NCAP Rating for Far-side Occupant Protection

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- *Wayne State University* – K. Yang;
- *Autoliv*; O. Bostrom, O. Ortenwall;
- *GM Holden* - L. Sparke and S. Smith; *General Motors* – R. Lange;
- *Ford* – S. Rouhana;
- *MoT, Australia* - C. Newland.

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- Pintar, F., Yoganandan , N., Stemper, B., Bostrom , O., Rouhana , S., Digges, K., and Fildes, B., “Far Side Impact Response and Dummy Biofidelity”, *Proceedings of the 2007 Stapp Car Crash Conference,* October, 2007.
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- Stemper, B., Stineman, M., Yoganandan, N., Gennarelli, T., and Pintar, F. “Effect of Common Experimental Storage Techniques on Arterial Biomechanics”, *Proceedings of the 2006 IRCOBI Conference,* pp.417-420, September 2006.
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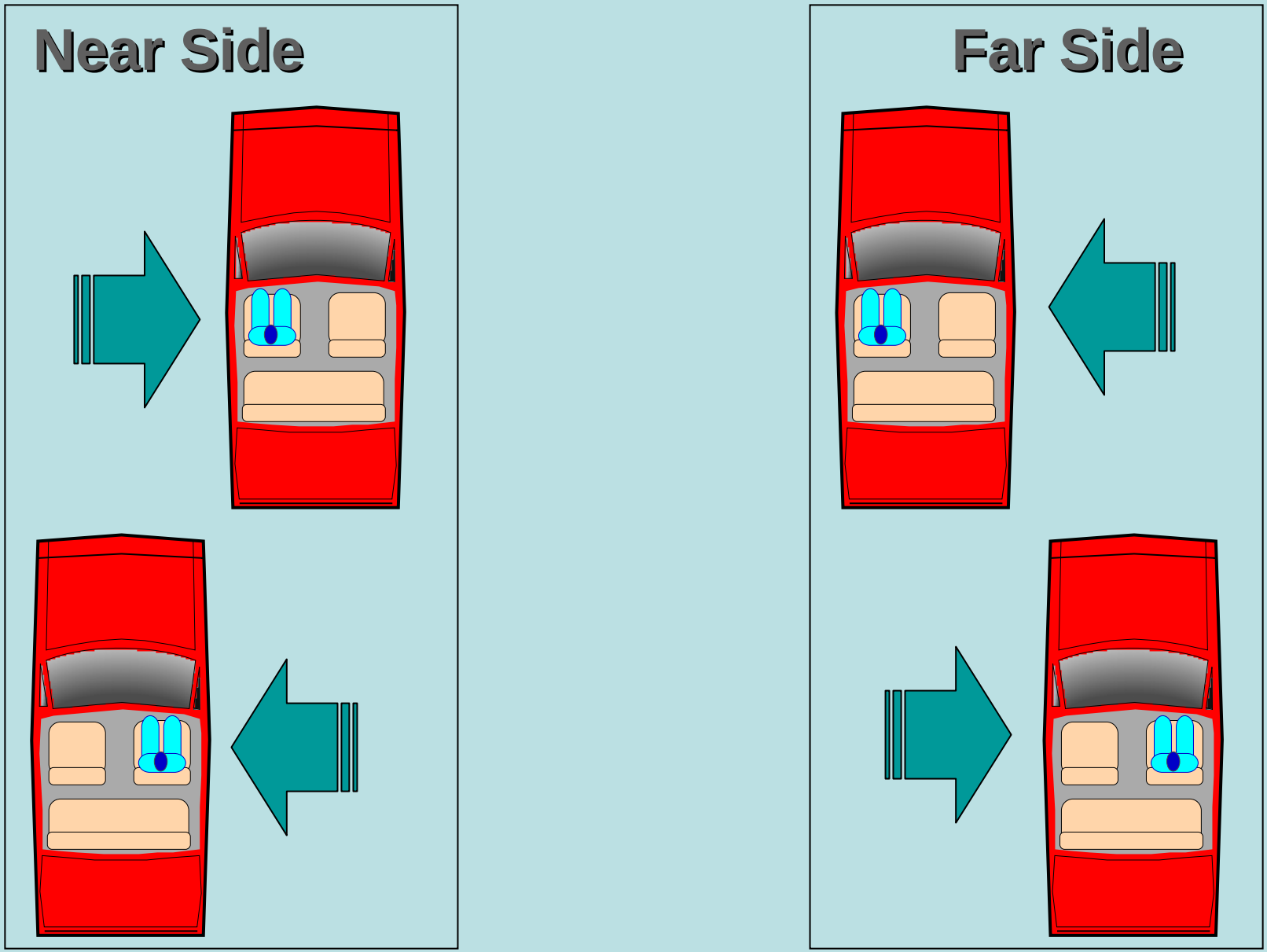
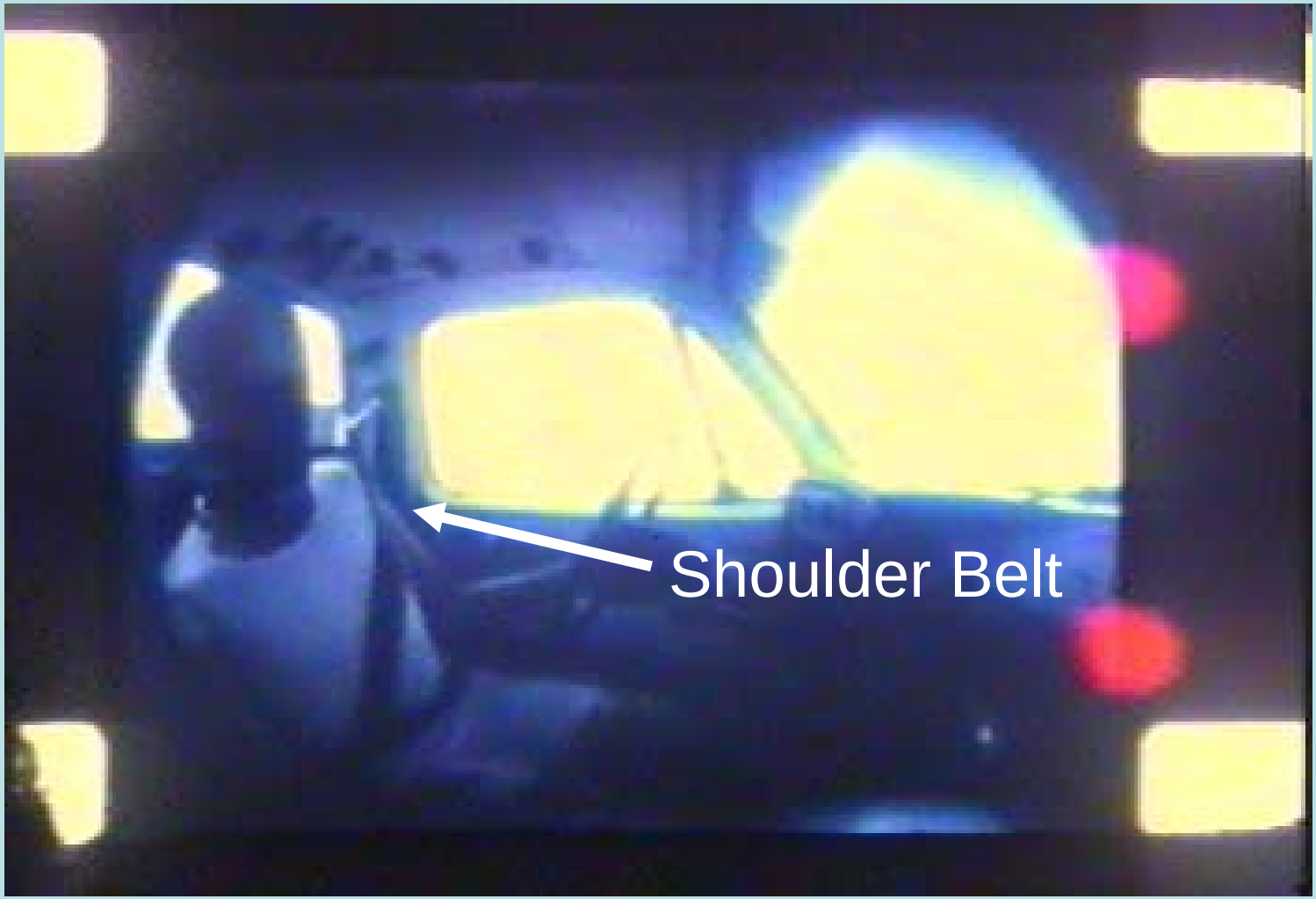
Side Impact Crashes



HIII Dummy in Far-side Crash

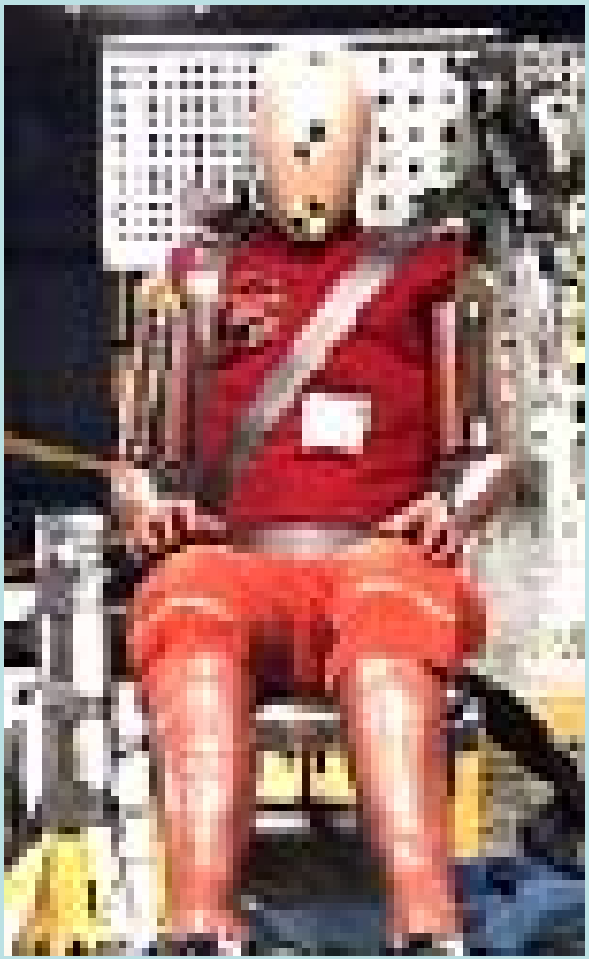
HIII Dummy in Far-side Rollover



What are the far-side countermeasures?

Toyota Center Rear Seat Air Bag Available in Japan

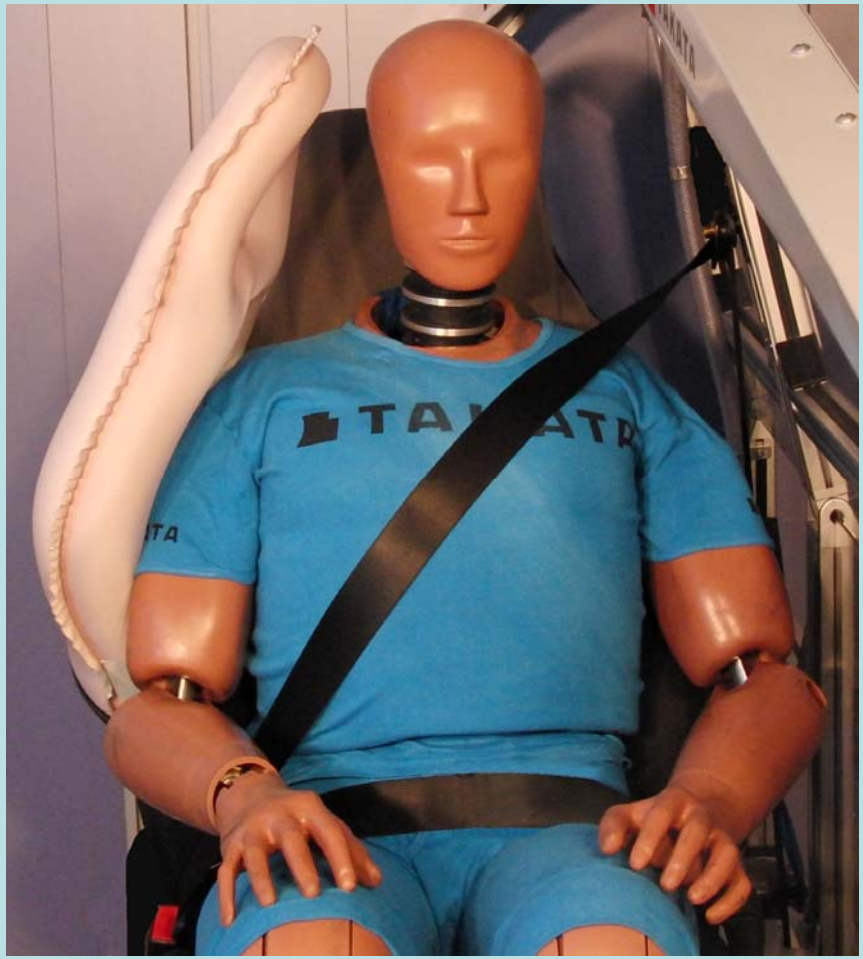
Autoliv Far-side Countermeasures



Rucksack Belt

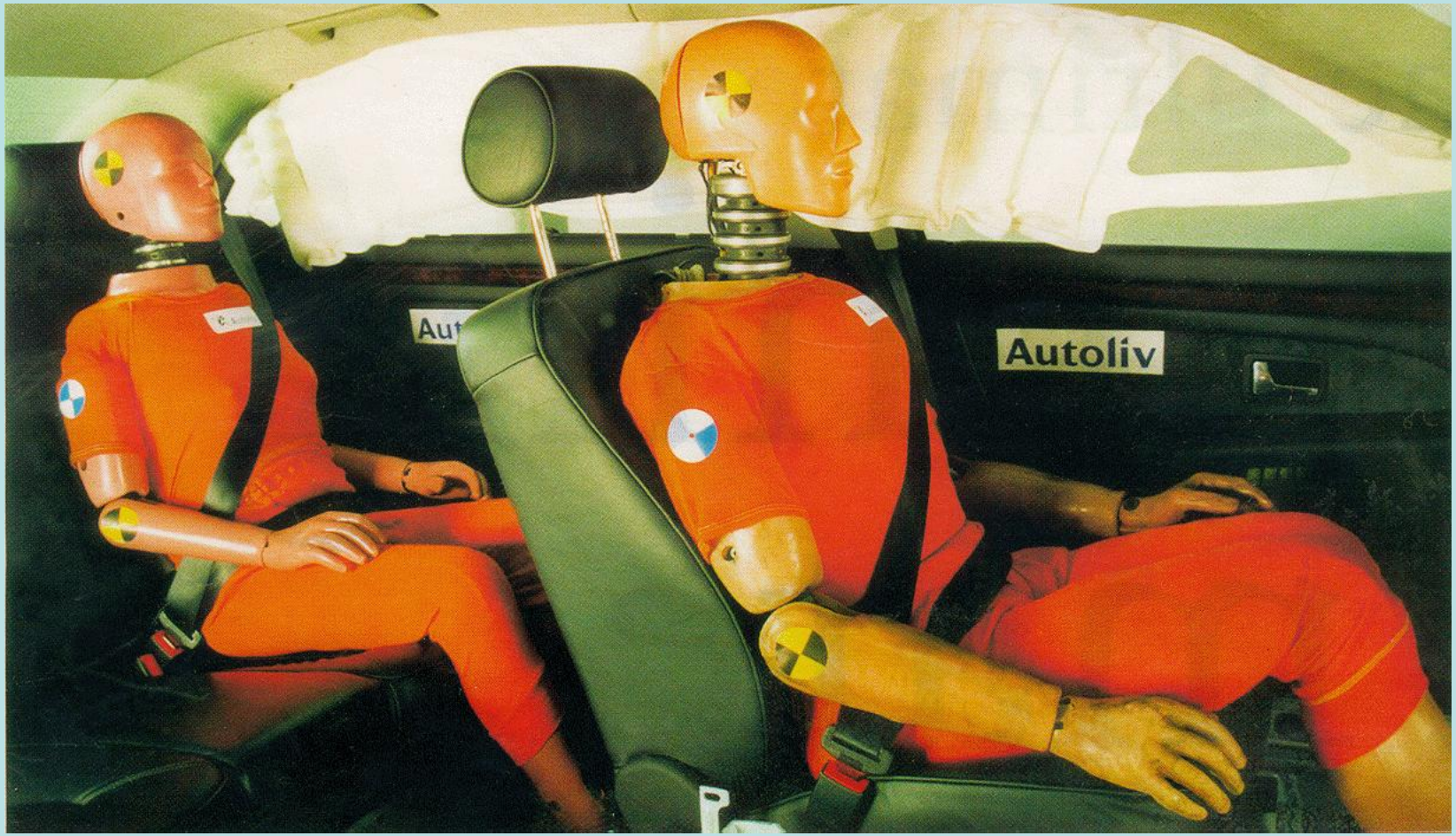
Center Air Bag

Takata Far-side Countermeasures

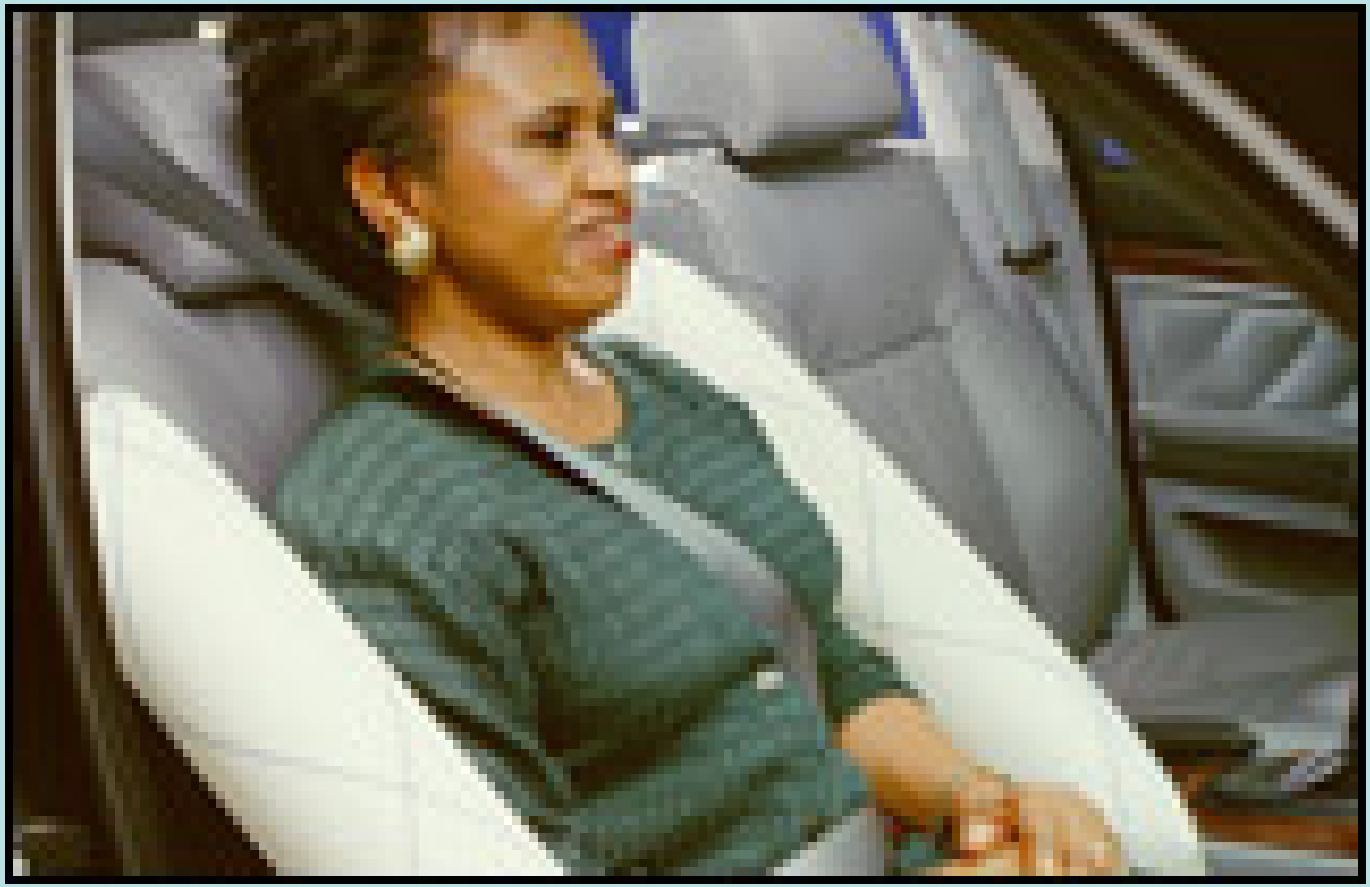


See Mercedes 2009 ESV

Air Curtain Head Protection (Shown for near-side protection)



Inflatable Near & Far Side and Protection



Ford Belt Concepts, Detroit 2001

V Belt

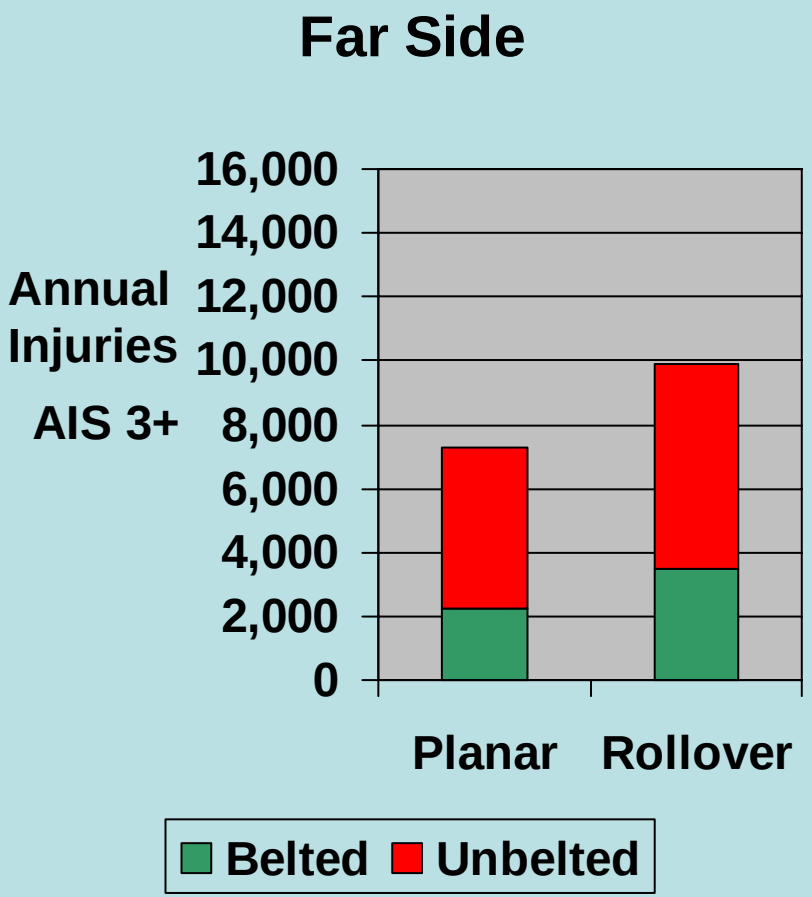
X Belt

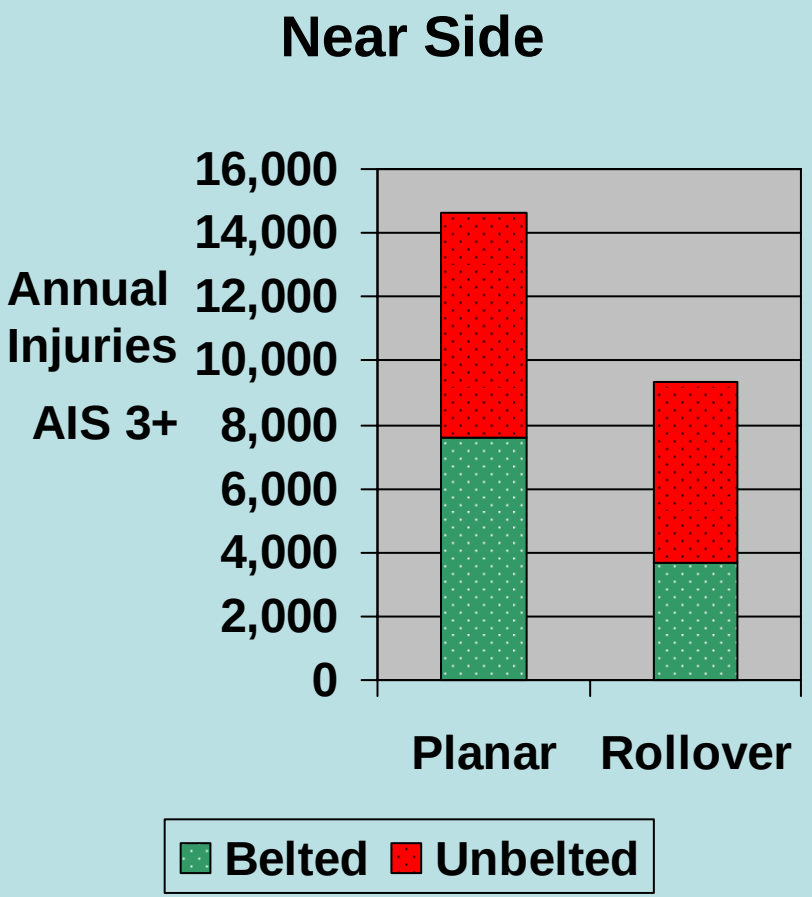
Pre-tensioned Belt

Far-side & Rollover Activation Required

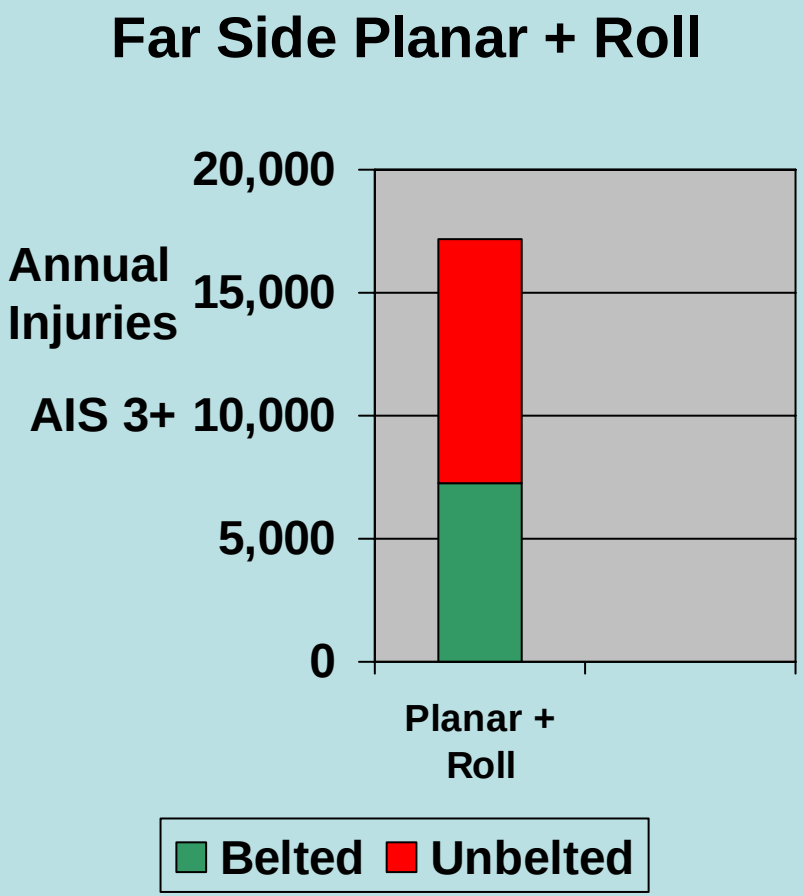
How big is the far-side injury problem?

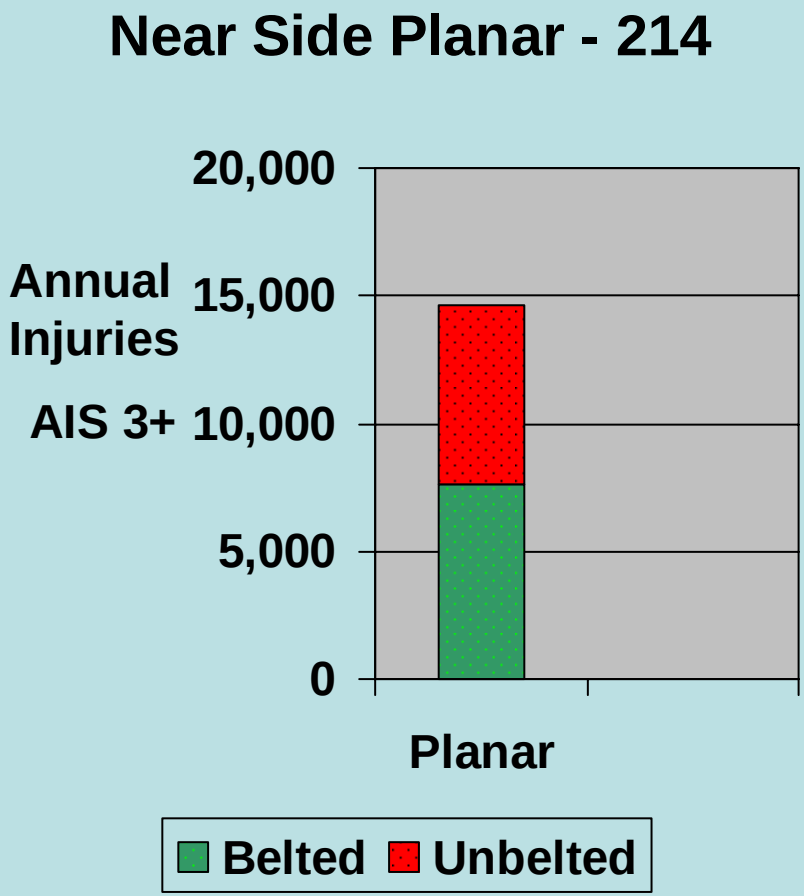
Annual Injured Occupants
Far-side vs. Near-side





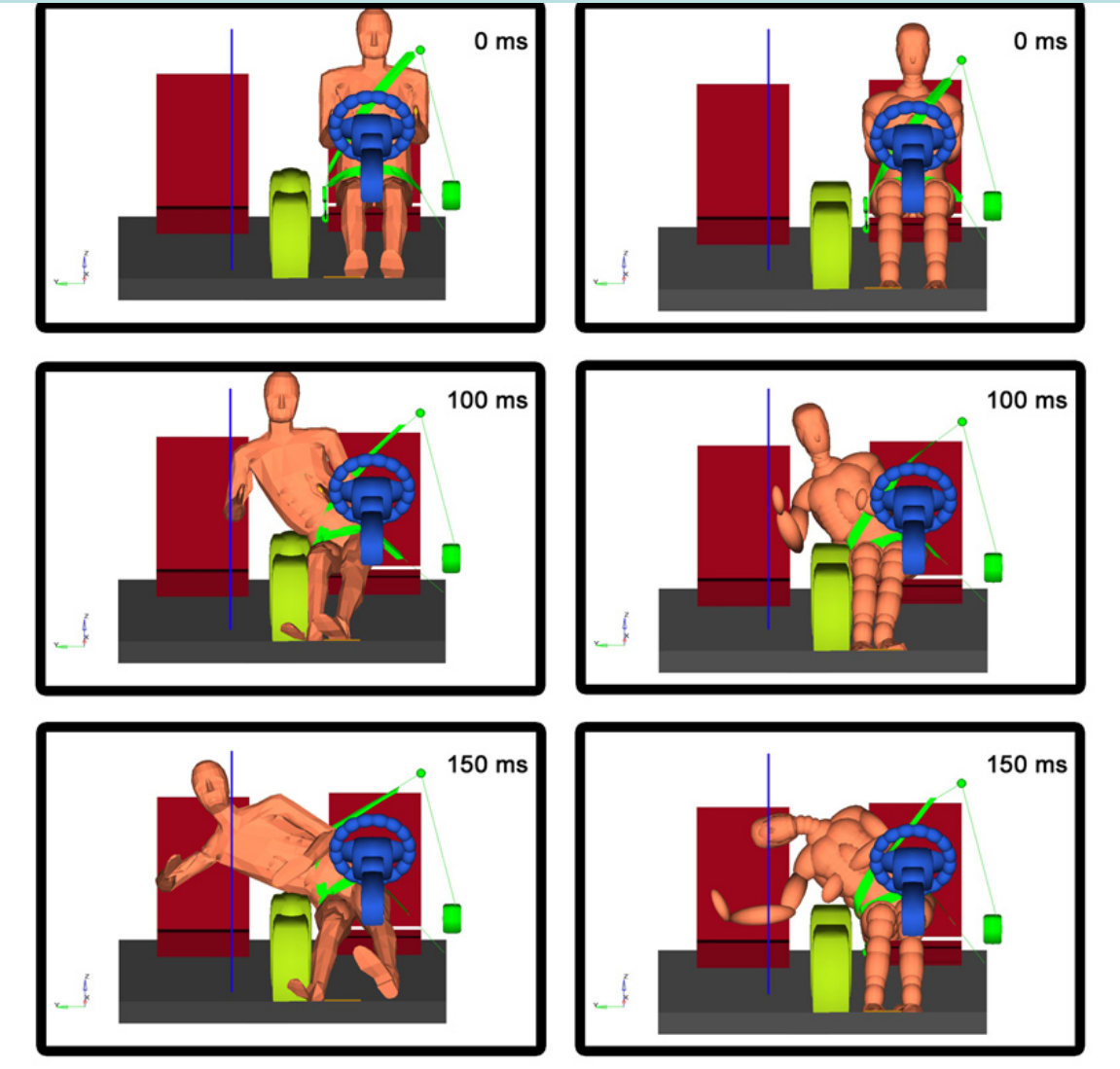
Far-side vs. FMVSS 214





What are the impediments to developing far-side countermeasures?

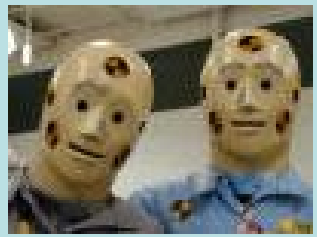
A suitable dummy is needed



Human HIII Dummy

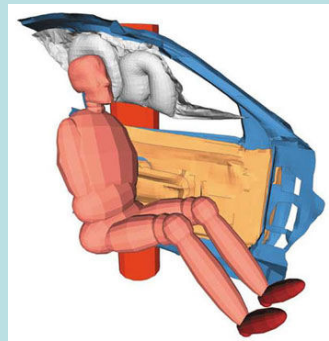
Research Questions in Far-side Protection

What dummies are suitable for evaluating countermeasures?



Approach:

- Determine far-side occupant kinematics by cadaver tests.
- Subject dummies to the same tests.



Candidate Far-side Dummies

WorldSID

THOR-NT

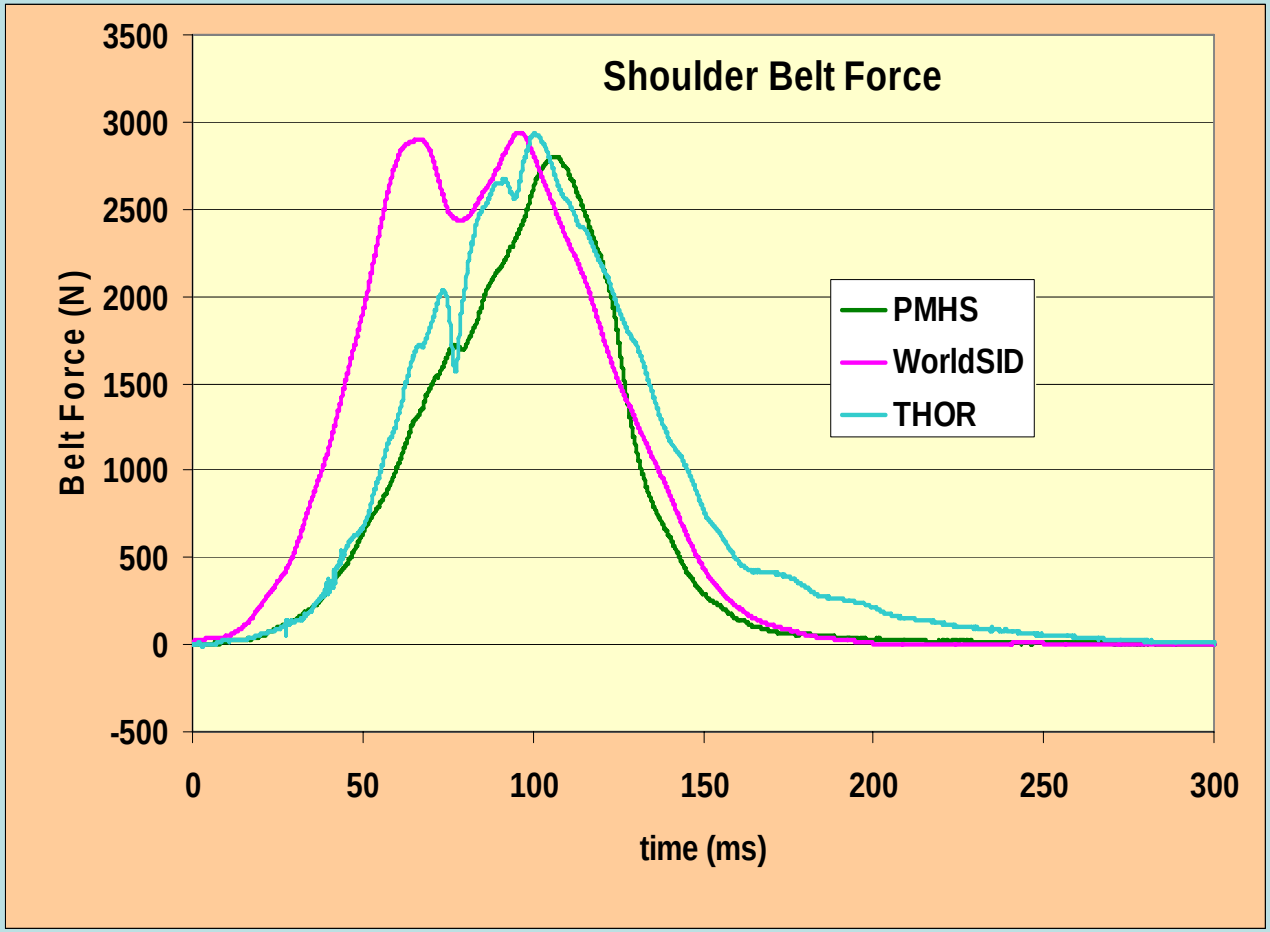
Initial Questions Regarding Conventional Belt Evaluation in Far-side Crashes

- Does the dummy load the belt properly?
- Does the dummy's head get to the correct place?

Illustration to follow is from 1 of 18 cadaver/dummy comparisons

Far Side Impact Sled Test Results
Belt Loading

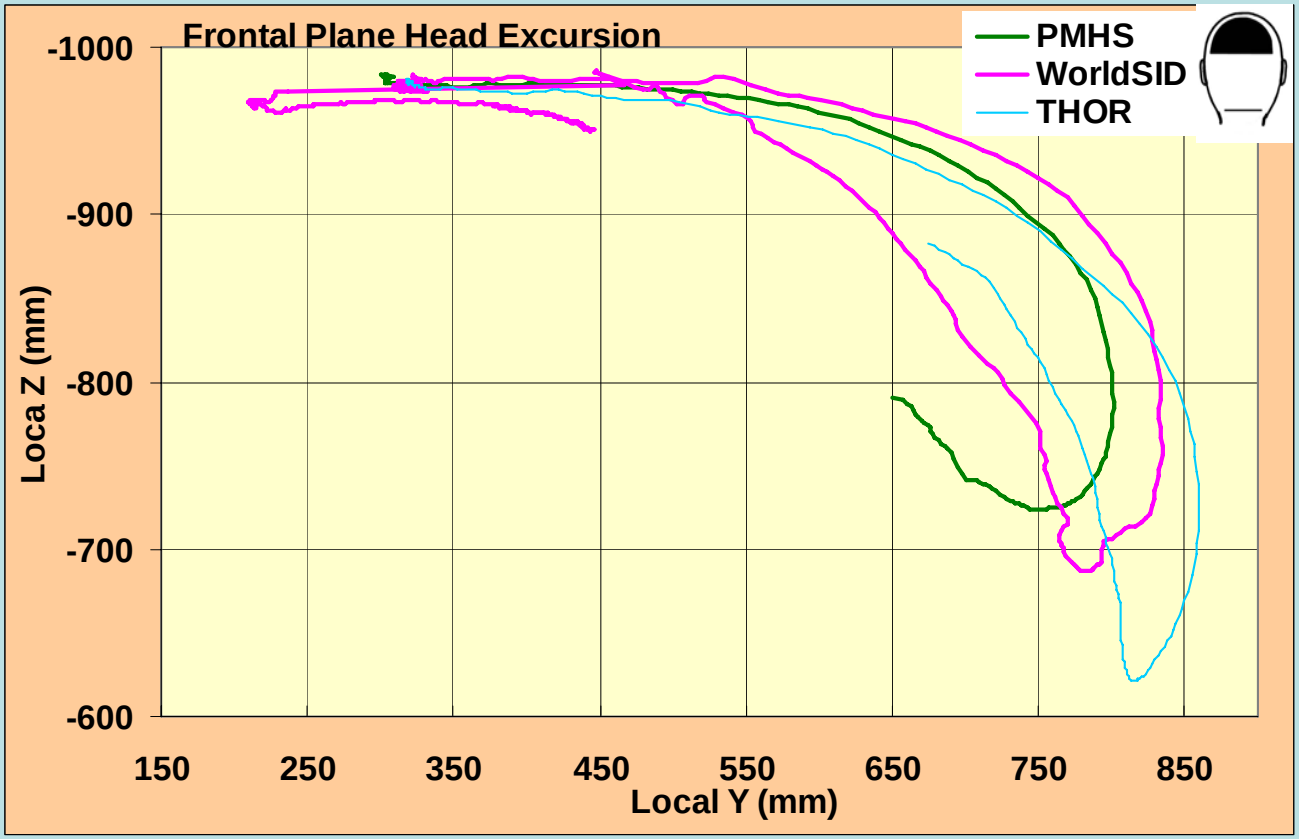
TEST 1: THOR-FSDS155 vs WS-FSDS119 vs PMHS-FSCS104



30 km/h run

Far Side Impact Sled Test Results Head Excursion –

TEST 1: WS-FSDS119 vs PMHS-FSCS104 vs THOR-FSDS155



30 km/h run

Conclusion: THOR and WorldSID are both suitable for far-side tests

Observations of Test Results

- Either dummy performs well in high severity tests with conventional 3-point belts when measuring
  - Shoulder belt load
  - Head kinematics
- Chest instrument relocation is needed for both
- Either dummy would be suitable for evaluating far-side protection offered by conventional belts in tests run by IIHS and NHTSA SNCAP tests

Australian DoT Test Results

Conducted side impact tests with both near-side and far-side dummies (WorldSID)

Results:

- The far-side dummy did not influence the measurements by the near-side dummy of injuries from the intruding side structure.

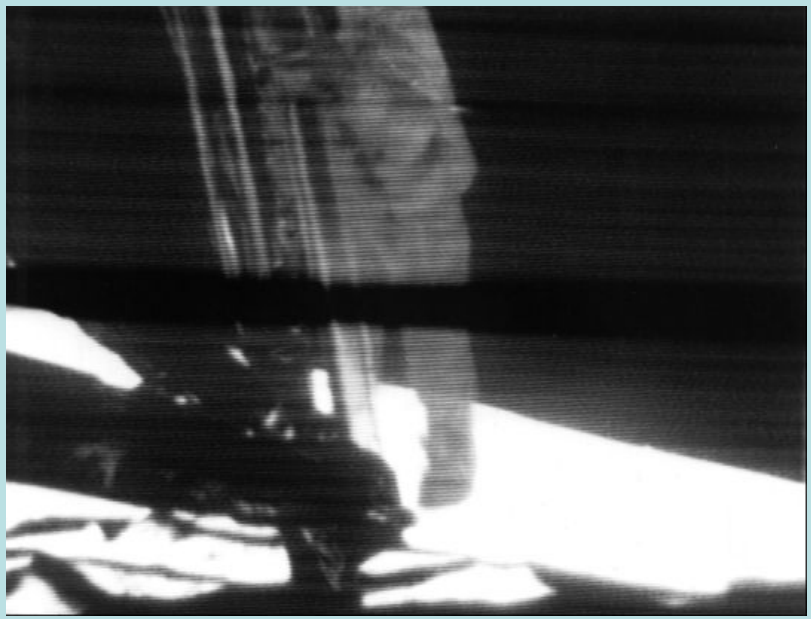
Conclusions

- Number of injuries in far-side planar crashes and rollovers exceed those in near-side planar crashes
- THOR and WorldSID are suitable for evaluating countermeasures in far-side crashes
- The presence of a far-side dummy does not interfere with the near-side injury measurement
- Numerous far-side countermeasures are under development
- There is no far-side safety consumer information

Observations

- Currently safety standards and consumer information tests do not deal with far-side countermeasures.

NCAP tests would provide the **first step**



NCAP Recommendation

- Include a far-side THOR or WorldSID in all NCAP Side Tests
- Provide a far-side rating based on head excursion limits.

Eventually:

- Use all far-side dummy readings to determine star rating
- Conduct tests without near-side dummy

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