

***NHTSA Research
Public Meeting
November 2001***



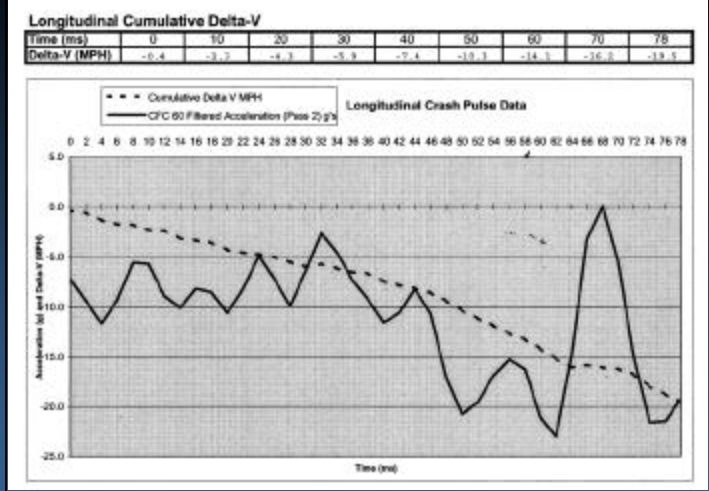
Event Data Recorders Update on Agency Activities





Major Activities

- **EDR WG**
- **T&B EDR WG**
- **Data Collection**
- **Web Site**
- **Round Robin Test**
- **Research**



EDR WG





NHTSA EDR WG

- **Strong industry participation**
- **Diverse membership**
- **Focused on light vehicles**

- **8 Objectives**
 1. Status of EDRs
 - OEM
 - Aftermarket
 2. Data elements
 3. Data retrieval
 4. Data collection and storage
 5. Permanent record
 6. Privacy and legal Issues
 7. Customers and users of EDR data
 8. Demonstration

- **Findings**
 - 26 findings
 - 3 major areas
 - Safety
 - Data Collection
 - Others



10 Findings From Executive Summary

1. EDRs have the potential to greatly improve highway safety
2. EDR technology has potential safety applications for all classes of motor vehicles
3. A wide range of crash related and other data elements have been identified
4. NHTSA has incorporated EDR data collection in its databases
5. Open access to EDR data (minus personal identifiers) will benefit researchers, crash investigators, and manufacturers in improving safety on the highways
6. Studies of EDRs in Europe and the U.S. have shown that driver and employee awareness of an onboard EDR reduces the number and severity of crashes
7. Given the differing nature of lightweight vehicles, compared to heavy vehicles, different EDR systems may be required to meet the needs of each vehicle class
8. The degree of benefit from EDRs is directly related to the number of vehicles operating with an EDR and the infrastructure's ability to use these data
9. Automatic crash notification (ACN) systems integrate the on-board crash sensing and EDR technology
10. Many systems utilize proprietary technology



NHTSA EDR WG

- **EDR WG completed final report August 2001**
 - Available on NHTSA-NRD web site under Crashworthiness Research
 - <http://www-nrd.nhtsa.dot.gov/>

- **EDR Docket NHTSA-1999-5218**



Truck and Bus EDR WG



- **Major Topics**
 - Data elements
 - Survivability
 - Event description

- **NTSB Related**
 - Recommendations
 - H-99-53
 - H-99-54

- **T&B EDR Docket NHTSA-2000-7699**

Representation

- **Truck users**
- **Motorcoach**
- **School bus manufacturers**
- **Truck manufacturer**
- **EDR user**
- **EDR manufacturer**
- **University**
- **Government**

Data Elements

- **26 Data Elements**
- **Grouped into 3 priorities**
 - 1
 - 2
 - Optional

Priority 1

- **Acceleration, X (Longitudinal)**
- **Acceleration, Y (Lateral)**
- **Acceleration, Z (Vertical)**
- **Accelerator Pedal Position**
- **Antilock Brake System Status (ABS)**
- **Automatic Transmission Gear Selection**
- **Belt Status (driver)**
- **Brake Status (Service Pedal, Emergency, Trailer)**
- **Engine RPM**
- **Identification**
- **Time/Date**
- **Vehicle Speed**
- **Wheel Speeds**

Priority 2

- **Air bag deploy time**
- **Air Bag Lamp Status**
- **Air Bag Status**
- **Battery voltage**
- **Cruise Control (and Auto Distance)**
- **Heading**
- **Lamp Status**
- **Retarder System Status**
- **School Bus Warning Lamp Status**
- **Steering Wheel Angle**
- **Traction Control**
- **Turn Signal/Hazard Operation**
- **Windshield Wiper Status**



Priority - Optional

- **Digital Imaging**
- **Vehicle Load**

Survivability Elements

- **Location**
- **Impact/shock**
- **Fire**
- **Immersion**
- **Temperature**
- **Penetration**
- **Crush**



NTSB Recommendation H-99-54

- **Parameters to be recorded**
- **Data sampling rates**
- **Duration of recording**
- **Interface configurations**
- **Data storage format**
- **Incorporation of fleet management tools**
- **Fluid immersion survivability**
- **Impact shock survivability**
- **Crush and penetration survivability**
- **Fire survivability**
- **Independent power supply**
- **Accommodate future requirements and technological advances**

WG's Findings on Survivability

- 1. Research may be needed to verify all the following requirements**
 - . Cost must be considered
 - . Review NHTSA large truck crash causation study to fine tune requirements
- 2. Location is the key to survivability**
 - . May vary by application/type of vehicle
- 3. Impact shock**
 - . 300 g, 50 milliseconds

WG's Findings on Survivability

4. Temperature

- -40 degrees C for 8 hours

5. Immersion

- Shallow immersion is the major concern for highway vehicles
- No immersion requirement

6. Fluid immersion

- Various vehicle fluids for 8 hours
 - Salt water
 - Water
 - Fuel
 - Oil

WG's Findings on Survivability

7. Penetration

- 200 lb. dropped from 3 ft. with a ½ -inch-diameter contact point

8. Crush

- Mounting location to minimize crush potential
- 500 pounds

9. Fire

- Considered low priority by the WG
- No requirements recommended

WG's Findings on Survivability

10. Independent power supply

- Eliminate need for vehicle electrical system to remain intact during crash
- Should have sufficient power reserve to record data
- Possibly 1 minute of reserve

11. Survivability of stored data

- Data should be stored in such a way so it will be maintained without external power for 30 days

Event Description

- **School Bus, Motorcoach, and Truck Requirements**
 - Events are different than light vehicles
 - May involve lower acceleration and change in velocity levels
 - Front and rear of vehicles may not react the same in a side crash
 - Combination vehicles (tractor/trailers) might require EDR on each vehicle, which would trigger
 - Significant event for the vehicle being equipped with EDR should trigger

Event Findings

- **Should be acceleration based (2-4 g's)**
- **Should account for frontal and side crashes**
- **May require different thresholds for forward, side, and vertical accelerations**



EDR-Related Data Collection at NHTSA



EDR Data Collection

Data Collection Forms

The image displays a series of overlapping windows from a software application, each titled "Vehicle Exterior Form, Case [Case Number] Vehicle #1". The windows are arranged in a descending staircase pattern from top-left to bottom-right. Each window contains a form with various fields and checkboxes. Visible fields include "Make", "Model", "Year", "Color", "Engine", "Transmission", "Drive Type", "Fuel System", "Brake System", "Steering System", "Suspension System", "Exhaust System", "Lighting System", "Wipers", "Mirrors", "Tires", "Rim", "Hood", "Roof", "Trunk", "Bumper", "Fender", "Door", "Window", "Glass", "Paint", "Interior", "Exterior", "Damage", "Notes", "Comments", "Date", "Time", "Location", "Officer", "Agency", "Case Number", "Vehicle ID", "VIN", "Plate Number", "Color", "Make", "Model", "Year", "Engine", "Transmission", "Drive Type", "Fuel System", "Brake System", "Steering System", "Suspension System", "Exhaust System", "Lighting System", "Wipers", "Mirrors", "Tires", "Rim", "Hood", "Roof", "Trunk", "Bumper", "Fender", "Door", "Window", "Glass", "Paint", "Interior", "Exterior", "Damage", "Notes", "Comments", "Date", "Time", "Location", "Officer", "Agency", "Case Number", "Vehicle ID", "VIN", "Plate Number".



Field Data Collection

- **EDCS – Electronic Data Collection System**
- **NHTSA currently collects EDR crash data in three major vehicle crash programs:**
 - NASS-CDS – A national statistically sampled data base, currently collecting data on about 4,000 crashes each year at 24 locations around the U.S.
 - SCI – A collection of targeted crash investigations looking at emerging safety issues
 - CIREN – A system of crash investigations conducted at hospitals, collecting about 400 cases per year.

EDCS EDR Tab

Vehicle Exterior Form, Case 2001-9-045K/ Vehicle #1

Vehicle | Damage | Specifications | Fuel | Fire | Crush | CDC | **EDR** | Sketches | Log | Review

EDR | Pre Crash | Crash | Times

Is EDR Information scanned into the case: Right Mouse Button, Alt and Shift Key to reveal test EDR forms

Identifiers


| | | | |
|----------------|----------------------|-----------------|----------------------|
| File Name | <input type="text"/> | Ignition Cycle | |
| EDR Version | <input type="text"/> | Event | <input type="text"/> |
| Report Version | <input type="text"/> | Investigation | <input type="text"/> |
| Deploy Status | <input type="text"/> | SIR Lamp Status | <input type="text"/> |

Driver

| | | | |
|------|----------------------|---------------|----------------------|
| Belt | <input type="text"/> | Weight Switch | <input type="text"/> |
| Seat | <input type="text"/> | | |

Passenger

| | | | |
|--------------------|----------------------|---------------|----------------------|
| Suppression Switch | <input type="text"/> | Weight Switch | <input type="text"/> |
| Belt | <input type="text"/> | | |
| Seat | <input type="text"/> | | |

 Close



Pre-Crash Tab Data Sub Tab

Vehicle Exterior Form, Case 2001-9-045K/ Vehicle #1

Vehicle | Damage | Specifications | Fuel | Fire | Crush | CDC | EDR | Sketches | Log | Review

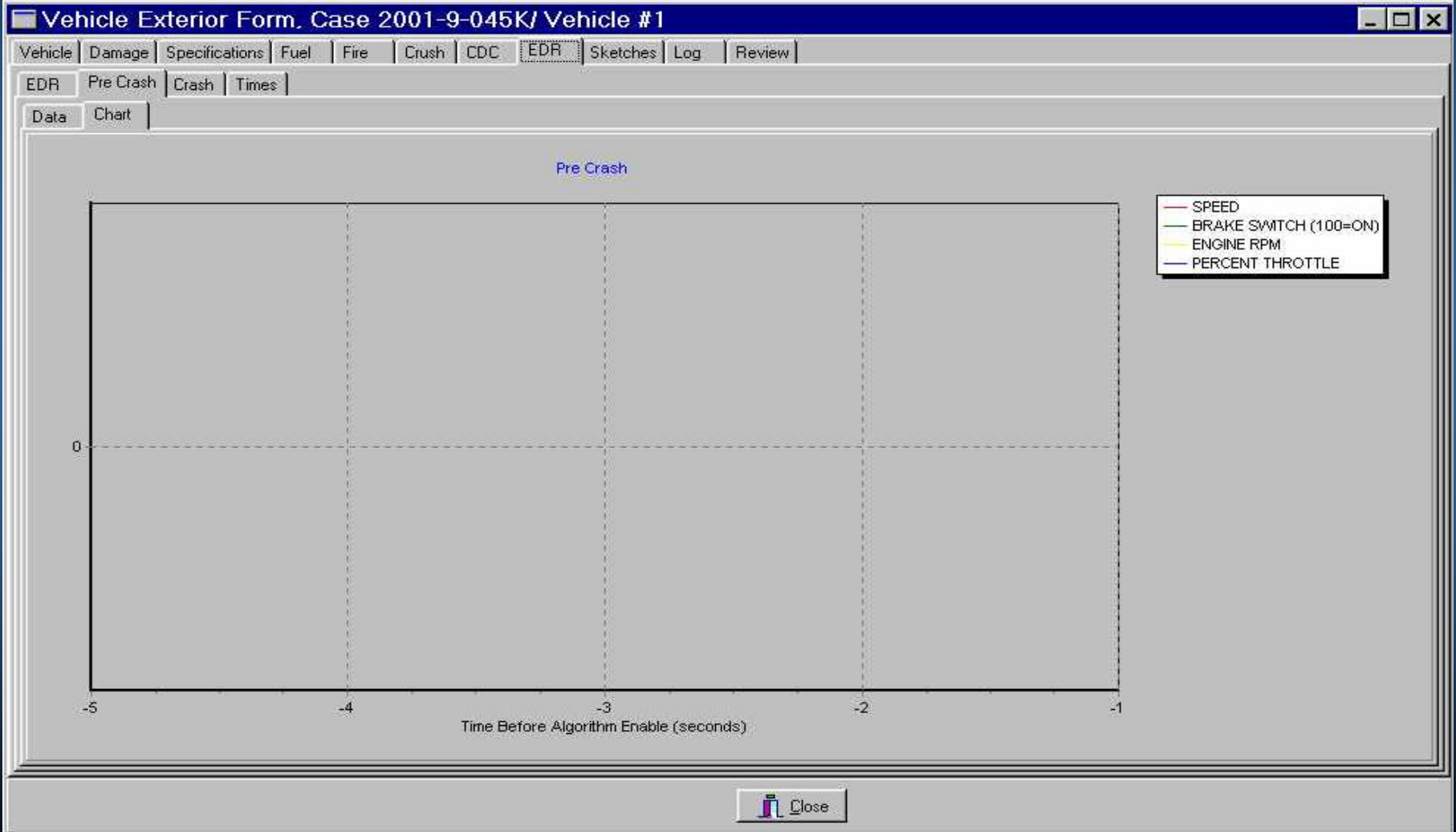
EDR | Pre Crash | Crash | Times

Data | Chart

| Pre-Seconds | Speed (MPH) | Engine Speed (RPM) | Throttle % | Brake Switch Circuit Status |
|-------------|-------------|--------------------|------------|-----------------------------|
| -5 | | | | |
| -4 | | | | |
| -3 | | | | |
| -2 | | | | |
| * -1 | | | | |

Close

Pre-Crash Tab Chart Sub Tab





Crash Tab Data Sub Tab/Tot DV

Vehicle Exterior Form, Case 2001-9-045K/ Vehicle #1

Vehicle | Damage | Specifications | Fuel | Fire | Crush | CDC | EDR | Sketches | Log | Review

EDR | Pre Crash | Crash | Times

Data | Chart

Total Delta V | Longitudinal Delta V | Lateral Delta V

| Milliseconds after Crash | Velocity Change (MPH) |
|--------------------------|-----------------------|
| * | 10 |

Close



Crash Tab Data Sub Tab/Lat DV

Vehicle Exterior Form, Case 2001-9-045K/ Vehicle #1

Vehicle | Damage | Specifications | Fuel | Fire | Crush | CDC | **EDR** | Sketches | Log | Review

EDR | Pre Crash | Crash | Times

Data | Chart

Total Delta V | Longitudinal Delta V | Lateral Delta V

| Time (ms) | Delta-V (MPH) |
|-----------|---------------|
| * | 10 |

Close



Crash Tab Data Sub Tab/Long DV

Vehicle Exterior Form, Case 2001-9-045K/ Vehicle #1

Vehicle | Damage | Specifications | Fuel | Fire | Crush | CDC | EDR | Sketches | Log | Review

EDR | Pre-Crash | Crash | Times

Data | Chart

Total Delta V | Longitudinal Delta V | Lateral Delta V

| Milliseconds after Crash | Velocity Change (MPH) |
|--------------------------|-----------------------|
| * | 10 |

Close



EDCS EDR Tab Times Sub Tab

Vehicle Exterior Form, Case 2001-9-045K/ Vehicle #1

Vehicle | Damage | Specifications | Fuel | Fire | Crush | CDC | EDR | Sketches | Log | Review

EDR | Pre Crash | Crash | Times

Side Sating Decision

| Description | Time |
|-------------|------|
| | |

Algorithm

| Description | Time (ms) |
|-------------|-----------|
| | |

Initiation

| Description | Driver | Passenger |
|-------------|--------|-----------|
| | | |

Close

Field Data Collection

| | |
|-----------------------|------------|
| ■ NASS | 217 |
| ■ SCI | 56 |
| ■ <u>CIREN</u> | 8 |
| ■ Total | 281 |

Event Data Recorder (EDR) Applications
for Highway and Traffic Safety



EDR Web Site



Photo by: Frank Staples

*EDRs Offer More Opportunities
to Enhance Safety.*



Home Page

- <http://www-nrd.nhtsa.dot.gov/edr-site/index.html>

OR

- <http://www.nhtsa.dot.gov>
 - Click on R&D
 - Click on Crashworthiness
- **Abstracts presented for all articles/research/patents/etc.**
- **Full documents can be viewed using Adobe viewer**

History Page

- **Event Data Recorder (EDR) Research History**
- **Brief overview of EDRs**
- **Includes mention of EDR working groups**

Using EDR Data

- The Use of EDR SAFETY Data
 - Provides list of uses
 - Provided a list of potential users

Research Page

- EDR Products, Research and Articles
- Includes general list of sources
- Provides over 50 articles on EDRs

Patent Page

- **Patents and Intellectual Property Articles**
- **Includes many EDR related patents**
- **About 15 items presented**

EDR Notes

- Notes from EDR Meetings
 - **EDR working group**
 - **T&B EDR working group**
 - **Same as presented on DMS**

News Articles

- Articles from the Media
- **Over 30 news articles**



Reference Material

- **Bibliography and Research Resources**
- **Compiled by: Professor T. Kowalick,
Sandhills Community College,
Pinehurst, North Carolina**
- **Reviewed by: Mary Ellen Tucker
The University of North Carolina at Chapel Hill
Highway Safety Research Center (NCHSRC)**
- **Over 300 titles**

Other Materials

- **Related Articles**
- **Somewhat related to EDRs**

Input

- **Corrections, comments, additions, etc.**
- **Contact the EDR webmaster at:
EDR.webmaster@nhtsa.dot.gov**

***Performance of Selected
Event Data Recorders***

Test Program

- **Compare the performance of selected EDRs**
- **Crash environment - severe impact condition**
- **30 mph**
- **Flat barrier**
- **2001 Ford F150 extended cab**
- **August 22, 2001**

Test Setup

- **EDRs installed on an aluminum plate attached to bed of truck**
- **Instrumentation**
 - IWI
 - SIS/MacBox/Ga Tech.
 - DriveCam
 - Endevco 7460 accelerometers (baseline)
- **SAE J211 Filter Class 60**

- **Collects accelerations data**
- **3 axis**
- **Uses SAE J-211 protocols for data collection**
- **Unit tested incorporated new prototype software (B6)**
- **Collects time of crash**

<http://www.iwiwitness.com/>

SIS/MacBox - GT

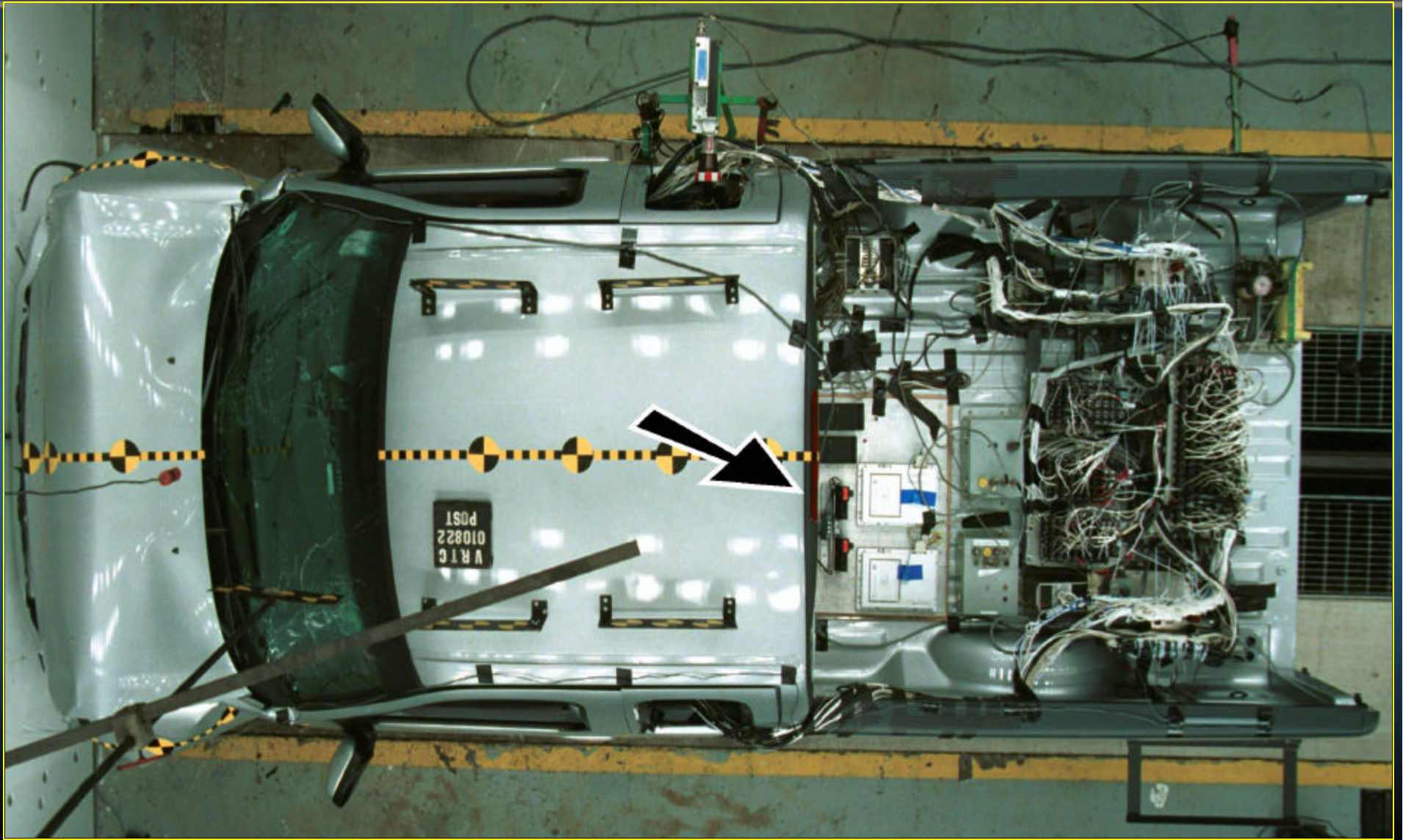
- **Collects accelerations data**
 - **3 axis (50 G), 2 axis (8 G)**
 - **Oversample 2400/sec, Record 300/sec**
 - **2 Prototypes tested, one with accelerometer algorithm, one continuous**
 - **GPS, seatbelt, brake, OBD**
 - **Download via digital cellular link**
 - **Expandable to include video**
- SIS - <http://www.safetyintelligence.com/digital.htm>**

Drive Cam

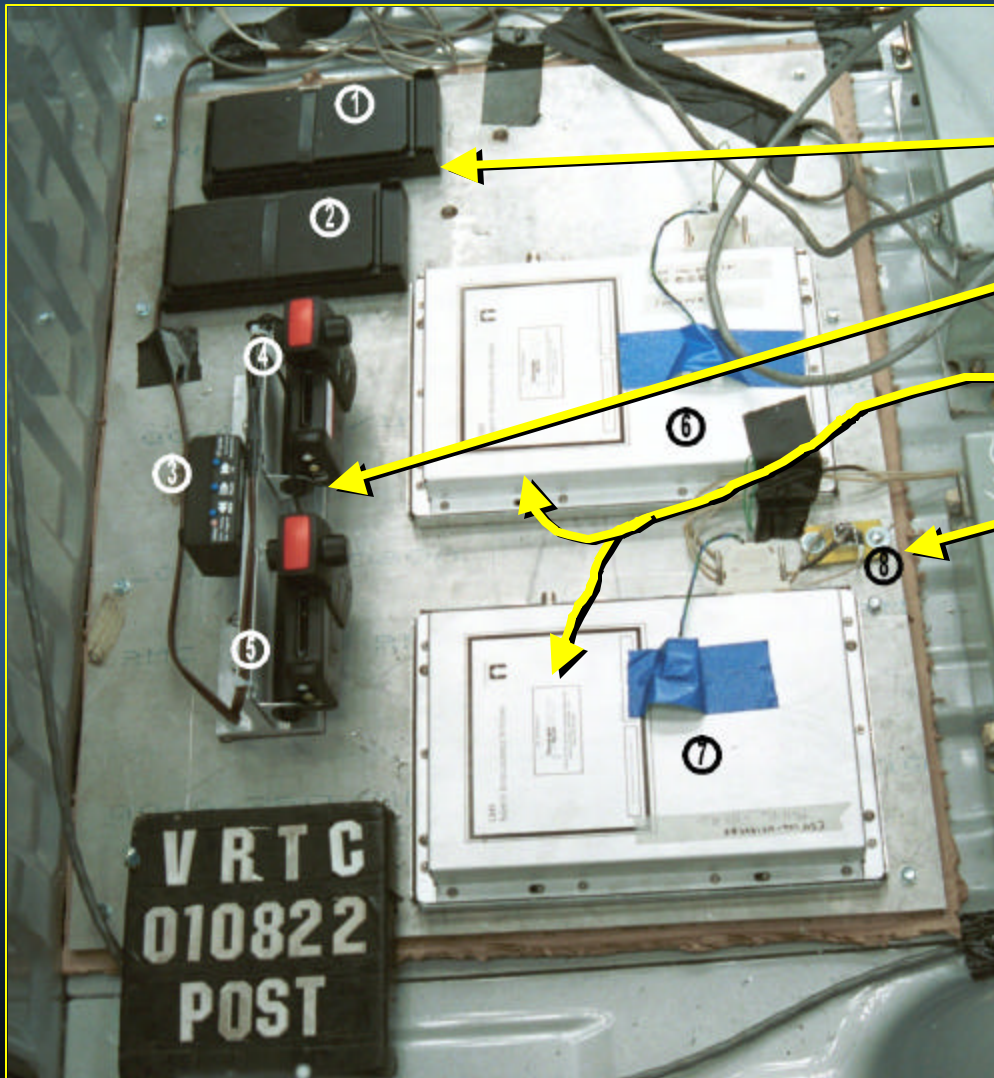
- **Collects video data**
- **Collects accelerations data**
 - 2 axis
- **Collects Audio Data**
- **Unit tested was a beta version of a new system**

<http://www.drivecam.com/>

Test Vehicle



EDR Mounting



1 & 2 - IWI

3, 4 & 5 - Drivecam

6 & 7 - G.Tech.

8 - Endevco 7460
accelerometers

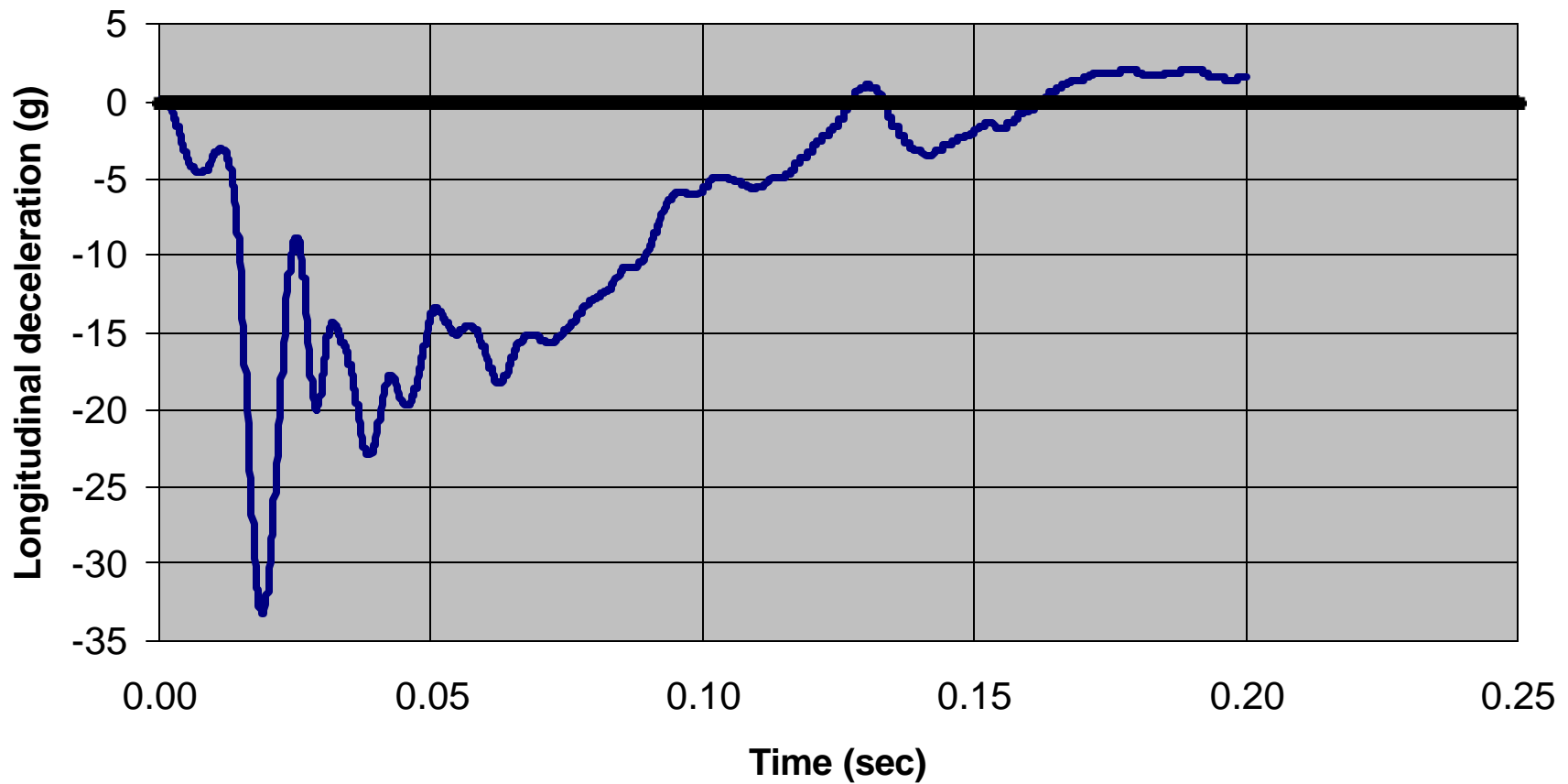
Frame Number : 0000



Frame Number : -0030

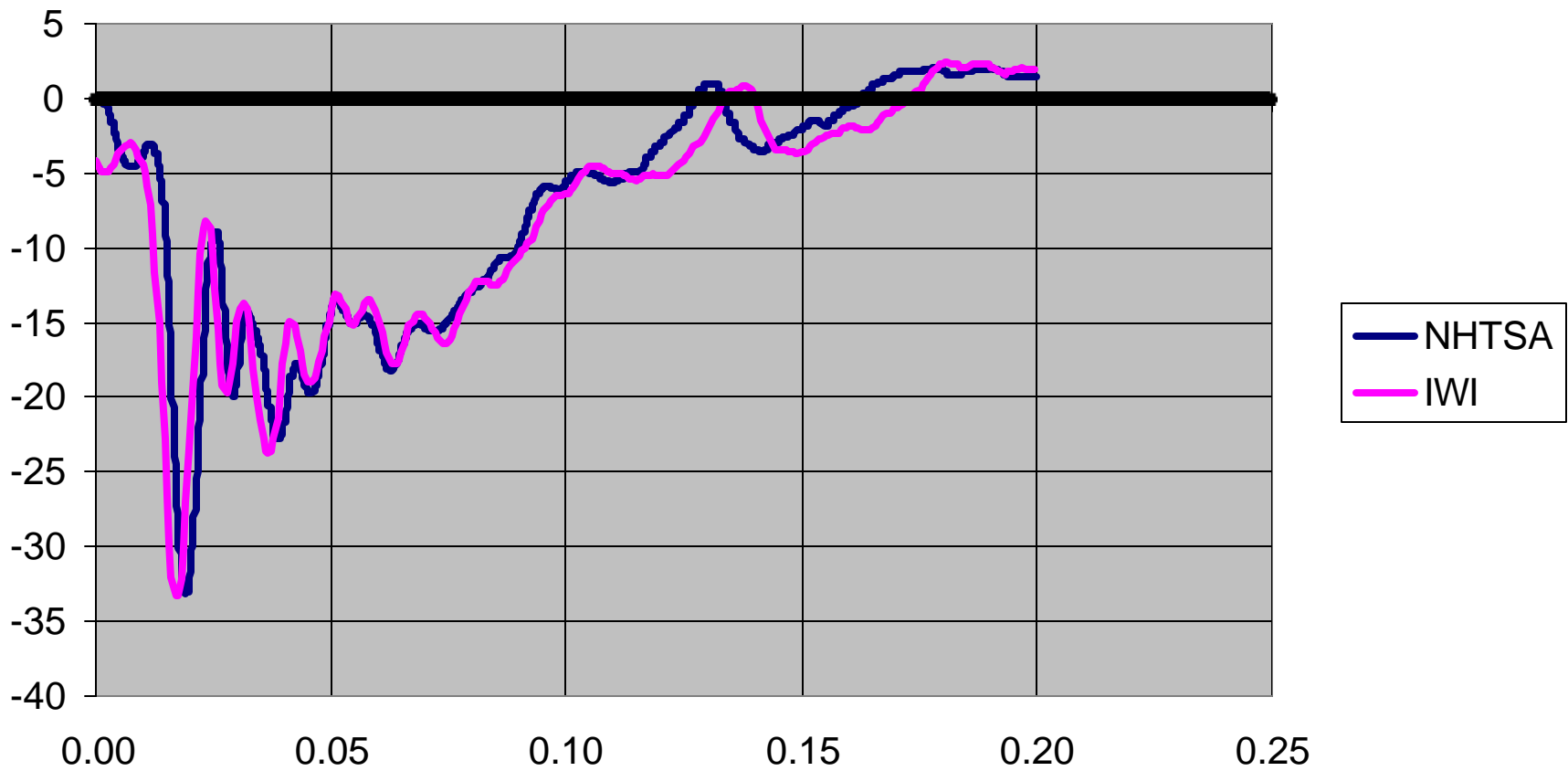


Crash Pulse on Truck Bed Plate

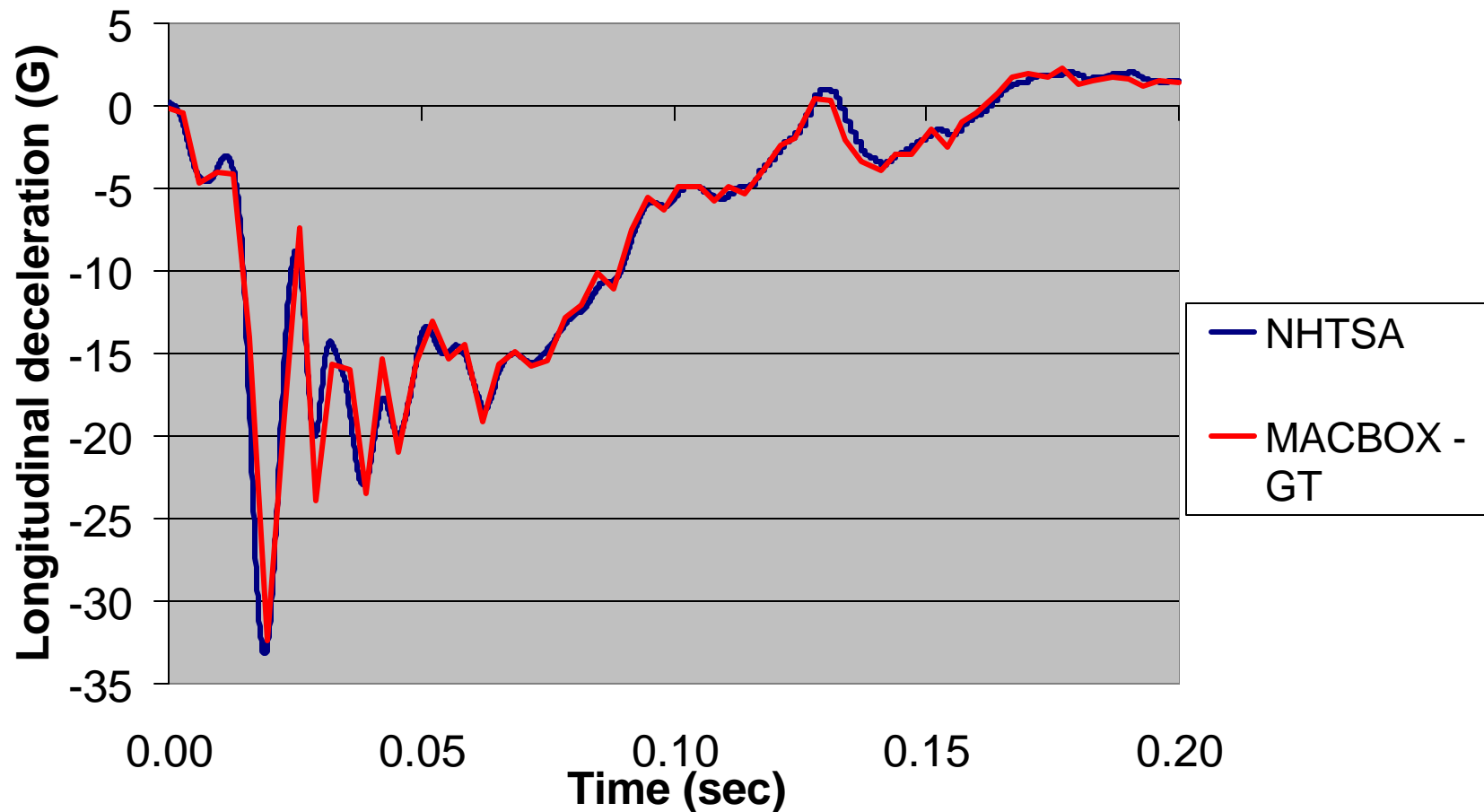




IWI & NHTSA



SIS/MacBox & NHTSA



Drive Cam Video

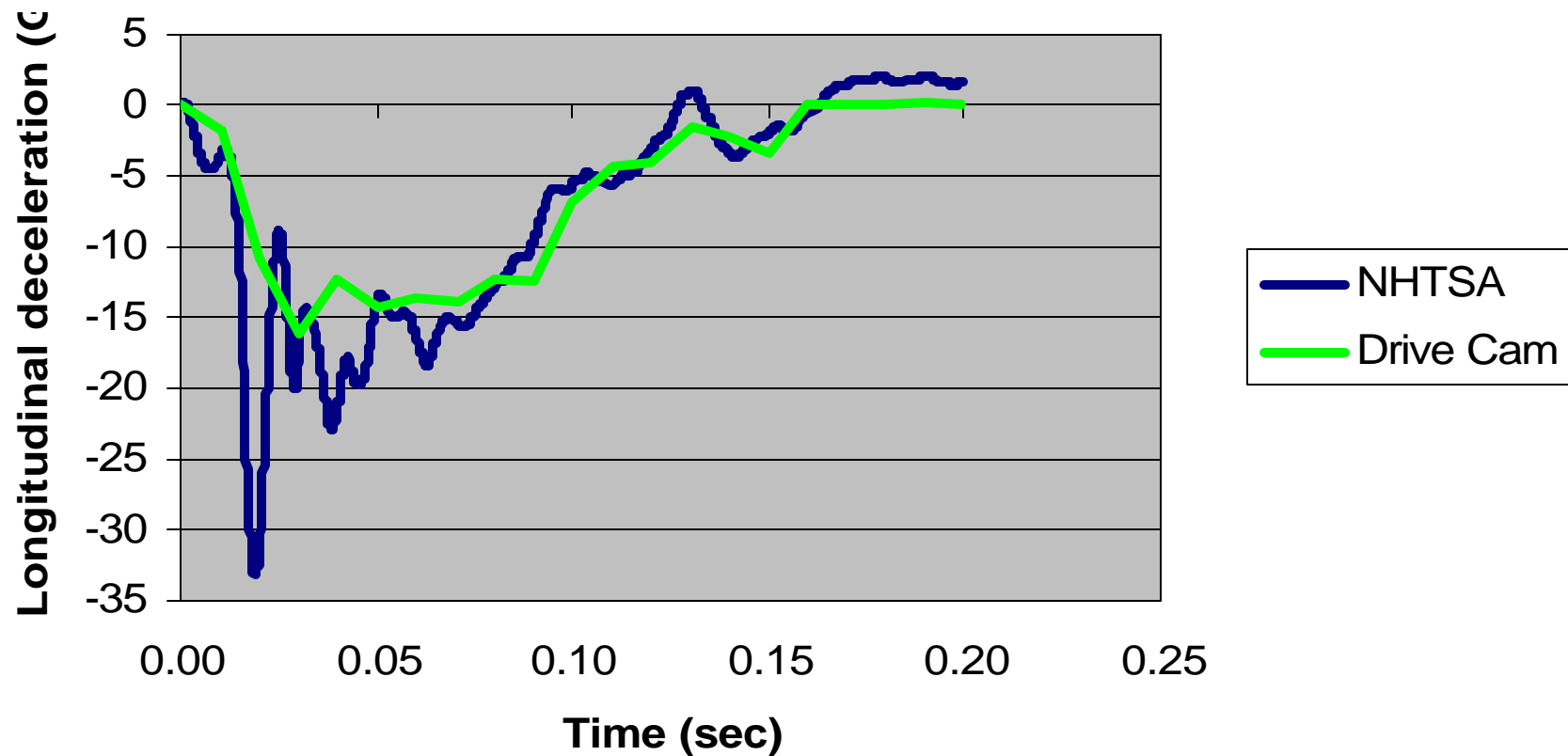


F: +0.15

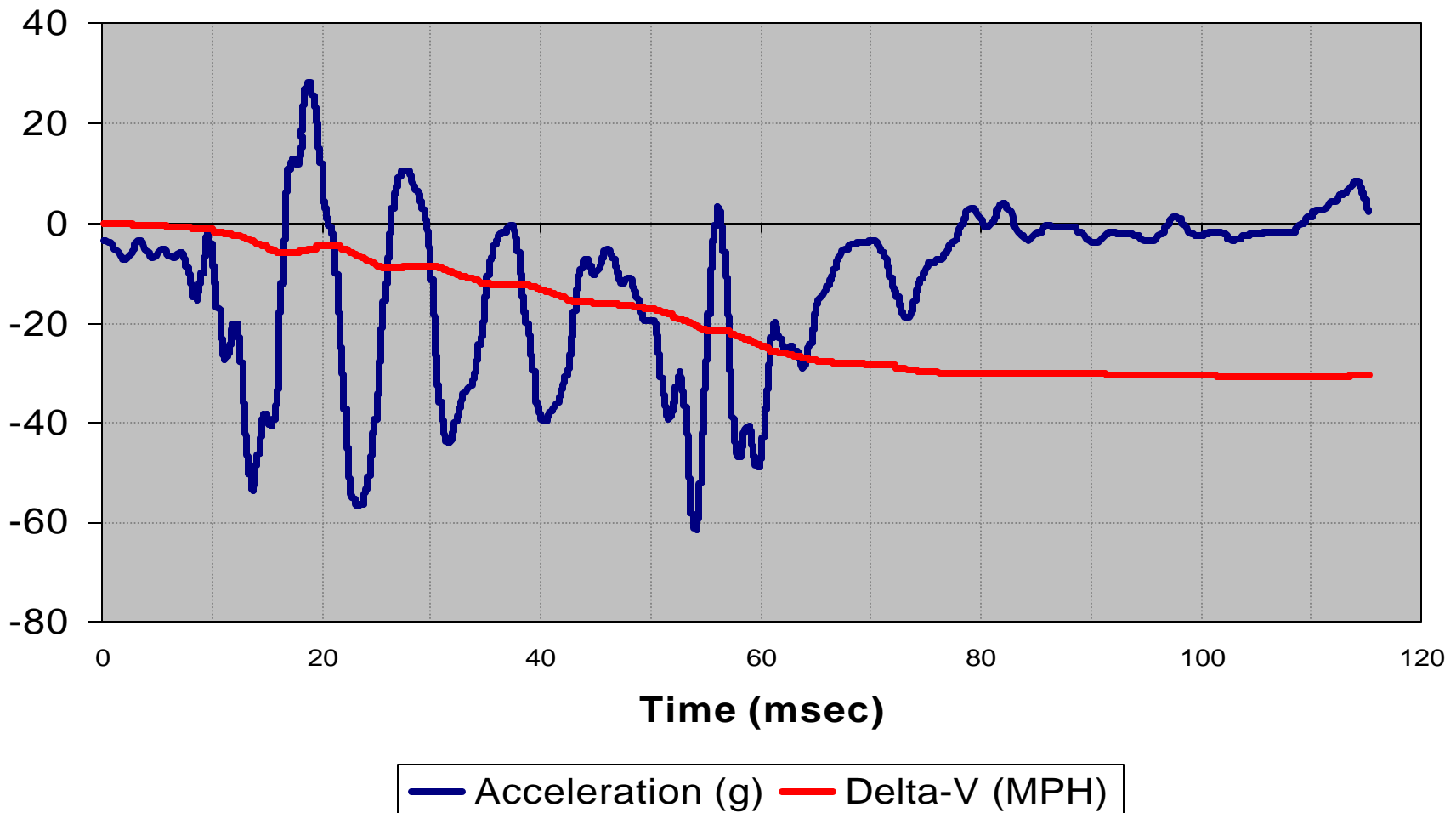
TIME - 10.00

L: - 0.09

Drive Cam & NHTSA



Ford EDR





Rulemaking

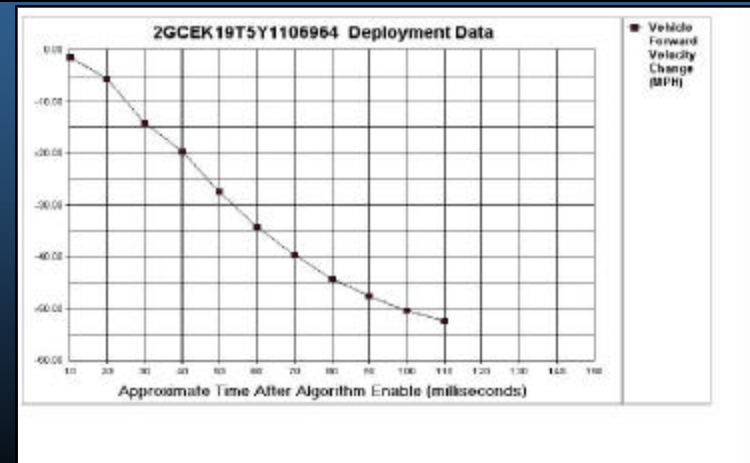
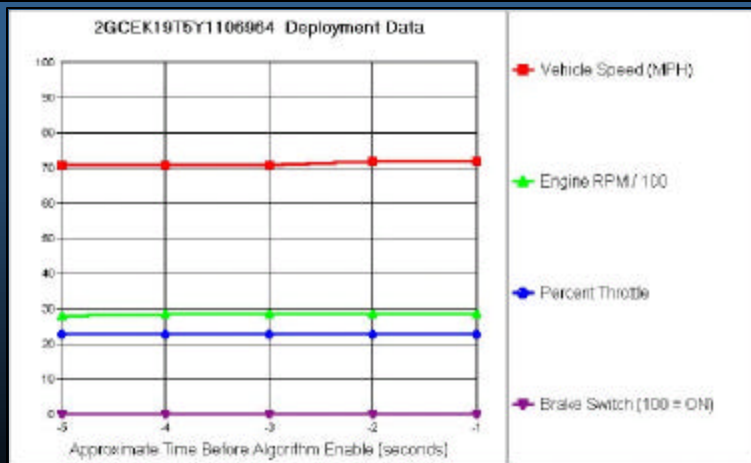


Petitions

- **Three petitions requesting NHTSA to require EDRs**
- **Two denied**
 - Agency agreed that these devices could improve safety
 - Industry moving forward
 - NHTSA WG activities looking at related issues
 - **Federal Register**
 - Price T. Bingham - 63 FR 60270 (Nov. 9, 1998)
 - Marie E. Birnbaum - 64 FR 29616 (June 2, 1999)
- **One New**
 - Mandate collection and storage of onboard data
 - Use a standardized format
 - Safety Intelligence Systems (no docket - in process)



EDR Research





Adv Occ Protection Special Study

- **NHTSA SCI Program**
- **Targeted crashes involving Advanced Occupant Protection systems along with Crash Data Recording Devices**
- **56 cases documented including EDR downloads available in final reports**
- **Case summary is reported quarterly on the web @ www.nhtsa.dot.gov/people/nsca/sci.**

- **Engineering analysis of EDR data**
 - Exploring the feasibility of using the NHTSA EDR database to evaluate current airbag triggering algorithms
 - Evaluate real-world airbag firing thresholds as a function of Delta $-V$ as computed from the current NHTSA collection of EDR crash pulses
 - Characterization of the EDR database cases by impact type, collision partner, Delta V and occupant injury outcome

- **New start to look at EDRs in relation to highway application**
- **Contract start – early 2002**

Future Projects

- **Traffic Safety Programs**
 - Law enforcement certification program
 - Development of training curriculum
 - Development of certification process



Questions?

