Applied Research Activities

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Structures and Restraints Research

Outline

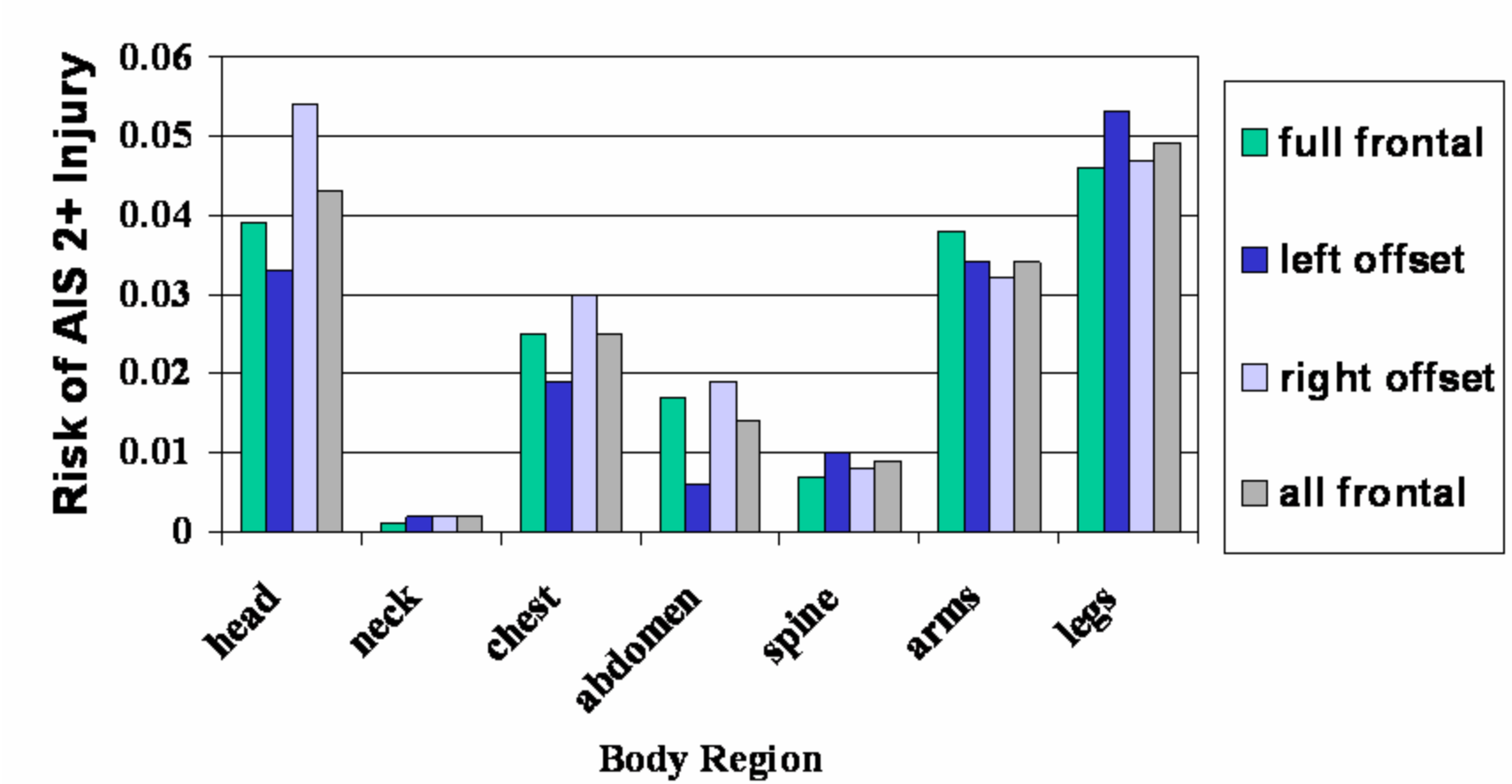
- **Offset Frontal Research**
- **Hydrogen Research**
- **Child Safety Research**

NHTSA Frontal Offset Program

LTVs that perform better in offset tests seem to have stiffer front ends, thus aggravating compatibility.

This near-term program is focused on lower leg injuries in passenger cars.

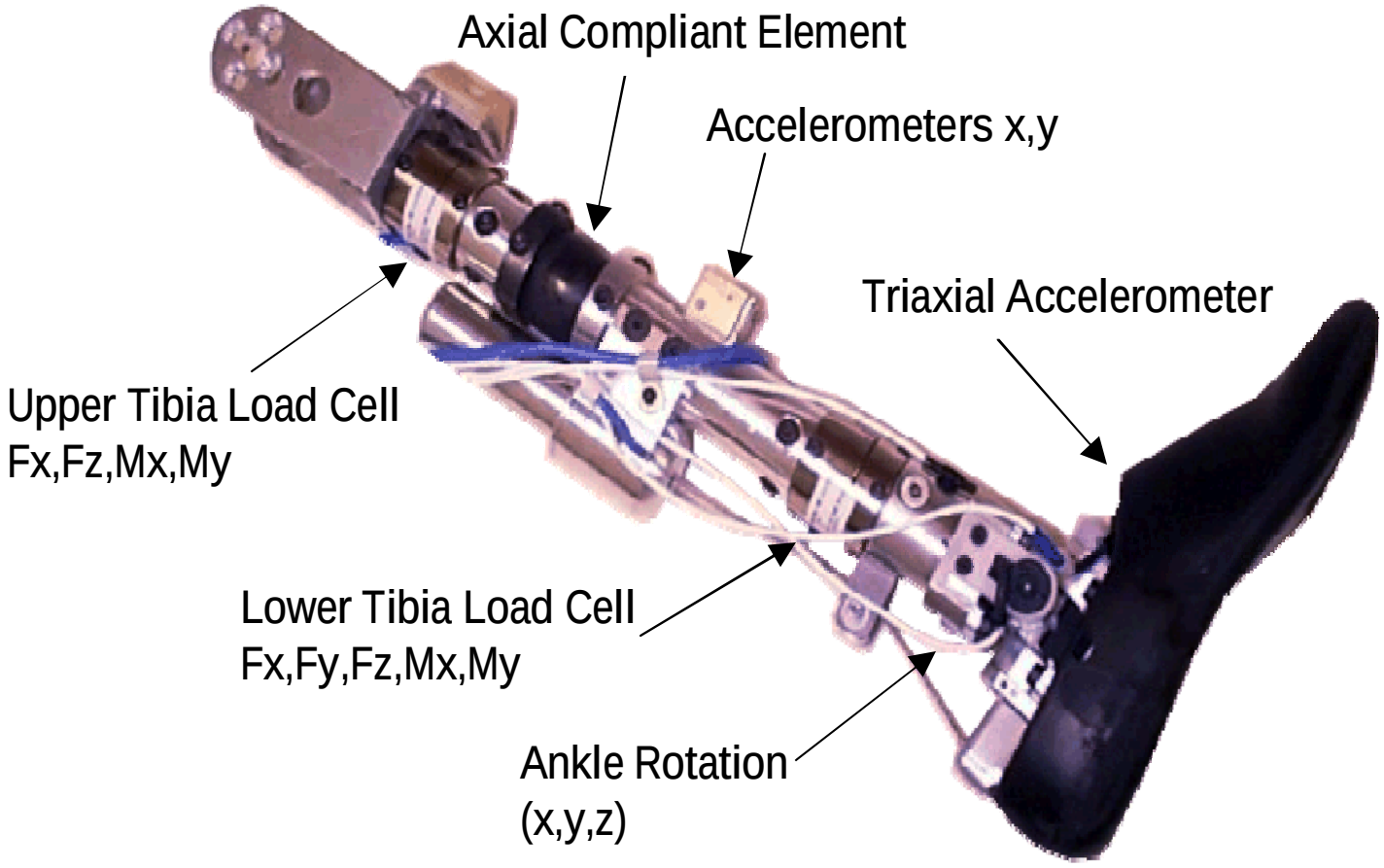
Risk of AIS 2+ Injuries for Different Crash Modes



Lower Extremity Injuries

- **NHTSA estimates approximately 110,000 occupants sustain AIS 2 or 3 lower extremity injuries every year (75% of these are in cars).**
- **Annual Cost estimated at $9.2 billion.**
- **Lower Extremity Injuries**
  - **Knee-thigh-hip complex**
    - 55% of AIS 2+ injuries
    - 42% Associated functional Life-years Lost to Injury
  - **Remaining Lower extremities**
    - 45% of AIS 2+ injuries (74% foot and ankle)
    - 58% Associated functional Life-years Lost to Injury
- **FMVSS 208 designed to reduce fatalities and serious head, neck and torso injuries in frontal crashes, as well as a reduction in femur fractures.**

Advanced Lower Leg (Thor-Lx/HIIIr) to Address Lower Leg Injuries



Research Plan

- **Investigate different seating procedures.**
- **Perform crash tests in stages (most vehicles receive top scores in IIHS tests – what will be the benefit of this rulemaking?)**
  - Stage 1 – evaluate seating procedures and explore poor performers. Identify effective countermeasures.
  - Stage 2 – implement a fleet representative test matrix.
- **Perform cost study of countermeasures.**
- **Thor-Lx federalization.**

NHTSA's Hydrogen, Fuel Cell, and Alternative Fuel Vehicle Safety Research Plan

Background

- **Why hydrogen?**
  - 2002 - FreedomCAR Program replaces PNGV. Advance development of fuel cell vehicles (FCVs) and hydrogen fuel infrastructure
  - 2003 – FreedomCAR and Fuel Initiative. Expands on FreedomCAR to make FCVs a viable choice by 2020
  - Reduce dependence on foreign oil, improve efficiency, reduce emissions

Vehicle Safety Research
Problem Definition

- **What are the unique safety challenges presented by hydrogen and fuel cell vehicles?**
  - Characteristics of hydrogen as an energy carrier differ from those of conventional vehicle fuels
  - Characteristics of hydrogen storage differ from storage of conventional fuels
  - Characteristics of fuel cells as high voltage electrical devices differ from batteries
  - Altered mass distribution may effect crashworthiness performance

NHTSA's Standards for Fuel System Integrity

Standard 301	Fuel System Integrity
Standard 302	Flammability of Interior Materials
Standard 303	Compressed Natural Gas (CNG) System Integrity
Standard 304	CNG Container Integrity
Standard 305	Electric Vehicles

Path to FMVSS for Hydrogen and Fuel Cell Vehicles

- **Conduct safety research in support of rulemaking objectives**
- **Promulgate equivalent 300 series FMVSS for hydrogen and fuel cell vehicles**
- **Facilitate International Harmonization through Development of Global Technical Regulations (GTR) in 2010 – 2012 timeframe**

Supporting Research

- **Component level testing:**
  - Fuel container, powertrain, and delivery system safety performance testing
- **Full vehicle performance testing:**
  - Crash – front, side, rear
  - Electrical isolation of fuel cell, cooling system and auxiliary batteries
  - Post crash handling and EMS
  - CAFE testing

Research Projects
Where are we now?

- **FY 2006 ($1,256,000)**
  - Failure Modes and Effects Analysis of hydrogen fueled vehicles
  - Electrical isolation test procedure
  - High pressure cylinder testing
  - Comparative assessment of codes, standards and regulations

FMVSS No. 213 Update

- **Published NPRM on Aug. 31, 2005 (Docket # 21245)**
  - Extend standard to cover child restraints recommended for up to 80 pounds.
  - Federalize and test with HIII 10YO dummy.
  - Withdraw the weighted HIII 6YO dummy.
  - Keep FMVSS No. 213 injury criteria unchanged.
- **Research efforts**
  - Additional evaluation of child restraints rated for use 50 – 80lbs
    - Consider performance, booster seat mass, etc.

Child Safety - Side Impact

- **Safety problem definition**
  - Near-term focus is 3 year olds
  - Mid-term focus is 6 year olds
  - Identification of injury frequencies - fatalities as well as moderate and severe injuries
  - Identification of injury types (i.e., body regions and source of injuries)
    - CDS analyses
    - Clinical analyses with CIREN and CHOP

Child Safety - Side Impact
Continued

- **Test procedure development: Near-Term Q3s Dummy**
  - Consider existing and new side impact procedures
    - Selection based on real-world injuries/outcomes

- **Test procedure development: Mid-Term Q6s Dummy**
  - Consider existing side impact countermeasures
    - Side airbag technologies (curtains, seat bags, etc.)
    - Vehicle interior components (door, sill, seatback, pillars, etc.)

Child Safety
Rear Seat Frontal Protection

- **Effects of seatbelt, seat geometry, and belt fit for large children.**
  - Consider real posture of large children
    - Vehicle seat – vary seatback, seat pad angle & height.
    - Belt geometries – vary lap and shoulder belt anchorages.
    - Static use evaluations.
  - Evaluate seat & belt fit dynamically – sled tests.
  - Propose optimal seat and belt geometries for larger children in rear seat.


Thank you