
<td>Not Foremost (Middle/Rear)</td>
</tr>
<tr>
<td>Occupant Size Classification, Front Passenger (Child)</td>
<td>Empty/Child</td>
</tr>
<tr>
<td>Occupant Position Classification, Front Passenger</td>
<td>Data Not Available</td>
</tr>
<tr>
<td>Frontal Air Bag Disable Indicator Status, Passenger (POL)</td>
<td>On</td>
</tr>
<tr>
<td>Safety Belt Status, Second Row, Left Side</td>
<td>Data Not Available</td>
</tr>
<tr>
<td>Safety Belt Status, Second Row, Right Side</td>
<td>Data Not Available</td>
</tr>
<tr>
<td>Safety Belt Status, Third Row, Left Side</td>
<td>Data Not Available</td>
</tr>
<tr>
<td>Safety Belt Status, Third Row, Right Side</td>
<td>Data Not Available</td>
</tr>
</tbody>
</table>

STANDARDIZATION?

- EDR Rule #3

  - Although there’s a lot of actual standardization; data elements vary by manufacturer

<table>
<thead>
<tr>
<th>Recording Status, Pre-Crash/Occupant</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time from Pre-Crash to TRG (msec)</td>
<td>100</td>
</tr>
<tr>
<td>Buckle Switch, Left Seat</td>
<td>Buckled</td>
</tr>
<tr>
<td>Buckle Switch, Right Seat</td>
<td>Buckled</td>
</tr>
<tr>
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</tr>
<tr>
<td>Seat Position, Driver</td>
<td>Rearward</td>
</tr>
<tr>
<td>Shift Position</td>
<td>Drive</td>
</tr>
</tbody>
</table>
**MYTH VS REALITY**

**MYTH**

- We can’t get the data because…
  - The vehicle is not supported for retrieval by the CDR Tool

**REALITY**

- Maybe
  - Not every car is going to have data
  - Not every manufacturer has an easily accessible tool to retrieve the data

- However…

---

**49CFR563.3 - APPLICATION**

- “563.3 Application.
  - This part applies to the following vehicles manufactured on or after September 1, 2012, if they are equipped with an event data recorder: passenger cars, multipurpose passenger vehicles, trucks, and buses with a GVWR of 3,855 kg (8,500 pounds) or less and an un-loaded vehicle weight of 2,495 kg (5,500 pounds) or less…”

More than 150 million registered vehicles with available data from 1994-2017 models!!
49CFR563.12 - DATA RETRIEVAL TOOLS

- "Each manufacturer of a motor vehicle equipped with an EDR shall ensure by licensing agreement or other means that a tool(s) is commercially available that is capable of accessing and retrieving the data stored in the EDR that are required by this part.

- The tool(s) shall be commercially available not later than 90 days after the first sale of the motor vehicle for purposes other than resale…"

CDR TOOL ACCESSIBLE VEHICLES
MYTH VS REALITY

**MYTH**
- We can’t get data because...
  - …Owner privacy “issues”
  - …Driver privacy “issues”?

**REALITY**
- Maybe...
  - “Driver Privacy Act of 2015”
  - “…(data) is the property of the owner or lessee of the vehicle in which the recorder is installed…”

  - Is this really about privacy or ownership?

---

**MYTH VS REALITY**

**MYTH**
- We can’t get data because...
  - We don’t have consent or other authority to retrieve the data

**REALITY**
- Maybe...
  - Who the owner “is” may vary by state

  - Owner consent required to investigate the claim?

  - Application of the cooperation clause?
OVER 66% OF THE TIME...

- Over 66% of the time, when the data showed that the claim didn’t occur as described, the claim was simply withdrawn by the claimant early in the investigation.

- Based on an independent review of hit while parked, unattended claims…
  - …when the CDR Tool is used to retrieve data from a vehicle or
  - …when a claimant/insured is asked for consent to retrieve data.

MYTH VS REALITY

**MYTH**
- Data is erased by “downloading”
  - The claimant’s lawyer won’t let us download the data because it will be erased or changed or altered in some way.

**REALITY**
- False
  - The CDR Tool is a read only device.
  - Using the CDR Tool properly does not erase or alter crash related data, period.
MYTH VS REALITY

MYTH

- We can’t get the data because...

- We don’t want “the liability”

REALITY

- False

- The “liability” red herring is a product of a recurring sales pitch by a vendor going back to the earliest days of the CDR Tool’s availability

- The notion is without basis in fact or reality

MYTH VS REALITY

MYTH

- We can’t get the data because...

- It’s too expensive...
  - …To hire a vendor
  - …To do it ourselves

REALITY

- Maybe...

- From a vendor, as with any service, the price of the service may vary and – as is often the case – a little “shopping around” might be a good idea

- In-house data retrieval within insurance companies, fleet management and risk management offices is on the rise as a cost effective way of making sure the data is available
CDR TOOL USE

- Across North America, fleet management, risk management and insurance companies have come to really embrace CDR technology in the recent past
  - Police agencies have been using the CDR Tool internationally since 2000

- Several companies have rolled out CDR Tools to their SIU investigators in various regions nationally

“DLC KIT?”

- Name given to the “Diagnostic Link Connector” (DLC) kit, part of the larger Crash Data Retrieval Tool system
  - A sort of “entry level” system designed to retrieve crash data in most in-car scenarios
  - Does not include the more than 60 direct-to-module cables and other components
END USERS

HOW IS THE CDR TOOL BEING USED?

- Depending on the company, the applications range from limited to wide scale use
  - In some cases, the company has limited the use to evaluating “hit while parked, unattended” claims
  - In other instances, the company has rolled out the system within their SIU or other unit for use in all claims
- Its use has prompted regional SIU training opportunities
CRASH AND LEARN 2015
NEW ENGLAND ASSOCIATION OF INSURANCE FRAUD INVESTIGATORS (NEAIFI)

- NEAIFI
- MAPFRE Insurance
- GEICO Insurance
- Plymouth Rock Assurance
- The Massachusetts State Police Collision Analysis Section
- The Boston, MA Police Department
- The Worcester, MA Police Department
- Mendon, MA Department of Public Safety
- The Central Massachusetts Law Enforcement Council Crash Reconstruction Team
- The Rhode Island State Police
- The Mendon, MA Fire Department
- Liddell Brothers, Inc.
- National Grid
- Karcraft
- The Collision Safety Institute
- Crash Data Group
- Collision Publishing

NEAIFI CRASH AND LEARN 2015
MYTH VS REALITY

MYTH

• Requires lots of special training to use

• There are lots of complicated components and parts of the CDR Tool and there’s a lot of training required

REALITY

• Maybe…

• Like any technology, one needs to learn how to use its components properly

• However, retrieving data is relatively simple and easily done

• In some cases, the analysis may be more complicated
BASIC CONNECTIVITY MODELS

- PC to interface module then either …
  - Through wiring already in place in the car or
  - To an airbag control module directly

Use the Bosch CDR DLC Kit for data retrieval!

FOCUSED TRAINING IN PLACE

- www.collisionsafety.net
VENDOR RESOURCES

- www.EDRExperts.com

INDEPENDENT EXPERTS

- Find qualified, experienced vendors regionally
- Including trainer/mentors
MYTH VS REALITY

MYTH

• The data isn’t (won’t be) admissible, why should we bother?

• Even if we get the data, it won’t be allowed at trial

REALITY

• False

• To date, there have been over 100 admissibility hearings and trials throughout North America and at least two State Supreme Court decisions relative to EDR Data

• EDR data has never been excluded as unreliable
  • It has been kept out because of bad or unqualified experts

MYTH VS REALITY

MYTH

• The data isn’t (won’t be) admissible, why should we bother?

• Even if we get the data, it won’t be allowed at trial

REALITY

• False

• EDR data has been the subject of numerous crash tests and other types of tests, published articles and has been validated time and again as objective and reliable when used properly in an investigation or analysis
MYTH VS REALITY

MYTH

• We don’t want the data because...
  • It’s going to hurt our settlement position
  • It’s going to go against our client

REALITY

• False

• EDR Rule #4: In every case, claim, or investigation there’s going to be one party who will like and the other party who will dislike some potential evidentiary photo, estimate, report, or witness statement but that does not mean you can simply ignore potentially valuable and readily available EDR data

DO YOU REALLY…?

• …Want to go into a case with just “some of the information?”

• …Want to settle a claim before finding out whether or not there’s information that favors your insured’s position?

• …Go in to arbitration, mediation or subrogation with only part of the information available?
  • Particularly when you have to assume the other side has it already?
THE “FIGHTING” PART: EDR DATA IN PRACTICAL APPLICATION

HOW SHOULD EDR DATA BE USED (PROPERLY)?

- Some examples from actual claims and crashes
  - Illustrating how the data can be used in claims

- Some are situations which will require a little more detailed analysis

  - The qualified vendor or

  - Well trained in-house investigator
Not all steps are applicable to all situations or module types.

Crash occurs & data MAY be recorded to EDR

Normal fact gathering

Is that “it?”
No, there’s more that can be done. Imaging and CDR report.

Human Environment Vehicle

Is the data from this crash?
Does the delta-V (direction and magnitude) and “age” of the data fit the “HVE”?

What about this crash can be matched to the data?
What do I know from the “HVE” to compare to the EDR data?

Is the data from this crash?
"THE FUSION AND THE DEER"

- The claim is that the insured hit a deer which deployed the airbags, photos were taken of the car after some shop teardown had been completed.
“THE FUSION AND THE DEER”

WHAT’S IN THE DATA?

- Crash severity (delta-V) for a front-to-rear impact

**Deployment Data (First Record)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value (MPH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontal airbag deployment, time to first stage deployment, driver (msec)</td>
<td>47.5</td>
</tr>
<tr>
<td>Frontal airbag deployment, time to 2nd stage, driver (msec)</td>
<td>197.5</td>
</tr>
<tr>
<td>Frontal pretensioner (inflator) deployment, time to 0th, other (msec)</td>
<td>47.5</td>
</tr>
<tr>
<td>Frontal airbag deployment, time to first stage deployment, front passenger (msec)</td>
<td>47.5</td>
</tr>
<tr>
<td>Frontal pretensioner (inflator) deployment, time to 0th, right front passenger (msec)</td>
<td>197.5</td>
</tr>
<tr>
<td>Time, maximum delta-V longitudinal (msec)</td>
<td>200</td>
</tr>
<tr>
<td>Maximum delta-V longitudinal (MPH)</td>
<td>0.45-0.70</td>
</tr>
<tr>
<td>Time, maximum delta-V lateral (msec)</td>
<td>89</td>
</tr>
<tr>
<td>Left or center front, satellite sensor discriminating deployment</td>
<td>Yes</td>
</tr>
<tr>
<td>Left or center, front satellite sensor activation</td>
<td>Yes</td>
</tr>
<tr>
<td>Right, front satellite sensor discriminating deployment</td>
<td>Yes</td>
</tr>
<tr>
<td>Right front satellite sensor activation</td>
<td>Yes</td>
</tr>
<tr>
<td>RCM, front sensor discriminating deployment</td>
<td>Yes</td>
</tr>
<tr>
<td>RCM, front sensor activation</td>
<td>Yes</td>
</tr>
</tbody>
</table>

- Given the weight of the car and weight of the largest deer ever taken in that area, one can **calculate** that the car would have been going almost **113mph** to have a -4mph delta-V
"THE FUSION AND THE DEER"
WHAT'S IN THE DATA?

- The claimant/driver said he was "just driving along at 40mph" then he saw the deer, swerved and braked.

<table>
<thead>
<tr>
<th>Times (sec)</th>
<th>Speed vehicle indicated MPH [kph]</th>
<th>Accelerator pedal, % full</th>
<th>Service brake, on/off</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5.0</td>
<td>99.6 (160.0)</td>
<td>19</td>
<td>Off</td>
<td>2</td>
</tr>
<tr>
<td>-4.5</td>
<td>99.6 (160.0)</td>
<td>16</td>
<td>Off</td>
<td>2</td>
</tr>
<tr>
<td>-4.0</td>
<td>99.6 (160.0)</td>
<td>16</td>
<td>Off</td>
<td>2</td>
</tr>
<tr>
<td>-3.5</td>
<td>99.6 (160.0)</td>
<td>16</td>
<td>Off</td>
<td>2</td>
</tr>
<tr>
<td>-3.0</td>
<td>99.6 (160.0)</td>
<td>16</td>
<td>Off</td>
<td>2</td>
</tr>
<tr>
<td>-2.5</td>
<td>99.6 (160.0)</td>
<td>16</td>
<td>Off</td>
<td>2</td>
</tr>
<tr>
<td>-2.0</td>
<td>99.6 (160.0)</td>
<td>19</td>
<td>Off</td>
<td>2</td>
</tr>
<tr>
<td>-1.5</td>
<td>99.6 (160.0)</td>
<td>19</td>
<td>Off</td>
<td>2</td>
</tr>
<tr>
<td>-1.0</td>
<td>70.7 (113.0)</td>
<td>19</td>
<td>Off</td>
<td>2</td>
</tr>
<tr>
<td>-0.5</td>
<td>70.2 (113.0)</td>
<td>20</td>
<td>Off</td>
<td>2</td>
</tr>
<tr>
<td>0.0</td>
<td>102 (160.0)</td>
<td>0</td>
<td>Off</td>
<td>2</td>
</tr>
</tbody>
</table>

Pre-Crash Data -5 to 0 sec (2 samples/sec) [10 samples/sec] (First Record)

CAR "BLACK BOXES"
- MYTHS, REALITIES & FRAUD FIGHTING

"WHO HIT WHOM FIRST?"
"WHO HIT WHOM FIRST?"

- Three car in-line crash, your insured is in the “middle car” and you have data from your insured’s car

**CDR File Information**

- User Entered VIN/Frame Number: 2T1BU4EEOAC00000
- Case Number: 00000000
- EDR Data Imaging Date: 04/15/2016
- Crash Date: 04/15/2016
- Filename: COROLLA 10 2T1BU4EEOAC000000 CDRX
- Saved on: Wednesday, April 15, 2015 at 15:00:00
- Collected with CDR version: Crash Data Retrieval Tool 15.3
- Reported with CDR version: Crash Data Retrieval Tool 15.3
- EDR Device Type: Airbag Control Module
- Event(s) recorded: Front/Rear (3)

"WHO HIT WHOM FIRST?"

- The insured’s car

© 2016 Collision Safety institute
“WHO HIT WHOM FIRST?”

- The other involved vehicles

- The insured's data reports 3 impacts, 3 recorded events

<table>
<thead>
<tr>
<th>Front/Rear Event Record Summary at Retrieval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Events Recorded</td>
</tr>
<tr>
<td>Most Recent Frontal/Rear Event</td>
</tr>
<tr>
<td>1st Prior Frontal/Rear Event</td>
</tr>
<tr>
<td>Prior Frontal/Rear Event</td>
</tr>
</tbody>
</table>

Longitudinal Crash Pulse (Most Recent Frontal/Rear Event, TRG 3 - table 1 of 2)
Max Longitudinal Delta V (MPH) | 39.1277 |

Longitudinal Crash Pulse (1st Prior Frontal/Rear Event, TRG 2 - table 1 of 2)
Max Longitudinal Delta V (MPH) | 22.0104 |

Longitudinal Crash Pulse (Prior Frontal/Rear Event, TRG 1 - table 1 of 2)
Max Longitudinal Delta V (MPH) | 53.1439 |
“WHO HIT WHOM FIRST?”

- The insured's pre-crash data gives us even more insight

<table>
<thead>
<tr>
<th>Pre-Crash Data, -5 to 0 seconds (Most Recent Frontal/Rear Event, TRG 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (sec)</td>
</tr>
<tr>
<td>Vehicle Speed [mph]</td>
</tr>
<tr>
<td>Brake Switch</td>
</tr>
<tr>
<td>Accelerator Pos</td>
</tr>
<tr>
<td>Engine RPM</td>
</tr>
<tr>
<td>Pre-Crash Data Status*</td>
</tr>
</tbody>
</table>

* "Invalid" may be set for NFI vehicle

- After eliminating the unrelated event, the insured's pre-crash data makes the sequence even more clear

**Front/Rear Event Record Summary at Retrieval**

- 3 events recorded:
  - Most Recent Frontal/Rear Event
  - 1st Prior Frontal/Rear Event
- Crash Type: Front/Rear
- Event & Crash Pulse Data:
  - Time (ms): 7.92
  - Speed: +22 mph

**Pre-Crash Data, -5 to 0 seconds**:<ref>Pre-Crash Data, -5 to 0 seconds (Most Recent Frontal/Rear Event, TRG 3)</ref>
“WHO HIT WHOM FIRST?”

- The insured's ISO records and EDR data clear up the sequence and the timing
  - The insured was rearended by the Ford first

- With a little work by a qualified crash reconstructionist, the Ford's impact speed is calculated to be about 34mph as the insured is moving behind slowed traffic at about 2-3mph
  - A little more work and we can find that, when the insured was hit, he was about 25ft behind the vehicle in front of him

CAR “BLACK BOXES”
- MYTHS, REALITIES & FRAUD FIGHTING

“THE BIGGER PILEUP”
5 CAR PILEUP
AND THE INSURED IS THE “#4” FORD

- Insured claims to have been stopped in heavy traffic and hit from behind, says he didn’t hit anyone else
  - #1 2014 Honda Accord
  - #2 2011 Toyota Sienna
  - #3 2015 Ford Mustang
  - **#4 2015 Ford Fusion**
  - #5 2012 Ram Cargo Van
  - All 5 vehicles are CDR Tool accessible
    - How might that impact the settlement posture?

5 CAR PILEUP
AND THE INSURED IS “#4”

- The only visible damage on the insured’s car is on the left rear but the #5 car (in front of the Fusion) says it was hit by the insured...was it?
5 CAR PILEUP
AND THE INSURED IS “#4”

- The data indicates only one recorded impact and a requirement for a minimum delta-V of 5mph needed to record an event

<table>
<thead>
<tr>
<th>System Status at Event (First Record)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete File Recorded (Yes/No)</td>
</tr>
<tr>
<td>Multi-Event, Number of Events</td>
</tr>
<tr>
<td>Time From Event 1 to 2 (msec)</td>
</tr>
<tr>
<td>Lifetime Operating Timer at Event Time Zero (sec)</td>
</tr>
<tr>
<td>Key-On Timer at Event Time Zero (sec)</td>
</tr>
<tr>
<td>Vehicle Voltage at Time Zero (V)</td>
</tr>
<tr>
<td>Energy Reserve Mode Entered During Event (Yes, No)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Deployment Data (First Record)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Delta-V, Longitudinal (MPH km/h)</td>
</tr>
<tr>
<td>Time, Maximum Delta-V Longitudinal (msec)</td>
</tr>
<tr>
<td>RCM, Side Driver (Lateral), Safing</td>
</tr>
<tr>
<td>RCM Side Passenger (Lateral), Safing</td>
</tr>
</tbody>
</table>

5 CAR PILEUP
AND THE INSURED IS “#4”

- The data shows a rear-to-front and left-to-right impact
  - But no front damage and no second event recorded
5 CAR PILEUP
AND THE INSURED IS “#4”

- The driver of the car ahead of the insured (car #5) claims the insured was moving forward and “may have hit me first”...but how does that correlate to the data from the insured Fusion?

If all of these cars had been downloaded and their EDR data compared, we would have a clearer, objective picture of...

- the actual order of events
- the speed of each car prior to and as a function of the crashes
- the severity of each impact as it might relate to injury potential

And even if we only had a couple more downloads and some basic reconstruction we would have a far better picture.
“EDR RULES” TO LIVE BY

- **EDR Rule #1**
  - The systems may not record data for a number of reasons BUT they *never record data* when the car’s been parked *with the key “off”*

- **EDR Rule #2**
  - There is *no “CDR” to download*; CDR is a Tool not a recorder

- **EDR Rule #3**
  - Although there is a NHTSA regulation in place, *that doesn’t mean there’s* a lot of actual *standardization*; data elements *vary by manufacturer*

**EDR RULE #4**

- In every case, claim, or investigation there’s going to be *one party who will like* and the *other party who will dislike* some potential evidentiary photo, estimate, report, or witness statement but that *does not mean you can simply ignore* potentially valuable and readily available EDR data

- If you don’t have the data, bet the other side will or will raise the issue that you could have preserved it and failed to.
FOR AN INVESTIGATOR TO USE EDR DATA...

- The investigator will have to determine if the vehicle might have **data recording potential**
- There has to be an **examination of the vehicle** (and sometimes the roadway)
- The EDR data has to be **retrieved and preserved**
  - And then **analyzed properly** in the **context of the crash at hand**

ARE YOU READY FOR “TOMORROW?”

- What we’ve talked about here is “today’s” technology
  - 49CFR563 doesn’t address **emerging future technologies**
- What about **self-driving cars**?
- What about **potential data from active safety systems**?
  - …autonomous braking systems?
  - …self-parking systems?
  - …collision avoidance systems?
  - …adaptive cruise control?
  - …pedestrian detection and pedestrian protection?