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Face to face with Ford's self-driving Fusion Hybrid research vehicles

We take a look inside the trunk of Ford's smartest research cars.

by Jonathan M. Gitlin - Aug 6, 2015 11:15am PDT

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DETROIT, MI—The future, or a slice of it, can be found in one of the many labs inside Ford's Research and Innovation Center. The center is a three-story brick affair on Ford's vast campus, but it wouldn't look out of place at a well-funded research university. Well-appointed labs branch out from gray-painted corridors lined with plastic bumpers, the kind you see in hospitals to prevent dents in the walls from people carting around heavy equipment. Young engineers from across the globe congregate to eat lunch in the airy atrium before heading back to carry on their research on metallurgy, new catalysts, or a myriad of other fields in which the Blue Oval has an interest.

We navigated the warren-like maze of corridors on our way to a workshop to meet some of the company's self-driving research vehicles, led by Randy Visintainer, Ford's head of autonomous vehicles. The workshop itself looks like a cross between a garage and research lab. Fume cupboards and lab benches share the space with three white Ford Fusion hybrids. These are Ford's autonomous driving research vehicles, and Visintainer—along with Jim McBride and Doug Rhode—is here to show off the technology that makes autonomous driving possible.



Apart from the sensor bar on the roof, this Ford Fusion Hybrid looks just like a normal car.



From the outside, the cars look almost entirely stock other than the sensor bars mounted to the roofs. These are studded with Velodyne lidar scanners. Each one of these is packed with lasers—which illuminate the sensor's field of view out to around 300 feet (100m)—and detectors that sense the reflected laser light. As configured during our visit, two of the sensors are mounted horizontally, and another two are angled down at about 30° to be able to scan the road around the vehicles.

A fifth lidar sensor is mounted upside down, which Ford has been using to scan the tops of buildings (since the lidar scanners have a limited vertical field of view). That last one apparently came about after Ford had some requests to create 3D scans of NASCAR race tracks.

Combining these sensors allows Ford to create point cloud 3D maps, one of which was displayed on a screen set up behind one of the cars. In addition to the lidar scanners, the Fusion Hybrids also have a number of optical cameras attached to the sensor bars, but beyond that, you'd never know there was anything particularly special about them.

That trend continues inside the cars. Again, the interiors are stock Fusion Hybrid, with the exception of a pair of large buttons in the cupholders between the driver and passenger seat. On the left is a big red button. I was told that this is common to all of Ford's research prototype vehicles, and it's a kill switch similar to the electrical cut-off found in racing cars.

The big yellow button that sits next to it is also a kill switch, but this one is for the autonomous driving function. Press it, and the car reverts back to a normal 'dumb' car like every other Fusion Hybrid on the road. In fact, there isn't even a dedicated autonomous driving button or switch; Visintainer's team has simply remapped the transmission shift lever so that moving it into "L" engages the self-driving mode.

Looking in the trunk of one of the autonomous Fusion Hybrids tells the real story. Even this gave me a little surprise, however. Far less of the trunk is taken up by electronics than one might think, and most of them are off-the-shelf components. The brains of the cars are found in a big metal cube, cooled by a pair of what look like stock Ford radiator fans. This is a cluster of five Intel i7 chips running Ubuntu Linux. Next to the compute cluster is a smaller box containing accelerometers and gyroscopes. This is the Inertial Measurement Unit (IMU), made by Applanix.

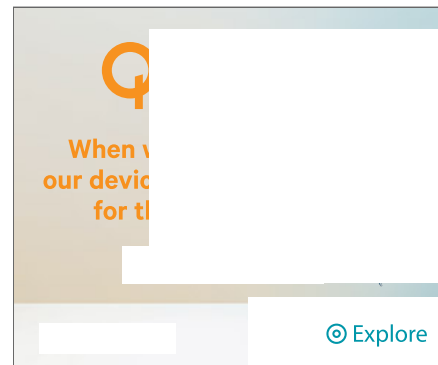
To the right of the Applanix IMU is a Wi-Fi modem and a Space Micro Autobox that connects the system to the car's drive-by-wire systems, and to the right of these are a couple of data loggers, an inertial navigation system that fuses the IMU's data with GPS and the car's odometer, and an ethernet switch. In front of these boxes are a breakout box for the car's CANbus, toggle switches that power all the different components, and an extra battery to cope with any additional power requirements.

Speaking with Visintainer, McBride, and Rhode painted a good picture of where the state of the art is with autonomous driving technology. As we found when we spoke to Prof. Edwin Olson at the [Mcity opening](#), it seems like there's still quite a gap between what's currently possible (NHTSA level 3 autonomous driving) and the end goal of car journeys where a human never takes control from beginning to end.

There is still quite a lot of work needed before a vehicle's sensor systems are capable of giving a car as much situational awareness as a human. Visintainer pointed out that the distances at which we can look down the road and see a traffic light (and whether it's red or green) might amount to a single pixel's width for a camera sensor, for example, and when we pull out of side junctions, we'll first look several hundred feet down the road before doing so to make sure it's clear.

Still, the Ford autonomous driving team believes that it can overcome these technical challenges. Moore's law will take care of most of the trunk space problem, and newer generation lidar sensors are about half the size of the ones mounted to these Fusion Hybrids. Meanwhile, the data generated by these autonomous automobiles in the coming months and years will refine the logic and decision-making routines that we'll need to safely share our roads with robots.

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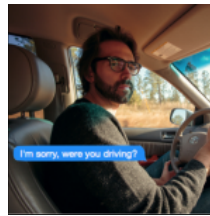
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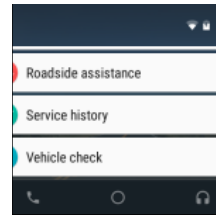
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