



AUTOMATED VEHICLE INDUSTRY ACTIVITIES IN MICHIGAN

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Sponsoring Organization:

Michigan Department of Transportation (MDOT)
425 Ottawa Street
P.O. Box 30050
Lansing, MI 48909

Performing Organization:

Center for Automotive Research (CAR)
3005 Boardwalk, Ste. 200
Ann Arbor, MI 48108

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This document provides a summary of major automated vehicle development activities that have taken place in Michigan, roughly covering the time period beginning in early 2014 (corresponding with the effective date of PA 231 and 251 of 2013) through the end of 2016.

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TABLE OF CONTENTS

1	Introduction	1
2	OEM Activities	3
3	Industry Suppliers and Resources	11
3.1	Tier 1 Suppliers.....	11
3.2	Other Suppliers and Industry Service Providers	14
3.3	Additional Industry Resources.....	18
4	Academia	21
4.1	University of Michigan.....	21
4.2	Additional University Resources	24
5	Summary	25
	Appendix A: Major Nationwide and Global Automated Vehicle Efforts.....	27



1 INTRODUCTION

In 2013, Michigan became the fourth US state to specifically regulate the testing of automated (self-driving) vehicles. Public Acts 231 and 251 of 2013 updated Michigan’s legal code to facilitate manufacturers, suppliers, and upfitters of automated vehicle technology to test prototype automated driving systems on public roads when registered with a special license plate (an ‘M-plate’). Michigan’s legal code was further revised with the adoption of Public Acts 332, 333, 334, and 335 (of 2016). The most impactful of these, PA 332 created a framework by which to deploy an “on-demand motor vehicle network.”

A principle goal of Michigan’s automated vehicle regulation was to stimulate the development of Michigan firms that develop automated vehicle technologies. The legislation was introduced by Sen. Mike Kowall, chair of the Senate Economic Development Committee, who stated that the legislation was introduced “to attract jobs stemming from this developing industry.”¹ The legislation was crafted in consultation with the office of Governor Rick Snyder, who promoted the effort to brand Michigan as the “automotive capital of the world.”² Additionally, the legislative process was supported and informed by OEMS, technology companies, and industry groups. Since the 2013 legislative effort, a wide variety of stakeholders have stepped up efforts to transition Michigan into a center of automated vehicle research and development.

This report documents and summarizes the progress of automated vehicle research and development activities in Michigan since the adoption of Public Acts 231 and 251 of 2013.

¹ Sloan 2014, pp. 1.

² Rick Snyder, Michigan State of State Address. January 16, 2013.



2 OEM ACTIVITIES

This section details activities that traditional auto manufacturers (OEMs) have taken towards the development of highly automated vehicles that are relevant to Michigan.

FIAT CHRYSLER AUTOMOBILES (FCA)

FCA gained automated vehicle notoriety in May 2016 when it was announced that Google would be purchasing 100 modified Pacifica minivans for automated vehicle testing.³ Google has since spun-off its self-driving efforts to a wholly-owned independent company, Waymo, and has purchased an additional 500 Pacifica minivans to deploy a test fleet of automated vehicles in Arizona.⁴



FIGURE 1: WAYMO'S MODIFIED AUTOMATED PACIFICA

FORD MOTOR COMPANY

Advanced driver assistance systems (ADAS) are widely available across Ford's product line. Semi-autonomous vehicle features available today in Ford vehicles include lane-keeping assist, adaptive cruise control, Pre-Collision Assist with Pedestrian Detection and active park assist – with Traffic Jam

³ Tommaso Ebhardt. "Fiat, Google Plan Partnership on Self-Driving Minivans." *Bloomberg Technology*. May 4, 2016.

⁴ Eric D. Lawrence and Marco della Cava. "Google's Waymo to test autonomous Chrysler's Pacifica minivans in public trial." *Detroit Free Press*. April 25, 2017.

Assist coming.⁵ Most of the ADAS systems in Ford's current product line were developed in Michigan. Ford's new F-150 is available with a feature that provides automated hands-free backing up of trailers.⁶



FIGURE 2: AUTOMATED FORD FUSION HYBRID TESTED AT MCITY, NOVEMBER 2015

Ford's R&D center in Dearborn continues to advance such technologies as big data analysis, mobility solutions, HMI, lightweighting, and rapid electric vehicle recharging. Ford is a founding member of the Mobility Transformation Center (MTC) at UM,⁷ and has collaborated with UM researchers to explore automated vehicle technology based on real-time lidar mapping.⁸ An automated Ford Fusion hybrid was the first vehicle to utilize MTC's Mcity (Figure 2).

Future research in more advanced automated vehicle technology will be centered in the new Silicon Valley Research Center as part of Ford's "Smart Mobility" program.⁹ Ford has been approved to test automated vehicle technology on public roads in California.¹⁰ It has also been reported that in addition to Ann Arbor and California, Ford would be conducting testing at a

⁵ @FordOnline. "Ford at CES Announces Smart Mobility Plan and 25 Global Experiments" January 8, 2015.

⁶ E.J. Schultz. "Ford touts 'backup trailer assist' function in new F-150 ads." *Automotive News*. November 25, 2015.

⁷ *MTC described infra* Section 4.1, page 18.

⁸ R. Colin Johnson. "Ford Self-Driving Cars On-the-Cheap." *EE Times*. January 20, 2015.

⁹ Brauer, Karl. "Ford Opens New Research and Innovation Center in Palo Alto." *Forbes*. January 22, 2015.

¹⁰ Ford. Press Release: "Ford to Begin Autonomous Vehicle Testing on California Roads: Silicon Valley Accelerates Smart Mobility Plan." December 15 2015.

new 1,000-acre proving ground in North Carolina. Ford has even been testing automated driving systems that function in snow.¹¹

Ford has pledged to invest over \$1 billion over five years in Pittsburg-based Argo IA to develop level 4 automation by 2021. Argo AI will have offices in Michigan and elsewhere.¹²

GENERAL MOTORS

Many ADAS and active safety technologies are available on GM cars and trucks today, such as adaptive cruise control, side blind zone warning and automatic park assist. GM has shown innovative thinking with concepts such as the automated Chevrolet EN-V.¹³



FIGURE 3: A CADILLAC SUV WITH A COMPLEX SENSOR SUITE SPIED IN ANN ARBOR IN SEPTEMBER 2015

GM has announced plans to introduce a hands-free, feet-free automated driving system.¹⁴ GM's promised "Super Cruise" highway autopilot system is

¹¹ Alex Davies. "The Clever Way Ford's Self-driving Cars Navigate in Snow." *Wired*. January 11, 2016.

¹² Dana Hull. "Ford Investing \$1 Billion in Startup Founded By Two Autonomous Car Pioneers." *Bloomberg Technology*. Feb 20, 2017.

¹³ General Motors. "Innovation: Design and Technology." Accessed February 2015 at: http://www.gm.com/vision/design_technology/emerging_technology.html

¹⁴ General Motors. "Cadillac to Introduce Advanced 'Intelligent and Connected' Vehicle Technologies on Select 2017 Models: Super Cruise and V2V technologies slated for production in about two years." September 7, 2014. Accessed February 2015 at:

being co-developed with supplier Delphi.¹⁵ GM has stated that Super Cruise will include DSRC connectivity, and GM has been assisting MDOT in connected vehicle deployment in Southeast Michigan.

GM has a small Silicon Valley Office since 2007, but doesn't do much R&D at that location.¹⁶ GM does extensive R&D at its Warren Tech Center, and is heavily investing to update those facilities.¹⁷ GM has been testing its Super Cruise technology at its proving grounds in Milford, MI.¹⁸ (Delphi has been developing its related technology in Silicon Valley and elsewhere.)

GM is a founding member of the MTC at UM. Hinting at GM's longer-term efforts, a Cadillac SUV with a sensor-suite suggesting research in high-levels of self-driving capability was spotted in Ann Arbor in September 2015 (Figure 3). In January 2016, GM announced a \$500 million investment in the ride-hailing service, Lyft. GM's President, Dan Ammann explained that GM would be working with Lyft to develop an "autonomous ... on-demand ride-sharing platform."¹⁹

GM's most significant investment in developing highly automated vehicles is a \$1 billion acquisition of Silicon Valley company Cruise Automation.²⁰

HYUNDAI

Hyundai America Technical Center, Inc. (HATCI) is the design, technology, and engineering arm for all North American models of the Korean-based Hyundai-KIA Motors Group. HATCI also has a California presence, but the Michigan location is the center of active safety and automated vehicle

<http://media.gm.com/product/public/us/en/technology/home.detail.html/content/Pages/news/us/en/2014/Sep/0907-its-overview.html>

¹⁵ Cunningham, Wayne. "Delphi's computerized chauffeur drives me around Las Vegas at CES 2015." CNET. January 8, 2015.

¹⁶ Nelson, Gabe. Interactive: Guide to Silicon Valley's auto corridor. Automotive News. June 16, 2014. Accessed February 2015 at: <http://www.autonews.com/article/20140616/OEM/140619948/guide-to-silicon-valleys-auto-corridor>

¹⁷ Gardner, Greg. "GM to invest \$1B in Tech Center, add 2,600 jobs." Detroit Free Press. May 14, 2015.

¹⁸ Keith Naughton. "Can Detroit Beat Google to the Self-Driving Car?" *Bloomberg*. October 29 2015.

¹⁹ Douglas MacMillan. "GM Invests \$500 Million in Lyft, Plans System for Self-Driving Cars." *The Wall Street Journal*. Jan 4, 2016.

²⁰ Dan Primack. "More on What GM Paid To Buy Cruise Automation." *Fortune*. July 21, 2016.

technology research in North America.²¹ As of March 2015, HATCI had 195 M-plates issued to the business, and is approved to test automated technology in Nevada. Hyundai-KIA has outlined a roadmap towards the production of fully automated vehicles by 2030.²²

MERCEDES BENZ

Farmington Hills, Michigan serves as the headquarters for Mercedes-Benz operations in the Americas region. Mercedes currently offers one of the most-capable automated driving systems Intelligent Drive—which combines full speed adaptive cruise control, steer assist, and automated emergency braking. Mercedes is working with HERE to develop digital maps that would allow higher levels of automation.²³ (HERE has created 3D digital maps for Southeast Michigan specifically to support testing self-driving technology.)

Mercedes R&D efforts are mostly based in Germany. Mercedes is not known to be conducting automated vehicle R&D in Michigan, but has expressed interest in the MDOT Connected and Automated Vehicle Working Group.

NISSAN

Nissan Technical Center North America (NTCNA), headquartered in Farmington Hills is the site of extensive product development and testing, but is not known to be a location of automated vehicle research.²⁴ Nissan is developing autonomous vehicle technology at its Silicon Valley Research Center in partnership with NASA, and is permitted to test automated vehicles in California.²⁵ Nissan is also road-testing autonomous vehicle technology near its headquarters in Japan.

²¹ <http://www.hatci.com/company.aspx>

²² Chris Bruce. “Kia will launch fully autonomous car by 2030.” *autoblog*. January 5, 2016.

²³ Nokia Power USA. “HERE powered self-driving Mercedes S-500 car showcased. May 16, 2014.

²⁴ Nissan. Corporate Info. Accessed February 2015 at: <http://www.nissanusa.com/about/corporate-info>

²⁵ Stern, Gabriella. “Robot Cars and ‘Coordinated Chaos.’” *The Wall Street Journal*. February 9, 2015.



FIGURE 4: NISSAN PROTOTYPE AUTONOMOUS DRIVE LEAF

Nissan has publicly set a goal of “commercially viable autonomous drive vehicles” by 2020.²⁶ Nissan is a founding member of the MTC at UM. As of March 2015, Nissan had over 200 M-plates registered through NTCNA.

SUBARU

Subaru Research and Development Inc. center in Ann Arbor focuses on electric vehicle powertrains, infotainment, and associated HMI. Select Subaru cars are available with Level 2 autonomy via the Eyesight system, which uses two cameras as primary sensors.²⁷ As of 2015, Eyesight includes forward-collision warning, lane-departure warning, and automatic braking to avoid low-speed collisions.²⁸ Subaru’s Eyesight system appears to have been developed primarily in Japan, but it is likely that the Ann Arbor location has had some involvement with systems integration and testing. Subaru does not have a presence in Silicon Valley. As of March 2015, Subaru has 15 M-plates issued to the company through the Ann Arbor site.

TOYOTA

Toyota’s recent corporate restructuring involved a significant expansion of the Toyota Technical Center, south of Ann Arbor. This location is the North American base for Toyota’s development of automated vehicle technology systems integration.

²⁶ Nissan. “The Future is Now.” Accessed February 2015 at:

<http://www.nissanusa.com/innovations/autonomous-car.article.html>

²⁷ Nelson, Gabe. “Subaru leads new IIHS ratings of Automatic braking technology.” Automotive News. September 27, 2013.

²⁸ Consumer Reports. “Want a 2015 Subaru Outback with EyeSight? For now, you might have to wait. We did.” October 24, 2014.



FIGURE 5: TOYOTA ADVANCED SAFETY RESEARCH VEHICLE TESTED ON MICHIGAN PUBLIC ROADS IN 2012.²⁹

In November 2015, Toyota announced the creation of an artificial intelligence research and development center in Silicon Valley. The company said the next five years of the project would amount in a \$1 billion investment.³⁰ It is not clear what the role of the Toyota Technical Center in Ann Arbor will be once the Silicon Valley Center is fully operational. Toyota also does much of its automated vehicle research in Japan.³¹

Toyota has recently stated that it is focused on improving safety through ADAS systems that provide “a partnership between the driver and the car.”³² Toyota has been issued 175 active M-plates³³ through the Technical Center, and Roush Industries has also been issued 30 M-plates specifically to test Toyota’s prototype ADAS systems.³⁴

Toyota is also investing in Michigan research facilities.³⁵

²⁹ Source: *Automotive Fleet*. Accessed March 2015 at: <http://www.automotive-fleet.com/news/story/2013/01/toyota-shows-advanced-active-safety-research-vehicle-at-ces.aspx>

³⁰ John Markoff. “Toyota Invests \$1 Billion in Artificial Intelligence in U.S.” *The New York Times*. November 6, 2015.

³¹ Makie Ramsey; Miho Inada; Yoko Kubota. “Japan Road Tests Self-Driving Cars to Keep Aging Motorists Mobile.” *The Wall Street Journal*. January 21, 2016.

³² Atiyeh, Clifford. “Toyota—of All Companies—Defends Drivers, Says It Won’t Build a Fully Autonomous Car.” *Car and Driver*. September 10, 2014.

³³ As of March 2015.

³⁴ Michigan SoS M-plate records obtained by CAR. (Not confirmed to be complete, some records appear to be missing. E.g., records furnished by SoS did not include any listings of M-plates registered to General Motors.)

³⁵ <http://www.engin.umich.edu/college/about/news/stories/2016/august/accelerate-artificial-intelligence-research>



3 INDUSTRY SUPPLIERS AND RESOURCES

This section details Michigan-based automated vehicle development activities by non-OEM entities such as major suppliers, technology companies, and industry groups.

3.1 TIER 1 SUPPLIERS

ROBERT BOSCH, LLC (BOSCH)

Robert Bosch LLC is a wholly owned subsidiary of German-based Bosch. The US-based subsidiary has six Michigan locations in total, including headquarters in Farmington Hills. Bosch has confirmed testing on-road automated vehicles in CA and MI.³⁶ Bosch has been named as a supplier to Google self-driving car and also supplies automated technologies for many automakers.³⁷ Bosch's Research and Technology Division does not have a Michigan location, but has offices in Palo Alto, Pittsburg, and Cambridge, MA. Bosch is a founding member of the MTC at UM. As of March 2015, Bosch is in possession of over 100 active M-plates allowing on-road testing of prototype vehicles. Many of these were explicitly issued for testing of components related to automated vehicle technology.

CONTINENTAL CORPORATION (CONTINENTAL)

Continental Automotive Systems, one of six groups of the German-based Continental Corporation, has its North American headquarters in Auburn Hills. Continental also has a powertrain division location in Dearborn. Continental has been permitted to test automated vehicle technology in Nevada, and is partnering with BMW on automated vehicle applications.³⁸ Continental has been named as a supplier to the prototype Google self-driving car prototype.³⁹ Continental's automated vehicle technology efforts are run through the new Intelligent Transportation Systems business unit

³⁶ Jan Becker. AUVSI Conference, June 2013.

³⁷ motoring.com.au. "Germany's key car industry supplier just keeps growing." Accessed February 2015 from: <http://www.motoring.com.au/news/2015/bosch-booms-48918>

³⁸ Boeriu, Horatiu. "BMW and Conti team up on next step towards highly automated driving." BMW BLOG. February 27, 2013.

³⁹ Walsh, Dustin. "Google puts its self-driving car in the hands of area suppliers." Crain's Detroit Business. January 15, 2015.

headquartered in Silicon Valley.⁴⁰ In December of 2014, Continental was issued ten M-plates for testing automated vehicle technologies.

DELPHI AUTOMOTIVE (DELPHI)

Now a U.K.-based corporation, Delphi maintains its North American headquarters and Innovation Center in Troy. Delphi has received automated vehicle testing permits in both Nevada and California. Delphi is also conducting automated vehicle research in Michigan and Pennsylvania. Delphi is using on-road testing to develop the technology that will go into Cadillac's upcoming "auto-pilot" system.⁴¹ Delphi has made DSRC V2V communication a critical component of its automated vehicle technology research.⁴² Delphi's automated technology efforts are run out of its new Silicon Valley facility.⁴³ Delphi recently tested its autopilot technology on a cross-country trip from California to New York.⁴⁴ Delphi is a founding member of the MTC at UM.

DENSO INTERNATIONAL AMERICA INC. (DENSO)

This Japanese corporation has its North American headquarters in Southfield. Denso has developed automated vehicle technologies and supported the USDOT's connected vehicle efforts and expressed a vision for "connected automation."⁴⁵ Denso's North American R&D efforts remain centered in Michigan, but the corporation has committed to growing its existing presence in Silicon Valley.⁴⁶ Denso is a founding member of the MTC at UM.

⁴⁰ Winter, Drew. "Continental Gets Serious About Autonomous Vehicles." WardsAuto. September 12, 2014.

⁴¹ Cunningham, Wayne. "Delphi's computerized chauffeur drives me around Las Vegas at CES 2015." CNET. January 8, 2015.

⁴² <http://delphi.com/media/media-releases/Details/Delphi%20advances%20automated%20vehicle%20project%20at%20CES%20adds%20V2E%20technologies>

⁴³ Cunningham, Wayne, "Delphi demos autonomous car technologies at new lab." CNET. September 19, 2013.

⁴⁴ Delphi Drive. Accessed April 2015 at: <http://www.delphi.com/delphi-drive>

⁴⁵ Berg, Roger. "Connected Automation: Improving Safety Through Connected Vehicle Technology." Industry Technical Workshop. Northwestern University Transportation Center. 2014. Accessed February 2015 from: <http://www.transportation.northwestern.edu/docs/2014/Autonomous-Vehicles-Workshop/2014.06.10.Berg.pdf>

⁴⁶ Denso. "Denso Expands Presence in Silicon Valley, California." News Release. May 29, 2014.

MAGNA INTERNATIONAL OF AMERICA, INC. (MAGNA)

Magna's Technology and product line includes electronic modules and vision systems. Magna has developed and demonstrated monocular camera-based traffic jam assist systems and automated emergency braking systems. Magna has been using the M-plate program to test automotive vision systems for active safety since at least 2012.

NVIDIA

This technology firm from Silicon Valley is best known for the introduction and development of graphics processing units (GPUs). However, NVIDIA believes that graphics processing technology will be central to highly automated vehicle systems, and is positioning itself to be a major player in this developing market.⁴⁷ This strategy may have contributed to the opening of a tech center in Ann Arbor. NVIDIA has introduced an integrated graphics chip array marketed as a "self-driving supercomputer." The device will be used in Volvo's Drive Me pilot in Sweden in 2017.⁴⁸

RICARDO NORTH AMERICA (RICARDO)

Ricardo's Van Buren Township location is the North-American headquarters of U.K.-based company. Highly automated vehicle technology is not a major focus for Ricardo (as opposed to active safety), but it has been involved in some projects such as the SARTRE road-train demonstration.⁴⁹ Ricardo has hinted that it plans to grow its connected and automated vehicle portfolio through its new Silicon Valley Tech Center.⁵⁰

ROUSH INDUSTRIES, INC. (ROUSH)

Though not in the development of automated vehicle technologies, this Michigan company became associated with automated vehicles when Google announced that Roush would be assembling Google's self-driving prototype vehicles in Livonia.⁵¹ Roush is in possession of several M-plates allowing the

⁴⁷ Francis, Esther. "Autonomous Cars: no longer just science fiction." nvidia.com. Accessed February 2015 at: <http://www.nvidia.com/content/tegra/automotive/pdf/autonomous-cars-no-longer-just-science-fiction.pdf>

⁴⁸ Don Clark. "Nvidia Announces Another Car Supercomputer at NES." *Wall Street Journal Digits Tech Blog*. January 4, 2016.

⁴⁹ Ricardo. "SARTRE road train premieres on public roads." Press Release. May 28, 2012.

⁵⁰ CBS Detroit. "Ricardo Completes Purchase of California Tech Center." January 20, 2014.

⁵¹ Priddle, Alisa. "Google driverless cars being built in Livonia." *Detroit Free Press*. January 14, 2015.

company to test prototype vehicles on public roads, including thirty issued specifically for testing automated crash avoidance systems on Toyota platforms. Roush has also been contracted for physical conversion of Chrysler Pacifica vans for Waymo (Google).

VALEO

This French corporation has several Michigan locations in addition to the North American headquarters in Troy. Valeo makes a variety of sensor and actuation systems, and has developed fully automated vehicle systems.⁵² Valeo does extensive research in Troy and recently opened an office in Silicon Valley.⁵³ Valeo was issued three M-plates in March 2013 to test machine vision systems on public roads.

ZF TRW

German-based supplier ZF Friedrichshafen AG (ZF Group) announced it would acquire TRW Automotive. Stefan Sommer, CEO of the ZF Group, said the main reason behind the company's decision to acquire TRW Automotive was the demand for technology to make autonomous driving possible in the coming years.⁵⁴ ZF TRW intends to expand its Northville site to boost research efforts on new transmission, steering, axle and chassis components.⁵⁵

3.2 OTHER SUPPLIERS AND INDUSTRY SERVICE PROVIDERS

AUTOLIV ELECTRONICS AMERICA (AUTOLIV)

Autoliv develops and supplies active and passive safety systems, and has obtained several M-plates for testing prototype safety systems and sensor systems. Autoliv has locations in Auburn Hills and Southfield. Corporate headquarters is in Sweden.

⁵² Bell, Duncan. "Valeo lines up self-driving cars for 2015 or maybe 2018." *techradar.com*. January 6, 2015.

⁵³ Crain's Detroit Business. "Q&A with Francoise Colpron: Valeo exec talks North American Expansion, sales growth." July 20, 2014.

⁵⁴ Snavely, Brent. "ZF Group: Demand for self-driving cars spurred TRW acquisition." *Detroit Free Press*. January 13, 2015.

⁵⁵ VanHulle, Lindsay. "ZF will invest \$71 million to boost R&D at U.S. tech center." *Automotive News Europe*. June 25, 2015.

HERE

HERE, formerly a division of Nokia, specializes in digital mapping for transportation applications. HERE has selected Southeast Michigan as one of just a few areas to map with high-definition digital technology for use in highly automated driving.⁵⁶ Here is now owned by a consortium of German automakers including Audi AG, BMW Group, and Daimler AG.⁵⁷

DURA AUTOMOTIVE SYSTEMS (DURA)

DURA engineers and manufactures a wide range of automotive components and control systems. DURA obtained three M-plates in January 2015 specifically to test “advanced driver assistance systems.” Dura’s worldwide HQ and Technical Center is located in Auburn Hills.

LUXOFT

Luxoft is a global software supplier specializing in HMI solutions, including automated vehicle technology.⁵⁸ In 2014, Luxoft announced the launch of its new U.S. office in the Detroit, Michigan to support its automotive line of business. “Through our presence in Detroit, Michigan, we plan to further grow our business with original equipment manufacturers and Tier-I suppliers as well as to better support our existing clients,” said Dmitry Loschinin, President and CEO of Luxoft.⁵⁹

DREW TECHNOLOGIES

Drew Technologies in Ann Arbor offers several products and services related to systems integrations of automobiles and data systems.⁶⁰

⁵⁶ HERE. Press Release. “HERE makes HD map data in US, France, Germany and Japan available for automated vehicle tests.” July 20, 2015.

⁵⁷ HERE. Press Release. “Nokia completes next stage of transformation with agreement to sell HERE to automotive industry consortium at an enterprise value of EUR 2.8 billion.” August 3, 2015.

⁵⁸ BusinessWire. “Luxoft Develops Human-Machine Interface (HMI) for Rinspeed Budii Autonomous Electric Vehicle Concept.” BusinessWire.com. March 10, 2015.

⁵⁹ Luxoft. “Luxoft Opens 21st Global Office in Detroit, Michigan.” Press Release. June 12, 2014.

⁶⁰ <http://www.drewtech.com/>

IAV AUTOMOTIVE ENGINEERING SERVICES, INC (IAV)

IAV is known to be working with Valeo in development of ADAS systems.⁶¹ IAV was issued twelve M-plates in November 2013 for general testing and engineering purposes, which may include testing automated vehicle systems. IAV demonstrated its Highly Automated Driving system at the 2014 ITS World Congress in Detroit.⁶² IAV is headquartered in Germany and much of the automated vehicle technology R&D is performed there.⁶³



FIGURE 6: IAV HIGHLY AUTOMATED VEHICLE

MERITOR WABCO

Meritor WABCO has unique experience in heavy vehicle control systems including simple automated vehicle systems like ABS and traction control.⁶⁴

P3

The global consulting firm P3 opened a “mobility innovation center” in Southfield dedicated to research and development of automotive technologies. The center offers a 10-car full vehicle workshop with prototyping capabilities, along with labs for testing connectivity, autonomous, and cyber security

⁶¹ “Auto OEMs, Intel, Valeo Launch Driverless Tech at CES 2015” Driverless Transportation. Accessed April 2015 at <http://www.driverlesstransportation.com/auto-oems-intel-valeo-launch-driverless-tech-at-ces-2015-7717>

⁶² <http://detroit2014.itsworldcongress.org/exhibitor-releases/iav-to-showcase-highly-automated-driving-technology-at-its-world-congress-in-detroit/>

⁶³ <https://www.iav.com/us/automotion-magazine/automotion-2015-issue-01/highly-connected-highly-automated>

⁶⁴ <http://www.meritorwabco.com/>

technologies. The center also offers private customer testing and validation labs.⁶⁵

PRATT & MILLER ENGINEERING

The Pratt & Miller robotics team offer systems integration, autonomous controls, unmanned platforms, and more for automotive and defense industry.⁶⁶

QUANTUM SIGNAL

Quantum Signal is an advanced engineering research and product development company located near Ann Arbor. The company works with a variety of customers in fields like defense, automotive, law enforcement, entertainment, and more. One core area is intelligent ground vehicle technology, and they have been working with the US Army as well as automotive OEMs and suppliers to enhance manned and unmanned systems for the last decade. Quantum Signal has also developed sophisticated simulation tools to rigorously test systems before they are deployed for road testing. Quantum Signal has been issued three M-plates to conduct critical on-road testing of systems that serve to enhance the safety and functionality of ground vehicle systems.⁶⁷

SOARTECH

SoarTech is a software company specializing in computational cognitive architecture, including automated vehicle platforms.⁶⁸ SoarTech is located in Ann Arbor.

TASS INTERNATIONAL (TASS)

Tass International provides a wide range of engineering services including the popular PreScan simulation software. Tass America's office is located in Livonia.

⁶⁵ <http://www.dbusiness.com/daily-news/Annual-2016/P3-Opens-Autonomous-Connected-Technologies-Testing-Center-in-Southfield/>

⁶⁶ <http://prattmiller.com/markets/automotive>

⁶⁷ Mitchell M. Rohde. CEO, Quantum Signal, LLC. Email to epdennis@cargroup.org. February 17, 2015.

⁶⁸ http://www.soartech.com/expertise/autonomous_platforms/

COMET CONSULTING, LLC

Brighton-based Comet Robotics assisted in the launch of the Autonomous Robotics for Installation and Base Operations (ARIBO) automated vehicle pilot. The U.S. Army initiated ARIBO as a series of automated vehicle pilots at a number of federal facilities and universities. A commercial version of ARIBO, called AMP'D, has also been launched.⁶⁹

It has been reported that Comet is managing the planned deployment of low-speed automated shuttles scheduled to begin in Tampa, Florida in Spring of 2016. Comet plans to subsequently deploy pilots in up to 30 U.S. cities.⁷⁰

DYSON

Best known for its costly but quality vacuum cleaners, British appliance manufacturer Dyson Ltd. has snapped up a promising Michigan-based battery start-up Sakti3. With the British firm now planning to spend as much as \$1 billion to set up a battery plant using Sakti3 chemistry, that is fueling speculation Dyson might offer the technology to the electric vehicle market.⁷¹ With Dyson's experience in robotics, a foray into automated vehicle technology may be in the company's future.

3.3 ADDITIONAL INDUSTRY RESOURCES

AUTOMATION ALLEY

Automation Alley is a technology business association and business accelerator dedicated to growing the economy of Southeast Michigan and enhancing the region's reputation around the world.

FT TECHNO OF AMERICA (FTTA)

FT Techno of America (FTTA) is an independent vehicle evaluation company specializing in test track rental and turnkey testing services at its proving ground and laboratory in Fowlerville.

⁶⁹ <http://www.cometrobotics.com/#about>

⁷⁰ Sage Lazzaro. "Self-Driving Cars Will Be in 30 U.S. Cities by the End of Next Year." *New York Observer*. March 15, 2015.

⁷¹ Paul A. Eisenstein. "From Vacuums to Electric Vehicles? Dyson Buys Promising US Battery Start-Up." *The Detroit Bureau*. October 20 2015.

MICHIGAN INTERNATIONAL SPEEDWAY (MIS)

Michigan International Speedway (MIS) provides automakers and after-market manufacturers the ability to test and develop connected vehicle systems and other technologies in a protected, neutral, closed, safe and convenient environment. MIS offers a reconfigurable network of tracks including the 2-mile oval. The facility's road courses feature elevation changes, natural line-of-sight interferences, garages, skid pad, off-road testing, a tunnel, and intersection and merge testing opportunities.

U.S. ARMY TANK AUTOMOTIVE RESEARCH DEVELOPMENT AND ENGINEERING CENTER (TARDEC)

TARDEC, the Army's automotive R&D center, is located in Warren, Mich., among its commercial counterparts in Metro Detroit. TARDEC has been developing automated vehicle technology for military vehicles, and has recently shown interest in partnering with auto industry developers to improve ADAS and self-driving software for urban environments.⁷²

SQUAREONE EDUCATION NETWORK (SQUARE ONE)

The Square One Education Network's purpose is to create and fund powerful, relevant experiences for K-12 teachers and students that creatively integrate science, technology, engineering, and mathematics (STEM) using best practice supported instruction through unique project designs. Square One's Autonomous Innovative Vehicle Design project challenges students to re-engineer a "Barbie Jeep" into an autonomous vehicle utilizing Arduino technology, GPS and sensors.

AMERICAN CENTER FOR MOBILITY

The American Center for Mobility is a non-profit testing and product development facility for future mobility, designed to enable safe validation of connected and automated vehicle technology, and accelerate the development of voluntary standards. The Center is currently seeking to raise about \$80 million to complete the first phase of construction. The State of Michigan has contributed \$50 million of this.⁷³

⁷² naias.com. "Driverless Technology Highlights Army NAIAS Offering. January 5, 2016.

⁷³ Ian Thibodeau. "State approves \$15M more for Willow Run autonomous site." The Detroit News. April 25, 2017.



4 ACADEMIA

With several highly-rated universities and colleges, Michigan is a global leader in academic research and development of automated vehicle technology. This section details some of the more relevant efforts.

4.1 UNIVERSITY OF MICHIGAN

The University of Michigan (UM) was recognized by the Michigan Secretary of State as a manufacturer of automated vehicle technology previous to the passing of PA 231.⁷⁴ UM now has three M-plates,⁷⁵ all related to development of an automated driving system in cooperation with Ford (Figure 7). UM's Perceptual Robotics Laboratory has conducted some of the most advanced automated driving research in Michigan. A UM engineering team has created lidar-generated 3D maps of Ann Arbor streets to test a vision-based self-driving algorithm.⁷⁶ Complex 3D maps are likely to be an essential component of first-generation highly automated vehicles.



FIGURE 7: AUTOMATED VEHICLE TECHNOLOGY TESTED BY THE UNIVERSITY OF MICHIGAN UNDER EXPANDED M-PLATE PROGRAM.

MOBILITY TRANSFORMATION CENTER

The Mobility Transformation Center (MTC) at the University of Michigan is a public/private R&D partnership that developing the foundations for a commercially viable ecosystem of connected and automated vehicles. One of

⁷⁴ Ryan Eustice, PhD. Associate Professor, University of Michigan. Email to epdennis@cargroup.org. February 25, 2015.

⁷⁵ As of March 2015.

⁷⁶ R. Colin Johnson. "Ford Self-Driving Cars On-the-Cheap." *EE Times*. January 20, 2015.

the central goal is to develop and implement an advanced system of connected and automated vehicles in Ann Arbor by 2021.⁷⁷

MTC is partially funded through private sector partners, including an affiliates program and the “MTC Leadership Circle.” The Leadership Circle members have each pledged \$1 million over a three-year span. The founding members of the MTC Leadership Circle are:

- Delphi Automotive PLC
- DENSO Corporation
- Econolite Group, Inc.
- Ford Motor Company
- General Motors
- Honda Motor Co., Ltd
- Iteris, Inc.
- Nissan Motor Co., Ltd
- Robert Bosch LLC
- State Farm Mutual Automobile Insurance Co.
- Toyota Motor Company
- Verizon Communications, Inc.
- Xerox Corp.



FIGURE 8: AERIAL VIEW OF MTC MCITY.

A key feature of the Mobility Transformation Center is the connected and automated vehicle testing facility called Mcity (Figure 8). Mcity simulates the broad range of complexities vehicles encounter in urban and suburban

⁷⁷ <http://www.mtc.umich.edu/>

environments. It includes approximately five lane-miles of roads with intersections, traffic signs and signals, sidewalks, benches, simulated buildings, streetlights, and obstacles such as construction barriers. Working with MDOT, UM researchers designed Mcity to evaluate the capabilities of connected and automated vehicles and systems. Testing new technologies in a realistic off-roadway environment is an essential step before a significant number of highly automated vehicles can be deployed safely on public roadways. Mcity opened on July 20, 2015. An automated Ford Fusion was the first vehicle to utilize the Mcity facilities in November 2015.⁷⁸

DRIVERLESS CARTS

The University of Michigan plans to test low-speed, 3-D printed driverless carts within the year. UM plans to study three such vehicles at the Mcity test site. If testing goes well, U-M will launch the driverless carts on its North Campus where they could develop into a driverless transit system that takes students, professors and staff to class, labs and offices. The university plans to develop a phone app that would let users request rides.⁷⁹



FIGURE 9: DRIVERLESS “SMART CART” TO BE TESTED AT MCITY

⁷⁸ Alisa Priddle. “First to test autonomous vehicle at Mcity is a Ford.” *Detroit Free Press*. November 13, 2015.

⁷⁹ Martinez, Michael. “U-M to test driverless 3-D printed carts.” *The Detroit News*. July 9, 2015.

UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH CENTER (UMTRI)

UMTRI, a transportation research institute within the University of Michigan, has an organizational structure that reflects the many disciplines--mechanical engineering, biomedical engineering, behavioral sciences, statistical analysis, public-policy analysis, and more--included in transportation systems research.

UNIVERSITY OF MICHIGAN DEARBORN (UM DEARBORN)

At U-M Dearborn, the robotics-engineering program covers autonomous vehicles, manufacturing, military programs, and human assistance. Freshmen also will have the opportunity to join the Intelligent Systems Club as well as a computer science co-op program.

4.2 ADDITIONAL UNIVERSITY RESOURCES

While the University of Michigan in Ann Arbor has actively lead in automated vehicle technology research, Michigan has a strong public University system with many programs relevant to automated vehicle technology, including the following:

MICHIGAN TECH RESEARCH INSTITUTE (MTRI)

The transportation projects that MTRI are currently involved in use a combination of remote sensing and GIS techniques along with in situ field data to solve transportation issues.

OAKLAND UNIVERSITY

Oakland University (OU) has an advanced Electrical and Computer Engineering Department offering multiple Master's and Ph.D. programs. OU also hosts the annual Intelligent Ground Vehicle Competition.

MICHIGAN STATE UNIVERSITY CANVAS

The MSU Mobility Studio is an integrated system of communication and controls for autonomous and connected vehicles and their environment. The centerpiece of the Mobility Studio is CANVAS—connected & networked autonomous vehicles for active safety.

5 2016 LEGISLATIVE UPDATE

In December 2017, Governor Snyder signed a series of four laws updating Michigan's legal code regarding automated vehicles.

5.1 PUBLIC ACT 332 OF 2016 (ENROLLED SB 995)

The most impactful law of the series was Public Act 332. PA 332 repealed provisions of the previous law that prohibited the commercial public operation of automated vehicles, and replaced it with a framework for public operation.

Under MCL 257 as amended by PA 332, motor vehicle manufacturers are eligible to operate an "on-demand automated motor vehicle network." To be approved to operate such a network, motor vehicle manufacturers must have manufactured vehicles in the United States certified to comply with federal motor vehicle safety standards, hold at least \$10 million in insurance, and show that the entity has operated automated motor vehicles under a public test program for a minimum of one million miles.

Passengers in automated vehicles within on-demand automated vehicle networks may use handheld electronic devices. For the purposes of traffic code enforcement, the automated driving system shall be considered the driver/operator of the vehicle.

The law also exempted platooning vehicles from certain laws regarding tailgating. Platooning vehicles must each have a properly-licensed human driver, and must operate such that other vehicles can safely exit and enter a limited-access highway.

MICHIGAN COUNCIL ON FUTURE MOBILITY

PA 332 calls for the creation of a council to advise the governor in matters of automated and connected vehicle technology. The council is tasked in the near-term with recommendations for statewide policy changes by March 2017, and will continue to make recommendations annually or more frequently thereafter. The council is made up of the following:

- Eleven appointees of the governor from local agencies or private sector
- One member appointed by governor to represent insurance interests
- Two state senators appointed by majority leader
- Two state representatives appointed by speaker of house
- The secretary of State or designee

- Director of MDOT or designee
- Director of Dept. of State Police or designee
- Director of Dept. of Insurance and Financial Services or designee
- Director of Dept. of Technology, Management, and Budget, or designee

5.2 OTHER BILLS

Accompanying PA 332 was PA 333, PA 334, and PA 335. Each of these incorporated minor amendments to the Michigan Code of Law regarding automated vehicles.

PUBLIC ACT 333 (ENROLLED SB 996)

This bill describes eligibility to participate in a SAVE project—including the operation of an on-demand automated motor vehicle network.

PUBLIC ACT 334 (ENROLLED SB 997)

This bill exempts private roads within a mobility research center from enforcement of the traffic code.

PUBLIC ACT 335 (ENROLLED SB 998)

This bill clarified limitation of liability to manufacturers of vehicles that are converted by third-parties to automated vehicles.

6 SUMMARY

As of March 2015, several companies have received M-plates with the explicit expressed purpose of testing automated vehicle technologies, including:

- Autoliv Electronics America
- Continental Automotive Systems
- Dura Automotive Systems
- Magna Electronics
- Quantum Signal
- The University of Michigan
- Robert Bosch LLC
- Roush Industries
- Valeo

The details of testing activities in Michigan are not well known. Michigan's M-plate program does not require a detailed description of the technology being developed.⁸⁰ Beyond the listed companies, some manufacturers and suppliers are likely testing automated vehicle technology under the M-plate program without having explicitly stated the nature of the technology being developed. Additionally, there may be testing of automated vehicle systems on Michigan's roads and elsewhere with normally-registered vehicles. A production vehicle could be upfitted with an automated driving system and registered, licensed, and operated under standard vehicle codes, and this would not likely violate any law so long as federal safety standards are not compromised.⁸¹

Michigan is not the only state where companies are testing automated vehicles on road. At least six companies have been approved to test automated vehicles in Nevada: Google, Audi, Continental, Delphi, Hyundai-Kia, and Daimler.⁸²

⁸⁰ Michigan's M-plate application requests applicant fill out the make and type of vehicle manufactured, and/or type of subcomponents produced. However, a review of records indicates that the SoS will issue a plate without very specific detail in these fields. Some applicants leave this field blank.

⁸¹ Michigan and most states do not have a legal framework that would lend itself to actively enforcing restrictions on FMVSS-certified vehicles. As of April 2015, we have not been able to find any examples of any legal actions arising from a FMVSS-certified vehicle modified with automated systems applications.

⁸² Daimler has received testing licenses for both Freightliner commercial trucks and a Mercedes light vehicle.

As of January 7, 2016, eleven companies have been issued autonomous vehicle testing licenses in California: Volkswagen, Mercedes, Google, Delphi, Tesla, Bosch, Nissan, Cruise Automation, BMW, Honda, and Ford. Testing is almost certainly occurring in additional states, but it is difficult to track testing activities in most states because they have not implemented a regulatory framework requiring such documentation.

In December 2017, Governor Snyder signed a series of four laws updating Michigan's legal code regarding automated vehicles. Manufacturers and developers of automated vehicles in Michigan are now provided a framework for both testing and deployment activities.

A list of significant automated vehicle R&D efforts outside of Michigan is provided in Appendix A.

APPENDIX A: MAJOR NATIONWIDE AND GLOBAL AUTOMATED VEHICLE EFFORTS (OUTSIDE OF MICHIGAN)

Location/Project	Details
European Union AdaptIVe	In January 2014, 29 partners from 8 countries kicked-off the AdaptIVe project. Lead by Volkswagen AG, the consortium will further applications for automated driving during three and a half years. The project is supported by the European Council for Automotive R&D EUCAR. The project volume amounts to € 25 million (~ \$28 million). Thereof, the European Union allocates € 14 million (~ \$16 million). The project includes utilization and extension of V2V protocols.
European Union CityMobile2	CityMobile2 is setting up a pilot platform for automated road transport systems, which will be implemented in several urban environments across Europe. In addition to the pilot activities, research will be undertaken into the technical, legal, financial, cultural, and behavioral aspects and effects on land use policies and how new systems can fit into existing infrastructure in different cities. ¹ The project is partially funded by the EC and coordinated by the Centre for Transport and Logistics at the University La Sapienza in Rome. ²
European Union V-Charge	The Autonomous Valet Parking and Charging (V-Charge) project seeks to develop fully automated valet parking and charging of electric vehicles using low-cost cameras and 3D maps. ³ The project is funded by the European Commission (EC) and involves partnerships with VW, Bosch, and others. ⁴
European Union SARTRE	The Safe Road Trains for the Environment (SARTRE) project, funded by the EC, was performed to develop strategies and technologies to allow vehicle platoons to operate on normal public highways with significant environmental, safety and comfort benefits. ⁵ The project concluded in 2012. Partnering organizations (including Ricardo, Volvo, and others) concluded that vehicle platooning is possible in mixed traffic, but several issues must be resolved before implementation. ⁶

¹ CityMobile2 Homepage. <http://www.citymobil2.eu/en/>

² Simpson, Burney. "Europe's CityMobile2 Tests Driverless Public Transit." *Driverless Transportation*. Accessed February 2015 at: <http://www.driverlesstransportation.com/europe-citymobil2-driverless-public-transit-2getthere-robosoft-easymile-8164>

³ Muehlfellner *et al.* "Evaluation of Fisheye-Camera Based Visual Multi-Session Localization in a Real-World Scenario." 2013 IEEE Intelligent Vehicles Symposium (IV). Gold Coast, Australia, June 23-26, 2013.

⁴ V-Charge. Accessed February 2015 at: <http://www.v-charge.eu/>

⁵ SARTRE. Accessed February 2015 at: <http://www.sartre-project.eu/en/Sidor/default.aspx>

⁶ SARTRE. "Partners conclude after the SARTRE project: Platooned traffic can be integrated with other road users on conventional highways." Press Release. September 17, 2012.

Location/Project	Details
European Union HAVEit	Partially funded by the EC, the Highly Automated Vehicles for Intelligent Transport (HAVEit) project designed and implemented a cross platform architecture for vehicle automation applications. HAVEit was completed in 2011. Contributing partners included VW, Volvo, Continental, and others. ⁷
Germany A9 Autobahn	The German government has specified the A9 motorway in Bavaria as a test site for automated and connected vehicles. A Minister of Transportation cited protection against monopolization of data, and specifically, reliance on Google, as motivation for the project, saying, “Germany must maintain digital sovereignty.” ⁸
Japan Sagami Expressway, Kanagawa Prefecture	The Sagami Expressway runs through the Sagami Robot Industry Special Zone, where the Kanagawa Prefecture aims to support companies developing robots for various purposes, including life assistance, medical care and disaster response. Nissan’s road tests of the self-driving vehicles are one of the projects supported by the prefecture. ⁹
Singapore Nanyang Technology University	NXP Semiconductors N.V. announced it signed an agreement with Singapore’s Nanyang Technology University (NTU) to establish a living, real-world smart mobility test bed on the NTU campus. ¹⁰
Singapore SMART	The Singapore-MIT Alliance for Research and Technology (SMART) - developed automated vehicle, named SCOT (Shared Computer Operated Transport), is operationally-ready for the public roads. SCOT relies on low-cost off-the-shelf LIDAR sensors which enable the car to drive autonomously, independent of GPS.
Singapore LTA	The Singapore Land Transport Authority (LTA) has identified a 4-mile test route for an automated vehicle testbed. Vehicles are planned for deployment in March 2015. ¹¹
Sweden ASTAZero Test Facility Gothenburg, Sweden	ASTAZero is a test environment for future road safety located in Gothenburg, Sweden. The site provides different traffic environments make it possible to test advanced safety systems and their functions for all kinds of traffic and traffic situations. In addition to the opportunity for testing, research and development, AstaZero also host demonstrations and assist with product launches, conferences and corporate events. ¹²

⁷ HAVEit. Accessed February 2015 at: <http://www.haveit-eu.org/displayITM1.asp?ITMID=6&LANG=EN>

⁸ *FAZ.net*. “Dobrindt plant Teststrecke für selbstfahrende Autos.” January 25, 2015. Accessed February 2015 at: <http://www.faz.net/aktuell/wirtschaft/neue-mobilitaet/f-a-z-exklusiv-dobrindt-plant-teststrecke-fuer-selbstfahrende-autos-13390268.html>

⁹ Kameda, Masaaki. “Nissan Road-tests self-driving vehicle.” *The Japan Times*. Nov 25, 2013.

¹⁰ NXP. “NXP and NTU Singapore Launch ‘Smart Mobility Test Bed’ to Accelerate the Introduction of Life-Saving Vehicle Communications.” Press Release April 10, 2015.

¹¹ Tan, Christopher. “Driverless cars to be tested on public roads.” *The Straits Times*. January 14, 2015.

¹² ASTAZero. Accessed February 2015 at: <http://www.astazero.com/>

Location/Project	Details
Sweden Volvo “Drive Me” Gothenburg, Sweden	The Drive Me pilot involves 100 self-driving cars using approximately 30 miles of selected roads in and around Gothenburg, Sweden. These roads are typical commuter arteries and include motorway conditions and frequent queues. ¹³ Volvo’s test fleet uses a private cloud-enabled digital map. ¹⁴
Switzerland Swisscom Driverless Passat	In cooperation with UVEK (the Federal Department of Environment, Transport, Energy and Communications) and Germany’s Autonomos Labs, Swisscom has fitted a VW Passat with sensors, computers and software to drive the vehicle autonomously. Special software analyses the data, recognises driving situations and issues the driving commands. Between 4 and 14 May 2015, the car was on test drives through the streets of Zurich. ¹⁵
United Kingdom Greenwich Automated Transport Environment (GATEway) London, UK	GATEway will see three public trials of zero emission, automated vehicles. The first will be automated shuttle transport on the Greenwich peninsula. The second will be autonomous valet parking of cars, enabling users to exit their vehicle while it finds a specified parking space autonomously. The third trial is to be defined based on the findings from the other trials and feedback from stakeholders. ¹⁶
United Kingdom Milton Keynes LUTZ Pathfinder Podcar Pilot	The city of Milton Keynes will host a trial of automated podcars, the LUTZ Pathfinder, scheduled to begin sometime in 2015. ¹⁷
United Kingdom Autodrive Initiative	The £19.2m (~ U.S. \$30 million) budgeted, three-year, UK Autodrive consortium is led by Arup and will test increasing levels of autonomy technologies on roads in Coventry and Milton Keynes. Partners include Jaguar Land Rover, Ford Motor Company, and Tata Motors. ¹⁸

¹³ Volvo Car Group. “Volvo Car Group’s first self-driving Autopilot cars test on public roads around Gothenburg” Press Release. April 29, 2014.

¹⁴ Denholm, Martin. “Move Over, Knight Rider... Volvo’s Got This.” *Wall Street Daily*. May 6, 2014. Accessed February 2015 at: <http://www.wallstreetdaily.com/2014/05/06/volvo-drive-me-driverless-cars/> (embedded video demonstration).

¹⁵ <https://www.swisscom.ch/en/about/medien/press-releases/2015/05/20150512-MM-selbstfahrendes-Auto.html>, accessed May 15 2015.

¹⁶ Crompton, Hayley. “GATEway.” *Digital Greenwich*. February 10, 2015.

¹⁷ <https://ts.catapult.org.uk/-/transport-systems-catapult-to-unveil-uk-s-first-driverless-pod> accessed April 2015.

¹⁸ Innovate UK. “Ford offers a peak into plans for driverless cars as part of a re-imagined future.” February 5, 2015. Accessed February 9, 2015 at: https://connect.innovateuk.org/web/intelligent-mobility/article-view/-/blogs/ford-offers-a-peak-into-plans-for-driverless-cars-as-part-of-a-re-imagined-future?p_p_auth=eZXOR9iG

Location/Project	Details
USA California Contra Costa Transportation Authority “GoMentum” Station	The Contra Costa Transportation Authority (CCTA) and City of Concord have repurposed the decommissioned Concord Naval Weapons Station near the San Francisco Bay as a testing facility for automated vehicle technologies. The 5,000-acre “GoMentum” Station contains 20-miles of paved, city-like roadway grids, buildings and other urban infrastructure, providing a realistic environment for automated vehicle systems testing. ¹⁹ Honda is the first major OEM to arrange to conduct testing at the facility. ²⁰
USA California Google Self-driving Project Mountain View, CA	Google has designed and assembled a fleet of low-speed vehicles to test and refine the companies automated-vehicle software. The vehicles and software rely on high-resolution 3D maps with extensive contextual data. The vehicles have been shown to be capable in highway and urban driving in areas that have been mapped out in this way. Currently, the vehicles are generally limited to areas in Mountain View, California.
USA California Silicon Valley ‘Auto Row’	California followed Nevada and Florida by enacting automated vehicle legislation in 2012. Google, Audi, Tesla, Nissan, Delphi, Bosch, and Mercedes have received permits to test in California as of February 2015. Silicon Valley is a new center of automotive technology research and development. The world’s nine largest automakers and three largest auto suppliers now have offices and research labs in Silicon Valley. Additionally, Tesla Motors has its headquarters and its assembly plant in the region. ²¹
USA Florida	Since becoming the second state to pass automated vehicle-related legislation, Florida has maintained an effort to establish the state as a center of innovation. Florida’s DOT has formalized the “Florida Automated Vehicles Program,” ²² and recently hosted the second annual automated vehicle summit. ²³ The University of South Florida Center for Urban Transportation and Research (CUTR) Automated Vehicle Institute focuses on the implementation, planning and policymaking behind automated vehicles as opposed to the technology itself. ²⁴ Florida’s legislation is not known to have prompted much commercial testing in the state, though Audi did demonstrate a traffic-jam pilot feature in July 2014. ²⁵

¹⁹ Catherine A. Cardno. “Testing Facility for Automated Vehicles Ready in Northern California.” *Civil Engineering Magazine*. ASCE. March 10, 2015.

²⁰ Honda. “Honda Testing Automated Vehicle Technology at Bay Area Navy Base.” Press Release. March 31, 2015.

²¹ Nelson, Gabe. Interactive: Guide to Silicon Valley’s auto corridor. *Automotive News*. June 16, 2014. Accessed February 2015 at: <http://www.autonews.com/article/20140616/OEM/140619948/guide-to-silicon-valleys-auto-corridor>

²² FDOT Florida Automated Vehicles Program Homepage. <http://www.automatedfl.com/>

²³ FDOT. Event Details, Florida Automated Vehicles Summit 2014. Accessed February 2015 at: <http://www.automatedfl.com/events/2014summit/>

²⁴ Roldan, Roberto. “USF launches new Automated Vehicle Institute.” *The Oracle*. November 27, 2013.

²⁵ Audi USA. “Audi shows Piloted driving will soon be ready for the road with Florida demonstration.” Press Release. July 25, 2014.

Location/Project	Details
USA Nevada	Nevada was the first U.S. state to adopt automated vehicle legislation and regulations in 2011. Nevada currently requires an application process to test automated vehicles in the state. Regulations are in place for consumer use, but the agency is only accepting applications for testing as of May 2015. Delphi, Google, Continental, Audi, and Daimler have received permission to test automated vehicles in the state.
USA New Jersey Fort Monmouth, New Jersey	Potential conversion of Fort Monmouth, an 1,100 acre former military base into a research and development center for automated vehicle technology. As of February 2015, stakeholders are in the process of developing a business plan. ²⁶
USA Pittsburg, PA Uber – Carnegie Mellon University Advanced Technologies Center	In February 2015, Uber and Carnegie Mellon University announced a strategic partnership that includes the creation of the Uber Advanced Technologies Center in Pittsburgh, near the CMU campus. The center will focus on the development of key long-term technologies in digital mapping, and vehicle automation. ²⁷

²⁶ Kornhauser, Alain. “Princeton University School of Engineering and Applied Science Sponsors Kick-off Meeting at Fort Monmouth for New Jersey Center for Automated Vehicles.” Draft Press Release. February 9, 2015.
<http://orfe.princeton.edu/~alaink/SmartDrivingCars/FtMonmouth/Draft1.0-PressReleaseFtMonmouthKickOffMtg.docx>

²⁷ CMU Press Release <http://www.cmu.edu/news/stories/archives/2015/february/uber-partnership.html>

