C9 How Prevalent are Defective Automobile Air Bags?

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The goal of this presentation is to address questions regarding the reliability of automobile air bags.

This presentation will impact the forensic community and/or humanity by answering questions regarding the reliability of automobile air bags.

INTRODUCTION: The automobile air bag is just one part in a complex electronic and mechanical system designed to inflate the air bag at the proper moment. Air bag malfunctions can manifest themselves in four ways. The air bag can deploy for no reason, the air bag can deploy early or late, the air bag can inflate only partially when full inflation is called for, or the air bag can fail to deploy when it should have. This paper addresses only the last issue.

Raymond Smith and Associates is currently working on 4 separate cases in which air bags failed to deploy. A reconstruction of the collisions showed that in all these cases, the air bags should have deployed. This surprisingly large number of failure to deploy cases raises the following question. Are there a large number of defective air bag systems in the current vehicle population?

CRITERIA FOR AIR BAG DEPLOYMENT: In general the air bag should deploy in a frontal or side impact if the speed change induced by the crash is between at least 15 m.p.h. The air bag should never deploy at a speed change of less than 9 m.p.h.

The speed change required for deployment with some of the newer two stage airbags and smart air bag systems that identify whether the occupant is small and sitting close to the air bag, can be higher.

CRITERIA FOR AIR BAG NON DEPLOYMENT TO MANIFEST ITSELF: Three things have to happen before an air bag nondeployment event will come to public attention.

1) The air bag system must be faulty
2) An accident must take place, where deployment should have occurred but did not
3) An injury sufficient to raise the visibility level of the failure, occurred

The air bag system contains sensors, a microprocessor, the air bag charge, the air bag, and a significant quantity of electronic circuitry. Due to the complexity of the system, there can be a large number of reasons for the air bag not to deploy when it should have deployed. Among the reasons the system might fail to deploy are the items that follow:

- An open circuit or communication failure within the system
- A short circuit within the system
- Sensor drift or improper sensor calibration
- Voltage drift in the power circuitry
- Software malfunction
- A microprocessor malfunction
- A faulty air bag charge
- Environmental issues, such as moisture or contaminant intrusion during production or while in use
- Poor system maintenance (an error code is displayed, indicating a problem, but no repair is performed)

THE MAGNITUDE OF THE PROBLEM: A sense of the seriousness of the air bag failure to deploy problem can be gained from examination of the National Highway Traffic Safety Administration's National Accident Sampling System Data. Every year the U.S. Government examines, analyzes, and documents key elements of a sampling of U.S. vehicle crashes. Most years the sampling contains data from 4,200 to 4,400 crashes.

Selecting from the NASS database one and two vehicle crashes, which involved frontal impacts resulting in a speed change in excess of 15
m.p.h. produced the data shown in Table 1. This vehicle speed change should have caused the air bags, in air bag equipped vehicles, to deploy.

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Table 1 Air Bag Deployment and Non Deployment Collisions for 2 Injury Levels

YEAR -Injury Severity	COLLISIONS WHERE AIR BAG DEPLOYED**	COLLISIONS WHERE AIR BAG SHOULD HAVE DEPLOYED BUT DID NOT	% OF COLLISIONS WHERE AIR BAG SHOULD HAVE DEPLOYED BUT
1998 All Injuries	335	8	2
Serious Injury	115	1	0.8
1999 All Injuries	362	20	5
Serious Injury	131	5	4
2000 All Injuries	397	24	6
Serious Injury	143	2	1
2001 All Injuries	383	17	4
Serious Injury	118	4	3
2002 All Injuries	457	24	5
Serious Injury	173	6	3

* Serious Injury is defined on the Abbreviated Injury Scale (AIS) as 3 to 5. An AIS 1 injury is relatively minor. AIS 5 injuries are fatal.

** Air bag deployed as a result of the collision

The table shows that, averaged over the 5-year period 1998-2002, the air bags did not deploy when they should have in 4% of the frontal crashes involving all injury levels. The non-deployment rate was 2% for crashes involving serious injury (AIS level 3 to 5).

It should be noted that the NASS statistics only document injuries that are apparent at the time of the accident. In many cases the seriousness of an injury may not be recognized for hours or days after an accident. Other serious injuries may not be well represented in the NASS database because the AIS scale was designed to categorize life-threatening injuries. On this scale the loss of an eye rates as an AIS 2 injury.

As “smart” air bag systems are introduced, a rise in the nondeployment figures due to an increase in the sophistication and complexity of the air bag systems may be seen.

If the nationwide percentage of vehicles with air bags that have the potential to fail to deploy was 4%, it would suggest that among the 170 million vehicles on the road today, there are millions of defective air bag systems, which will not deploy when needed. This poses a potentially significant risk to the public.

Air Bag, Automobile, Non-Deployment

