

Using EDR Data to Characterize Advanced Air Bag Performance

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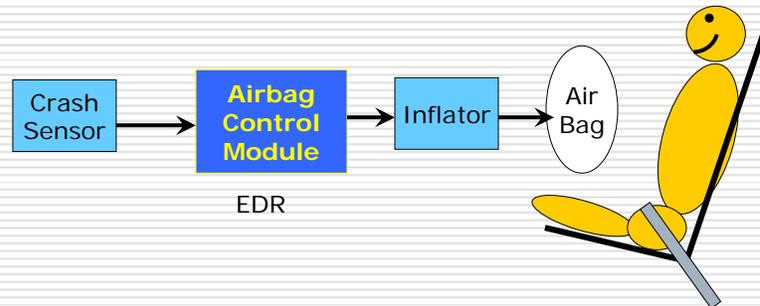
NHTSA

15 May 2007

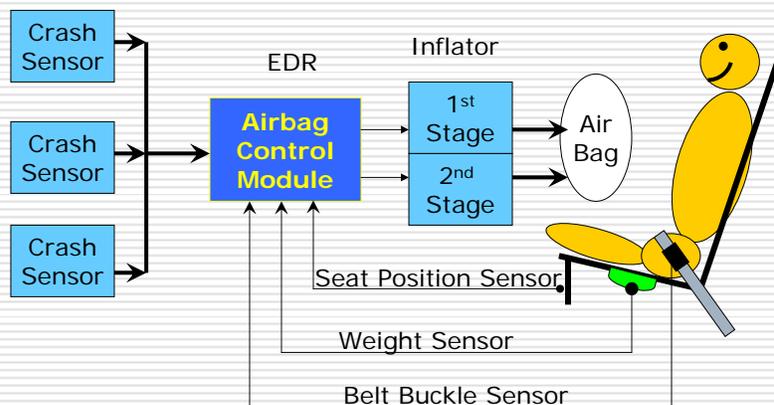
Advanced Frontal Air Bags

- FMVSS 208 Upgrade
- Full phase in MY 2006
- Dual Stage Air Bags
- Suppression or LRD for Children
- Smart Air Bags
 - Deployment can adapt to Belt Status, Occupant Position, Crash Severity, other factors

Single Inflator Air Bag System



Advanced Air Bag System



Objectives

Find:

- ❑ How well advanced air bag deployment algorithms perform in the field
- ❑ Feasibility of using EDRs to study advanced air bag performance

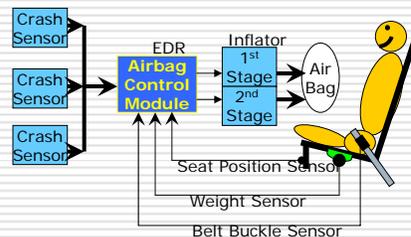
What do GM EDRs Record?

For Driver and RF Pass

- ❑ Time to Deploy 1st Stage
- ❑ Time to Deploy 2nd Stage
- ❑ Belt Buckle Status

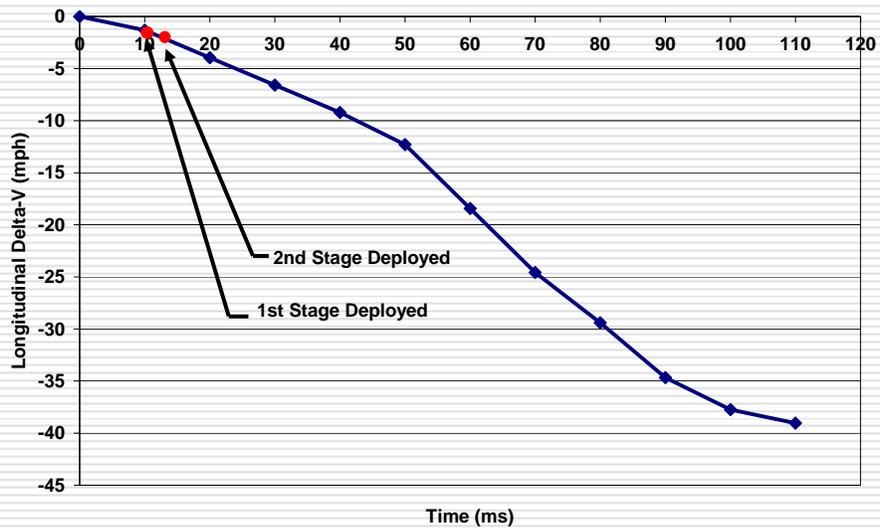
Passenger Only

- ❑ Seat Track Position
- ❑ Suppression (Y/N)



What do GM EDRs Record?

(2006 Pontiac Grand Prix)



Virginia Tech EDR Database

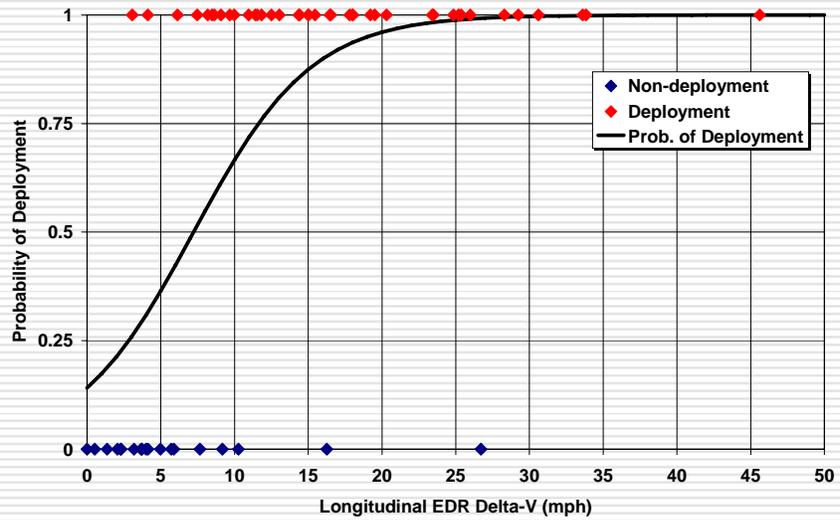
Source	Total Number of Cases
NASS 2000	22
NASS 2001	195
NASS 2002	362
NASS 2003	463
NASS 2004	673
NASS 2005	554
Total	2,269

Case Selection

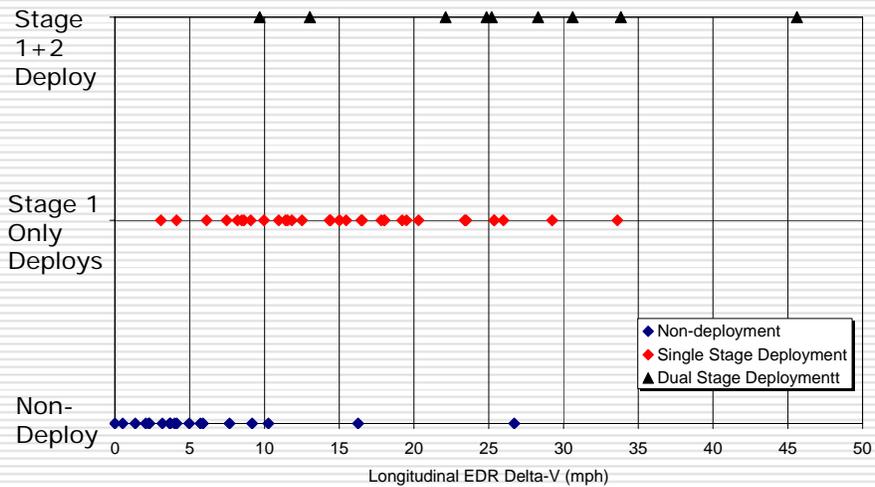
- GM Vehicles only
- Equipped with Advanced Air Bags
 - Certified to the FMVSS No. 208 upgrade
- Result - 106 Cases

Deployment vs. Delta-V

Probability of Driver Air Bag Deployment by Delta-V

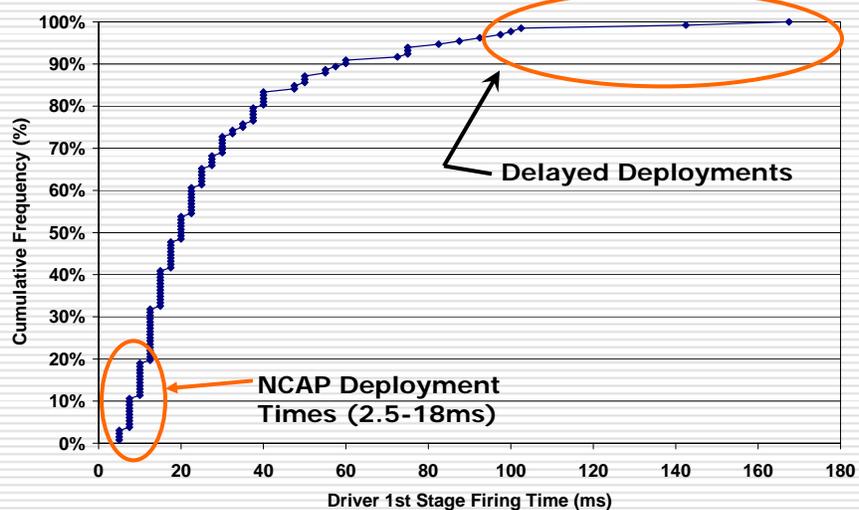


Driver Air bag Dual-Stage, Single-Stage, and Non-deployments vs. Delta-V



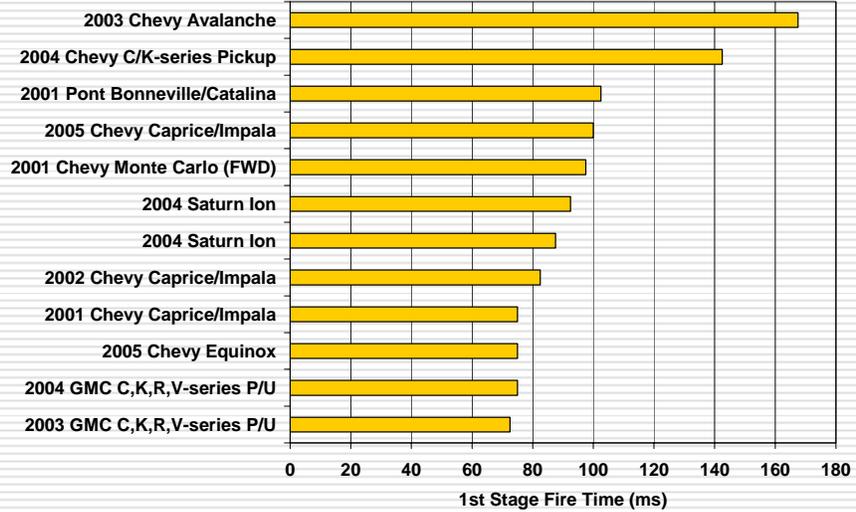
When do Advanced Air Bags Deploy?

Distribution of Driver 1st Stage Air Bag Deployment Time



Delayed Deployments

(4 Certified Advanced Compliant Cases, 8-preCAC Cases)



Narrow / Offset Collisions

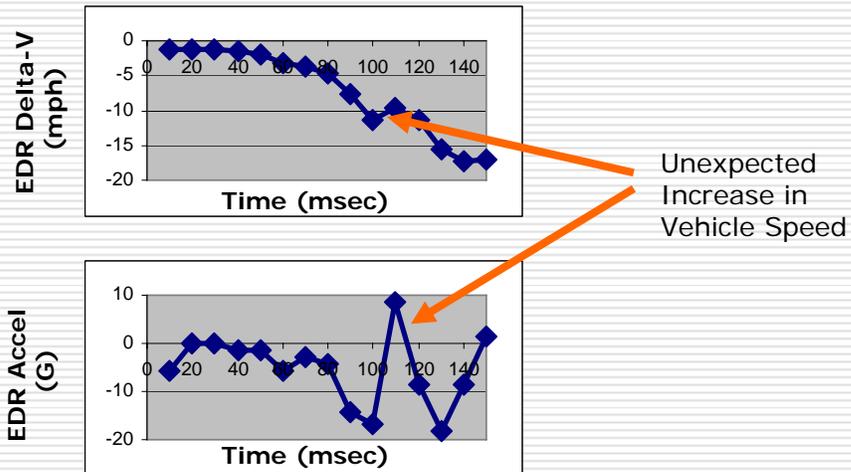
**Impact with Small Sign and Pole
(Case 2004-12-052)**



**Impact with fire hydrant on
vehicle's right
(Case 2003-12-162)**

Abnormal Crash Pulses

(Case 2004-50-087)



Characteristics of Cases with Delayed Deployments

NASS Case Number	Narrow/Offset	Low DV	Abnormal data	Multi Impact
2004-75-126 *	✓	✓	✓	✓
2004-50-087 *	✓		✓	✓
2004-12-052	✓			✓
2005-04-062	✓		✓	✓
2001-41-133	✓		✓	✓
2004-08-108	✓	✓		✓
2004-11-082			✓	
2003-12-162	✓	✓		✓
2005-76-009 *	✓		✓	✓
2005-12-149	✓	✓	✓	✓
2004-48-181	✓	✓	✓	
2003-50-110 *	✓			✓

Passenger Air Bag Suppression

RF Passenger Suppression Cases (Driver Air Bag Deployed)

When Driver Bag Deployed,
& RF Passenger Present,
RF Passenger Bag Deployed 12 of 14 times

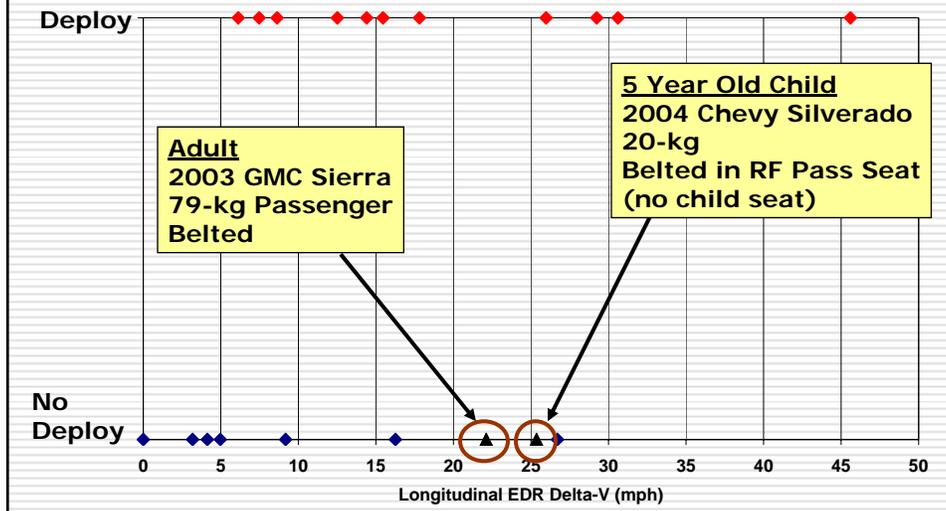
Right Front Passenger	RF Air bag Deployed	RF Air bag Suppressed	Total
Adult	12	1	13
Child	-	1	1
None	3	27	30
Total	15	29	44

When No RF Passenger,
Driver Bag Deployed but
RF Bag Suppressed 27 of 30 times

RF Passenger Suppressed,
Despite presence of
Passenger

Passenger Air Bag Deployments

(Passenger present in all cases)



Limitations

- ❑ Small Data Set (106 cases)
- ❑ GM Vehicles Only
- ❑ Clinical Data Set may not be nationally representative

Conclusions

- EDRs provide excellent insights into advanced air bag performance
- Delayed Deployments in over 10% of cases
- Air Bag Suppressed in presence of RF Passenger at Delta-V as high as 22 mph

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