The fusion of mind and machine

Ford brings autonomous vehicle research team to Arizona for testing by Jennifer Johnson

Arizona's sunshine and hot weather climate brought Ford's autonomous vehicle research team to its Arizona Proving Grounds facility in Wittmann in March for a series of tests, some of which involved nighttime driving performance.

Jim McBride, Ford technical leader for autonomous vehicles, has been working on Ford's autonomous vehicle research team for more than a decade. He was in town to showcase the vehicle to local media at Co+Hoots co-working space, and to explain Ford's involvement in autonomous vehicle research.

"Our goal, when we get to production, is to make it affordable to the masses," McBride said, adding that he expects the technology to be ready for mass production in the next four to five years. "Almost all of the cars today that have adaptive cruise control or lane keeping aids have a radar on the car, and those radars used to cost $20,000 or more. Today, they cost a couple of hundred dollars."

Ford triples autonomous fleet

Earlier this year, Ford announced that it was tripling its fleet of fully autonomous Ford Fusion Hybrid test vehicles—making it the largest autonomous fleet in the industry.

During 2016, Ford will add 20 Fusion Hybrid autonomous vehicles, bringing the company's autonomous fleet to about 30 vehicles being tested on roads in California, Arizona and Michigan.

Building on more than a decade of Ford autonomous vehicle research, this expansion is a key element of Ford Smart Mobility—the plan to take Ford to the next level in connectivity, mobility, autonomous vehicles, the customer experience, and data and analytics. The newest vehicles are on Ford's third-generation autonomous vehicle development platform, built using Fusion Hybrid sedans, similar to the second-generation platform.

Sensing, software and hardware

Ford is using Velodyne's newest LiDAR sensors—named Solid-State Hybrid Ultra PUCK Auto for its hockey puck-like size and shape—on its third-generation autonomous vehicle platform. LiDAR emits short pulses of laser light to precisely scan the surrounding environment millions of times per second and determine the distance to objects, allowing the vehicle to create a real-time, high-definition 3D image of whatever's around it.

Solid-State Hybrid Ultra PUCK Auto sensors boast a longer range of 200 meters, making them the first auto-specific LiDAR sensors capable of handling different driving scenarios. Ultra Puck will accelerate the development and validation of Ford's virtual driver software, which serves as the decision-making brain that directs vehicle systems.

In 2015, Ford transitioned from the research phase of development to the advanced engineering phase.

No lights? No problem

National Highway Traffic Safety Administration data finds the passenger vehicle occupant fatality rate during dark hours is about three times higher than the daytime rate.

Under the cover of night, a Ford Fusion Hybrid autonomous research vehicle with no headlights has recently navigated lonely desert roads at the Arizona Proving Ground, a perilous task for a human driver.

Driving in pitch black is an important development, in that it shows that even without cameras, which rely on light, Ford's LiDAR—working with the car's virtual driver software—is able to steer flawlessly around these winding roads. While it's ideal to have all three modes of sensors—radar, cameras and LiDAR—the latter can function independently on roads without stoplights.

To navigate in the dark, Ford self-driving cars use high-resolution 3D maps—complete with information about the road, road markings, geography, topography and landmarks like signs, buildings and trees. LiDAR pulses pinpoint the car on the map in real time. Additional data from radar gets fused with that of LiDAR to complete the full sensing capability of the autonomous vehicle.

For the desert test, Ford engineers, sporting night vision goggles, monitored the Fusion from inside and outside the vehicle. LiDAR sensors shoot out 2.8 million laser pulses a second to precisely scan the surrounding environment. Night vision allowed them to see the LiDAR doing its job in the form of a grid of infrared laser beams projected around the vehicle as it drove past.

"Inside the car, I could feel it moving, but when I looked out the window, I only saw darkness," recounts Ford research scientist and engineer Wayne Williams. "As I rode in the back seat, I was following the car's progression in real time using computer monitoring. Sure enough, it stayed precisely on track along those winding roads."

"Adding the latest generation of computers and sensors, including the smaller and more affordable Solid-State Hybrid Ultra PUCK Auto sensors, helps bring Ford ever closer to having a fully autonomous vehicle ready for production," McBride said. ■