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MICHIGAN: AT THE INTERSECTION OF MOBILITY AND INNOVATION

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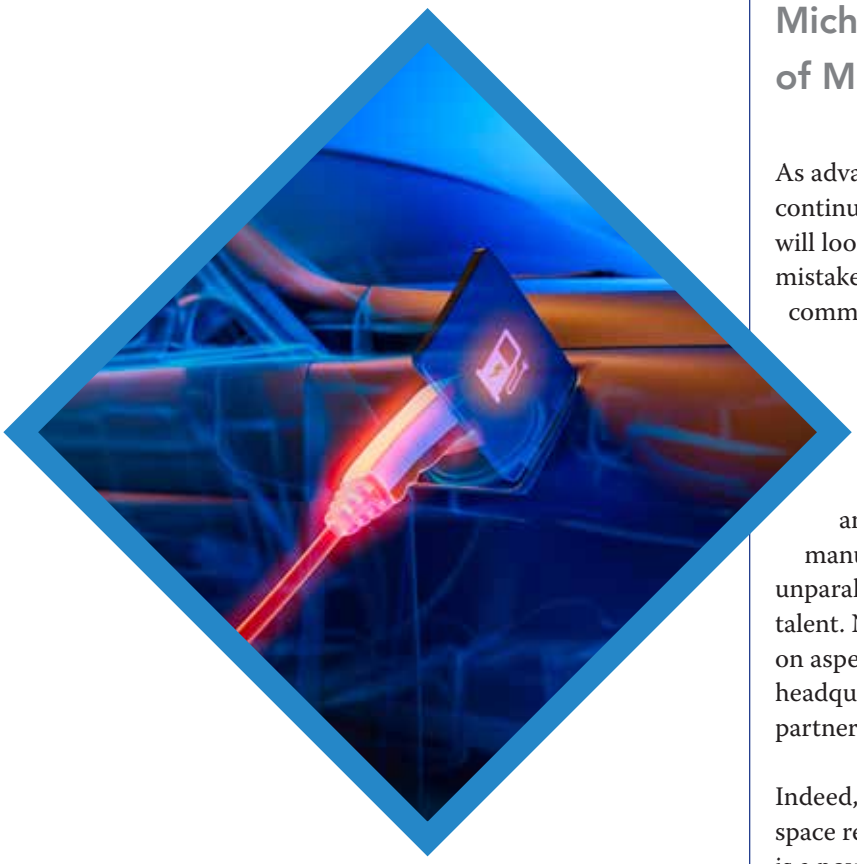

"This isn't the Rust Belt. You've got sophisticated people doing sophisticated things."

—Paul Fleck, CEO, Dataspeed

Where the Action Is

Michigan: At the Intersection of Mobility and Innovation

As advances in autonomous and electrified technology continue, the vehicles and mobility networks of the future will look different than those of the past. But make no mistake, future mobility innovations share one thing in common: Michigan is where it happens.

Michigan has always been ground zero for America's auto innovation. Michigan is also the place to be for the world's major vehicle companies, along with suppliers from Asia and Europe who have located R&D centers and manufacturing facilities here to be near the state's unparalleled bench of engineering and manufacturing talent. Now the numerous small startups working on aspects of future mobility, wherever they may be headquartered around the globe, also come to Michigan to partner with legacy firms.

Indeed, any company hoping to succeed in the mobility space recognizes that Michigan is the place to be. There is a powerful concentration of resources to help them succeed here — particularly an abundance of public-private collaborations that are helping to advance the future of mobility.

In this white paper, we'll look at the initiatives that are keeping Michigan in the forefront of innovation. We'll also introduce some of the many firms that are doing cutting-edge work in the space and include practical advice to help startups get in the game.

DRIVEN BY URGENCY

The state of Michigan is committed to ensuring Michigan remains the worldwide leader in the mobility space. In 2020, Michigan Gov. Gretchen Whitmer created a new

Office of Future Mobility and Electrification (OFME) and appointed state economic development veteran Trevor Pawl to lead it. The new office is building on a Michigan Economic Development Corporation-led partnership of mobility organizations, communities, educational institutions, research and development and government agencies that began in 2017 to develop and deploy mobility technologies.

OFME is designed to enhance concierge-level services currently being provided to mobility companies. Working across state government, academia and private industry, OFME is developing dynamic mobility and electrification policies and supporting the startup and scale-up of emerging technologies and businesses.

Pawl says a sense of urgency is driving the innovation — an urgency born of concern over climate change, changing lifestyles and the arrival of the "Internet of Things" that allows all manner of connectivity among everyday devices.

"When you look at the next 10 years, electric vehicle sales are expected to pass internal combustion engine sales by 2030," Pawl says. "Software will represent more than 50 percent of vehicle (technology) by 2030. Autonomous vehicles are expected to take off later this decade with over 50 percent of new vehicle production being at least partially autonomous."

Inevitably, mobility innovation either starts in Michigan or finds its way here for testing and further development — and it extends beyond vehicles. It also applies to roadways, intersections, signage and other elements of the broader transportation network — a blend of engineering, telecommunications, urban planning, software and more.

In Michigan, it all comes together in what is the largest deployment of freeway and surface street Vehicle to Infrastructure (V2I) technology in the U.S. Automakers and small startups are also working together on imaging technology, vehicle-to-vehicle (V2V) and vehicle-to-roadway (V2R) communications, electrification advances and so much more for the vehicles and transportation infrastructure of the future.

Take Ford Motor Co., which is investing several hundred million dollars in its new mobility research campus in Detroit's Corktown district, including renovating the long-dormant Michigan Central train station to serve as its hub of future mobility research.

Small startups are in the game, too. For example, a company called Derq, based in Dubai, has partnered with the city of Detroit mobility office and the Michigan Department of Transportation (MDOT) to test ideas for "smart" intersections and other infrastructure to reduce accidents and manage traffic flow.

As Paul Fleck, founder and CEO of mobility startup Dataspeed, puts it, "This isn't the Rust Belt. You've got sophisticated people doing sophisticated things."

ADVANCES IN ELECTRIFICATION

Although autonomous vehicle (AV) technology grabs a lot of the headlines, electrification is advancing fast, too. Dozens of electric vehicle (EV) models are in the works, and by some estimates, about three-fourths of all new vehicle sales will be electric by midcentury.

Two cutting-edge product lines are boldly advancing: EV pickup trucks and SUVs.

In October 2020, General Motors unveiled plans for its GMC Hummer electric pickup and expects the vehicle to go into production at GM's Factory ZERO Detroit-Hamtramck assembly center starting in late 2021; GM has invested $2.2 billion in retooling the plant to build all-electric vehicles.

Ford's F-150 pickup, the bestselling vehicle in the U.S. for decades, expects an electric version to be ready for sale in 2022. The Chevy Silverado promises an electric vehicle by about 2025. And Rivian, founded in 2009, got a huge boost in late 2019 when Amazon ordered 100,000 EV vans as part of its plan to convert its delivery fleet to 100 percent renewable energy by 2030.

All of these efforts benefit from significant investment in Michigan.

AMERICAN CENTER FOR MOBILITY

A key venue for mobility innovation is the American Center for Mobility (ACM), a collaborative effort of MDOT, the MEDC, multiple Michigan universities, a corporate leadership group called Business Leaders for Michigan and accelerator and talent portal Ann Arbor SPARK.

ACM's focus is on next-generation mobility innovation through research, testing, standards development and educational programs. Opened in 2018, the facility is located on more than 500 acres at the historic Willow Run site in Ypsilanti near Detroit Metropolitan Airport where it offers a "smart test center" for the testing and validation of connected and autonomous vehicles and related technologies.

Also in the works are a technology park for the co-location and incubation of mobility startups and an events center for showcasing connected and autonomous vehicle technologies.

"There's a lot of planning on near-term technology systems, the things that are going to go into our cars in the

Example: A company called FLIR that develops night-vision technology brought a Ford Fusion equipped with its thermal imaging system to the ACM testing center. The tests showed that adding thermal imaging that detects heat profiles from people provides a clear advantage over visible light cameras in detecting pedestrians at night, when most fatal pedestrian accidents happen and when visible light cameras perform least well. The tests are likely to translate into new technology added to vehicles in the future to enhance pedestrian safety.

Example: In October 2020, the U.S. Department of Energy announced more than $7 million in funding for a Michigan-based cybersecurity company called The Dream Team LLC to develop infrastructure that will protect the electric grid from cyberattacks on electric vehicles and electric vehicle-charging systems. Testing of the electric roadways and vehicle-to-grid tech will be done at ACM's testing facilities.

next few model years," says ACM President and CEO Reuben Sarkar, who came to ACM after a decade at General Motors, where he was the lead engineer on the first-generation electric drive unit for the Chevy Volt. He also served as deputy assistant secretary of transportation for the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy.

"There's a lot of emphasis and focus on that in addition to how do I get to a fully automated vehicle that drives itself," he adds. "So, we cover the spectrum from what's the latest lane-assist technology and automated braking, and complementing that with the long-term work."

PARTNERING FOR SUCCESS

As described earlier, partnerships are key in this environment of innovation. Startups developing software and other technologies that address one aspect of mobility often team up with larger players and their platforms.

May Mobility, operator of autonomous shuttles in congested urban centers, has partnered with Toyota and BMW to develop its driverless technology. Dataspeed collaborates with Ford to provide the needed link between Ford's vehicles and multiple startup firms eager to test some aspect of innovation.

Major public and nonprofit entities have also initiated joint efforts to foster the broader ecosystem needed for mobility innovation. In today's rapidly evolving mobility space, innovation would not be possible without such partnerships.

"We have 80,000 to 90,000 engineers here. We have the talent set here. We have the regional companies here," says ACM's Sarkar. "We have a lower cost base here. There's the notion that we're competing with Silicon Valley, but at some point, the pendulum swings and you're getting more for your dollar and you're closer to the companies, and the ecosystem is here."

ACM is among nonprofit entities including the University of Michigan's MCity testing site and the Michigan Mobility Institute that are part of what is actually a rapidly expanding ecosystem supporting research and education to advance innovation in the mobility space and support startups.

And while other innovation hubs around the world boast of their own mobility advances, Michigan is best positioned to remain at the center.

"We have an immense opportunity to be a large part — if not the leading part — in creating how the world moves," says Chris Thomas, co-founder of Assembly Ventures, a new venture capital firm investing in mobility. "But we have to understand this is not a birthright. This is something that is in front of us that we have to work incredibly hard for.

"But if we do that work, the ability for us to leverage what we have been to become what we really want to be is going to be fantastic."

Let's meet some of the players in this new world of mobility innovation.

CASE STUDY: DATASPEED

CATALYST FOR TESTING

Dataspeed plays a key role in developing autonomous vehicle technology. Its "by-wire" product serves as the interface between the basic vehicle platform — typically a Ford Fusion or Lincoln MKZ — and the many software or hardware add-ons that other companies are developing to enhance autonomy capability.

Now with about 35 staffers based in suburban Detroit, Dataspeed has a team of engineers who are playing a key role in enabling a host of other companies, from major manufacturers to tiny startups, to test their AV technology.

Paul Fleck, a former product engineer for Ford, founded Dataspeed as a startup in the Macomb-OU Incubator within the Velocity Collaboration Center in Sterling Heights.

Q+A WITH PAUL FLECK OF DATASPEED

Q: You started your company in 2008. What was its direction then and how did it evolve?
Fleck: "The first major milestone was transitioning from

providing only engineering services to providing a product — our by-wire kit — which was readily adapted by the AV industry. The profits from sales of this product enabled us to grow and expand. We continue to add more products, services and capabilities (that are) focused primarily on the growing AV industry."

Q: Please explain that by-wire system.
Fleck: "There's four things you need to make an autonomous vehicle. You need a platform, a vehicle; you need a by-wire control, the interface to control the vehicle; you need a suite of sensors and computers to sense the environment and act on it; then you need an AV stack — the software, the operating system. Any autonomous vehicle has some semblance of all those things. (With our by-wire product) we're able to do full control of the throttle, brake, the steering and the shift mechanisms inside a Lincoln MKZ or a Ford Fusion. And then it was made available to the general community and there was quite a need for it. It was the right product for the right time."

Q: Who are your customers?
Fleck: "We've had literally hundreds of different customers, from small startups that nobody ever heard of to Fortune 500 companies, like Intel, that use a variety of vehicles with our technology in it."

Q: How have you raised capital for your growth?
Fleck: "As a bootstrapped company, we have been able to grow without any outside investment. (But) I was an early awardee of a BAF (Business Accelerator Fund) grant by the MEDC. That was 2012; I was one of the first awardees of that, a $48,000 BAF grant. I can honestly say that money at that time was pivotal to the success of this company. I don't know if I would be here today if not for that grant."

Q: What advice would you have for other mobility startups? Any do's and don'ts?
Fleck: "Mobility startups need to recognize that this industry is rapidly changing. They need to listen to their customers and amend their plans accordingly. It is taking much longer than originally anticipated before widescale use of AVs. Startups need to understand this and build this revised time frame into their plans."

CASE STUDY: ARGO AI

PLAYING TO STRENGTHS

Argo AI is a self-driving technology company with headquarters in Pittsburgh and an engineering and testing center in Detroit. Partnering with Ford on the automaker's own mobility research and development endeavors, Argo AI builds the software, hardware, maps and cloud-support infrastructure necessary for autonomous vehicles. Alan Hall, Argo's director of communications, talked about the company's work in Michigan.

Q+A WITH ALAN HALL

Q: What were the key milestones in Argo AI's growth?
Hall: "Argo was founded in late 2016 and received our first investment from Ford Motor Co. in February 2017. With Ford, we found a partner that shared the Argo values and pragmatic approach to developing self-driving cars — in particular, the fact that they are an enabler for new business models and consumer experiences, not just an end unto themselves. Our relationship plays to the strengths of both companies: Argo brings vast experience in robotics, hardware and software development to build the self-driving system, and Ford brings its expertise in serving customers and manufacturing vehicles at scale. Our most recent milestone was the June 2020 close of Volkswagen Group's investment in Argo, which served as strong validation of the progress we'd made in development of a self-driving system. With VW as our second automaker partner and investor, Argo expanded internationally by establishing a European headquarters in Munich, Germany."

Q: What advice would you have for other mobility startups?
Hall: "The secrets to success will be different for different companies. Our advice is to find partners and collaborators that share your same values, approach complex problems with an aligned approach and remain true to your company's mission and purpose.

"For Argo, we have been focused on collaboration. Collaboration is core to who we are as a company, and we structured our business model around the importance of deep collaboration with automakers because of how critical it is to ensure safety and reliability — especially when it comes to scaling the deployment from hundreds to thousands and ultimately millions of vehicles across the globe."

Q. Why Michigan?
Hall: "We have a presence in Michigan for several reasons. Our presence in Michigan has enhanced our ability to collaborate with Ford and key suppliers, as well as other mobility groups, local leaders and community members, to understand how self-driving technology can improve cities around the country. Our first investor and customer, Ford, is based in Michigan, and the close proximity between the Argo engineering center in Allen Park and Ford's product development campus in Dearborn and their base for self-driving business development in Corktown has enabled our teams to work closely together to integrate the Argo self-driving system with Ford vehicles.

"Additionally, Argo tests our self-driving technology in multiple cities because it exposes our self-driving system to a diverse set of complex scenarios that will enable us to rapidly expand to many cities in the future. Testing in the Detroit area allows us to learn how our self-driving system operates in yet another environment and varied weather conditions.

"For instance, the Motor City really earns its name by offering an astounding diversity of road types. Some Detroit streets are wide and can often have unmarked lanes, presenting our vehicles with the challenge of having to reason through how to navigate while predicting what other drivers may do so we don't cause unnecessary congestion. Other residential streets are narrow two-lane roads with cars parked on either side. Combine that with overhanging tree branches, which we don't often see in other urban environments, and you've got a very dynamic situation. Add in pop-up construction that's occurring all over the city, and you've got a diverse, condensed training ground that really informs our development efforts. Finally, Michigan has a strong supplier

diversity and a large talent pool in the automotive industry, making it a great place to do business."

Q: How can a startup get in on the action in Michigan?
Hall: "A great first stop is Michigan's newly created Office of Future Mobility and Electrification, which is headed by Trevor Pawl. That office is helping lead collaboration between the state, academic institutions and the private sector."

CASE STUDY: MAY MOBILITY

PARTNERSHIPS PAY OFF

May Mobility, founded in 2017 and headquartered in Ann Arbor, deploys autonomous shuttles to get people in congested urban centers where they need to go safely and easily. The company ran pilots in multiple cities, including Columbus, Ohio, and Providence, Rhode Island, and now operates regular service in Grand Rapids and Detroit.

In December 2019, May completed its $50 million Series B round of fundraising led by Toyota Motor Corp., with participation by BMW and others. It was another example of the partnerships found between startups and established players.

May was co-founded by Edwin Olson, a professor of computer science and electrical engineering at the University of Michigan, who previously served on Ford's driverless car program and co-directed autonomous driving projects at the Toyota Research Institute. Currently with about 100 staffers, May hopes to add another 30 to 40 by early 2021. Tara Lanigan, May's director of policy and advocacy, shares insights about the company.

Q+A WITH TARA LANIGAN

Q: Is May Mobility finding all the talent it needs?
Lanigan: "It's definitely a challenge to find, especially engineering talent when there are places like Silicon Valley that have a lot to offer, especially with compensation. That said, we're increasingly open to remote options, especially with the pandemic changing the landscape of that anyway. I think also having major universities, figuring out how to involve them in retaining people who went through undergrad in Michigan and might normally turn around and go to San Francisco or New York, that's definitely been a support network for us. It is on everyone's mind. I know it's on the MEDC's mind, it's on a lot of lawmakers' minds, and we're trying to work together with new initiatives like the Michigan Mobility Institute, trying to address this directly."

Q: Do you see "first mile and last mile" — providing a shuttle between transit stops and remote parking lots to a commuter's ultimate destination — as the service that companies like May will provide?
Lanigan: "That's part of it. That's one of our use cases. We're also seeing an increasing interest in demand for a point-to-point service area where you can use an app. That's definitely where we're leaning as well."

Q: Where do you see mobility in Michigan going?
Lanigan: "It's a lot of pilots, testing, research. I think in the next four or five years we'll see it become more scalable, something that's a solution that isn't just in Detroit for a year or Grand Rapids for a year, but where we're seeing our fleet expanding in those cities and aligning with the city planners and how they're reimagining mobility for their cities. For us, that largely means complementing public transit, working with other micro-transit companies to see how we can embed with each other. I don't think in five years we'll be in every city in America, but we'll be in more cities, and seeing how we're growing in those is really exciting to us, especially in Michigan and the Midwest in general."

INVESTORS ARE READY

In this mobility innovation world, access to capital remains the key concern of small startups. Fortunately, Michigan enjoys a growing number of pre-seed, angel and venture capital funds that startups can look to for

investment. A good place to start is the Michigan Economic Development Corporation's entrepreneurship office; it can offer the support and resources that entrepreneurs need, as well as assistance finding investment partners. (For more information, visit ***michiganbusiness.org/entrepreneurship.***)

GET IN THE GAME

Jessica Robinson is co-founder of Assembly Ventures, a transatlantic mobility-focused venture capital fund that invests in and strategically supports entrepreneurs and mobility companies. She offers advice to startups hoping to get in on the mobility action.

1 Do your homework. "As a fund focused on mobility, know that we're pretty knowledgeable about the industry. But don't assume that we're engineers and focus solely on the tech in your pitch. We'll be interested in both the technology and the business case for what you're building. Take some time to get to know our backgrounds and how our prior work and investments might be helpful. (Not everyone does this, and it shows.) And don't worry if you're not in the automotive industry. Mobility is much more than that."

2 Know your geography. "With a footprint in the U.S. and Europe, we're excited about companies that are interested in growing in and into those geographies. Our presence in Michigan and Germany means we are connected with the decision-makers at the manufacturers, suppliers, operators and infrastructure technology firms and can make introductions."

3 Gain some traction. "Know the stage that we typically invest in and how that lines up to your growth. For instance, we will invest primarily in Series A and Series B rounds. That means that the company has a working product and some early customers. It's OK if you're still figuring out how to scale, but some traction is important. If your company is earlier than that, we're probably still glad to meet you but will want to track your progress some more before engaging."

TIPS FROM THE TOP

Trevor Pawl offers these suggestions on how to leverage Michigan's Office of Future Mobility and Electrification resources.

1 Connect. "If it's dealing with the movement of people or goods, talk to us. There's a couple of directions we could take you in. We could make a customer connection, explore grant possibilities to activate a new technology or we could help navigate a policy issue."

2 Capital. "The first (direction) could involve access to capital. We could help you demystify government resources. To startups, government just seems so complicated and tangled — where do I go? Where do I start? We have grant programs that essentially track the different mobility challenges in our state and then look for startups to partner with."

3 Testing and Piloting. "Say you have a startup that's going to make intersections safer. We fund that for a couple of months to see if there's a business model there."

4 Targeted Customer Matching. "To a startup, all that matters is getting your first couple of customers. We can help do that. We have supply chain matching programs that we partner with. Henry Ford's original assembly line created a system where each task got done in the proper sequence. So going back to that assembly line concept, we're the first stop on the line. That's the role that we play."

For more information on resources provided by the Michigan Economic Development Corporation and the Office of Future Mobility and Electrification, start by visiting ***michiganbusiness.org/pure-partnership***.