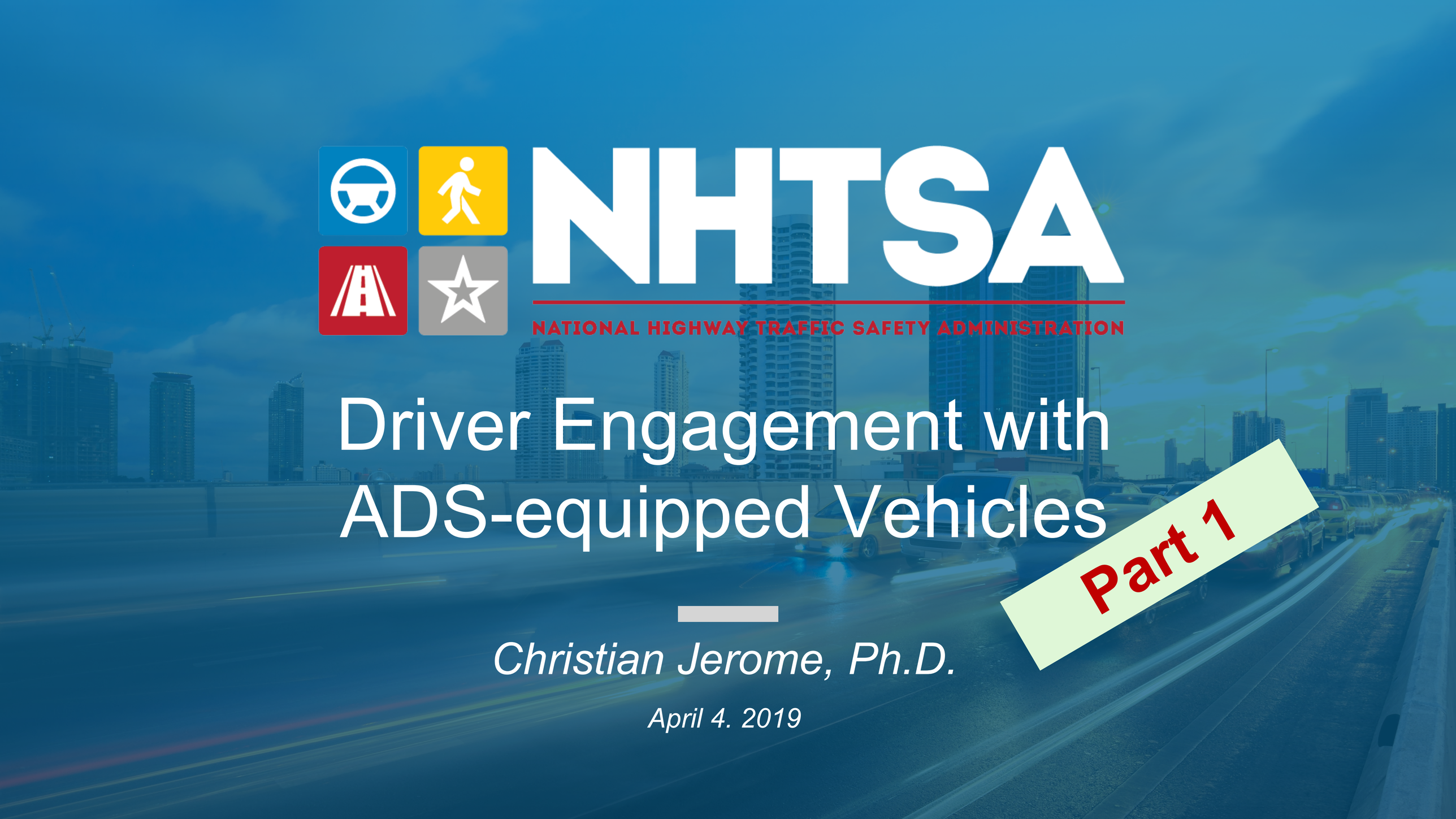


NHTSA

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Driver Engagement with ADS-equipped Vehicles

Part 1

Christian Jerome, Ph.D.

April 4. 2019

AGENDA

1. Introduction and Background
2. What is the Safety Problem?
3. Definitions
4. Research Goals and Objectives

Introduction and Background

- ADS-equipped vehicles have the potential to improve highway safety
  - supporting or supplementing driver performance
    - providing precise vehicle control during normal driving
    - maintaining appropriate driver attention to traffic and roadway conditions

- SAE Level 3 -4 can be both manually and ADS controlled
- Particularly for Level 3, the human driver is expected to maintain awareness of the driving environment if the automation technology is challenged and must transfer control back over to the human driver

The Safety Problem

NTHSA: Our mission is to save lives, prevent injuries, and reduce economic costs due to road traffic crashes, through education, research, safety standards, and enforcement

37,133

NUMBER OF LIVES LOST ON U.S. ROADWAYS IN 2017.

10,874

DRUNK DRIVING DEATHS IN 2017

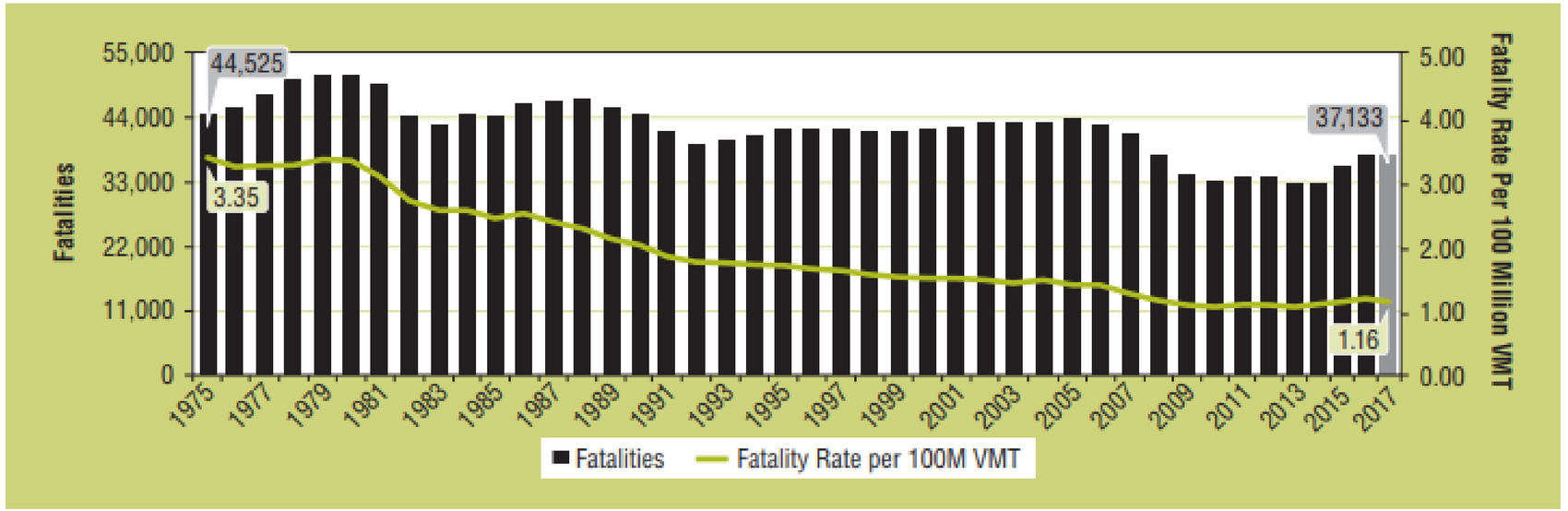
3,450

DEATHS IN DISTRACTION-RELATED CRASHES.

The Safety Problem

2017 Crash Data

Fatalities and Fatality Rate per 100 Million VMT, by Year, 1975–2017



Sources: FARS 1975–2016 Final File, 2017 ARF; Vehicle Miles Traveled (VMT): FHWA.

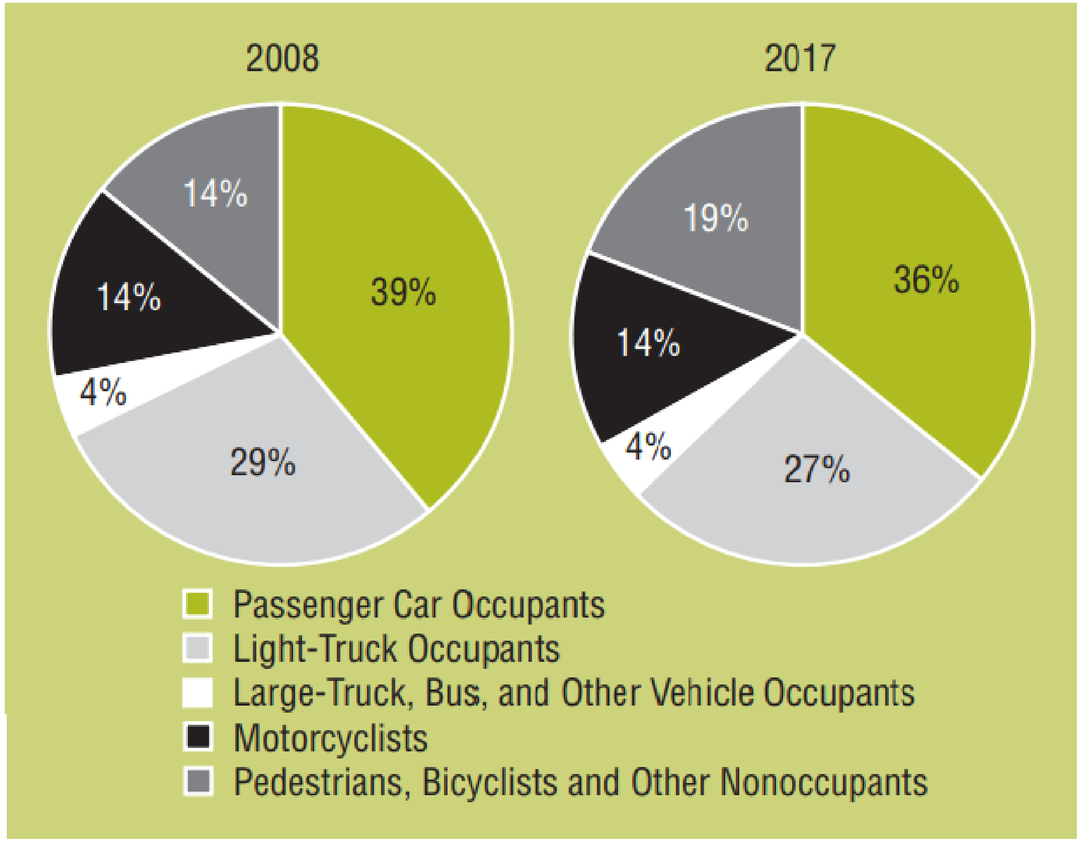
- New technology shows promise in reducing those numbers

The Safety Problem

2017 Crash Data

- Changes in fatality composition between 2008 and 2017

Fatality Composition, 2008 and 2017



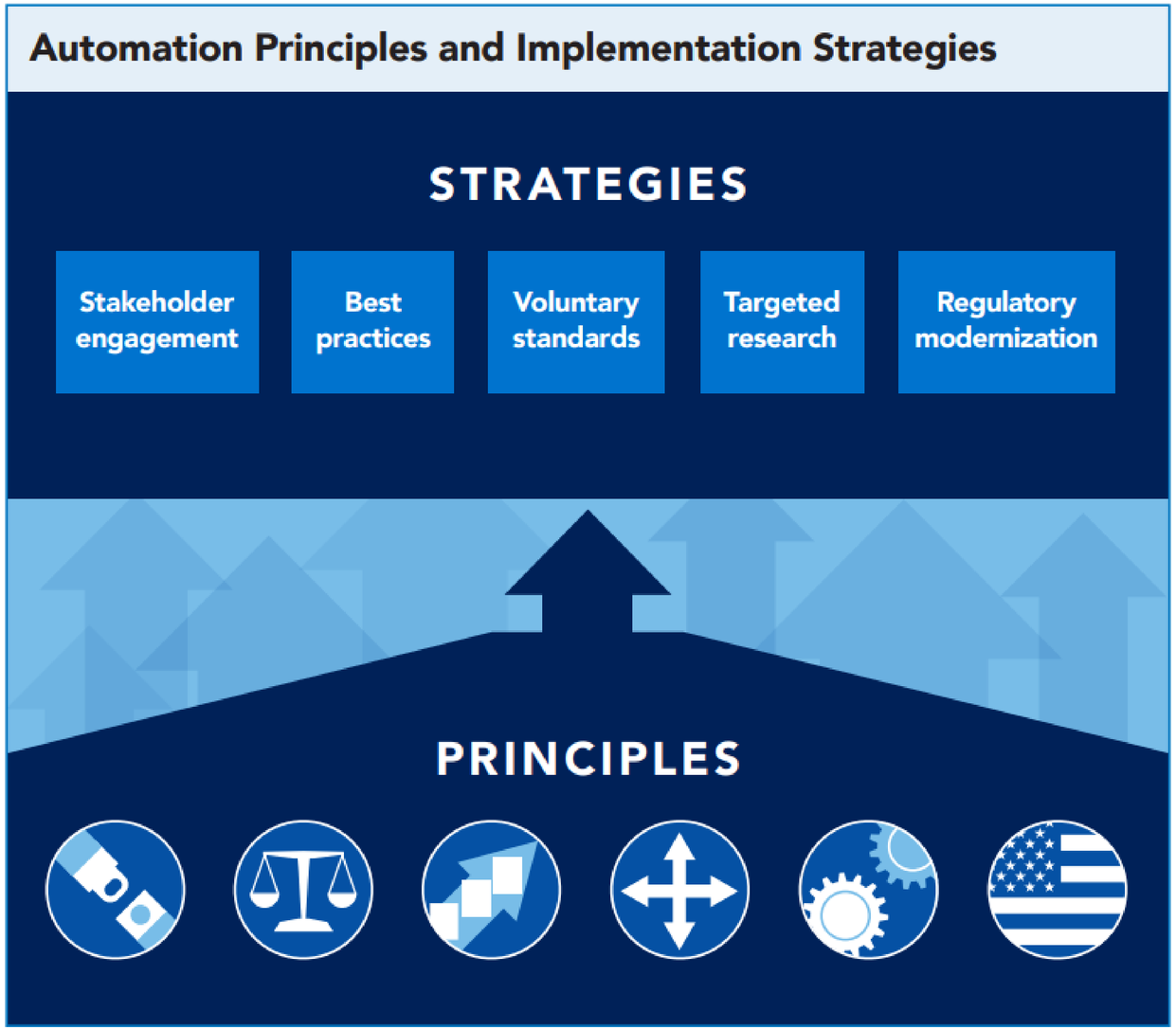
Source: FARS 2008 Final File, 2017 ARF
Note: Sum of individual slices may not add up to 100 percent due to rounding.

Potential Safety Benefits and Concerns

- ADS (vs. human drivers)
  - can see more and act faster than human drivers
  - have the potential to remove human error from the crash equation
  - have the potential to reduce crashes, prevent injuries, and save lives
- Research has shown human drivers:
  - over trust, over rely, and are complacent
  - fail to monitor the environment
  - reduce confidence in making decisions after system failure

  - inaccurate mental models of automation
  - will disengage from the driving task when they are not actively controlling the vehicle

Integrating Automation Safely



Definitions

- In-the-loop
  - in physical control of the vehicle and monitoring the driving situation
- On-the-loop
  - not in physical control of the vehicle, but monitoring the driving situation
- Out-of-the-loop
  - not in physical control of the vehicle, and not monitoring the driving situation, OR in physical control of the vehicle but not monitoring the driving situation
- Engagement → Disengagement
  - the degree of physical control and situation monitoring required and expected from the human driver

Research Goals and Objectives

- Systematically investigate
  - effects of individual and combined disengagement factors on driver re-engagement time and success
  - strategies to overcome these disengagement challenges
  - assessment of factors that could evaluate their efficacies
- Understanding disengagement and how re-engagement can be optimized will be important to ensure that ADS vehicles are designed for these situations and safety is maintained

Potential Research Questions

1. What factors affect driver re-engagement time and success?
2. How does the duration of disengagement affect the ability to resume control?
3. How does the degree of disengagement affect the ability to resume control?
4. Is there an interaction between the duration and degree of disengagement with the ability to resume control?
5. What are the currently proposed/deployed strategies for keeping drivers engaged?
6. How does each engagement strategy overcome the issues related to driver out-of-the-loop (disengagement)?
7. What is the effectiveness of each tested engagement strategy?

Concluding Remarks

- Expected to maintain awareness
- Reduced driver interactions
- Effects of individual and combined disengagement factors

Questions?

Christian Jerome, Ph.D.
Research Psychologist

Department of Transportation
National Highway Traffic Safety Administration
Office W46-414
1200 New Jersey Avenue SE., Washington, DC 20590
Office: 202-366-9872 • FAX: 202-366-8546