

# crash test

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# Human factors drive safety

The idea of self-driving cars is creating next-level safety concerns for all road users – and the big question with AVs is, who’s in the driver’s seat?

According to the Brookings Institution, by 2040 one-quarter of all cars will be autonomous vehicles. Other estimates put that number as high as 50%. While AVs push the limits of technology, testing, infrastructure impacts and new legal frameworks, it’s public safety that is one of the biggest causes for concern.

Over the years, automotive safety standards have expanded to include drivers, passengers and now a wide range of vulnerable road users such as pedestrians, bicyclists and the hearing impaired. The idea of self-driving cars is creating next-level safety concerns for everyone.

SAE International and the International Organization for Standardization (ISO) defined the six levels of driving automation, also known as SAE J3016. Level 0 starts with traditional old-school, all-manual controls. Level 1 includes some driver-assist functions. By Level 2, ADAS

THOR-50M



SLICE6 IN-DUMMY DAS



THOR-AV-50M



ABOVE: The DTS ATD team anticipates that only minor updates to the Slice6 wiring harness will be required to support new THOR-AV in-dummy data acquisition configurations. THOR images: Humanetics

BELOW: As new autonomous and active safety technologies make their way into the mainstream, R&D in passive safety testing remains critical to keep occupants and vulnerable road users safe

can steer and accelerate. Level 3 is called conditional automation, and by Level 4 it is officially considered self-driving. By Level 5 (aka steering wheel optional) zero human attention or interaction is required.

Earlier this year, important updates to SAE J3016 were announced with the goal of clarifying definitions in concise and consistent

language. “Since its launch in 2014, the mobility industry has looked to SAE’s levels of driving automation for citation in official documents where precise language is essential, such as in laws, regulations, guidance documents and standards,” says Barbara Wendling, chairperson for the SAE J3016 Technical Standards Committee.

Having clear requirements is also a critical part of the development process. “It’s important that research and regulations stay a step ahead so that cars can be properly tested when full autonomy is available,” says Tamer Abubakr, ATD systems manager at Diversified Technical Systems (DTS). “Because things are less regulated now, technology can advance much faster. It’s a balance of regulation and the speed of advancement.

“It may also help put people at ease when buying







ABOVE: AV regulatory requirements will determine how in-dummy DAS should be implemented in future dummies

LEFT: A DTS engineer works on a THOR Slice6 integration project



and having AVs on the road, knowing they are fully tested and safe,” Abubakr affirms.

According to NHTSA, 94% of all serious motor vehicle crashes are due to human error or choices. But taking away driver control is not foolproof either. Until Level 5 is reached, the question of who has control of the steering wheel remains the subject of many studies.

Current research is focused on measuring reaction times, not whether man or machine is the superior driver. Part of the Eriksson & Stanton 2017 study focused on measuring ‘take over reaction time’ in a variety of scenarios. Part of that included when and how a ‘take over request’ was issued to the driver.

The study found that times ranged from 1.9 seconds to 25.7 seconds depending on task engagement. A crash impact on average takes only 150ms (for reference, a human blink lasts 100ms or 1/10<sup>th</sup> of a second). In theory, that means even with the fastest take over reaction

times, a vehicle could have been in 12 crashes.

Human studies like this are an important part of R&D, but much of automotive safety testing involves crash test dummies. Although there are currently no test regulations that specifically apply to AVs, the newest frontal impact anthropomorphic test device, called THOR, now has an AV counterpart. Humanetics has made modifications to the lumbar and thoracic regions to allow THOR-AV-50M (50<sup>th</sup> percentile male) and THOR-AV-5F (5<sup>th</sup> percentile female) to recline. As out-of-position testing continues to expand, it’s likely to result in new test protocols, and updated injury corridors and regulations.

“We are in the golden age of AV development,” comments Abubakr. “THOR-AV is the first of its kind for occupant safety R&D testing. The technology is there. But it will take a while for public opinion to trust it and for regulations to be in place.”

Part of that testing includes continuing to advance features

such as crash avoidance detection and passive safety features such as new seatbelt restraint systems. It’s also important that ATDs match the anthropometry of all humans in terms of size, weight and gender.

“All of this research and information is what helps establish new requirements and laws. In-dummy DAS is part of the key to making testing easier, faster and more reliable,” says Abubakr.

DTS is a pioneer in miniaturizing data acquisition systems and sensors for automotive safety testing. It was part of the original WorldSID ISO taskforce in charge of creating the first in-dummy DAS solution for a regulation ATD. In 2015, DTS began development of the WIAMan blast manikin for the US Army and the new Slice6 data acquisition system.

“The current fleet of frontal or side-impact dummies weren’t designed to measure vertical loads, so we had to develop something new. Integrating AV crash dummies

with in-dummy DAS is just the next new thing,” says Abubakr.

THOR-AV is still in a prototype stage, but this will be one of the next Slice6 in-dummy integration projects on the horizon for DTS.

“We see radical changes coming in autonomous vehicles and seat positioning, so the THOR-AV needs to have the capacity to be adapted to multiple seating positions. However, we want our customers to have the option to buy a complete THOR-AV device or to make incremental changes using THOR 50<sup>th</sup> modification kits for the pelvis and neck, or kits that address NHTSA’s specifications once they are published,” says Jeff Lewis, chief commercial officer at Humanetics Group.

For decades, industry advocates have worked to implement global road safety initiatives with the ultimate goal of no road traffic fatalities or serious injuries. Until that point of zero road accidents is reached, continued development in both active and passive safety is important and relevant.

“I think companies will develop the safest systems, even if it is monetarily driven. Social pressures and awareness are big influencers, but ultimately I believe that companies will prove they care about the human factor and do the right thing,” concludes Abubakr. ◀



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