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Evaluation of Injury Risks from Side Impact Air Bags

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Introduction

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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

Introduction (Cont.)

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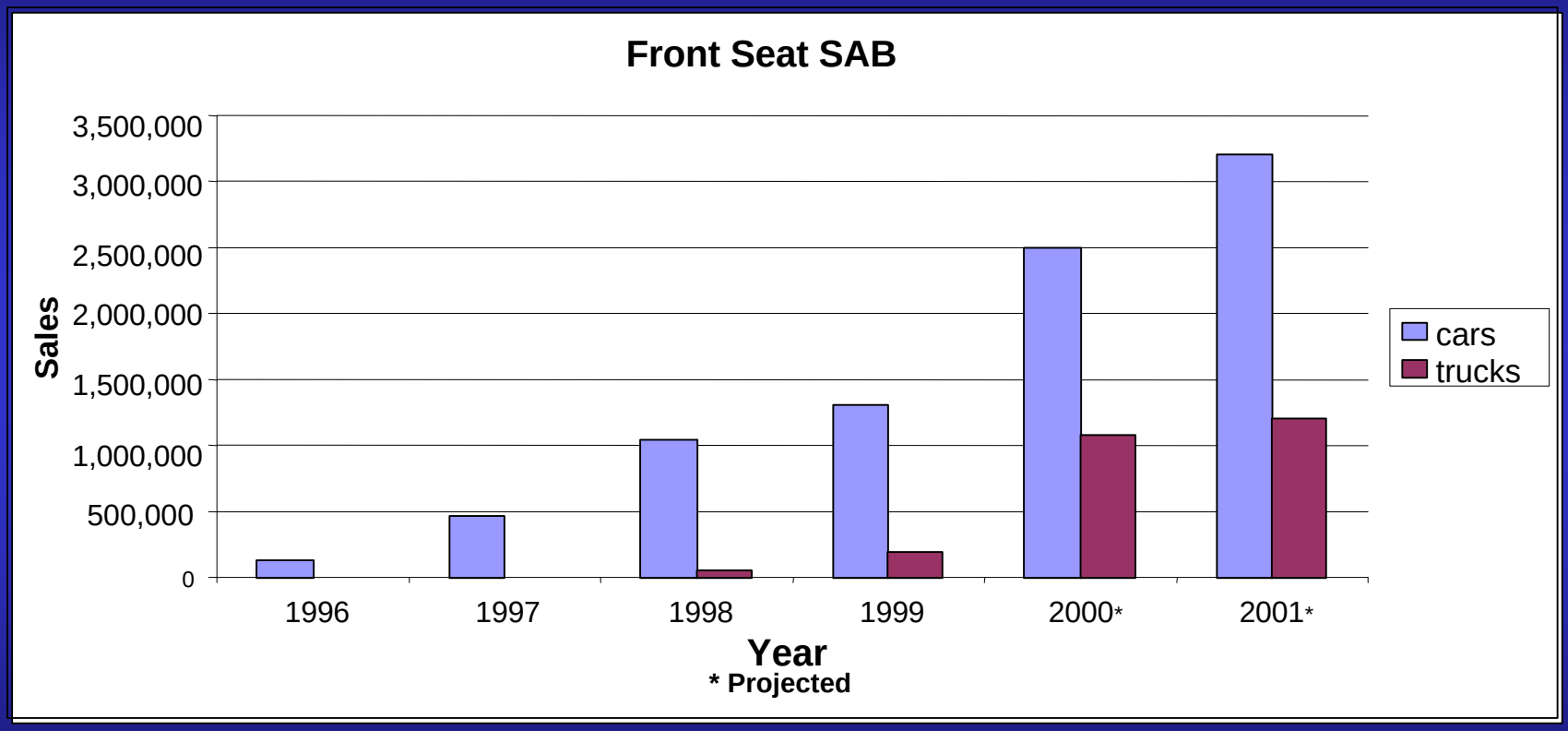
- Use of SAB projected to become prevalent



- Market Share of SAB equipped vehicles in 2001
  - Passenger Cars 36% projected
  - LTV/SUV 15% projected

Background

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- Fall 1998 – NHTSA study at Medical College of Wisconsin (MCW) – Paper 99SC03, 43rd Stapp Conf. 1999
- 1998 – Transport Canada study – Paper 2000-01-ST-02, 44th Stapp Conf., 2000
- April 1999 – NHTSA Public Meeting
- May 1999 – Letter from Dr. Martinez to Alliance, AIAM
- Summer 1999 – Research initiated at VRTC/NHTSA
- Aug 2000 – Technical Working Group (TWG – Alliance, AIAM, AORC, IIHS) recommendations – ISO WG3
- June 2001 – 17th ESV Conference – Paper # 331

Test Conditions
Vehicle Selection

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

(F+R) = Front and rear seat air bags
(R) = Rear seat air bags

Test Conditions
Test Positions

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- 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

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- 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

Test Conditions
Injury Criteria

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- 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

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

Observations

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- 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.)

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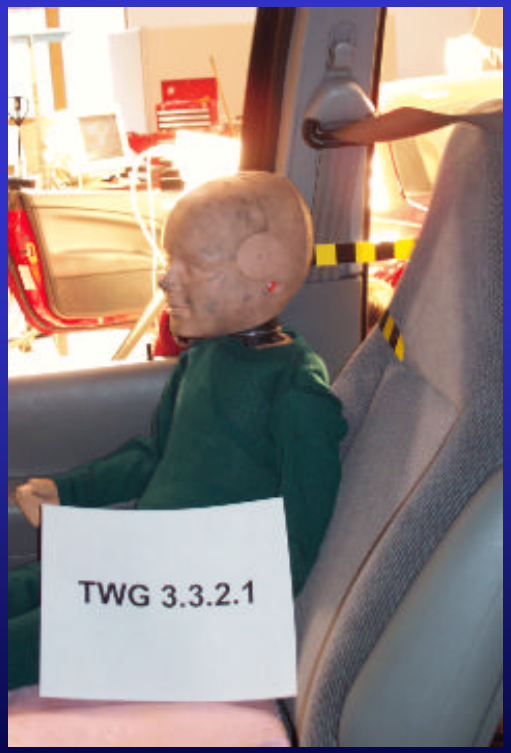
- TWG 3.3.2.1 (leaning sideways on a booster) – good at measuring the loads on the head-neck region of the 3 year old.
- In certain vehicles, the TWG position results in the head being away from the seat back.



Observations (Cont.)

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- Additional positions locate the head of the 3 year old leaning sideways at a range of locations along the seat back.

Observations (Cont.)

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- 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.

Observations (Cont.)

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- 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

Conclusions (3 and 6 YO)

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- 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)

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- 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

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- 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