Megatrends in mobility

Where silicon meets steel—along with a great many other innovative new materials. We take you behind the scenes of Ford's intensive present-day applications of future-think processes. BY JOE SAGE

"Further with Ford" is an annual event as intensive and comprehensive as the products and processes it presents. Usually held at the Dearborn Development Center in Michigan, where there is already plenty of cutting edge technology at hand, this year it took place instead in the San Francisco Bay Area, as a great deal of the latest developments are happening in the heart of Silicon Valley, at the new Ford Research and Innovation Center in Palo Alto.

The burgeoning introduction of semi-autonomous driving features over the past few years—or electronic-mechanical driving control and assistance features that turn out to have taken us halfway there—along with a drumbeat about fully autonomous vehicles, has escaped no-one's attention and has been a bit disquieting to the driving enthusiast. Ford's mission statement seems to recognize all this from both ends: a need to accommodate the growing jam of today's urban traffic, while not forgetting the soul of the all-American free and independent driver.

Our activities in the Bay Area fell into two areas: some behind-the-wheel time and a series of laboratory tours. These were intertwined with a series of presentations and a closing keynote speech. The overall theme was connectivity, increasingly integrated with transport in general and global product development in the name of modern mobility.

We had one-on-one time with everybody from Ford engineers to conceptual futurists, to experiential program leaders, to urban cyclists, to botanists and 3D modellers.

Immersion behind the wheel

Our day began on a San Francisco pier converted to a modern building with first-class meeting space, plus a large paved area perfect for our driving-related demonstrations. San Francisco was a perfect location for the broader messages, as well, as its density and terrain amplify issues of crowded driving—and certainly of parking.

Driving technologies explored included established features, brand new features and evolutionary combinations of the two.

Revealed in 2007 and launched in 2008, Ford's original SYNC system broke much new ground, but also generated a fair amount of criticism. A new MyFord Touch system—which also bore the SYNC name and was generally regarded as (though not named) SYNC 2—replaced it over time, starting in some 2011 models. On the leading edge of those times, it promised more comprehensive smartphone integration, but again found some frustrated users.

Enter SYNC 3, an entirely new system with touchscreen implementation and—as distracted driving concerns have spread throughout the industry—broader and more conversational voice command technology. No distracted driving for us this day—we played with it while parked.

Ford was an early implementer of active park assist for parallel parking and early this year had introduced it to perpendicular parking, starting with the familiar-looking but all-new 2015 Ford Edge, which we had experienced at the Edge's product launch, held in Scottsdale. Again dovetailing with an all-new but familiar product—the Ford F-150, reborn this year with intensive use of aluminum in body and frame—Ford had recently announced a Pro Trailer Backup Assist feature, which we were eager to try. (As with other parking features, it's helpful for the unskilled, but might slow down the experienced trailer user.)

All these features combine—and expand upon—existing positioning and control technologies, as well as on-board camera technologies, which have expanded considerably (the perpendicular parking feature provides a 180-degree view of the street before you ease out of your space).

The industry has seen some research demonstration of truly self-driving cars—that is, without anyone behind the wheel—which can drop you at the door and take themselves off to find a great parking space and tuck themselves in. One of the more cutting-edge tricks we saw in San Francisco was a Ford implementation of assisted parking that allows the driver to exit—but stick around—to control parking via their smartphone. This has a very common practical application, for easing in and out of tight spots with no opening and closing of your doors needed while parked.

Immersion in the lab

We then traveled by corporate coach to Palo Alto. Ford opened its first Silicon Valley office in 2012. Relocation this year to its new Research and Innovation Center in Stanford Research Park dramatically expands the team's working space as well as their collaboration with Stanford University, which in 2013 had joined existing Ford relationships with the University of Michigan and MIT. The Center is on track to employ 125 researchers, engineers and scientists by year's end.

"This new research center shows Ford's commitment to be part of the Silicon Valley innovation ecosystem—anticipating customers' wants and needs, especially on connectivity, mobility and autonomous vehicles," said Ford president and CEO Mark Fields. "We are working to make these new technologies accessible to everyone, not just luxury customers."

The Palo Alto center is plugged into a global network of Ford research and innovation centers, including Dearborn, which focuses on advanced electronics, human-machine interface, materials science, big data and analytics; Aachen, Germany, which focuses on next-generation powertrain research, driver-assist technologies and active safety systems; and Melbourne, Australia, which provides automotive and transport research, testing and product development. Further expansion of the network is planned for the near future.

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The Palo Alto facility is headed by technical director Dragos Maciuca, previously an Apple engineer, with a background in consumer electronics, semiconductor manufacturing, aerospace and automotive. Maciuca brings extensive experience advising Silicon Valley startups, developing and commercializing products, collaborating with universities and leading cross-functional teams. He holds an MBA from the University of California Berkeley Haas School of Business, and a PhD from Berkeley in Mechanical Engineering.

Maciuca heads up a facility where the latest in everything from wearable computers to machine learning will find their place in the vehicle and mobility industries. An ever-increasing array of developments will be applied across the whole Ford lineup within five years—an ambitious goal that will only snowball further as the future unfolds.

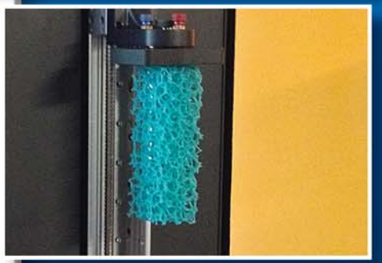
This is also where the buzz about autonomous vehicles will achieve real world traction. The collaborative network is readying systems for production, with the first implementations to be launched in specific locations that are fully geo-fenced, 3D-mapped and start with "easy weather places." They assure us these will be vehicles that "are still a joy to drive," as enthusiasts breathe a big sigh of relief—with fingers crossed.

Henry Ford Technical Fellow Jim Buczkowski, director of electrical and electronic systems, says the next generation of features will mark the "democratization of technology"—with a goal of delivering the best features, not just the first.

It all starts—well, some of it starts—with bicycles. InfoCycle programs in both Palo Alto and Michigan are applying sensors to bikes—using OpenXC, Ford's open source hardware and development platform—with Bluetooth smartphone connectivity. These will gather comprehensive data about how cyclists use developed infrastructure to meet their transportation needs. Information gained will be useful from a safety standpoint, but will also reveal a lot about innovative alternative mobility patterns more likely used by bicycles, which can then be adapted to 3D mapping and vehicular geo-fencing patterns.

One fascinating new company that is in the right place—and has found the right partner—at the right time is Carbon3D, who have developed an entirely new, very rapid and very accurate way to 3D model in a liquid bath, at 25 to 100 times the speed of familiar layer-by-layer 3D printing. The process produces objects with great complexity and consistent mechanical properties from a wide variety of polymeric materials. Thus, the ability to develop and test products and parts for assembly, fit and accessibility is vastly improved.

OpenXC also has a vehicle onboard system, a small module that records a wide range of information readable to mobile or web applications. Integrated data includes everything from traditional diagnostics to steering wheel motion, engine torque and transmission position—all of which will lead to advances in both fuel economy and assisted or autonomous technologies. These modules will be installed by Ford engineers and by daily drivers. For better or worse (you may need to learn to behave yourself), these systems may also one day lead to data-driven insurance rates.



SYNC-embedded AppLink connects smartphone features with in-car systems, automatically picking up such services as Pandora, Spotify, NPR one, SiriusXM and iHeartRadio, as well as full-spectrum music and news, all with info and graphics transferred to the touchscreen. Voice control is available for all of the above, and app developers have access to the AppLink ecosystem for ongoing integration of new functions.

Onboard tech systems will also now be available via a MyFord Mobile app extension for Apple Watch and Android Wear. Easily synced with your other mobile devices, this can lock or unlock your vehicle, find your misplaced parked car, or display your vehicle mileage, driving efficiency, EV charging status—even the full owner's manual.

We've been exposed to the use of such things as plastic bottles or spun soybeans to manufacture seating materials in the past. A fascinating breakout on our tour, presented by Ford Research

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senior technical leader for materials sustainability Debbie Mielewski—who has BSE, MSE and PhD degrees in chemical engineering from the University of Michigan, has over 40 referred journal publications and holds 10 US patents—highlighted her team's work in development of sustainable plastic materials that meet stringent automotive requirements, including natural fiber reinforced plastics and polymer resins made from renewable feed stocks. (On hand was an appetizing display of corn, tomatoes, soybeans, coconuts, bamboo and grains.) Dr. Mielewski's mission is to improve Ford's environmental footprint, with a strong belief that these new materials will dominate the market in the future.

We had met virtual reality and advanced visualization technology specialist Elizabeth Baron during a virtual reality laboratories tour in Dearborn five years ago. This day, she had an entirely new generation of immersive experiences for us to try. Sitting in an armchair in California wearing a VR headset, we were transported to the innovation centers in Germany and Australia, where we could hands-on experience variable vehicle controls in a variety of driving situations (we could even set ourselves up for righthand drive in Australia). Activities and reactions are all recorded, and with motion capture can be revisited and analyzed.

Immersion in the forces of nature

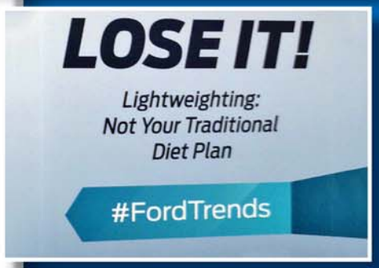
All of the above gets packaged into our old friend the motor vehicle. Aerodynamics and lightweight materials are key to fuel efficiency, and lightweighting technologies were our next to last stop. As one automotive engineer once told us, for every pound you want to save, you have to find 16 ways to do it—every ounce is a challenge. Automakers are out to save pounds by the dozens, even hundreds, while constantly improving safety, sound insulation and solid vehicle handling.

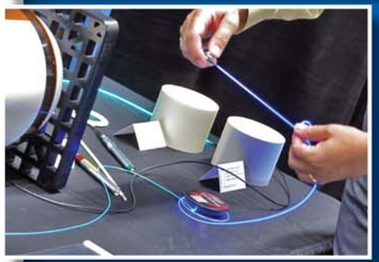
We were given a point-by-point rundown on the Ford Fusion-based Multi-Material Lightweight Vehicle (MMLV) project, with a graphic-embedded example on hand illustrating weight-saving details from extruded aluminum sills to boron pillars to carbon fiber instrument panel and seats. We held old and new coil springs in our hands to experience their staggering reduction in weight.

The fruits of such labors are already coming to market in the rebirth of the Ford GT supercar for model year 2017—on hand to great acclaim from media who had seen the reveal in Detroit last winter. Powerful, lightweight and stunning, it's proof that discipline can be fun and rewarding.

Another approach to reducing the transport footprint, multi-modal solutions—reducing your use of your car by switching over to a bicycle for your final leg to the office (expected to become a

requirement in some urban centers)—brought us to our last stop: the MoDe:Flex, Ford's third-gen eBike. This has a frame-embedded battery and motor, and variable front, rear and wheel assemblies, interchangeable for road, city or mountain bike use. The bike neatly folds to store inside any Ford vehicle, where it can recharge while stowed.





Immersion in the future

The event was comprehensively tied together at the end in a keynote speech by CEO Fields, who both expanded upon and unified the company's broad range of visions, their collective goals and the current state of transport evolution (as always, well ahead of where many think it is). Fields then mingled freely with the media, many of whom have known him well throughout his career.

The mission is well stated in the company's own words: "Our vision is to truly change how the world moves—again. Henry Ford did that a century ago, when he manufactured affordable automobiles for the masses. ... We are focused on protecting the freedom of movement of people and goods—a freedom that is being affected by large societal megatrends such as urbanization and increased traffic congestion. To address the risks as well as the opportunities, Ford and society as a whole must change the way we think, collaborate and behave. ... (we are using) innovation to take Ford to the next level in connectivity, mobility, autonomous vehicles, big data and the customer experience." ■