SAE Government and Industry Meeting

Frontal Crash Protection

Real World Experience with Event Data Recorders

May 14, 2001

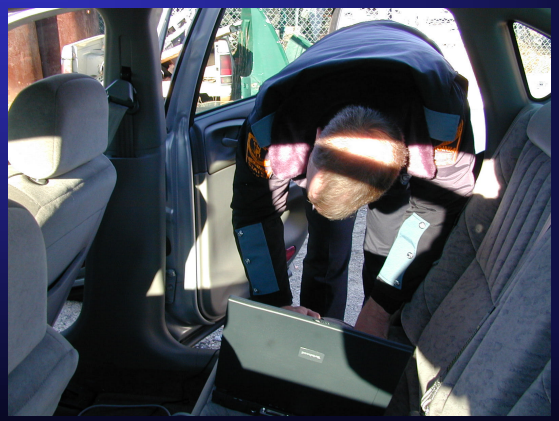
Augustus "Chip" Chidester
John A. Hinch
National Highway Traffic Safety Administration

NHTSA
People Saving People
http://www.nhtsa.dot.gov

Event Data Recording Topics

NHTSA
People Saving People
http://www.nhtsa.dot.gov

- EDR Working Group
- EDR Field Data Collection
- Future EDR Programs at NHTSA



EDR Working Group

NHTSA
People Saving People
http://www.nhtsa.dot.gov

- In early 1998, the Motor Vehicle Safety Research Advisory Committee (MVSRAC) Crashworthiness Subcommittee organized a working group to study EDRs.
- The main objective of the Working Group was to facilitate the collection and utilization of collision avoidance and crashworthiness data from on-board Event Data Recorders.

EDR Working Group

People Saving People
http://www.nhtsa.dot.gov

- To facilitate achieving this objective, the WG developed a set of sub-objectives, which include:
  - 1) status of EDR technology;
  - 2) data elements;
  - 3) data retrieval;
  - 4) data collection and storage;
  - 5) permanent record;
  - 6) privacy and legal issues;
  - 7) customers and uses of EDR data; and
  - 8) demonstration of EDR technology.

EDR Working Group

NHTSA
People Saving People
http://www.nhtsa.dot.gov

- The working group has met routinely, about three times per year, through the end of 2000.
- The working group is currently documenting their findings in a technical report that will be published in 2001.
  - All materials provided to the working group, along with the final approved minutes from each meeting, were placed in the Department of Transportation's Document Management System (DMS), docket NHTSA-99-5218.
  - These dockets are viewable and printable from the DMS, which can be located using an Internet browser at **http://dms.dot.gov**. (Search for docket 5218.)

EDR Program at NHTSA:
Field data collection

People Saving People
http://www.nhtsa.dot.gov

- 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, and;
  - CIREN – A system of crash investigations conducted at hospitals, collecting about 400 cases per year.

EDR Program at NHTSA:
Field data collection

People Saving People
http://www.nhtsa.dot.gov

EDR Download Success by Manufacturer, Crash Program, and Downloading Agency

Program	GM (read by NHTSA/EISS)		FORD		Totals	
	Att.	Comp.	Att.	Comp.	Att	Comp.
SCI	7[18]	7[18]	28	28	53	53
NASS	41[1]	34[1]	6	5	48	41
Totals	48[19]	41[19]	34	33	101	94

EDR Program at NHTSA:
Field data collection

NHTSA
People Saving People
http://www.nhtsa.dot.gov

Methodology:

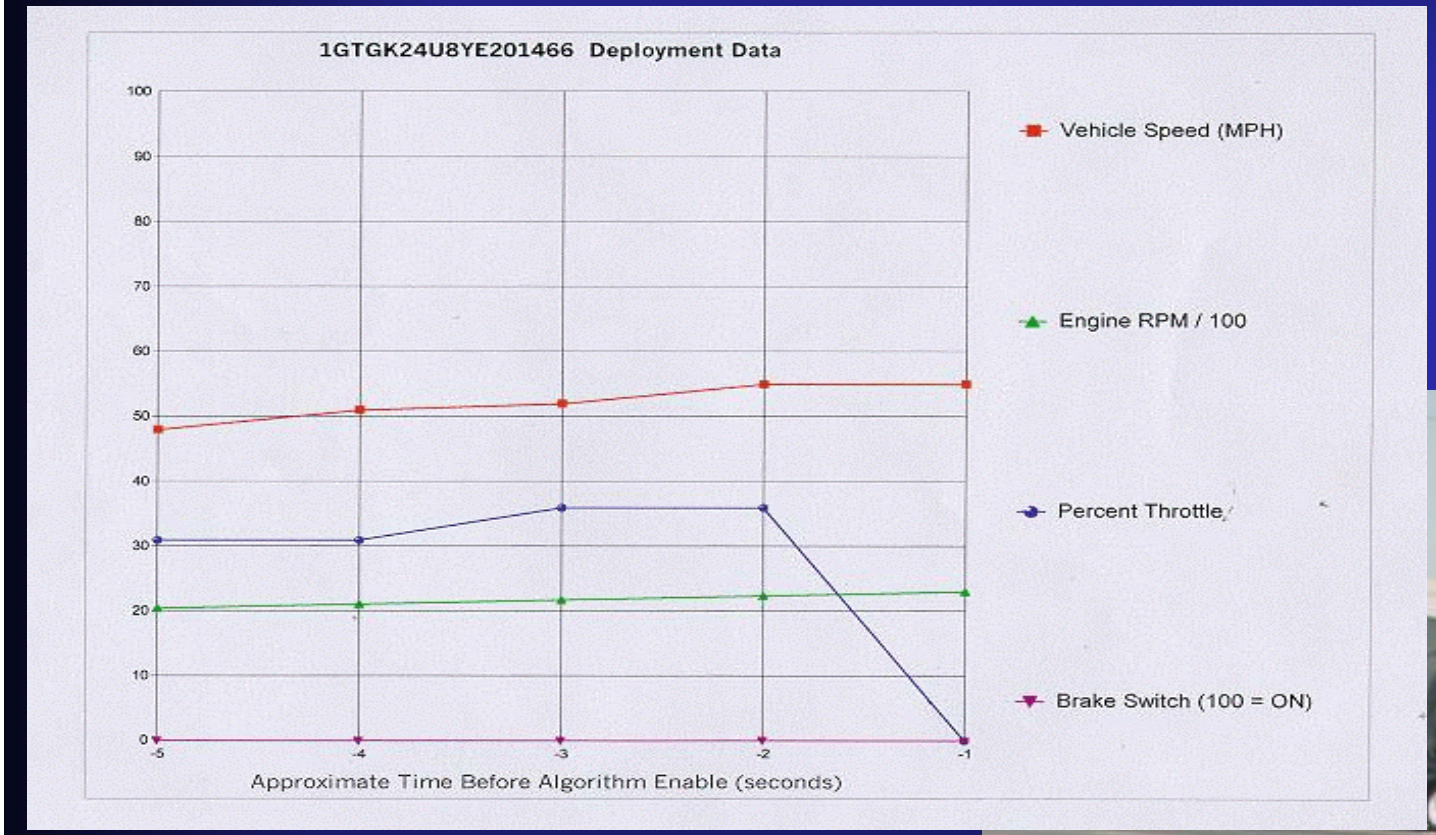
GM:

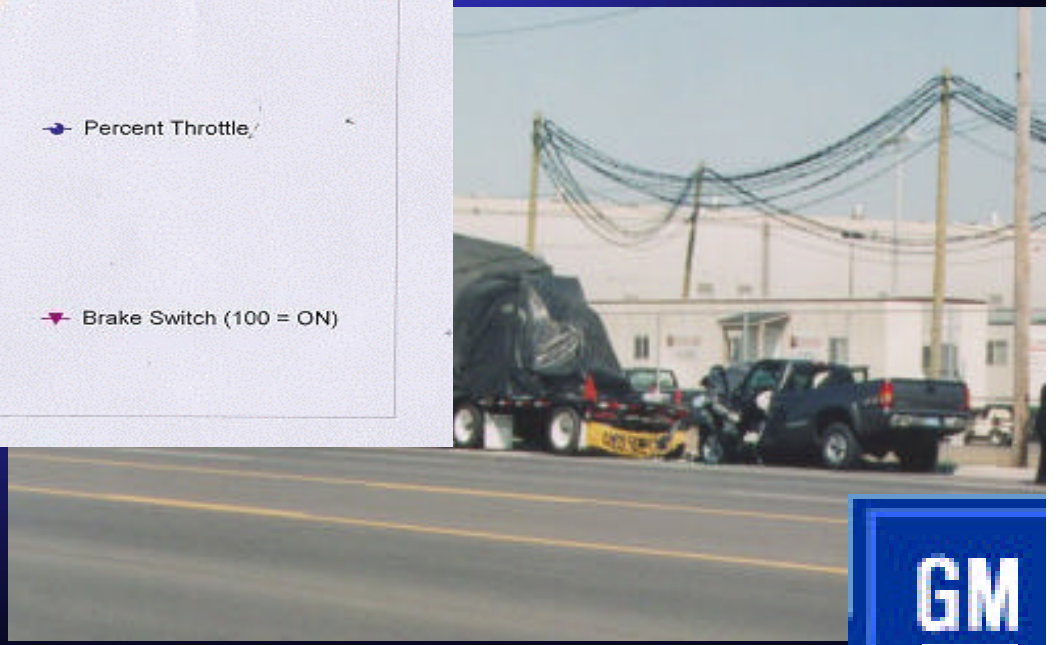
- Sensing and Diagnostic Module (SDM):
  - **Primary function is to control the deployment of the occupant protection systems.**
- This system records a longitudinal acceleration.
- Data related to the driver and passenger air bag deployment including:
  - **5 seconds of pre-crash data**
    - vehicle speed, engine RPM, engine throttle opening, and brake application
  - **Up to 300 milliseconds of crash pulse**
  - **Driver Seat belt use**

GM

EDR Program at NHTSA:
Field data collection

NHTSA
People Saving People
http://www.nhtsa.dot.gov





GM

EDR Program at NHTSA:
Field data collection

NHTSA
People Saving People
http://www.nhtsa.dot.gov

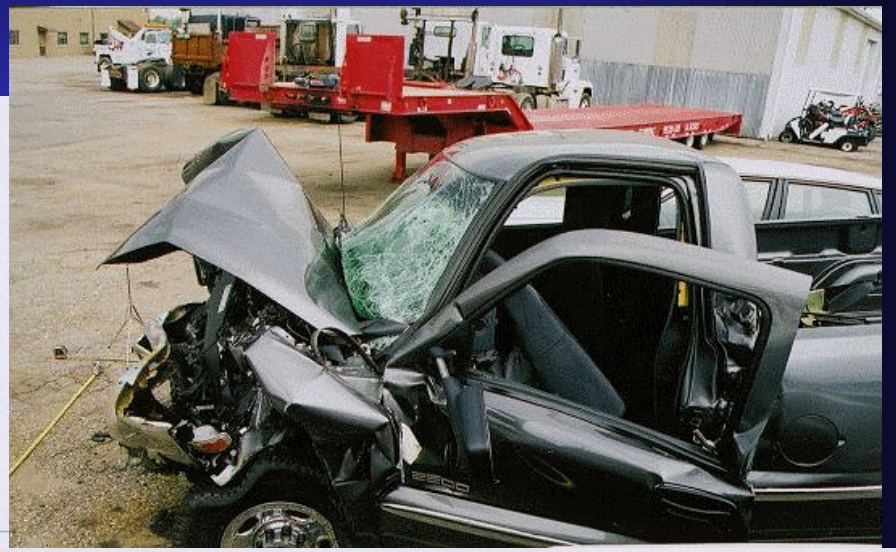
1GTGK24U8YE201466 System Status At Deployment	
Warning Lamp Status	OFF
's Belt	BUCKLED
enger Front-Air Bag	OFF
n Cycles At Deployment	1022

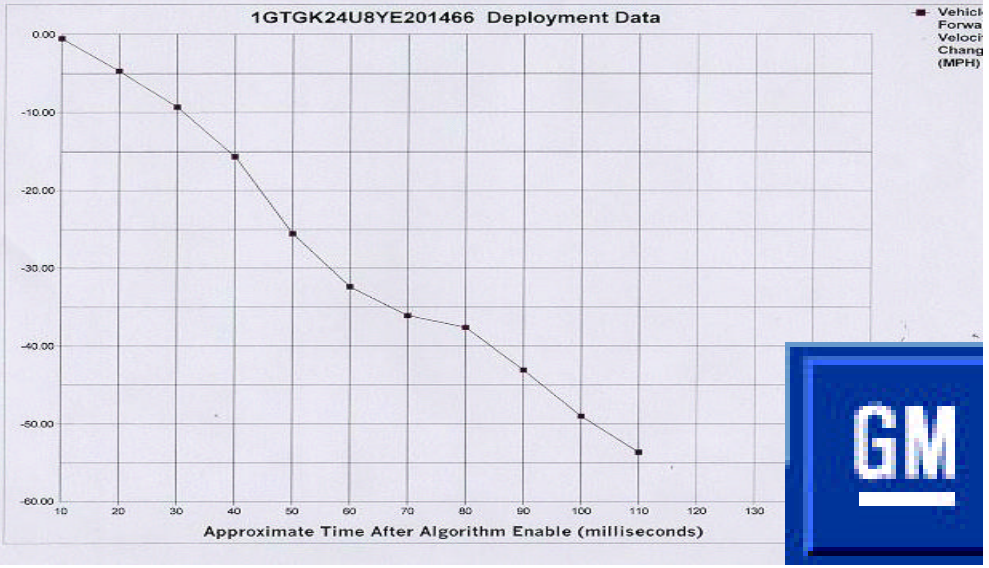
PRE-CRASH DATA	Electronic Data Validity Check Status = VALID			
nds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle	Brake Switch Status
	48	2048	31	OFF
	51	2112	31	OFF
	52	2176	36	OFF
	55	2240	36	OFF
	55	2304	0	OFF

DEPLOYMENT DATA

conds After AE	10	20	30	40	50	60	70	80	90	100	110
ty Change (MPH)	-0.50	-4.67	-9.28	-15.65	-25.52	-32.32	-36.05	-37.59	-43.07	-49.00	-53.61

Between Deployment and Near Deployment Events (msec)	N/A





GM

EDR Program at NHTSA:
Field data collection

People Saving People
http://www.nhtsa.dot.gov

Methodology:

- Ford:
  - Restraint Control Module (RCM)
    - **Primary function is to control the deployment of the occupant protection systems.**
  - This system records longitudinal and lateral acceleration.
  - Data related to the driver and passenger air bag deployment including:
    - **80 milliseconds of crash pulse**
    - **Deployment strategy of the dual-stage air bag system**
    - **Seat belt use**
    - **Pre-tensioner operation**
    - **Driver seat position**

EDR Program at NHTSA:
Field data collection

NHTSA
People Saving People
http://www.nhtsa.dot.gov

EDR Control Module Data

Data Validity Check:	Valid	EDR Model Version:	141
Left (Driver) Side Bag Deployment Time (ms):			Not Deployed
Right (Passenger) Side Bag Deployment Time (ms):			Not Deployed
Passenger Airbag Switch Position During Event:			N/A
Diagnostic Codes Active When Event Occurred:			0

Algorithm Times

Actual initiation depends on restraint system status (below).

	ms
Time From Algorithm Wakeup to Pretensioner:	8
Time From Algorithm Wakeup to First Stage - Unbelted:	10
Time From Algorithm Wakeup to First Stage - Belted:	21
Time From Algorithm Wakeup to Second Stage:	0

Restraint System Status

Driver Seat Belt Buckle:	Engaged
Passenger Seat Belt Buckle:	Not Engaged
Driver Seat Track In Forward Position:	No
Passenger Seat Weight Switch Position:	N/A

Deployment Initiation Attempt Times

	Driver	Passenger
Time From Algorithm Wakeup to Pretensioner Deployment Attempt:	8	Unbelted
Time From Algorithm Wakeup to First Stage Deployment Attempt:	21	21
Time From Algorithm Wakeup to Second Stage Deployment Attempt:	Disposal	Disposal

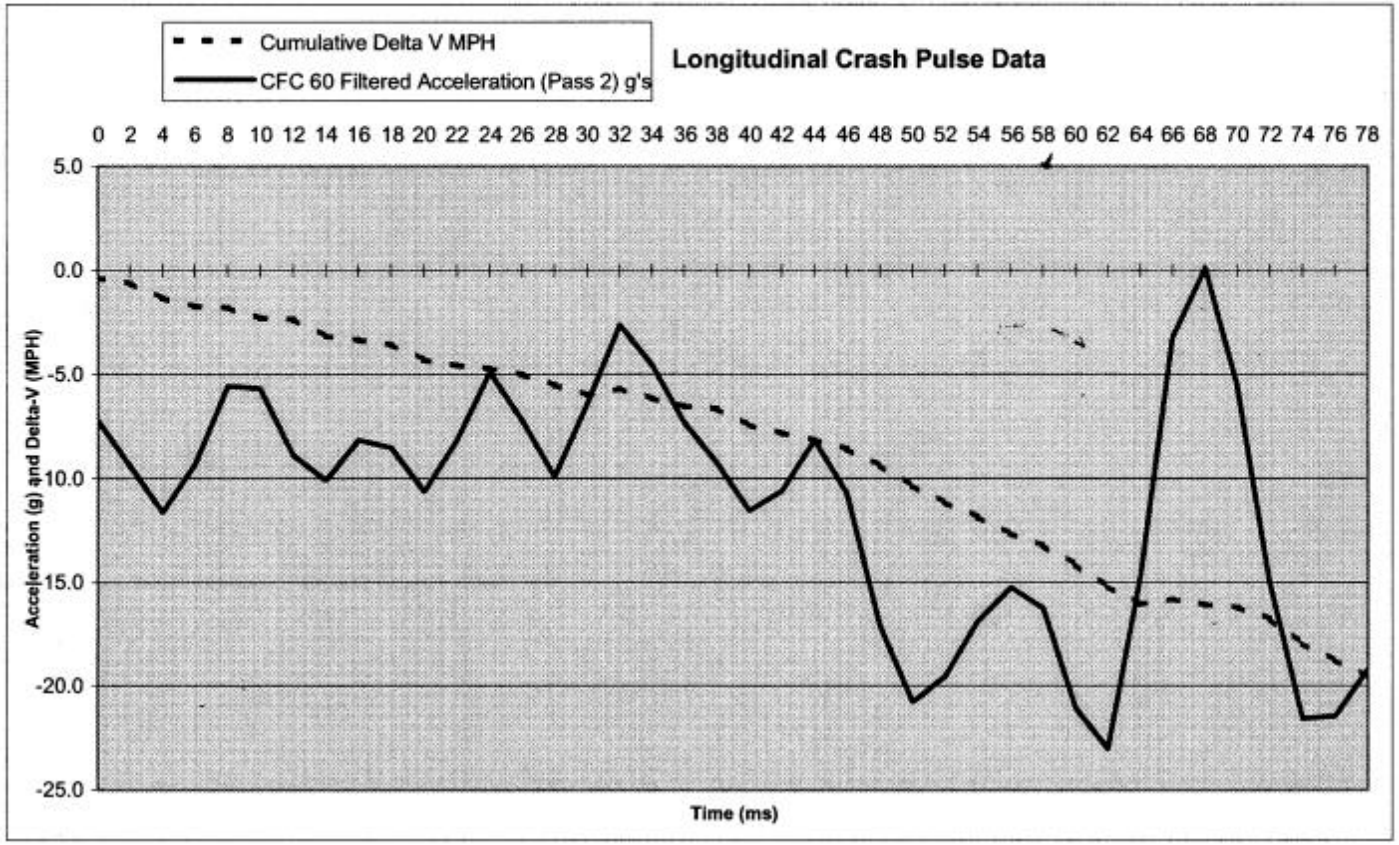
Ford

EDR Program at NHTSA:
Field data collection

NHTSA
People Saving People
http://www.nhtsa.dot.gov

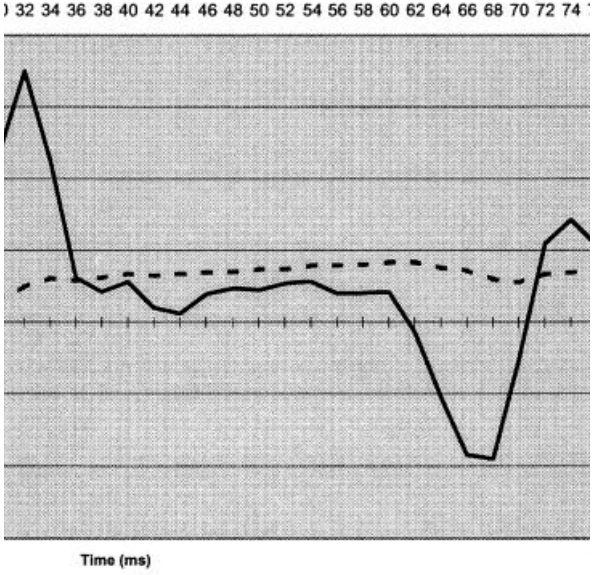
Longitudinal Cumulative Delta-V

Time (ms)	0	10	20	30	40	50	60	70	78
Delta-V (MPH)	-0.4	-2.3	-4.3	-5.9	-7.4	-10.3	-14.1	-16.2	-19.5



30	40	50	60	70	7
0.7	1.4	1.5	1.7	1.1	1

Lateral Crash Pulse Data



Ford

EDR Program at NHTSA: What We Have Learned

People Saving People
http://www.nhtsa.dot.gov

- Some EDR output data may be lost or questionable
  - Due to loss of power loss and sensor problems.
- Enhancement of the crash reconstruction.
  - Crash pulse, time to deployment, restraint usage, etc
- Improvement in data quality.
  - Used for validation of data.
  - Improves data completion.

EDR Program at NHTSA: What We Have Learned

NHTSA
People Saving People
http://www.nhtsa.dot.gov

- The most effective method to observe and/or measure the performance of **Advanced Occupant Protection Systems** is through the EDR data.
  - Deployment logic

t Control Module Data

Validity Check:	Valid	EDR Model Version:	141

(Driver) Side Bag Deployment Time (ms):	Not Deployed
t (Passenger) Side Bag Deployment Time (ms):	Not Deployed
enger Airbag Switch Position During Event:	N/A
nostic Codes Active When Event Occurred:	0

orithm Times Actual initiation depends on restraint system status (below).	ms
From Algorithm Wakeup to Pretensioner:	8
From Algorithm Wakeup to First Stage - Unbelted:	10
From Algorithm Wakeup to First Stage - Belted:	21
From Algorithm Wakeup to Second Stage:	0

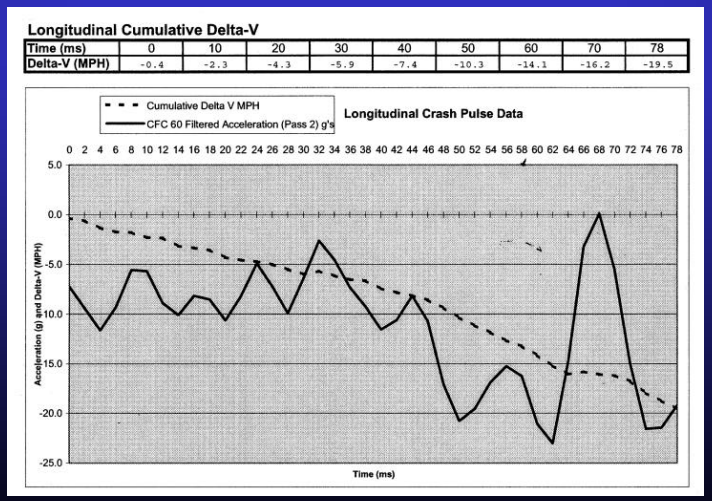
traint System Status

r Seat Belt Buckle:	Engaged
enger Seat Belt Buckle:	Not Engaged
r Seat Track In Forward Position:	No
enger Seat Weight Switch Position:	N/A

loyment Initiation Attempt Times	Driver	Passenger
From Algorithm Wakeup to Pretensioner Deployment Attempt:	8	Unbelted
From Algorithm Wakeup to First Stage Deployment Attempt:	21	21
From Algorithm Wakeup to Second Stage Deployment Attempt:	Disposal	Disposal

Longitudinal Cumulative Delta-V

Time (ms)	0	10	20	30	40	50	60	70	78
Delta-V (MPH)	-0.4	-2.3	-4.3	-5.9	-7.4	-10.3	-14.1	-16.2	-19.5



Other Activities with AOPSS
Coordination with Industry

NHTSA
People Saving People
http://www.nhtsa.dot.gov

- **Working with Crash Investigators, Engineers and Designers**
  - **Case-by-Case Evaluation on**
    - EDR Readouts
    - Real World Performance of the Advanced Occupant Protection System Technologies

FUTURE: EDR Program at NHTSA

NHTSA
People Saving People
http://www.nhtsa.dot.gov

- Future
  - **NHTSA will continue to Research**
  - Standardized EDR data set
  - Program to supply EDR readers and Training to law enforcement.
  - Add EDR output to Police Crash Reports.
  - Severity Indicator in FARS.

Questions