

How Do Autonomous Trucks Work?

Autonomous Trucking Conference

Alex Rudin

September 15, 2025

MITRE

© 2025 THE MITRE CORPORATION. ALL RIGHTS RESERVED. APPROVED FOR PUBLIC RELEASE. DISTRIBUTION UNLIMITED 24-03526-3.

1

MASE Lab

Mobile Autonomous Systems Experimentation



Robotics experimentation across air, land, and sea

© 2025 THE MITRE CORPORATION. ALL RIGHTS RESERVED. APPROVED FOR PUBLIC RELEASE. DISTRIBUTION UNLIMITED 24-03526-3.

Levels of Driving Automation



SAE J3016™ LEVELS OF DRIVING AUTOMATION™

Learn more here: [sae.org/standards/content/j3016_202104](https://www.sae.org/standards/content/j3016_202104)

Copyright © 2021 SAE International. The summary table may be freely copied and distributed AS-IS provided that SAE International is acknowledged as the source of the content.

	SAE LEVEL 0™	SAE LEVEL 1™	SAE LEVEL 2™	SAE LEVEL 3™	SAE LEVEL 4™	SAE LEVEL 5™
What does the human in the driver's seat have to do?	You are driving whenever these driver support features are engaged – even if your feet are off the pedals and you are not steering			You are not driving when these automated driving features are engaged – even if you are seated in “the driver's seat”		
	You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety			When the feature requests, you must drive	These automated driving features will not require you to take over driving	
Copyright © 2021 SAE International.						
	These are driver support features			These are automated driving features		
What do these features do?	These features are limited to providing warnings and momentary assistance			These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met		
	These features provide steering OR brake/acceleration support to the driver			This feature can drive the vehicle under all conditions		
Example Features	• automatic emergency braking • blind spot warning • lane departure warning			• traffic jam chauffeur • local driverless taxi • pedals/steering wheel may or may not be installed		
	• lane centering OR • adaptive cruise control			• same as level 4, but feature can drive everywhere in all conditions		

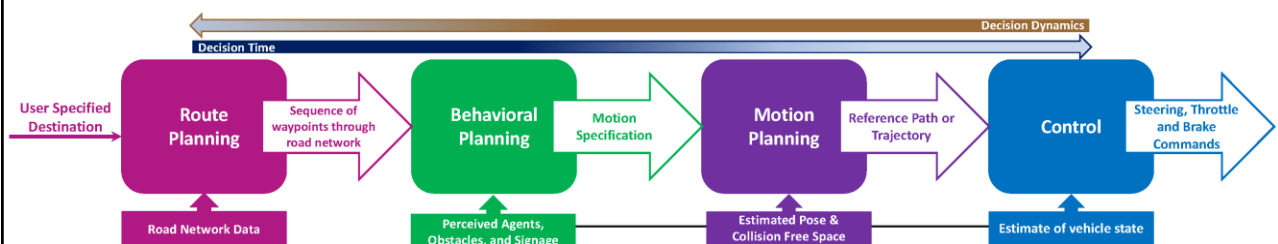
- Most autonomous trucks fall in Level 3 (with driver support as requested) or Level 4 (without driver support under operational conditions)
- Level 0-2 driver support features are increasingly prevalent but require driver control
- The “everywhere in all conditions” requirement for Level 5 remains a challenge

MITRE

© 2025 THE MITRE CORPORATION. ALL RIGHTS RESERVED. APPROVED FOR PUBLIC RELEASE. DISTRIBUTION UNLIMITED 24-03526-3.

3

Decision-Making Process



Autonomous trucking companies use a set of **base maps** to provide the vehicle with background knowledge on the route and reduce dependency on real-time sensing

These phases involve **perceiving** the environment, **predicting** the motions of other agents, **deciding** on an optimal behavior, building a **trajectory**, and determine the **actuator** commands to execute the trajectory

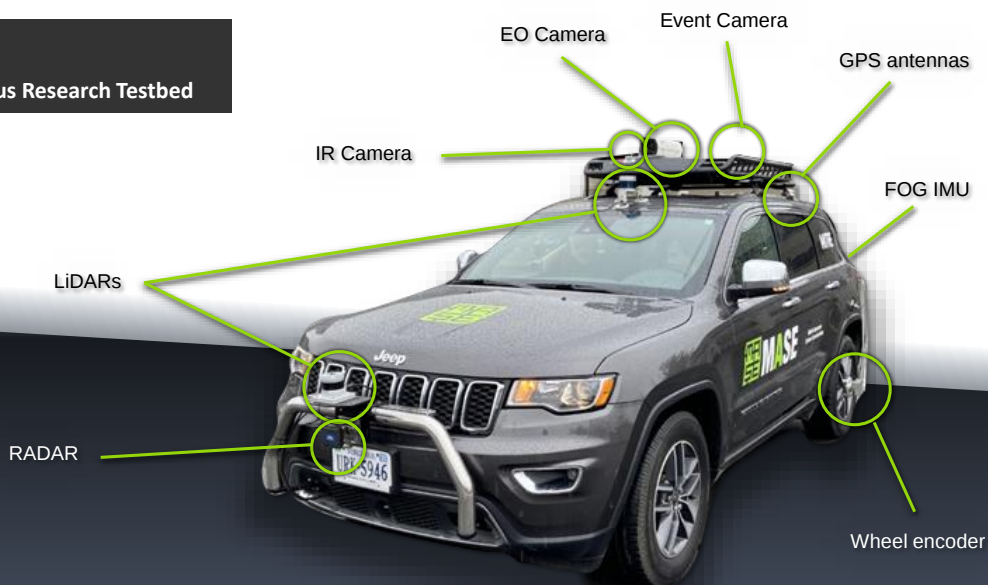
MITRE

© 2025 THE MITRE CORPORATION. ALL RIGHTS RESERVED. APPROVED FOR PUBLIC RELEASE. DISTRIBUTION UNLIMITED 24-03526-3.

4

DART

Driverless Autonomous Research Testbed



Other Potential Sensors:

- Microphones
- Road friction
- Internal fault monitors

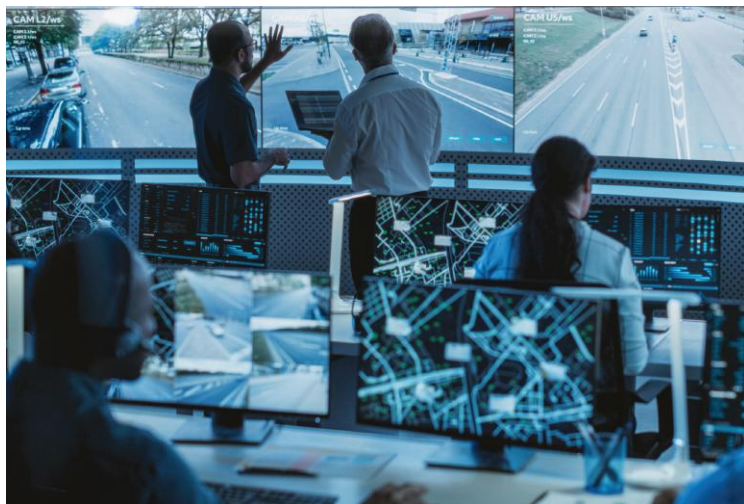
2019 Jeep Grand Cherokee with integrated drive-by-wire, computing, localization, perception, and power electronics



© 2025 THE MITRE CORPORATION. ALL RIGHTS RESERVED. APPROVED FOR PUBLIC RELEASE. DISTRIBUTION UNLIMITED 24-03526-3.

MITRE

Remote Support



- Autonomous truck fleets are supported by remote operators who monitor operations and intervene when challenging situations arise
- Remote operators are typically not given full control of the vehicle, but rather the autonomous driver remains responsible for safety

MITRE

© 2025 THE MITRE CORPORATION. ALL RIGHTS RESERVED. APPROVED FOR PUBLIC RELEASE. DISTRIBUTION UNLIMITED 24-03526-3.

6

Thank you!

Alex Rudin – Autonomy Policy and Strategy Group Lead
arudin@mitre.org



© 2025 THE MITRE CORPORATION. ALL RIGHTS RESERVED. APPROVED FOR PUBLIC RELEASE. DISTRIBUTION UNLIMITED 24-03526-3.