Automated Vehicle Basics

A few key messages…

- The transition to an automated vehicle future will be long.
- What's good for humans is good for robots.
- Automation does not happen in a vacuum.
- Automation is not a single concept or application.

What are automated vehicle technologies?

At least one element of sustained vehicle control (e.g., steering, acceleration, brakes) occurs without direct driver input.

A driving automation system:

- Gathers information from sensors (e.g., radar, lidar, camera) and other inputs, such as map and communications data.
- Classifies objects (moving or stationary) and predicts their likely behavior.
- Makes appropriate decisions on speed and steering inputs.

Source: USDOT Volpe National Transportation Systems Center

The images above show examples of what vehicles can "see" from sensor inputs, such as lidar units (top image) and cameras (bottom image).

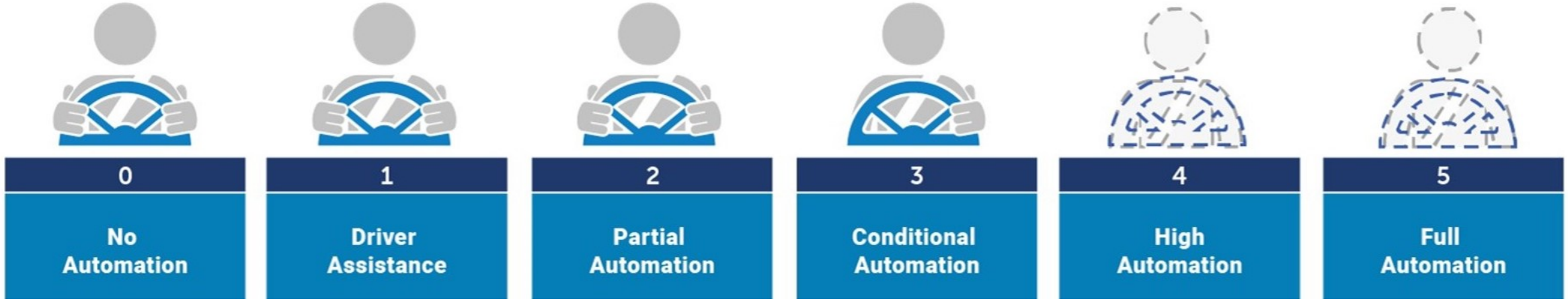
Levels of automation

What exists today:

- Level 0 includes momentary assistance functions
- Level 1 and Level 2 are in some production vehicles
- Level 4 exists on guideways

What is being tested:

- Levels 1, 2, and 3 (e.g., truck platooning)
- Level 4 not on a guideway (e.g., low-speed automated shuttles)



Source: USDOT (Adapted from SAE J3016 Standard - see SAE J3016 website (link) and SAE J3016 diagram (link))

Challenges

- Environment
  - Urban and suburban
  - Rural (including agricultural lands and wilderness areas)
  - Different speeds, trip patterns, and demographics
- Infrastructure Conditions
  - Less infrastructure (e.g., paved roads, sidewalks, communications)
  - Degraded infrastructure (e.g., pavement, lane markings, signs)
- Weather Conditions
  - Precipitation (rain, sleet, snow)
  - Visibility (fog, dust storms)
  - Road conditions (slippery due to ice, obscured with snow)
- Human-machine interface (HMI)
- Safety assurance
  - Complex software – difficult to verify safety
  - Cybersecurity

Source: USDOT