C41 Late Deployment of an Air Bag Due to Multiple Sensor Bounce

Holly A. Adams, BS, Automotive Data Consultants, 15439 Smithaven Place, Centreville, VA 20120*

Upon completion of this presentation, attendees will have learned about one of the ways an electro-mechanical airbag sensor can delay a deployment.

This presentation will impact the forensic science community by high- lighting one of the ways an airbag can deploy late and cause injury to the vehicle occupants.

Accident Scenario: A single vehicle accident involving a 1997 GMC Jimmy. The subject vehicle went off the road to the right, struck several smaller objects, went into a ditch, struck a tree and overturned. The driver of the vehicle (female, 5 ft tall, approximately 95 lbs) was found submerged and seat belted. The air bags deployed, and the cause of death was listed as neck injuries.

The1997 model year sport utility vehicle has a first generation air bag system. A first generation air bag system consists of external sensors connected to an air bag computer that does not make any deployment decisions. The air bag computer diagnosis fault codes, records them and records the timing between sensor closures in a deployment.

In order for the air bags to deploy in this vehicle, two different sensors with different sensitivities must be closed simultaneously to complete a circuit that allows current to flow through the air bag igniter. The closure of one sensor will not deploy the air bags. Additionally, if one sensor closes and then opens, and then the other sensor closes, the air bags will not deploy because the sensors were not closed simultaneously.

The data downloaded from the air bag computer showed the following information:

1. There was only one crash recorded.
2. The air bag warning light, or MIL (Malfunction Indicator Lamp), was off when the deployment circuit was completed (overlap).
3. There was no Active/Current, Cycle or History fault codes, or DTCs (Diagnostic Trouble Codes), present when the deployment circuit was completed.
4. The MIL was recorded as “off” at the time of overlap, and showed no indication of having ever been “on.”
5. The arming sensor closed first.
6. The time from arming sensor closure until the first discriminating sensor closed (overlap or completion of the firing circuit) was 14.64 ms.
7. The time from first discriminating sensor closure until overlap was 124.44 ms.
8. Overlap lasted for at least 7.78 ms.
9. The driver’s seatbelt was recoded as being buckled.
10. At the time of the data download, there was one DTC present in the history of the DERM. It was DTC 51: Crash Detected, which is an expected fault code after a deployment.

The vast disparity between the time from arming sensor closure to over- lap (14.64 ms) and the time from first discriminating sensor closure to over- lap (124.44 ms) indicates the following scenario. The arming sensor closed and then opened. After the arming sensor opened, one of the discriminating sensors closed, starting the clock for the first discriminating sensor to over- lap time. Then the discriminating sensor opened and the arming sensor closed for a second time. Finally, one of the discriminating sensors closed simul- taneously with the arming sensor, completing the circuit and deploying the air bag. This opening and closing of sensors is known as “bounce.”

In this case, the bouncing of the arming and discriminating sensors caused a late deployment of the air bag, which may have caused the death of the driver.

Air Bag, Sensor, Bounce

 ** Presenting Author*