



AUTONOMOUS TRUCK DESIGN

Autonomous technology won't just transform your business. It will utterly revolutionize modern truck designs as well.

By Jack Roberts

Have you ever given any thought to what a fully-formed autonomous truck would look like? I'm not talking about the mildly futuristic demonstrator models — SuperTrucks, Inspiration Trucks and the like — we've seen over the past few years.

I'm talking about a Class 8 highway tractor, conceived, designed and built from the ground up as a Level 4 autonomous vehicle per SAE's J3016 definition, with the expectation that a human being will be onboard for less than 1% of its entire working life.

It's a startling concept. But consider this: Trucks — any vehicle, really — are simply tools designed to move either human beings or their goods from Point A to Point B in a reasonable amount of comfort and safety. As a result, all vehicles are designed from the get-go with human beings, and their needs, wants and desires, foremost in mind.

But what if a human being is taken almost entirely out of the equation? What happens to truck design, then?

It's a fascinating thought. Because for the first time in more than a century, since the first automotive engineers began redesigning carts and wagons to accommodate powertrains and human ergonomics, designers will have no preset requirements to constrain them when it comes to maximum vehicle efficiency and productivity. The proverbial "blank sheet of paper" or today's "blank computer screen."

And while I'm no engineer, it seems that the three areas this new design freedom will be most apparent concern vehicle weight, available space and aerodynamic design.

All three design aspects are deeply intertwined, of course. But let's start by thinking first about weight and space, since any modifications made in those two areas will lead to greater aerodynamic opportunities and flexibility later on in the design process.

Most people, when they begin to consider a fully autonomous Class 8 highway truck, focus first on the vehicle's sleeper berth. And that's because it's the most obvious element of the vehicle designed for human ergonomics. Clearly there is no need for a sleeper on a Level 4 autonomous truck and all the myriad of goods that go along with it. You no longer need a bed. You don't need closet space, a work desk or a nook for a mini-fridge, either. The same goes for APUs or any other type of idle reduction systems designed to keep drivers comfortable during rest periods.

And, as a designer, you no longer have to worry about head space, lighting requirements (natural or electric) or even noise insulation. Interior aesthetics and ergonomics are meaningless. All those

things are gone — simply wiped from the slate — and all that space and weight saved now can be transitioned to carrying more cargo for profit.

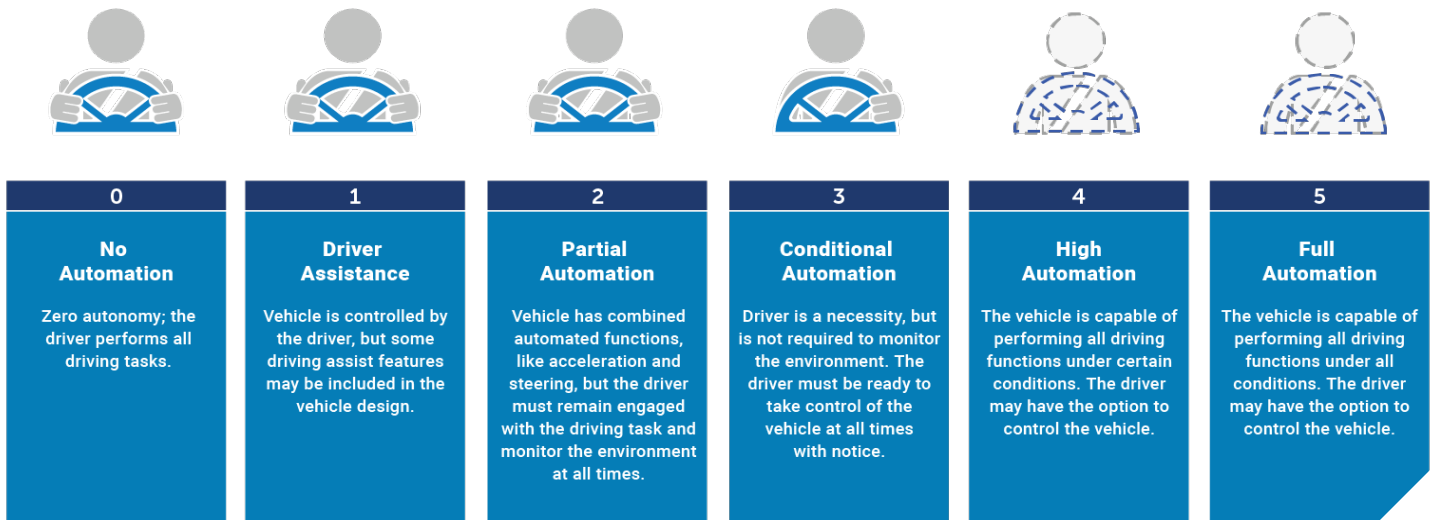
But that's just the beginning. What about the front of the truck cab? The driver's compartment? What changes can be made there? A lot more than you're probably thinking right now, actually.

For starters, you no longer need air-ride seats, paneling, carpet, cupholders, gloveboxes or storage nooks and crannies. Stereo or infotainment system? Gone. HVAC system? Gone, too.

But that's just the beginning. In a Level 4 autonomous truck you also don't need any gauges, switches, dashboards or armrests. And, in all likelihood, a lot of safety equipment we take for granted today will probably go away as well. You're not going to need sun visors. Rear-view mirrors are redundant at this point, as well. Seat belt systems and air bags will be greatly scaled down too — if not removed from the design entirely. And really, what about the overall dimensions of the front cab itself? From the beginning of the automotive age, vehicles have been designed with side-by-side human seating as the primary engineering focus.

“When one begins to consider the massive implications fully autonomous control systems will have on the basic design and configuration of commercial vehicles, it becomes easy to see how disruptive this technology will be in the decades to come.

But there's no need for any arrangement of that sort in a fully autonomous truck. Because now we're getting down to the essence of what a Level 4 autonomous vehicle is really all about — moving freight. Not humans. So, the critical design factor at this point will be: How often will a human operator be on board? And for how long? And doing what?



The conventional wisdom now is that direct human interaction with a Level 4 autonomous truck would likely be limited to either technicians or yard workers moving the vehicle into very precise locations for either maintenance work or cargo loading and unloading. And so, the reasoning goes, you will need some sort of jump seat and rudimentary steering capability — along with some sort of minimal safety restraint systems designed for low-speed operation — for those situations.

But what if that line of thinking is outdated too?

What if that technician or that yard worker could simply move the truck where they wanted it with a steering/control app on their tablet or smartphone? Companies like ZF already have showcased similar systems. So, it's not unreasonable to think that there might not be a need for a seat or a steering wheel at all on a Level 4 autonomous truck. And, if that's the case, then you really don't need windshields, windows, doors or access steps, ladders and handles, either. At least not to the extent that you do today.

And all of this, then, brings us to the aerodynamic design phase of things. Because, as you can see, the engineers designing this sort of vehicle have to only make minimal ergonomic considerations for humans. In fact, it's not unreasonable to assume that beyond an access hatch and some sort of crawl space for maintenance purposes, there might not be any design aspect on the vehicle for human comfort or productivity.

In this vision of an autonomous truck, the current model of a truck cab with a sleeper berth is outdated and useless, already pure wasted weight and space. The "truck" itself now becomes 100% dedicated to the powertrain and the various autonomous vehicle control systems onboard already and not much else.

In this scenario, engineers suddenly will be free to design trucks in ways that are currently unimaginable. Engines, radiators, exhaust

systems, turbochargers — in fact every component on the truck — now can be placed on the chassis for maximum performance without any regard for long-term human comfort.

Ultra-aerodynamic designs reminiscent of today's super cars suddenly will be attainable goals with resulting revolutionary design changes for trailers. Lighting and safety will be the dominant limiting factors for vehicle design. But beyond that, almost anything will be possible.

The space freed up by the tractor may translate to longer, more capable trailers carrying more cargo cube and weight while staying inside today's accepted maximum vehicle lengths. This means more paid cargo per trip per vehicle, the ultimate goal of improved efficiency in trucking.

It's a strange vision of the future and an almost complete departure from more than a century of vehicle design principles that most of us don't think twice about. But, when one begins to consider the massive implications fully autonomous control systems will have on the basic design and configuration of these commercial vehicles, it becomes easy to see how disruptive this technology will be in the decades to come.

About the Author: Jack Roberts is a transportation journalist who has been covering North American commercial vehicles for 25 years and has developed a reputation as a leading authority/futurist concentrating on new trucking technology, including autonomous vehicles, battery-electric trucks and emerging blockchain technology.



The North American Council for Freight Efficiency (NACFE) works to drive the development and adoption of efficiency enhancing, environmentally beneficial, and cost-effective technologies, services, and operational practices in the movement of goods across North America. NACFE provides independent, unbiased research, including Confidence Reports on available technologies and Guidance Reports on emerging ones, which highlight the benefits and consequences of each, and deliver decision-making tools for fleets, manufacturers, and others. NACFE partners with Rocky Mountain Institute (RMI) on a variety of projects including the Run on Less fuel efficiency demonstration series, electric trucks, emissions reductions, and low-carbon supply chains. www.nacfe.org