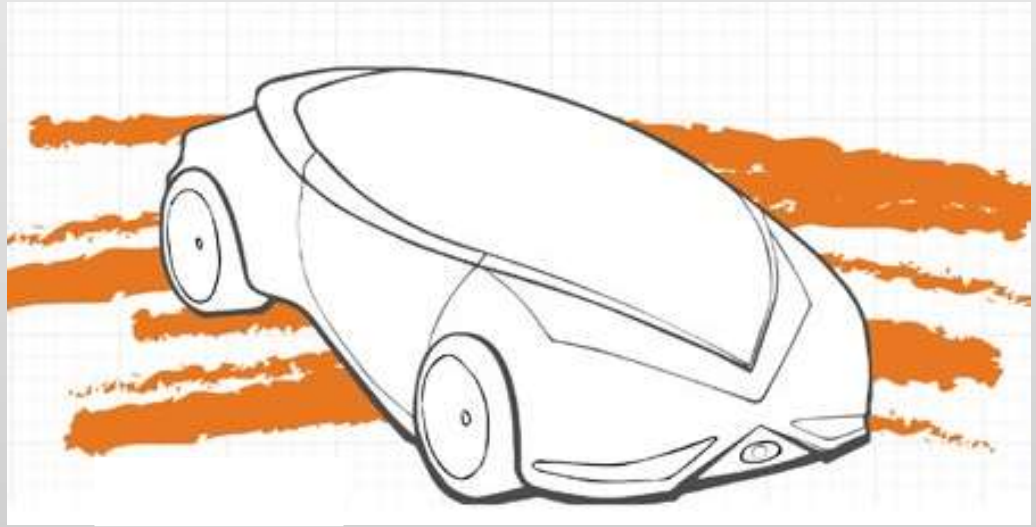
Stakeholder Meeting: FMVSS Considerations for Automated Driving Systems



WiFi Login Information

Network: MediaCntr_Net

Password: OpenHouse2018

Opening Remarks

Cem Hatipoglu, Director
Office of Vehicle Crash Avoidance and Electronic Control Research, NHTSA

Project Remarks

Ellen Lee
Human Injury Research Division
NHTSA

Project Overview

Myra Blanco, Director
Center for Public Policy, Partnerships, and Outreach
VTTI

Technical Translation Approaches to FMVSS for Vehicles with Automated Driving Systems

Project Overview

Stakeholder Meeting

April 3, 2018

VIRGINIA TECH TRANSPORTATION INSTITUTE

Core Team

Myra Blanco, Ph.D.
PI & Program Manager

Michelle Chaka, M.S.
Co-PI & Crash Avoidance Lead

Clay Gabler, Ph.D.
Co-PI & Crashworthiness Lead

VTTI's FMVSS Expert Group
William Hollowell, Ph.D.
Joseph Kanianthra, Ph.D.
Priya Prasad, Ph.D.
George Soodoo, M.B.A.
Kenneth Weinstein, J.D.

Research Team Members

Industry Group
GM, Nissan

Research Institutions
Booz | Allen | Hamilton, SwRI

Test Facilities
DRI Dynamic Research, Inc., mga research corporation

Project Objective

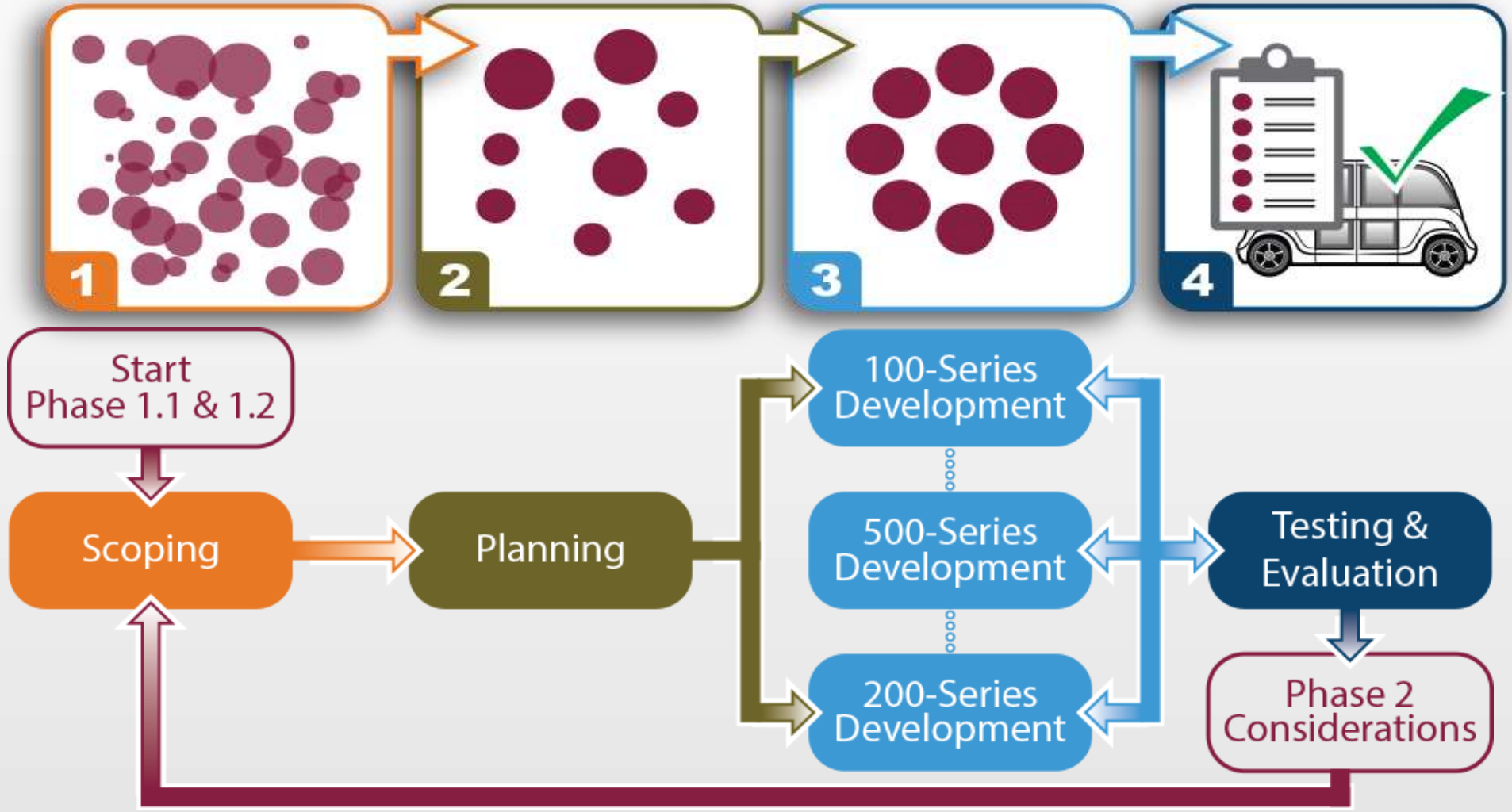
- Research and identify **potential barriers** for self-certification and compliance verification of innovative new vehicle designs precipitated by Automated Driving Systems (ADSs).

- Research alternative approaches and provide the National Highway Traffic Safety Administration (NHTSA) information about potential **technical translations** of Federal Motor Vehicle Safety Standards (FMVSS) and related test procedures.

Project Focus

- ADS-equipped vehicles designed **without conventional user interfaces** (e.g., steering, braking/accelerating, transmission gear selection)
  - A type of ADS-DV without human-vehicle controls
  - Phase 1 – Conventional seating
- Vehicle performance vs. Driver performance

Approach


1
2
3
4
Start
Phase 1.1 & 1.2
Scoping
Planning
100-Series
Development
500-Series
Development
200-Series
Development
Testing &
Evaluation
Phase 2
Considerations

ADS Framework & Concepts

Framework: Categories and Features

- **Entry/Egress**
  - Doors
  - Key/Theft Protection/User Authentication
- **External Communication**
  - Auditory Indicator
  - Exterior Illumination
  - Stop Lamp
  - Taillamps
  - Turn Signals
  - Wireless Intent Communication

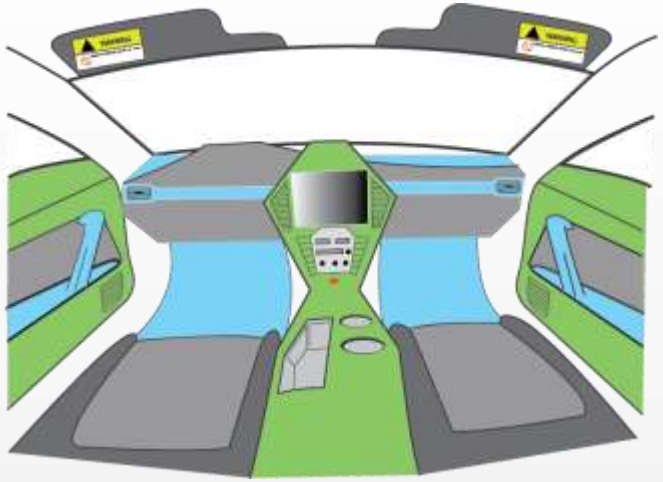
Framework: Categories and Features

- **Seating Configuration and Occupant Protection**
  - Child Restraint
  - Head Restraint
  - Inflatable Restraint
  - Seat Belt
  - Seating
  - Upper and Lower Extremity Restraints
- **User Communication**
  - Mounted Displays
  - Panic Button (Voluntary)
  - Portable Device Destination Input
  - Portable Device User Communication
  - Portable Device Window/Comfort Input
  - Telltales

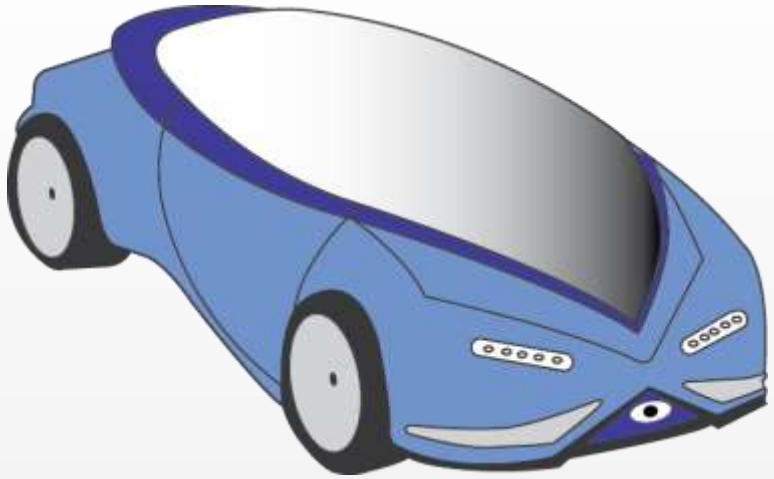
Framework: Categories and Features

- **Vehicle Control**
  - Accelerator/Brake Pedals
  - Bidirectional Vehicle Motion
  - Parking Brake System
  - Shifter
  - Steering Wheel
- **Visibility**
  - Headlamp
  - Hood
  - Mirror
  - Rear Visibility System
  - Sun Visor
  - Window
  - Window Defog/Defrost
  - Windshield
  - Windshield Wiper

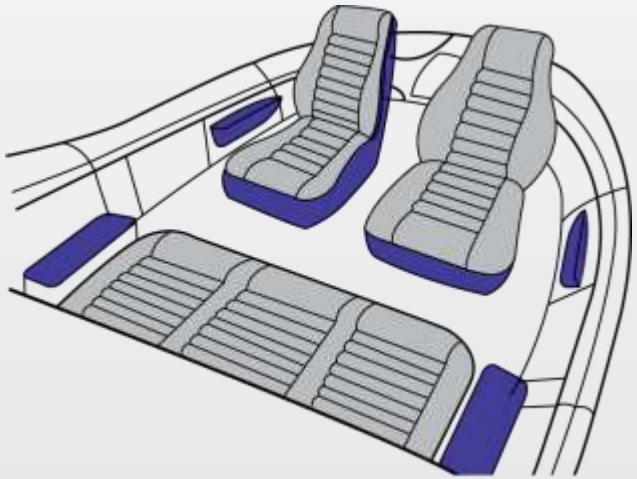
Four Research Concept Vehicles



First Generation



Transitional



Revolutionary

Low-Speed

100-Series: Crash Avoidance & Crosscutting Themes

Sample Topics: Crash Avoidance

- **101** Controls and Displays
- **102** Transmission shift position sequence, starter interlock, and transmission braking effect
- **103** Windshield Defrosting and Defogging
- **104** Windshield Wiping and Washing
- **108** Lamps, reflective devices, and associated equipment
- **110** Tire Selection and Rims and Motor Home/Recreation Vehicle Trailer Load (10,000 lbs. or Less)
- **111** Rearview Mirrors
- **113** Hood Latch System
- **114** Theft protection and rollaway prevention
- **118** Power-operated window, partition, and roof panel systems
- **124** Accelerator Control Systems
- **125** Warning Devices
- **126** Electronic Stability Control Systems
- **138** Tire pressure monitoring systems
- **141** Quiet car

FMVSS 100-Series: Common Themes

- Controls and Displays
- Designated Seating Position
- Driver (Operator)
- Front Driver/Passenger Position(s)
- Front/Rear of Vehicle
- Service Brake Application
- Shift Position (gear, select, reverse)
- Vehicle Loading including Test Driver and Instrumentation
- Visibility

200-Series: Crashworthiness, Occupant Protection & Crosscutting Themes

Sample Topics: Crashworthiness

- **201** Occupant protection in interior impact
- **202** Head restraints
- **203** Impact protection for the driver from the steering control system
- **204** Steering control rearward displacement
- **205** Glazing materials
- **206** Door locks and door retention components
- **207** Seating Systems
- **208** Occupant Crash Protection
- **210** Seat Belt Assembly Anchorages
- **214** Side Impact Protection
- **216a** Roof Crush Resistance: Upgraded Standard
- **219** Windshield Zone Intrusion
- **222** School Bus Passenger Seating and Crash Protection
- **225** Child Restraint Anchorage Systems
- **226** Ejection Mitigation

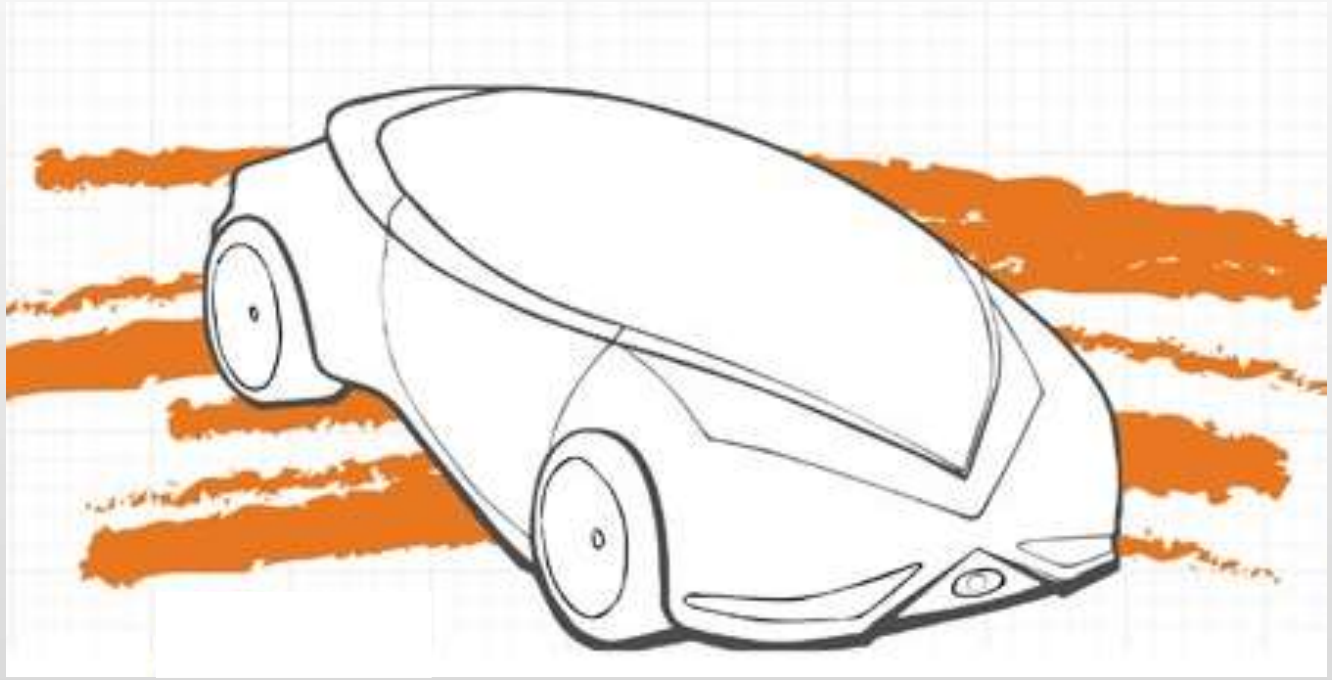
FMVSS 200-Series: Common Themes

- Assumes Front Row is Preferred Seating Position
- Dummy Positioning References
- Driver/Front Passenger Designated Seating Position(s)
- Equipment to be Tested May Not Be Present
- Front/Rear of Vehicle (“Forward-Facing” References)
- Reference to a Driver
- Telltales

Expert Panel

Key Topics to Consider during the Crash Avoidance, Crashworthiness, and Occupant Protection Discussion

Stakeholder Meeting: FMVSS Considerations for Automated Driving Systems



Expert Panel: George Soodoo

FMVSS 101 – Controls and Displays

Purpose

- To make it easy to access, see, and recognize vehicle controls, telltales and indicators
- To make it easy to select vehicle controls under daylight and nighttime conditions
- To help the driver pay attention to the driving task

Observation #1

The stated purpose of FMVSS 101 includes several words that indicate a high level of involvement for the human driver

- This creates potential challenges for translation

Definitions

DRIVER means the occupant of a motor vehicle seated immediately behind the steering control system. *(Part 571.3)*

CONTROL means the hand-operated part of a device that enables the driver to change the state or functioning of the vehicle or a vehicle subsystem. (*FMVSS 101)*

TELLTALE means an optical signal that, when illuminated, indicates the actuation of a device, a correct or improper functioning or condition, or a failure to function. *(FMVSS 101)*

Observation #2

The definition of *DRIVER* presents one of the big challenges to the translation of the 100-series standards

- ADS driver does not need a seat behind a steering wheel
- ADS driver does not need hand-operated controls
- ADS driver does not need optical signals to be informed of malfunctions

Translation Challenges

- Information needs and command needs for the ADS driver are currently not specified
- No standards or procedures are specified that would prioritize warnings for the ADS driver, such as a brake failure (RED telltale) versus ABS malfunction (YELLOW telltale)
- Research may be needed on relevant telltales for AVs
  - To whom is telltale information conveyed? - vehicle occupants, owners, or maintenance person?
  - Where in the vehicle is telltale information displayed, if at all?

Observation #3

Look for nuances in the regulatory language that could make the difference in the ability to translate, for example:

- *Drive the vehicle forward down a 10 percent grade and stop it with the service brakes (FMVSS 114 S6.2.3(a))*

Expert Panel

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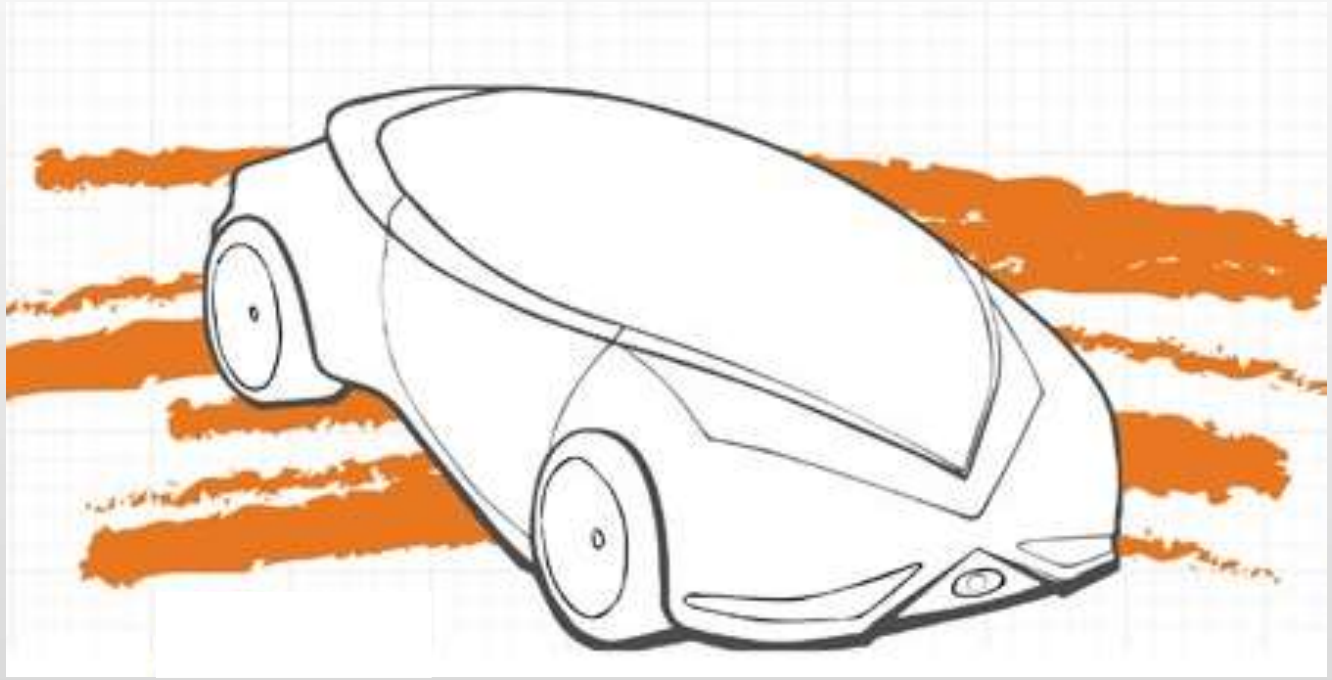
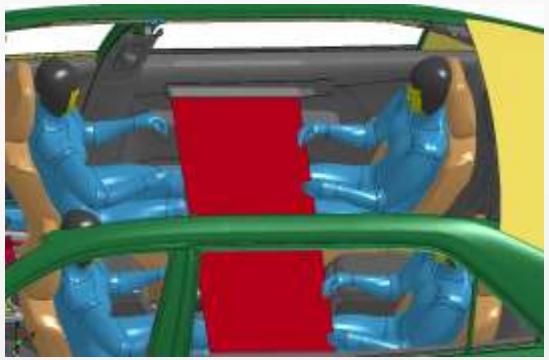


Expert Panel: William Hollowell, PhD

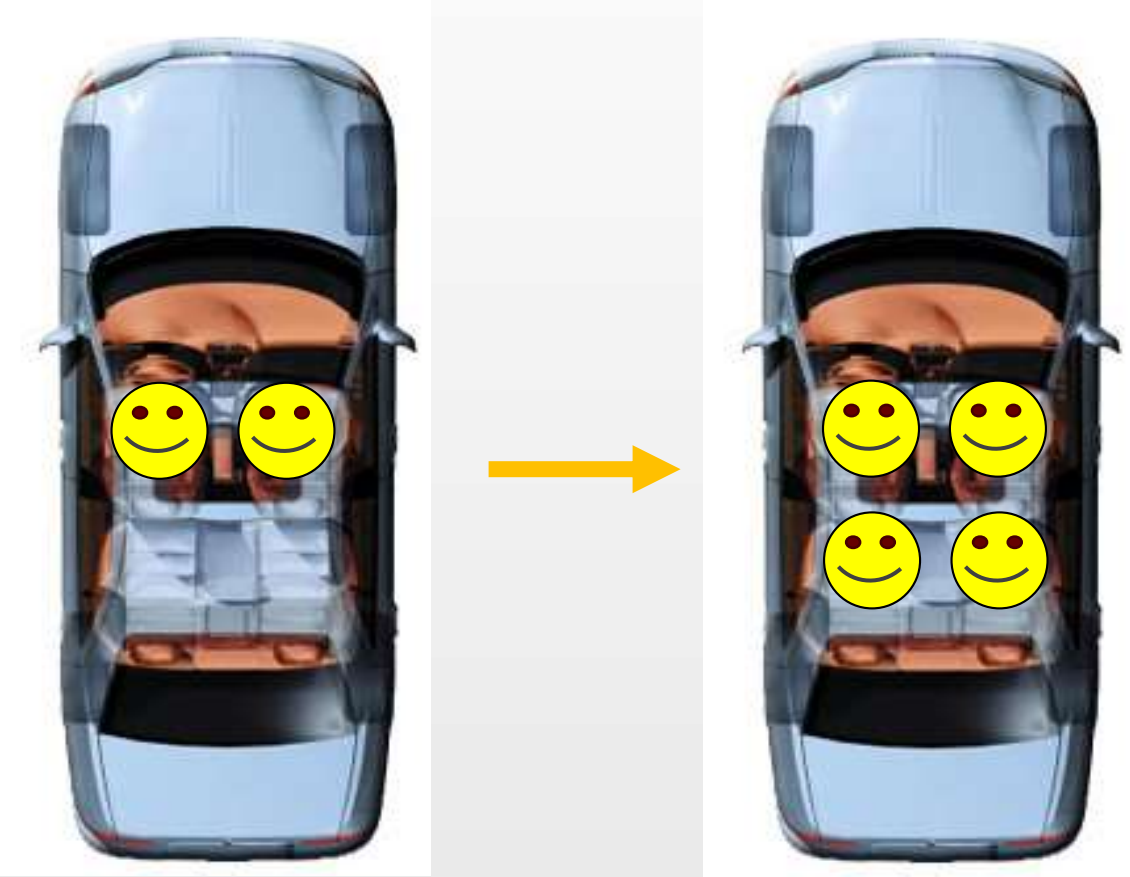
Conventional vs. Unconventional Seating



Phase 1:
Conventional Seating

Phase 2:
Unconventional Seating

FMVSS 208 Frontal Crash Test – Option 1



FMVSS 208
(current)

FMVSS 208
(Option 1)

- Tests front outboard seating positions
- In ADS-DV, preferred seating position may not be front seats.
- Test-procedure dummy alignment assumes forward-facing seats.

Expert Panel

Key Topics to Consider during the Crash Avoidance, Crashworthiness, and Occupant Protection Discussion

Next on the Agenda

- 10:45 AM: Concurrent Breakout Sessions
  - Use question cards
    - Name optional, but would help if we need clarifications about your question/comment
  - Locations
    - 100-Series Working Group – Oklahoma City Room
    - 200-Series Working Group – 8, 9, 10 Rooms
- 12:00 PM: Lunch – Cafeteria (no reentry)
- 1:30 PM: Breakout Sessions Continue

Thank You!

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