Occupational Motor Vehicle Safety: Engineering and Technology-Based Research

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Presentation outline

- Center for Motor Vehicle Safety (CMVS) overview
- Current and future engineering work
- CMVS midcourse review: Engineering/technology results and future directions
- Complementary work with partners

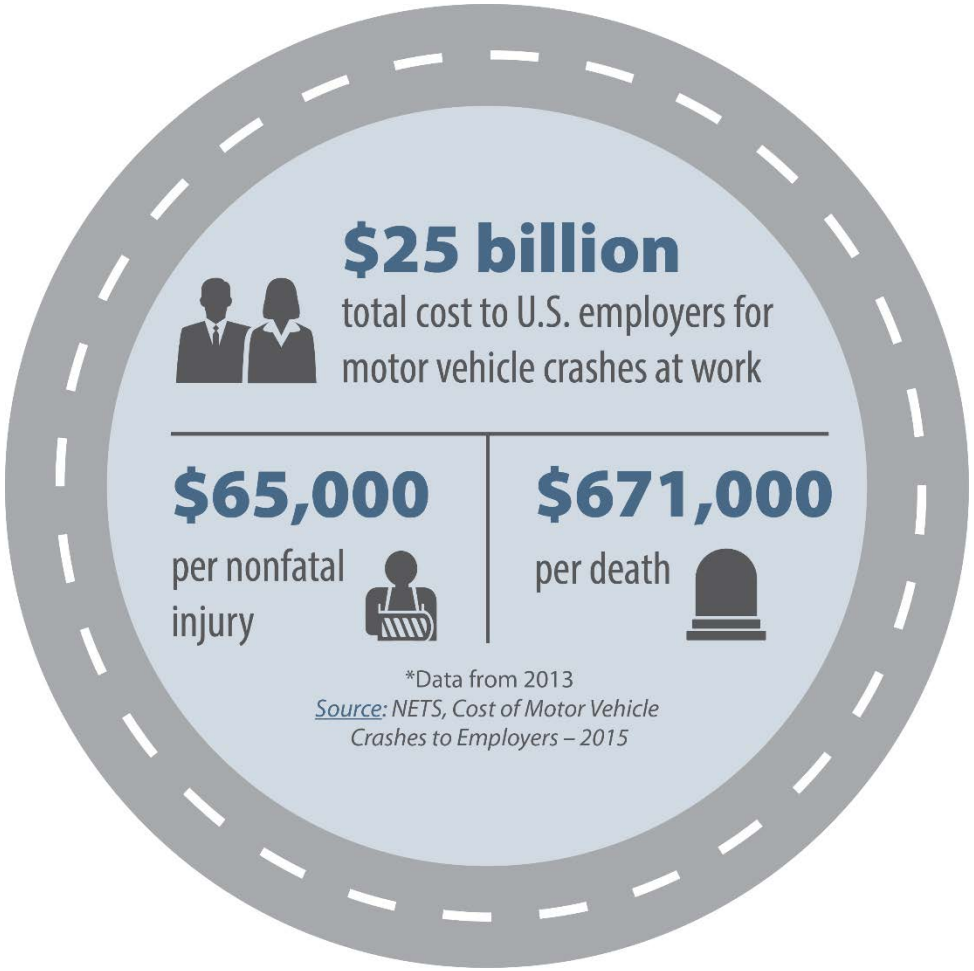
What we do

The CMVS conducts research and develops recommendations to prevent work-related motor vehicle crashes and resulting injuries.

- ✓ **Knowledge**
- ✓ **Partnerships**
- ✓ **Policy**
- ✓ **Communication**

Why we do it

- Motor vehicle crashes are the leading cause of U.S. work-related deaths.
- Over 23,000 deaths 2003-2015
- 1st or 2nd leading cause of death in every major industry group



CMVS strategic goals 2014-2018

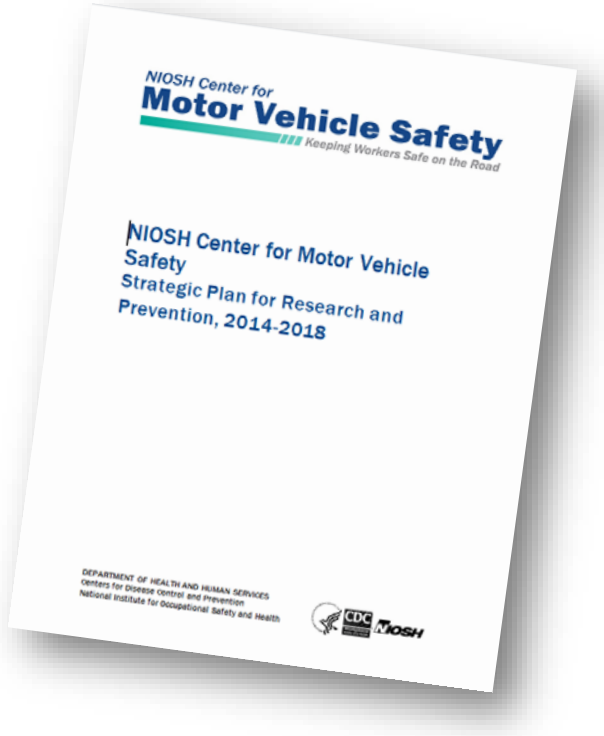
Goal 1: Identify risk factors for work-related crashes

Goal 2: Apply engineering and technology-based safety interventions

Goal 3: Promote evidence-based policies and practices

Goal 4: Share NIOSH research with global partners

Goal 5: Communicate safety and policy recommendations



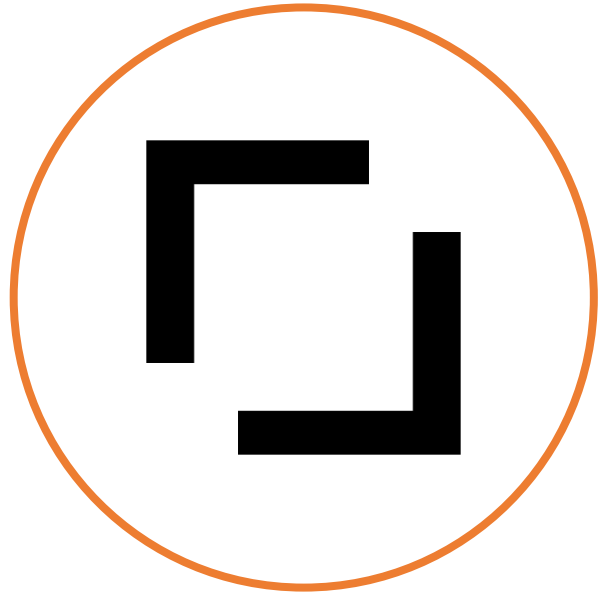
Strategic Goal 2

Reduce the incidence and severity of work-related motor vehicle crashes by implementing **engineering and technology-based safety interventions** and studying the positive or negative safety consequences of new technologies installed in vehicles.

Engineering and technology research

Our niche and strategies:

- Play to our strengths, but be positioned to address emerging issues
- Maintain focus on occupational vehicle use
  - Emphasis on special-use vehicles
- Fill research gaps – don’t duplicate others’ work

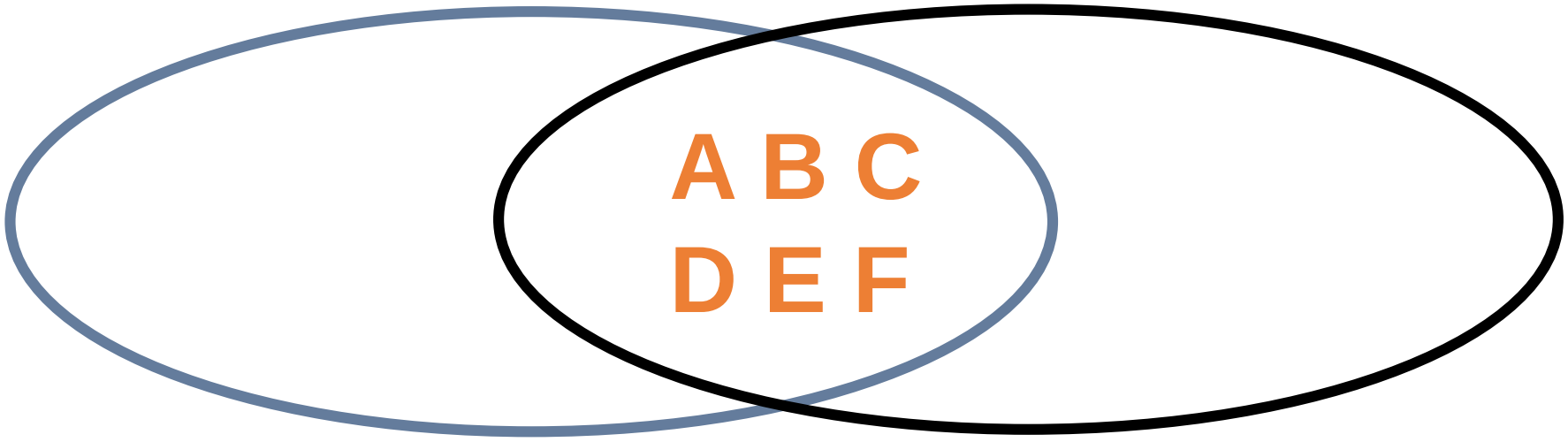


Current and future engineering work

Background • Experience • Resources • Initiative

Vehicle safety and engineering & technology

Relation: Anthropometry, Biomechanics, Cognitive issues,
Digital simulation, Emerging technology, and Fatigue control



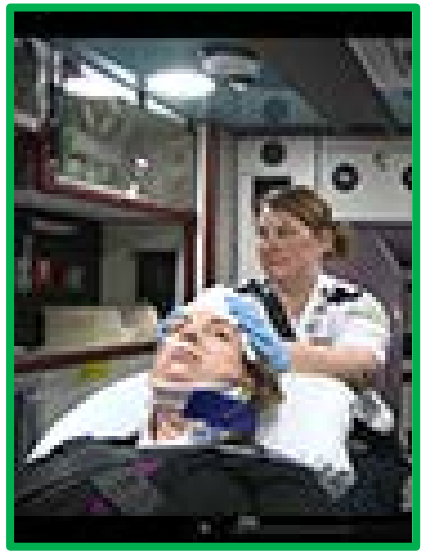
Anthropometry

Aim:

- Improved driver visibility and control operation
- Increased post-crash survivability by enhanced seat and body restraint configurations

Truck drivers

Fire fighters



EMS

Cab design

Law enforcement

Anthropometry

- NIOSH Anthropometry Webpage
- Anthropometric Study of U.S. Truck Drivers: Methods, Summary Statistics, and Multivariate Accommodation Models (NIOSH Publication No. 2015-116, 2015)
- Seat and Seatbelt Accommodation in Fire Apparatus: Anthropometric Aspects (Applied Ergonomics, 2015)
- EMT Anthropometry Datasets (NIOSH Dataset RD-1008-2016-0)
- Anthropometric Procedures for Protective Equipment Sizing and Design (Human Factors, 2013)

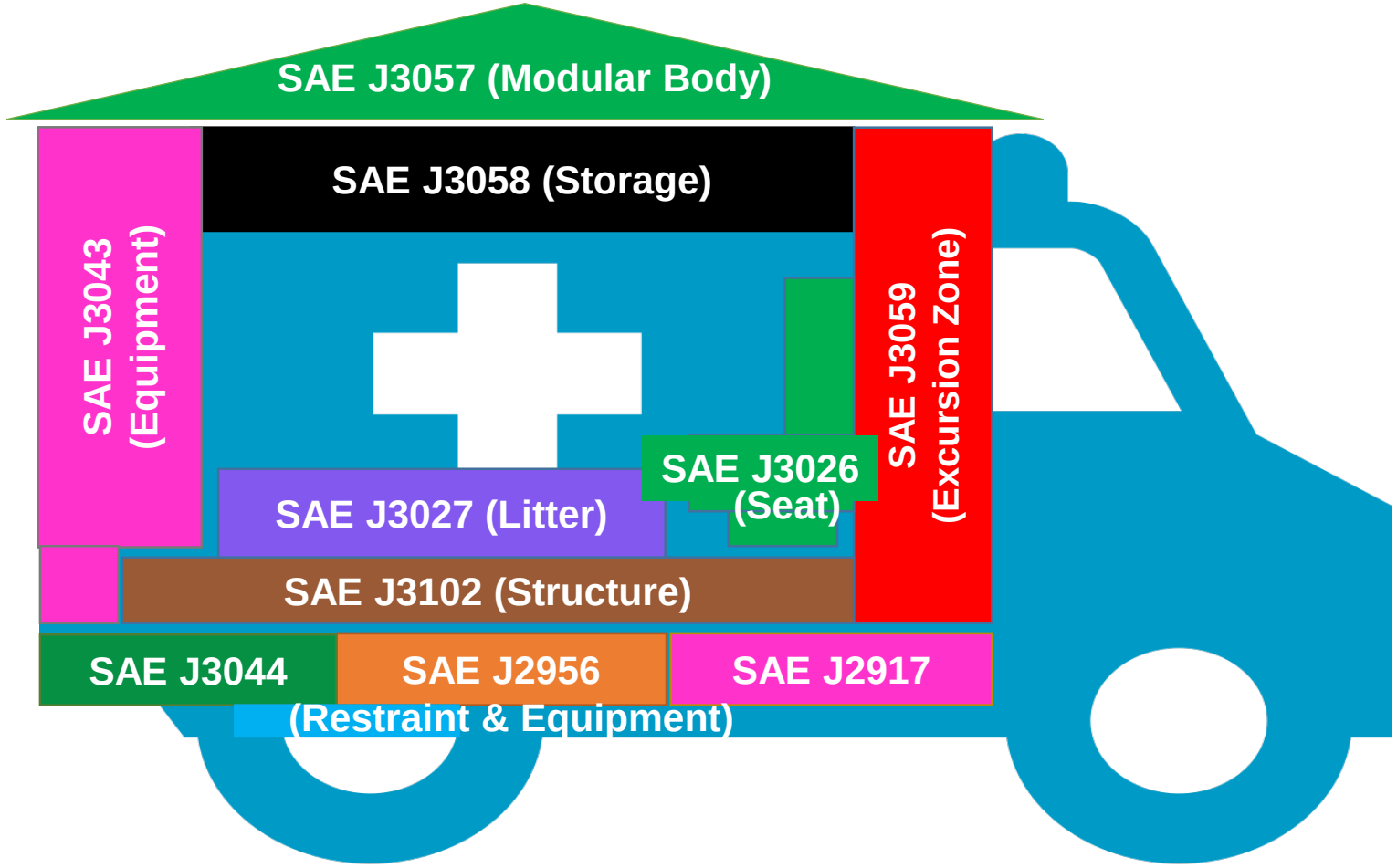
To retrieve a publication, please place your curser over the title, right click your mouse, and select Open Hyperlink

Biomechanics

Aim:

- Enhance vehicle design and configurations to improve occupant impact survivability when in a crash

Biomechanics



Cognitive issues

- How do occupational drivers respond to yellow lights?
- When and where should a driver stop or prepare to stop?
- What level of effectiveness can an in-vehicle assistant device have to reduce red-light running?

Cognitive issues

- Science-based safety guidelines will be available to stakeholders, community, and professional drivers.
- Developed intersection modules, vehicle dynamic models, and digital dashboards can be used for hazard recognition training.

Digital simulation

- Digital simulations overcome crash hazards that human subjects and researchers may encounter in field experiments.
- NIOSH is establishing its capacity in vehicle safety digital simulation, building on experience in digital human modeling.

Digital simulation

- We are building a driving simulation scenario library which includes a series of intersections, roads, and townships.
- The simulation modules and vehicle dynamic models can be shared with research partners for collaborative research.

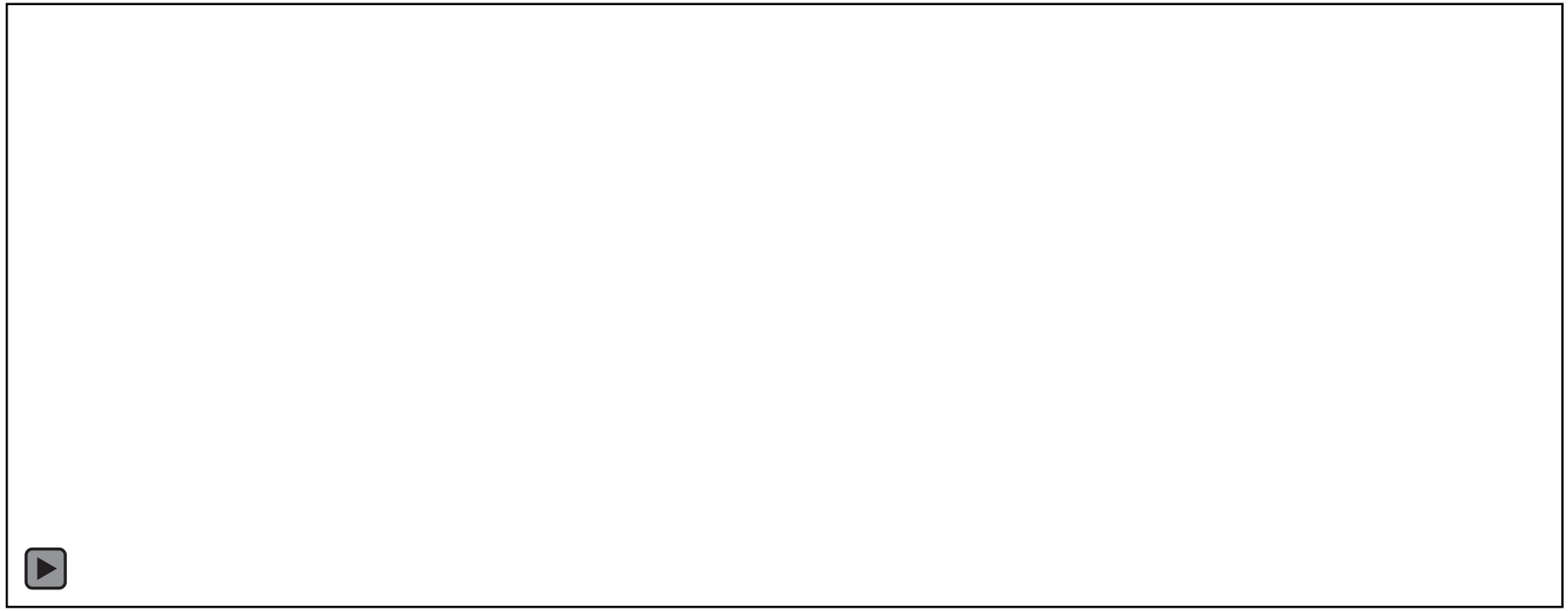
Emerging technology

Aim:

- Effectiveness of advanced driving assistance systems
- Effectiveness of connected-vehicle technologies

Emerging technology

- Evaluating the performance and acceptability of an advanced speed warning system for fire trucks

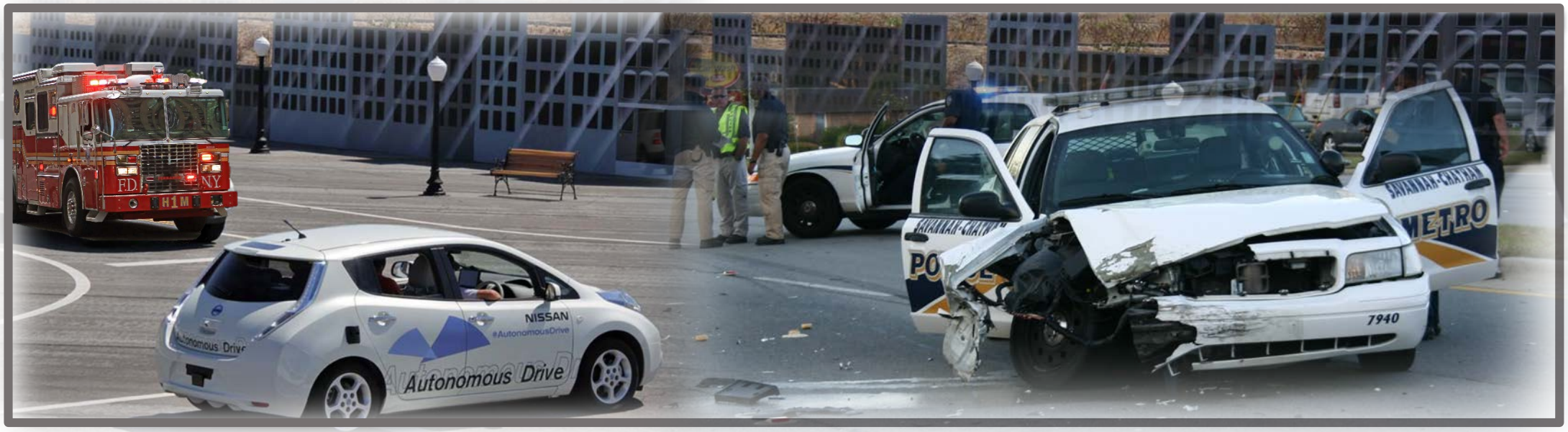


Fatigue

- Truck driver sleep pattern study shows importance of drivers receiving adequate sleep the night before they drive.
- Build capacity in evaluating fatigue controls through eye tracking, electrocardiography, and other assessment methods.

Fatigue

- Interaction of emergency vehicles with autonomous vehicles
- Safe operation of connected emergency vehicles
- Procedures to take over autonomous vehicles in emergency conditions



Epidemiologic research involving technology

Field evaluation of an in-vehicle monitoring system

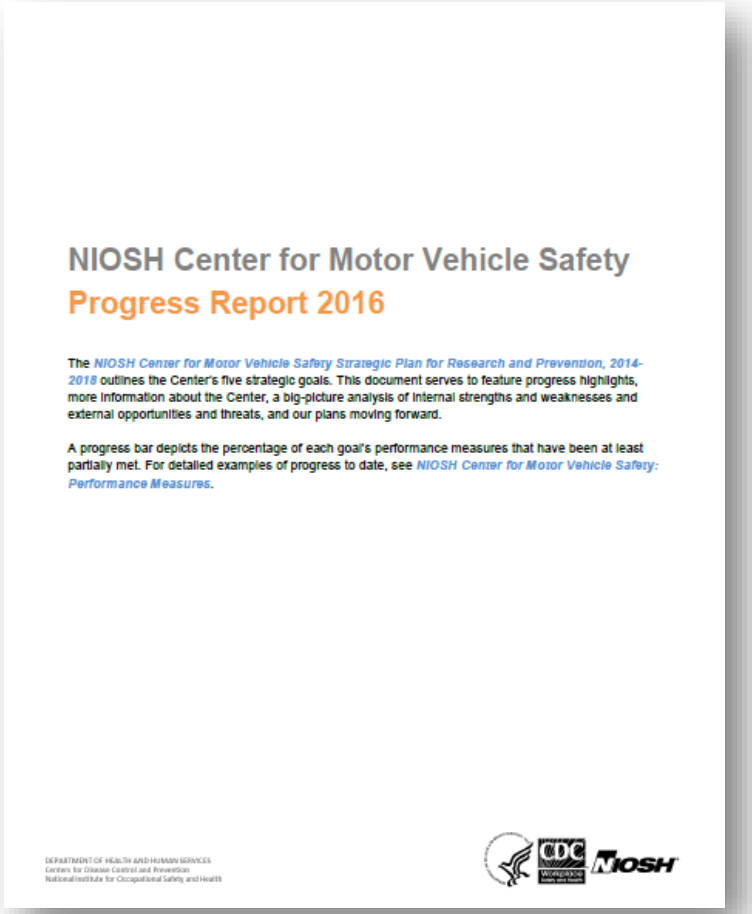
- Interventions: in-vehicle lights and supervisory coaching
- Warning lights alone reduced risky driving behaviors, but lights combined with coaching was more effective

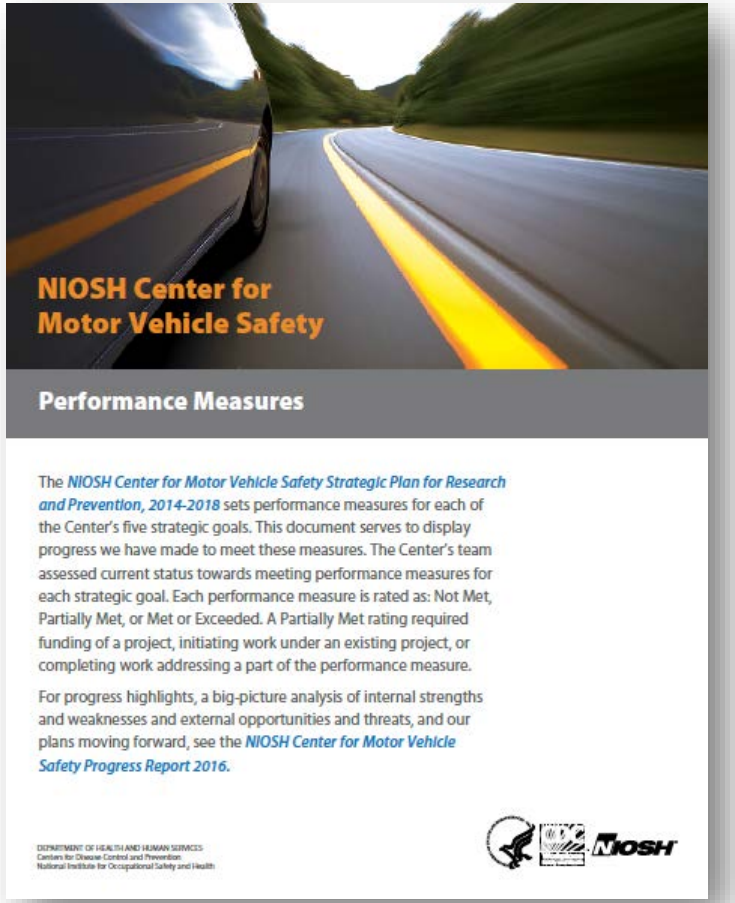
New research on fatigued and distracted driving in the oil and gas extraction industry

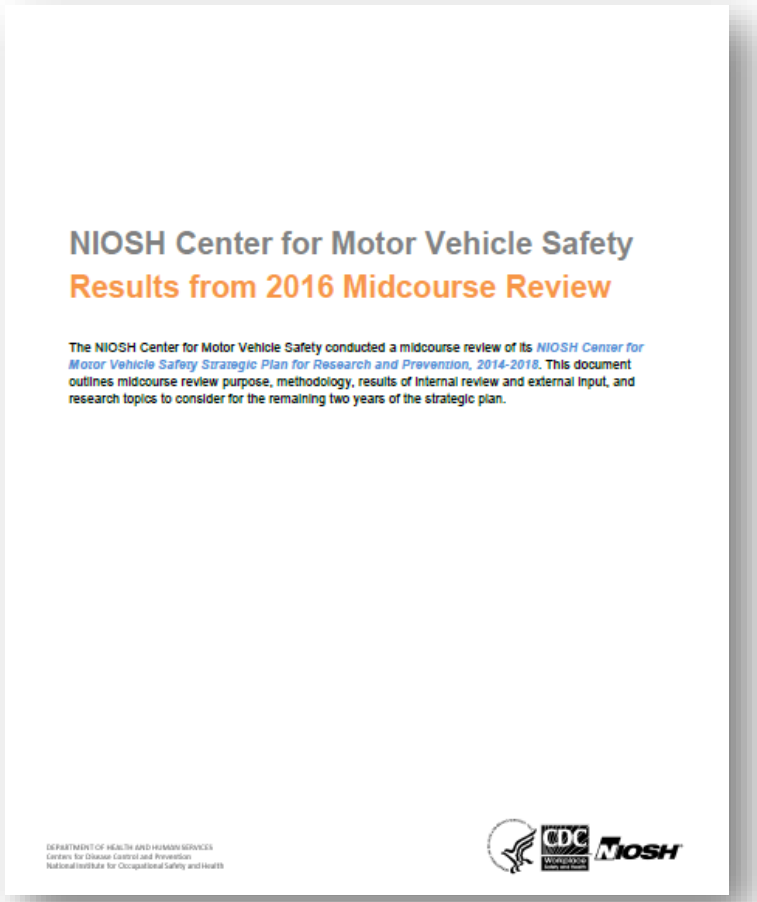
- Describe driving practices
- Examine correlation between results from fatigue detection technology and IVMS
- Co-variates: job tasks, time on task, shift types and lengths

Bell JL et al [2017]. Evaluation of an in-vehicle monitoring system (IVMS) to reduce risky driving behaviors in commercial drivers. Journal of Safety Research 60:125-136.

CMVS midcourse review







Progress report

Performance measures report

Final report

Results of our self-assessment

Goal 1: Identify risk factors for work-related crashes

Goal 2: Apply engineering and technology-based safety interventions

Goal 3: Promote evidence-based policies, standards, and regulations

Goal 4: Collaborate with global partners

Goal 5: Communicate safety and policy recommendations

Progress on CMVS performance measures

- Two-thirds of 46 total performance measures (PMs) fully or partially met
- Strategic Goal 2 PMs:
  - Fully met: Truck driver and emergency responder anthropometry
  - Partially met: ADAS for fire apparatus, intersection safety

Comments from reviewers and the public

In-vehicle technologies:

- How engineering- and technology-based tools (ADAS, crash avoidance) in work vehicles affect safety of all road users
- Emergency response settings
- Drivers' interactions with in-vehicle technologies, and tools to educate workers

Connected-vehicle technologies:

- Assess effectiveness in reducing work-related crash risk in emergency response settings and other occupational driving

Comments from reviewers and the public

Highly-automated vehicles (HAVs):

- Engage companies using “driverless” cars as research partners to learn how HAVs impact safety of all road users
- Build enough flexibility into future strategic plans to allow timely response to emerging issues

Midcourse review: The way forward with engineering and technology

Research

- Maintain current niche: special-use vehicles operated in work environments
- Build foundation for research on HAVs and connected-vehicle technology

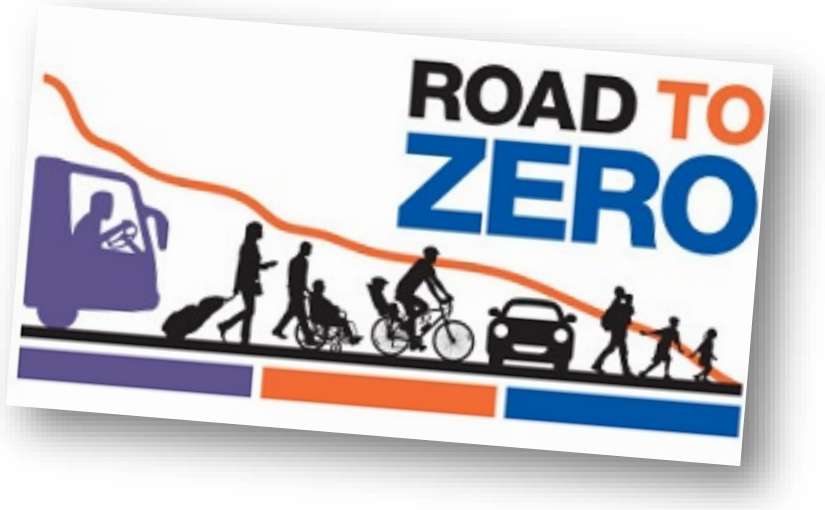
Policy and communication

- Consider policy implications of new technology for all types of workplace vehicle operations

Road to Zero Coalition

Goal: Eliminate traffic fatalities within the next 30 years.

- **Led by:** National Safety Council and U.S. DOT agencies
- **Short-term:** Reverse increase in traffic deaths
- **Long-term:** Develop scenarios leading to zero deaths, including HAV deployment



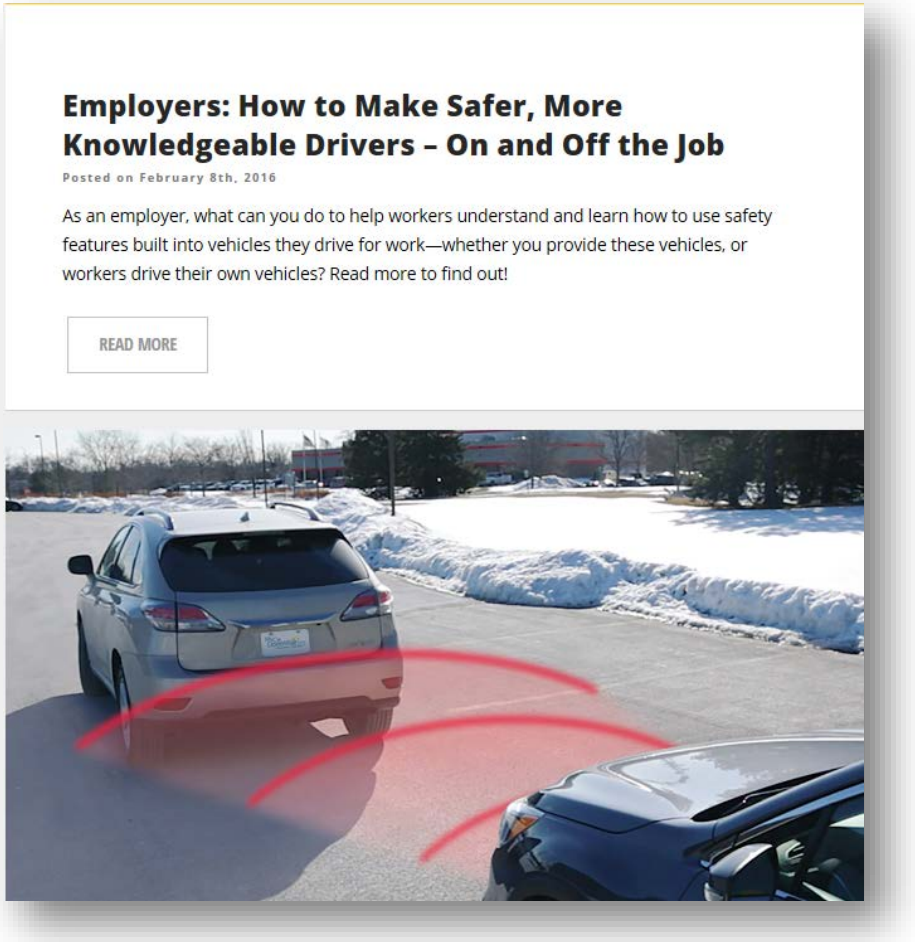
MyCarDoesWhat.org

A national campaign to help educate drivers on new vehicle safety technologies designed to help prevent crashes.

NIOSH blog post for MyCarDoesWhat.org

Main messages:

- Workers can use *MyCarDoesWhat* to better understand advanced safety features.
- As major vehicle purchasers, employers can increase road safety for all by demanding safe vehicles.

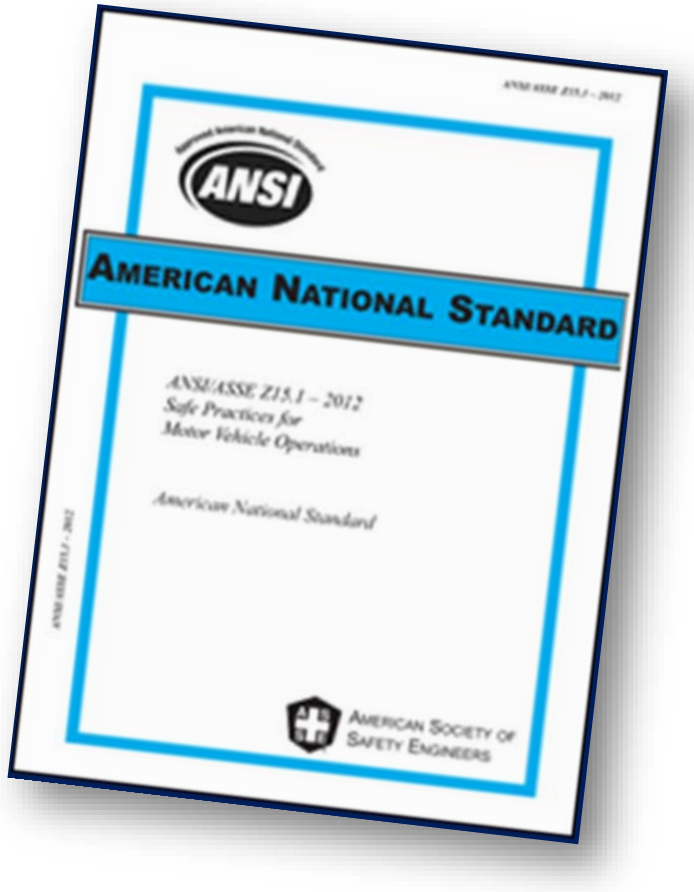


https://mycardoeswhat.org/employers-can-help-make-drivers-safer

ASSE/NSC Subcommittee on Automated Vehicles

Aim: Develop standards for automated vehicles in fleets

- Subcommittee of the ANSI Z15 committee
- Will consider technical and policy implications of highly-automated vehicles for fleet operations



Questions for the Board of Scientific Counselors

Q1: Within the niche we've established, are there other engineering and technology research topics NIOSH should pursue?

Q2: What expertise and lab facilities should we prioritize for development, to better fulfill our mission to improve the safety of occupational drivers?

Q3: Would further policy engagement around highly-automated vehicles be helpful – both to inform our own research and to enable us to provide timely and accurate information to our stakeholders?

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