Evaluation of Injury Risks from Side Impact Air Bags

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Several types of side impact air bag (SAB) systems
- Thorax
- Head and thorax
- Head

Different designs
- Seat mounted
- Door mounted
- Window curtain
- Inflatable tubular
Use of SAB projected to become prevalent

Market Share of SAB equipped vehicles in 2001

- Passenger Cars: 36% projected
- LTV/SUV: 15% projected
Fall 1998 – NHTSA study at Medical College of Wisconsin (MCW) – Paper 99SC03, 43rd Stapp Conf. 1999


April 1999 – NHTSA Public Meeting

May 1999 – Letter from Dr. Martinez to Alliance, AIAM

Summer 1999 – Research initiated at VRTC/NHTSA


## Test Conditions

### Vehicle Selection

<table>
<thead>
<tr>
<th>Seat Mounted</th>
<th>Door Mounted</th>
<th>Roof Mounted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thorax</td>
<td>Head/Thorax</td>
<td></td>
</tr>
<tr>
<td>99 Geo Prizm</td>
<td>99 Ford Windstar</td>
<td>99 Volvo S80</td>
</tr>
<tr>
<td>99 VW Jetta</td>
<td>99 Mercury Cougar</td>
<td>00 Mercedes S430</td>
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<tr>
<td>99 Volvo S80</td>
<td>99 Saab 95</td>
<td>00 BMW 528i</td>
</tr>
<tr>
<td>00 Audi A6 (F+R)</td>
<td>00 Nissan Maxima</td>
<td>00 Audi A6</td>
</tr>
<tr>
<td>00 Cadillac Deville (R)</td>
<td></td>
<td>01 Saturn L200</td>
</tr>
</tbody>
</table>

(F+R) = Front and rear seat air bags  
(R) = Rear seat air bags
→ TWG recommended positions – Baseline

→ Study high speed videos of “blank deployments”

→ Develop additional test positions, variations of TWG positions, MCW positions

→ Goal – most severe loads for dummies of various sizes
Test Conditions
Dummies Used

- Hybrid III 3 year old
- Hybrid III 6 year old
- 12 month CRABI
- Instrumented according to TWG recommendations
- Additional tests in progress with SID-IIs
Thorough evaluation of injury criteria, IARV – planned

Interim values used – TWG recommendations

FMVSS 208 Interim Final Rule values
- 3 YO chest deflection (34 mm used – TWG 36 mm)
- 6 YO HIC (700 used – TWG 723)
Status of Research

- 3 YO, 6YO seat and door mounted SAB – completed
- 12 mo CRABI – partially completed
- Roof mounted bags – partially completed
- Repeatability – ongoing
Observations

- 3 & 6 YO – high loads possible in most SAB systems, especially from
  - Door mounted bags and
  - Seat mounted head-thorax combination bags.

- The TWG 3.3.2.2 (peek-a-boo) – good at measuring injuries to the chest of 3 year old occupants.
Observations (Cont.)

→ TWG 3.3.2.1 (leaning sideways on a booster) – good at measuring the loads on the head-neck region of the 3 year old.

→ In certain vehicles, the TWG position results in the head being away from the seat back.
Additional positions locate the head of the 3 year old leaning sideways at a range of locations along the seat back.
Certain TWG positions may not be attainable in some vehicles.

Certain TWG positions not considered likely to produce significant loads on the dummies for the vehicles in this study.

A “leaning sideways” type position is not included in TWG procedures for door mounted systems for 3 and 6 year old occupants.
→ The dummy responses for restrained 12-month CRABI dummy in front and rear seats have been low in the 9 tests performed to date (14 tests planned)

→ Considerable efforts were spent in locating the correct replacement parts (module, mounting hardware, etc.) for the SAB systems
TWG procedures are capable of discriminating SAB systems

High loads are possible in some current SAB systems

TWG positions do not always produce the highest loads

For seat mounted systems – Variations of the TWG 3.3.2.1 (leaning sideways for seat mounted bags) allow
  - Head to be closer to the air bag module
  - Head at a range of locations along seat back

For Door mounted systems
  - “Leaning sideways” type of position for door mounted bags added
Conclusions (12 mo CRABI)

- TWG does not address 12 month infant dummies
- Additional test procedures developed to evaluate restrained 12 month CRABI dummies
- Low dummy responses in tests performed to date on restrained dummies in front and rear seats
Conclusions

→ NHTSA has initiated a program for evaluating SAB systems

→ TWG recommendations include
  - Proposed test devices
  - Performance criteria
  - Test procedures for various size occupants.

→ The current study addresses the test procedures

→ A thorough assessment of the TWG performance criteria is planned

→ Research is ongoing on
  - Roof mounted bags
  - SID-IIs and other dummies
  - Repeatability issues