C39 Dangers Associated With In-Seat Occupant Sensing Systems

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After attending this presentation, attendees will understand how flaws in occupant sensing systems can lead to unwanted airbag suppression.

This presentation will impact the forensic science community by explaining how in-seat occupant sensing systems can sometimes call for suppression when an airbag deployment is actually desirable.

History of In-Seat Occupant Sensing Systems: In 2000, the National Highway Traffic Safety Administration (NHTSA) published their final rule for Federal Motor Vehicle Safety Standard (FMVSS) 208, which is the standard related to occupant crash protection. The purpose of the final rule was to reduce the risk of serious airbag injuries to small women and young children. In the final rule, NHTSA gave manufacturers the option of either developing an airbag capable of a low risk deployment, or provisions for the airbag system to identify the right front seat occupant and suppress deployment of the airbag as needed. In the low risk deployment option, the airbag must deploy in such a manner as to not be injurious to children and small females in a series of tests. Most manufacturers chose the airbag suppression option and developed cushion-based, in-seat sensors to help identify the occupant. With the development of cushion-based, in-seat sensors, it was soon discovered that there was an overlapping zone between the 5th percentile female (152.4cm, 46.3kg) and a 30kg child. In order to remedy this overlapping zone, manufacturers created seat cushion sensors that not only looked at the occupants' weight, but also utilized a pressure map. These systems had difficulty identifying a human versus a dummy occupant due to the pressure map created by the dummy. Because of this difficulty, NHTSA ultimately allowed manufacturers to bypass their suppression system in their crash tests. This created a scenario where a 5th percentile female human could be classified as a child if their buttocks created a pressure map that was misinterpreted by the system as a child, and they would not receive the benefit of an airbag in a crash. Also manufactures are free to develop their own seat-mounted sensing devices for discriminating between a small woman and a child. Because the sensing devices differ according to vehicle model, testing with human surrogates is advised when airbag suppression is suspected.

Case Study: The restrained 19-year-old female, right front passenger of a passenger car sustained a serious brain injury in an impact with a tree. The Delta V experienced by the vehicle was between 35 and 40mph. The right front passenger weighed as much as a 5th percentile female and was the same height, but was nonetheless identified by the in-seat sensing system as a child and her airbag did not deploy. Without the airbag deployment, she traveled forward until her head struck the dashboard. Had the airbag deployed, she would not have sustained permanent and serious brain injury. To test the performance and accuracy of the in-seat sensor, she was placed in exemplar vehicles and the airbag activation light was photographed. Depending on how she sat in the seat, i.e.; orientation of her thighs, the airbag was or was not suppressed.

Conclusions: In conclusion, airbag suppression is helpful in preventing injuries to small children, but in-seat sensing systems can create a situation where a small female is mistaken for a child and is left without the protection offered by airbag deployment.

Airbag Suppression, FMVSS 208, In-Seat Sensing Systems

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