COMMITTEE ON TRANSPORTATION & INFRASTRUCTURE
SUBCOMMITTEE ON HIGHWAYS AND TRANSIT

"THE FUTURE OF AUTOMATED COMMERCIAL MOTOR VEHICLES: IMPACTS ON SOCIETY, THE SUPPLY CHAIN, AND U.S. ECONOMIC LEADERSHIP."

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I. Introduction

Chairman Crawford, Ranking Member Holmes Norton, distinguished members of the Subcommittee, it is my honor to testify before you today. The autonomous vehicle industry appreciates the strong engagement of members of this Subcommittee on autonomous vehicle ("AV") policy.

The Autonomous Vehicle Industry Association ("AVIA") is the unified voice of the AV industry,[1] and we represent the world's leading trucking, technology, ridesharing, automotive, and transportation companies. This cross-section of companies demonstrates the widespread interest in developing AV technology across industries. Our mission is to bring the tremendous safety, mobility, transportation, and economic benefits of AVs—otherwise known as SAE International Levels 4- and 5-capable vehicles—to consumers and businesses in a safe, responsible, and expeditious manner.[2] Vehicles operated by AVIA members have driven more than 44 million

[1] Our members include: Apple, Aurora, Cavnue, Cruise, Embark, Ford, Gatik, Kodiak, Lyft, May Mobility, Motional, Nuro, TuSimple, Uber, Volkswagen Group of America, Volvo, Volvo Autonomous Solutions, Waabi, Waymo, and Zoox. *See Our Mission and Members*, AVIA, https://theavindustry.org/about/mission.

[2] SAE's J3016 standards have been adopted industry wide. Level 2 systems (often called advanced driver assistance systems or "ADAS") are available on vehicles today and are capable of "partial driving automation," requiring human supervision at all times. Level 3 vehicles have "conditional driving automation," where the vehicle requires human interaction only in specific situations. Only Level 3, 4, and 5 vehicles are equipped with automated driving systems ("ADS"). *See Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles – J3016_202104*, SAE International, https://www.sae.org/standards/content/j3016_202104/ (last visited Sept. 10, 2023).

autonomous miles on U.S. public roads, a distance roughly equivalent to 184 trips to the moon or 1,767 trips around the world.[3]

During the COVID-19 pandemic, our nation woke up to the importance of trucking to our nation's economy. At AVIA, our members work to harness the power of technology to build the world's safest trucks, which we believe will allow U.S. motor carriers and companies to further enhance segments of their trucking fleets and operations. AV technology is one of the critical tools in the continued evolution of the trucking industry, and can play a key role in complementing the work of trained, professional drivers.

For decades, AVs have been a technological aspiration for our country's most brilliant innovators. Today, AVs are a reality and are increasingly being deployed on America's roads and highways, using advanced technology to perform all aspects of the driving task. In states as diverse as Arizona, Arkansas, California, Florida, Michigan, and Texas, AVs provide valuable transportation services, transporting both passengers as part of autonomous ride-hailing fleets, and goods as part of trucking fleets and middle- and last-mile delivery operations. Autonomous trucking is one the technology's most promising applications and will deliver safer roads, as well as supply chain, global competitiveness, and workforce benefits.

Since this Subcommittee last examined autonomous trucks in a hearing in February 2022, the development of the autonomous trucking industry has increased significantly, bringing us closer to safer roads and more resilient supply chains. A diversity of well established companies, including Walmart, Kroger, FedEx, IKEA, and Tysons Foods, are partnering with AV truck developers to move freight. The confidence these companies and many others have in autonomous trucking represents a growing consensus in the trucking industry about the criticality of AV

[3] *AVIA Data Shows 44 million+ Driven And Outstanding Safety Record*, AUTONOMOUS VEHICLE INDUS. ASS'N, https://theavindustry.org/resources/blog/data-44million-miles (last visited Sept. 10, 2023).

technologies. In addition, the U.S. Department of Defense has embraced autonomous technology, including technology developed by AVIA member companies, to keep America's soldiers safer.[4] It is vital that policymakers also embrace the further development of autonomous trucking and other applications of dual-use AV technologies to protect the United States' lead in an increasingly global industry, and ensure that the safety and economic benefits of AVs are felt by Americans across the country.

In recent years, the United States has faced unacceptably high levels of roadway crashes and fatalities, a trend that the adoption of autonomous trucks and other AVs can help combat. There is an epidemic of deaths on America's roads, with over 42,000 traffic fatalities in both 2021[5] and 2022,[6] according to National Highway Traffic Safety Administration's ("NHTSA") estimates. In 2022 alone, 5,887 people died in crashes involving large trucks, a 2% increase in fatalities from 2021.[7] This increase is part of a decade-long pattern, with a 47% increase in such fatalities between 2011 and 2021.[8] Further, 2021 saw large trucks involved in over 117,000 crashes that resulted in an injury, a 12% increase from 2020.[9] Autonomous vehicles are programmed to be model drivers, staying at or below the speed limit and observing traffic laws and rules of the road. Autonomous trucking technology is designed to improve the safety of commercial truck driving by eliminating

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[4] *Kodiak and the U.S. Army's Autonomous Driving Program*, AUTONOMOUS VEHICLE INDUS. ASS'N, https://theavindustry.org/resources/blog/kodiak-and-the-us-army-autonomous-driving-program (last visited Sept. 10, 2023).

[5] NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., U.S. DEP'T OF TRANSP., DOT HS 813 298, EARLY ESTIMATES OF MOTOR VEHICLE TRAFFIC FATALITIES AND FATALITY RATE BY SUB-CATEGORIES IN 2021, 1 (2022), https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813298.

[6] NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., U.S. DEP'T OF TRANSP., DOT HS 813 428, EARLY ESTIMATE OF MOTOR VEHICLE TRAFFIC FATALITIES IN 2022, 1 (2023), https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813428.

[7] NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., U.S. DEP'T OF TRANSP., DOT HS 813 448, EARLY ESTIMATE OF MOTOR VEHICLE TRAFFIC FATALITIES AND FATALITY RATE BY SUB-CATEGORIES IN 2022, 1 (2023), https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813448.

[8] Nat'l Safety Council, *Large Trucks*, NSC INJURY FACTS, https://injuryfacts.nsc.org/motor-vehicle/road-users/large-trucks/ (last visited Sept. 10, 2023).

[9] *Id.*

blind spots, having 360 degree perception of its surroundings, and safely navigating around other road users.

Autonomous trucks have already demonstrated a remarkable safety record, without a single fatality in more than seven years of operations and millions of miles driven on public roads. This safety record is supported by data collected by NHTSA. For over two years, NHTSA has required AV companies to report every incident—no matter how minor—that occurs while an automated driving system ("ADS") is engaged as part of Standing General Order 2021-01 ("SGO").[10] During this period, only one reported incident involving an autonomous truck resulted in injuries, and the cause of that incident was a human-driven vehicle that collided with an autonomous truck. As the autonomous trucking industry continues to grow, so will the roadway safety improvements the technology provides.

The further deployment and integration of autonomous trucks into America's logistics network will help optimize the transportation of freight nationwide, bringing goods directly to consumers faster and helping to ease the ongoing supply chain crisis. At present, the United States is not hauling all the freight it could, and this is holding back our farmers, ranchers, and manufacturers. This gap is due to a variety of factors, including a truck driver shortage that the American Trucking Associations estimates to be nearly 78,000 truck drivers. This number is set to double by 2031.[11] Autonomous trucking offers a means to address supply chain inefficiencies by filling workforce gaps, enhancing fleet flexibility, and reducing travel times.

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[10] *See* NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., SECOND AMENDED STANDING GENERAL ORDER 2021-01 (2023). https://www.nhtsa.gov/sites/nhtsa.gov/files/2023-04/Second-Amended-SGO-2021-01_2023-04-05_2.pdf.

[11] *Driver Shortage Update 2022*, AM. TRUCKING ASS'N (Oct. 25, 2022), https://ata.msgfocus.com/files/amf_highroad_solution/project_2358/ATA_Driver_Shortage_Report_2022_Executive_Summary.October22.pdf.

American workers also stand to benefit from the gradual adoption of autonomous trucking. A U.S. DOT-funded study found that autonomous trucking will increase U.S. employment by up to 35,000 jobs per year on average.[12] As demand for freight hauling continues to grow, automated trucks can help shippers keep up with that demand, supplementing and augmenting human driven fleets. With AVs hauling more long-haul freight, more opportunities will be created for truck drivers in their communities. This will also allow companies to strategically place their drivers where they are needed most, and ensure America's truck drivers can remain in and near their communities and sleep in their own beds.

Let me be clear: autonomous vehicles must coexist with America's truck drivers and the goal of industry is to create more opportunity for all in our country. The autonomous vehicle industry needs America's truck drivers as partners in addressing the supply chain challenges our country faces. A growing AV industry will also continue to create new job opportunities at AV trucking companies for workers with a range of educational backgrounds and experiences, including local drivers, technicians, operations center workers, and more.

The wider adoption of AVs will also bring important fuel efficiency benefits, with studies pointing to a 10% cut in fuel consumption for autonomous trucks.[13] AVs will produce more environmental benefits compared to traditional vehicles.

The widespread distribution of the benefits of autonomous trucking depends in part on the continued U.S. global leadership in the AV industry. The United States is currently leading the way on autonomous trucks, but China and other countries are determined to catch up and surpass

[12] ROBERT WASCHIK ET AL., JOHN A. VOLPE NAT'L TRANSP. SYS. CTR., FHWA-JPO-21-847, MACROECONOMIC IMPACTS OF AUTOMATED DRIVING SYSTEMS IN LONG-HAUL TRUCKING, 1 (2021), https://rosap.ntl.bts.gov/view/dot/54596.

[13] *Self-Driving Trucks Cut Fuel Consumption by 10%*, SAE INTERNATIONAL (Dec. 19, 2019), https://www.sae.org/news/2019/12/tusimple-autonomous-trucks-cut-fuel.

the United States' progress. Only if policymakers and industry work together to build a robust AV ecosystem that includes autonomous trucks can we ensure that American workers and consumers are able to reap the full benefits of AVs.

I. AV Technology Is a Vital Tool for Improving Roadway Safety

The United States is in the midst of an epidemic of roadway fatalities and injuries, which autonomous trucks and other AVs can alleviate. America's roads have become increasingly dangerous for truck drivers and other road users alike. 2022 saw over 42,000 deaths on America's roads,[14] with 5,887 of those deaths involving at least one large truck.[15] The 2022 statistics, egregious as they are on their own, show only part of the story when it comes to traffic fatalities on our roads. Unfortunately, traffic deaths have been steadily rising over the last decade, increasing by 47% between 2011 and 2021, and by an additional 2% between 2021 and 2022.[16] A National Safety Council analysis of NHTSA data showed a 12% increase in injuries from crashes involving a large truck from 2020 to 2021, and recorded over 117,000 such incidents in 2021 alone.[17]

Human error, including speeding, unfamiliarity with the roadway, and fatigue, is a major contributor to roadway incidents. Autonomous trucks are designed to remove that error from the equation, as they do not drive distracted or tired. AVs have built a significant safety record through more than a decade of development, testing, and deployment. ADS-equipped vehicles have now driven millions of miles autonomously, with vehicles operated by AVIA members driving more than 44 million autonomous miles on public roads in the U.S. alone.[18] Reinsurer Swiss Re recently published an analysis of 3.8 million autonomous miles driven by passenger AVs operated by AVIA

[14] NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., *supra* note 7.
[15] NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., *supra* note 8.
[16] *Id.*
[17] Nat'l Safety Council, *supra* note 9.
[18] AUTONOMOUS VEHICLE INDUS. ASS'N, *supra* note 3.

member Waymo. The analysis found that when compared to baseline human drivers, Waymo AVs reduced bodily injury claims by 100 percent, and reduced property damage claims by 76 percent.[19] These results led Swiss Re to conclude that Waymo's AVs are "significantly safer towards other road users than human drivers are."[20] Another analysis by Cruise, an AVIA member that has likewise driven more than one million miles autonomously, found that when benchmarked against human drivers the company's AVs were involved in 54% fewer collisions overall, and 73% fewer collisions with a meaningful risk of injury.[21]

Autonomous trucks have also demonstrated a strong safety record. Fourteen incidents involving an autonomous truck have been reported under NHTSA's SGO in over two years of data collection, and only one reported incident involved injuries. That sole incident was caused by a human-operated vehicle cutting into the AV's lane and colliding with the AV. In contrast, 5,788 people died[22] and 117,000 people were injured in incidents involving traditional large trucks in 2021 alone.[23]

AV safety is also subject to detailed requirements and multiple layers of regulatory oversight at the federal level. Both passenger AVs and autonomous trucks are regulated by NHTSA,[24] which administers broadly applicable motor vehicle safety standards and collects incident data from AV companies under the SGO. NHTSA also has authority to recall vehicles

[19] LUIGI DI LILLO ET AL., COMPARATIVE SAFETY PERFORMANCE OF AUTONOMOUS- AND HUMAN DRIVERS: A REAL-WORLD CASE STUDY OF THE WAYMO ONE SERVICE (2023), https://arxiv.org/ftp/arxiv/papers/2309/2309.01206.pdf.
[20] *Id.*
[21] Louise Zhang, *Cruise's Safety Record Over 1 Million Driverless Miles*, CRUISE (Apr. 28, 2023), https://getcruise.com/news/blog/2023/cruises-safety-record-over-one-million-driverless-miles/.
[22] NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., U.S. DEP'T OF TRANSP., DOT HS 813 435, OVERVIEW OF MOTOR VEHICLE TRAFFIC CRASHES IN 2021, 18 (2021).
[23] Nat'l Safety Council, *supra* note 9.
[24] Like all motor vehicles, AVs are subject to the U.S.'s longstanding self-certification process, which relies on thorough safety testing by manufacturers without the costly and laborious pre-approval structures found in Europe and elsewhere.

that present an unreasonable risk to safety, removing such vehicles from the road when necessary. This structure ensures room for innovation in motor vehicle technologies while retaining rigorous oversight on manufacturers.

Autonomous trucks are also subject to an additional legal framework established by the FMCSA, a regulatory structure for which there is no parallel for passenger vehicles. FMCSA administers standards for commercial motor vehicles ("CMV") related to safety, inspections, hazardous materials, drivers, and enforcement. With respect to interaction with weigh stations and the commercial vehicle inspection system, our members have worked closely with the Commercial Vehicle Safety Alliance ("CVSA"), motor carriers, and law enforcement to develop a robust inspection process for autonomous trucks, which CVSA calls the Enhanced CMV Inspection Program for autonomous trucks.[25] Moreover, safety operators in autonomous trucks are subject to relevant requirements established by FMCSA, such as Commercial Driver's License requirements and hours of service limitations.

In March of 2023, AVIA published a federal policy framework for AVs,[26] which would build on efforts by NHTSA and FMCSA and support the safe and efficient deployment of AVs across the country. In the framework, AVIA calls for several policies that the U.S. DOT could undertake to assist the wider deployment of autonomous trucks, including, but not limited to:

[25] *See* COMMERCIAL VEHICLE SAFETY ALLIANCE, CVSA ANNOUNCES NEW ENHANCED CMV INSPECTION PROGRAM FOR AUTONOMOUS TRUCK MOTOR CARRIERS (Oct. 4, 2022), https://www.cvsa.org/news/new-enhanced-cmv-inspection-program/.

[26] AUTONOMOUS VEHICLE INDUS. ASS'N, FEDERAL POLICY FRAMEWORK FOR OUR AV FUTURE (MARCH 2023), https://theavindustry.org/resources/AVIA-Federal-Policy-Framework-for-Our-AV-Future.pdf.

- Codification of FMCSA's 2018 interpretation that the Federal Motor Carrier Safety Regulations ("FMCSRs") do not require a human driver to operate or be present in a CMV being operated by a Level 4 or Level 5 ADS.
- Completion of the Final Rule on Safe Integration of ADS in Commercial Motor Vehicles. FMCSA should swiftly complete a rule or series of rules that will encourage autonomous truck developers to safely expand operations and commercialization. This would include updating existing human-focused hours of service and drug testing rules to reflect the operational realities of ADS-equipped vehicles.

The adoption of these policies by the U.S. DOT would support the growth of the autonomous trucking industry while retaining traditional federal oversight of commercial vehicle operations.

II. AVs Hold Tremendous Economic Promise and Can Help Create New Jobs While Alleviating Supply Chain Challenges

The continued development of autonomous trucking will fundamentally improve interstate commerce by improving the manner in which goods move in our country, with autonomous trucks increasing middle-mile and long-haul efficiency and capacity, and in turn improving the efficiency of countless industries that rely on moving goods on trucks, such as agriculture, retail, and manufacturing. The disruptions born of the COVID-19 pandemic have shed light on the fragility of supply chains and choke points in how we move goods and materials of all kinds. Supply chain failures make it harder for farmers to get their crops to market, while leaving consumers scrambling for finished products as store shelves empty. By 2026, AVs could represent not only a potential

$1 trillion market,[27] but also a key solution to supply chain troubles, all while decreasing transportation costs and improving safety.

One major supply chain challenge facing the United States is a shortage of nearly 78,000 truck drivers, and that figure is projected to almost double by 2031.[28] Given the deliberate timeline for AV truck deployment, autonomous trucking will not cause significant displacement of current jobs in the trucking industry,[29] but it can serve as one tool to reduce strains on the supply chain caused, in part, by the longstanding truck driver shortage. At the same time, AV trucking also holds substantial potential to decrease the cost of consumer goods, reduce delivery costs, and raise earnings for workers across the economy.

A. AVs Will Help Grow the American Economy

The wider deployment of autonomous trucks will have economic benefits far beyond the trucking industry. By 2050, the value of public and consumer benefits of AV deployment, including reduced congestion, avoided accidents, and saved time, could add up to $796 billion annually.[30] In California alone, the knock on effects of the introduction of autonomous trucking could increase the state's real GDP and welfare by at least $6 billion a year.[31] Given this, policies that support the further development of the AV industry will help grow the U.S. economy and

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[27] TECONOMY PARTNERS, FOREFRONT: SECURING PITTSBURGH'S BREAK-OUT POSITION IN AUTONOMOUS MOBILE SYSTEMS ES-1-2 (2021), https://ridc.org/wp-content/uploads/2021/10/PGH-Autonomy-Report-Executive-Summary.pdf.

[28] AM. TRUCKING ASS'N *supra* note 12.

[29] *See* SECURING AMERICA'S FUTURE ENERGY, AMERICA'S WORKFORCE AND THE SELF-DRIVING FUTURE REALIZING PRODUCTIVITY GAINS AND SPURRING ECONOMIC GROWTH (June 2018), https://avworkforce.secureenergy.org/wp-content/uploads/2018/06/SAFE_AV_Policy_Brief.pdf.

[30] *Id.* at 9.

[31] *Autonomous Long-Haul Trucking Stands to Grow the Golden State's Economy While Creating Jobs and Raising Wages Without Mass Driver Layoffs*, SILICON VALLEY LEADERSHIP GROUP (Apr. 13, 2022), https://www.svlg.org/study-shows-autonomous-trucking-will-grow-californias-economy/.

support the economic competitiveness of American businesses across many industries, in turn supporting the continued growth of the U.S. economy.[32]

The growth in autonomous trucking is poised to run in parallel with an ever-growing market for freight trucking, with the Bureau of Transportation Statistics estimating that freight activity in the United States alone will grow fifty percent from 2020 to 2050, reaching a projected value of $36.2 trillion. With trucking representing roughly 72% of all freight transportation tonnage,[33] the number of trucks on the road, autonomous and human driven, will need to grow as well. AVs will be able to help fill that demand and supplement existing human drivers.

For consumers, AVs are positioned to reduce general transportation costs and the cost of goods, and ensure goods are made more readily available and closer to home. Sixty-five percent of U.S. consumable goods are brought to market by trucks, and the implementation of autonomy in the trucking sector stands to decrease operating costs by about 45%—resulting in savings between $85 billion and $125 billion, which can be passed on to consumers and transportation workers.[34] Finally, through the introduction of shared AV fleets, transportation costs—which amount to the second-largest expense for most households—could be reduced by as much as $5,600 per year.[35] The wider deployment of AVs for consumer deliveries and personal

[32] Jack Caporal, William O'Neil, and Sean Arrieta-Kenna, *Bridging the Divide: Autonomous Vehicles and the Automobile Industry*, CSIS (Apr. 14, 2021), https://www.csis.org/analysis/bridging-divide-autonomous-vehicles-and-automobile-industry.
[33] *ATA Truck Tonnage Index Increased 2.4% in May*, AM. TRUCKING ASS'N (July 20, 2023), https://www.trucking.org/news-insights/ata-truck-tonnage-index-increased-24-may.
[34] Aisha Chottani, Greg Hastings, John Murnane, and Florian Neuhaus, McKinsey & Co., *Distraction or Disruption? Autonomous Trucks Gain Ground in US Logistics* (Dec. 10, 2018), https://www.mckinsey.com/industries/travel-logistics-and-infrastructure/our-insights/distraction-or-disruption-autonomous-trucks-gain-ground-in-us-logistics.
[35] SAFE, *FOSTERING ECONOMIC OPPORTUNITY THROUGH AUTONOMOUS VEHICLE TECHNOLOGY* (July 2020), https://safe2020.wpenginepowered.com/wp-content/uploads/2020/07/Fostering-Economic-Opportunity-through-Autonomous-Vehicle-Technology.pdf.

transportation would be particularly impactful in food deserts, rural communities, and other areas that do not have significant, accessible public transit options.[36]

Preserving American leadership in the AV industry is key to ensuring that the economic benefits of AV deployment reach American companies, workers, and consumers. By developing a supportive national AV policy framework, the federal government can promote widespread AV deployment and commercialization, which will help secure continued U.S. leadership against foreign competitors and unlock greater opportunities for American companies to test and deploy AVs safely.

B. Autonomous Trucks Can Create New Jobs and New Opportunities for the Transportation Workforce

Autonomous trucks will be part of a comprehensive trucking ecosystem that coexists with human truck drivers, and ultimately the customers of AV trucking companies will decide how the technology is applied in the marketplace. We need truck drivers and they are a vital part of America's supply chain. The adoption of this technology will not lead to mass layoffs, and can help create a positive lifestyle change for thousands of truckers, allowing them to stay closer to home instead of driving routes that keep them on the road for weeks at a time. The technologies being developed and deployed by AVIA members will allow drivers to spend more nights in their own beds instead of in the sleeper berth of a truck.

As noted above, the U.S. trucking industry also faces a longstanding shortage of drivers, and is currently short of nearly 80,000 truck drivers due to a long-term decline in new drivers entering the profession, and an annual turnover rate exceeding 90% in certain parts of the

[36] *See* Joann Muller, *How Autonomous Vehicles Could Improve Mobility for the Poor*, Axios (July 17, 2020), https://www.axios.com/2020/07/17/autonomous-vehicles-mobility-poverty.

industry.[37] AVs can help fill the gap and, as the demand for freight carrying grows, expand the industry's carrying capacity over time by supplementing human operated vehicles. Given the timeline for AV truck deployment, autonomous trucking will not likely cause significant displacement of jobs in the trucking industry,[38] but it can serve as one tool to reduce strains on the supply chain. Indeed, a U.S. DOT study has found that most autonomous trucking adoption scenarios would not lead to layoffs for existing truckers.[39]

Beyond truck driving, the further adoption of autonomous trucking will support employment overall. A recent study found that in California, which already allows smaller AVs to operate, the introduction of autonomous trucking would create 2,400 jobs.[40] A Federal Highway Administration study has found that the adoption of autonomous trucking will increase total U.S. employment by up to 35,100 jobs per year on average and raise annual earnings for all U.S. workers by between $203 and $267 per worker per year.[41]

The AV industry itself has already created new jobs and brought new investment, tax revenue, resources, and human capital to states across the country, including Arkansas, California, Alabama, Arizona, Arkansas, Kansas, Nevada, New Mexico, Oklahoma, Pennsylvania, Michigan, Florida, Washington, Colorado, and Texas. In communities across those states, the AV industry is providing opportunities for workers with a wide array of expertise and educational backgrounds, including many jobs that do not require a college degree. These jobs include auto technicians, fleet managers, safety operations specialists, sensor calibrators, transportation planners, and many others to serve the growing needs of AV fleets and AV manufacturers. As the industry continues

[37] AM. TRUCKING ASS'N, *supra* note 12.
[38] *See* SECURING AMERICA'S FUTURE ENERGY, *supra* note 39.
[39] ROBERT WASCHIK ET AL, *supra* note 13.
[40] SILICON VALLEY LEADERSHIP GROUP *supra* note 41.
[41] ROBERT WASCHIK ET AL., *supra* note 13.

to expand, delivery workers and grocery store employees will be involved in selecting, packing, and delivering goods to consumers, among other jobs and roles. The wider deployment of AVs can create over three million new jobs by 2035, all while expanding access to affordable delivery services, according to a study conducted by Steer.[42]

The AV industry is also investing in partnerships to create the jobs of tomorrow. These investments not only move AV technology forward, but also prepare the American workforce to compete globally. For example, AVIA member Aurora has partnered with Pittsburgh Technical College to create and launch a new associate degree program that trains autonomous service engineer technicians.[43] Similarly, AVIA member Nuro has developed programs with De Anza Community College in California and San Jacinto Community College in Texas that offer a new career pathway to prepare the next generation of autonomous fleet technicians.[44] The initiatives include a free tuition option, access to paid internships and part time work, and preference for full time jobs with and benefits upon graduation. In San Francisco, another AVIA member, Cruise, partners with a local non-profit organization, Humanmade,[45] to help build bridges between historically underserved communities and the advanced manufacturing economy through skills training, education, access to advanced tools and machinery, interview workshops and other resources.

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[42] STEER, ECONOMIC IMPACTS OF AUTONOMOUS DELIVERY SERVICES IN THE U.S. xi (2020), https://www.steergroup.com/sites/default/files/2020-09/200910_%20Nuro_Final_Report_Public.pdf.

[43] *Pittsburgh Technical College Launches Robotics and Autonomous Engineering Technology Program*, PITTSBURGH TECHNICAL COLLEGE, https://www.pghtech.org/news-and-publications/PTC_Robotics (last visited Sept. 10, 2023).

[44] *Autonomous and Electric Vehicle Technician Pathway*, DE ANZA COLLEGE, https://www.deanza.edu/autotech/av (last visited Sept. 10, 2023); Press Release, San Jacinto College and Nuro, San Jacinto College and Nuro Announce First AV Technician Certificate Program in Texas (Feb. 24, 2023), https://www.newsfilecorp.com/release/156026/San-Jacinto-College-and-Nuro-Announce-First-AV-Technician-Certificate-Program-in-Texas.

[45] *Workforce Development Programs*, HumanMade, https://www.humanmade.org/workforce-development (last visited Sept. 10, 2023).

III. U.S. Leadership in AV Technology Continues to Face Challenges

Today, the United States is the global leader in the AV industry, with a robust ecosystem of American companies working on all aspects and applications of the technology. However, the United States must not assume it will win the global AV race and sustain its leadership position in a market potentially worth multiple trillions of dollars.[46] To ensure continued U.S. leadership in AV development and deployment, we must get three things right: technology development; capital investment; and public policy.[47]

The United States is leading in the first two categories. AVs are an American invention, with many of the leading voices in AV development today having participated in Defense Advanced Research Projects Agency ("DARPA")-sponsored challenges in the early 2000s. The work of these pioneers led to an explosion in AV development over the last decade, as they built dynamic companies across the United States. American companies have developed the most advanced AV technology to date, and billions have been invested in innovative AV companies, ranging from dogged startups to established players with experience scaling in the transportation sector.

Despite this lead, the United States is at severe risk of falling behind the rest of the world on AV public policy, which would deny Americans the technology's lifesaving mobility and efficiency benefits and harm the United States' global economic competitiveness. The American

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[46] SONIA ABHAY, ALLIED MARKET RESEARCH, AUTONOMOUS VEHICLE MARKET BY LEVEL OF AUTOMATION (LEVEL 1, LEVEL 2, LEVEL 3, LEVEL 4, AND LEVEL 5), APPLICATION (CIVIL, DEFENSE, TRANSPORTATION & LOGISTICS, AND CONSTRUCTION), DRIVE TYPE (SEMI-AUTONOMOUS AND FULLY AUTONOMOUS), AND VEHICLE TYPE (PASSENGER CAR AND COMMERCIAL VEHICLE): GLOBAL OPPORTUNITY ANALYSIS AND INDUSTRY FORECAST, 2021-2030 (2022), https://www.alliedmarketresearch.com/autonomous-vehicle-market; TECONOMY PARTNERS, *supra* note 37.

[47] *See also Economic Danger Zone: How America Competes to Win the Future Versus China*: *Hearing Before the Subcom. on Innovation, Data, and Com. of the H. Comm. on Energy and Com.*, 118th Cong. (2023) (statement of Jeff Farrah, Executive Director, Autonomous Vehicle Industry Association), https://theavindustry.org/resources/testimony/Witness_Testimony_Farrah_IDC_2023_02_01_Hearing_dac1666f21.pdf.

AV industry is at an inflection point, as the technology is now being commercialized and the benefits of AVs are beginning to accrue. Now is the time for policymakers to establish a national policy framework that prioritizes American leadership and has Congress, the U.S. DOT, and the private sector acting in partnership. While federal efforts to establish such a framework have stalled in the last several years, a majority of states have recognized the benefits of AVs by expressly approving AV operations on their roads.

Make no mistake: the United States can continue to lead the way on AVs, if we as a nation clear the path to safe commercialization and do so with urgency. The United States must commit itself to AV leadership to ensure that the safety, economic, mobility, and efficiency benefits of AVs can be felt not only in the states where AVs are already on the road, but nationwide.

A. Competition on AV Leadership from Abroad

America's leadership role is integral to securing the economic growth, job creation, and many safety and societal benefits offered by AVs. The United States currently faces considerable foreign competition, including from China, Europe, and Japan.

China. China's government has invested heavily in the development of AVs in recent years as part of its strategy to overtake and replace foreign market leaders, leading to projections that China's share of the AV market will be worth approximately 50% of the market's overall estimated value by 2025.[48] Reflecting China's investment in AVs, the Chinese government issued a joint strategy in 2020 prioritizing AV development and establishing goals for the large-scale production of AVs by 2025, calling for at least 20% of all new vehicles sales to have SAE Level 4 capabilities

[48] *See* Anjani Trivedi, *China Sets the Rules of the Road*, WASH. POST (Oct. 12, 2022, 6:31 PM), https://www.washingtonpost.com/business/china-sets-the-rules-of-the-road/2022/10/11/db25bdda-49b0-11ed-8153-96ee97b218d2_story.html.

by 2030.[49] In 2022, China's Ministry of Transportation released rules in an effort to commercialize driverless mobility.[50] Meanwhile, eight major cities in China currently allow testing of driverless ride-hailing services, and multiple AV companies have obtained permits in these cities to operate autonomous taxis.[51] One company, AutoX, backed by e-commerce giant Alibaba, announced the launch of autonomous taxis on public roads across an area three times the size of Manhattan within Shenzhen in January 2021.[52] Apollo Go, backed by China's leading search engine, Baidu, began publicly testing its robotaxis in Shanghai in September 2021.[53] According to Baidu, one million rides have already been completed since it rolled out the service, and it plans to expand into dozens of other Chinese cities by 2030.[54] Baidu expanded its driverless ride-hailing services to public roads in Beijing in April 2022, where another China-based AV company, Pony.ai, also deploys driverless robotaxis.[55] In August, Baidu received a permit to carry passengers from central Wuhan to the Wuhan Tianhe Airport, a major regional hub, and the first time AV routes in China have extended to an airport.[56] Another Chinese company, WeRide, recently received the first ever permit to operate an AV in the United Arab Emirates.[57] Many other Chinese companies are

[49] Takashi Kawakami & Naoshige Shimizu, *China's Self-Driving Car Push Hits Legal and Cost Roadblocks*, NIKKEI ASIA (Jan. 19, 2023), https://asia.nikkei.com/Business/Automobiles/China-s-self-driving-car-push-hits-legal-and-cost-roadblocks.
[50] *See* Anjani Trivedi, *supra* note 58.
[51] *Id.*
[52] Rita Liao, *China's Robotaxis Charged Ahead in 2021*, TECHCRUNCH (Jan. 14, 2022, 8:20 AM), https://techcrunch.com/2022/01/14/2021-robotaxi-china/.
[53] Rebecca Bellan, *Chinese Tech Giant Baidu Begins Publicly Testing Apollo Go Robotaxis in Shanghai*, TECHCRUNCH (Sept. 14, 2021, 1:24 AM), https://techcrunch.com/2021/09/13/chinese-tech-giant-baidu-begins-publicly-testing-apollo-go-robotaxis-in-shanghai/.
[54] *Robotaxis are taking over China's roads. Here's how they stack up to the old-fashioned version*, CBS NEWS (Aug. 18, 2022), https://www.cbsnews.com/news/china-robotaxis-self-driving-cabs-taking-over-cbs-test-ride/.
[55] Rebecca Bella, *Baidu, Pony.AI Win First Driverless Robotaxi Permits in China*, TECHCRUNCH (Apr. 27, 2022, 11:21 PM), https://techcrunch.com/2022/04/27/baidu-pony-ai-win-first-driverless-robotaxi-permits-in-china/.
[56] David Leggett, *Daidu First in China to Offer Driverless Airport Rides*, Just Auto (Aug. 31, 2023), https://www.just-auto.com/news/baidu-first-in-china-to-offer-driverless-airport-rides/.
[57] Rebecca Bellan, *China's WeRide Secures Self-driving Vehicle License from UAE*, TECHCRUNCH (July 4, 2023), https://techcrunch.com/2023/07/04/chinas-weride-secures-self-driving-vehicle-license-from-uae/.

investing in AV technology and testing, including Huawei, Didi Chuxing, and Momenta. Further, these companies are attracting investment from other countries around the world.[58]

China's focus on advancement in this space should be alarming, as no American policymaker should want to see a world where China dominates the AV market. This scenario presents immense national security challenges and would also mean the United States would not see much of the job creation from a prosperous AV industry.

European Union ("EU"). In August 2022, the European Commission issued the first EU-wide safety regulations for the automated driving systems of "fully automated" vehicles, enabling EU-wide approvals for commercial deployment of vehicles with these systems.[59] This marked the first multinational safety regulation for fully automated vehicles and provided added certainty to the AV industry but also a significant competitive advantage for the region.

Japan. Japan incorporated SAE Level 4 autonomous driving into its traffic law in April of this year.[60] This is the latest step in Japan's demonstrated support for AVs, following Japan's enactment of a Road Transport Vehicle law in 2020 recognizing AVs and establishing a related inspection regime and permit system.[61]

B. AVs and National Security

American leadership in the AV industry is also a matter of national security. Since before the days of the DARPA challenge, the Department of Defense ("DOD") has been interested in developing and deploying autonomous ground vehicles as tools on the battlefield and for logistics.

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[58] *Id.*

[59] Commission Implementing Regulation 2022/1426 of Aug. 5 2022, Laying Down Rules for the Application of Regulation (EU) 2019/2144 of the European Parliament and of the Council as Regards Uniform Procedures and Technical Specifications for the Type-Approval of the Automated Driving System (ADS) of Fully Automated Vehicles, 2022 O.J. (L 221).

[60] Graham Hope, *Japan to Greenlight Self-Driving Vehicles in 2023,* IOT WORLD TODAY (November 3, 2022), https://www.iotworldtoday.com/transportation-logistics/japan-to-greenlight-self-driving-vehicles-in-2023.

[61] Kazuhiro Ogawa, *Japan Revamps Laws to put Self-driving Cars on Roads*, NIKKEI ASIA (Mar. 9, 2019), https://asia.nikkei.com/Politics/Japan-revamps-laws-to-put-self-driving-cars-on-roads.

Autonomous trucks could replace manned vehicles on dangerous convoy missions, allowing for greater flexibility in logistics without putting soldiers in harm's way,[62] while other AVs can augment existing assets and undertake high-risk frontline missions like reconnaissance.[63]

AVIA member Kodiak recently partnered with the DOD's Defense Innovation Unit as part of the Army's ongoing Robotic Combat Vehicle program.[64] This partnership connects Kodiak's AV expertise directly to DOD experts as they work to develop the next generation of combat vehicles. Congress included language in the House-passed fiscal year 2024 National Defense Authorization Act supporting the Robotic Combat Vehicle program's leveraging of dual-use commercial ADS and pushing other branches to follow the Army's lead in autonomous software procurement.[65]

The future of these programs, and their potential to keep soldiers out of harm's way, depends on maintaining U.S. leadership in the AV industry. Preserving American leadership will keep the United States ahead of competitors while saving lives—both on distant battlefields and on highways here at home. Further, ensuring a robust U.S. AV industry and retaining a dynamic civilian AV industry can provide vital expertise and technology for military automation programs, while DOD funding can provide added support for civil AV development, creating a positive feedback loop that will help the long-term sustainability of the AV industry.

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[62] Maj. Brian Mathews, *Autonomous Vehicles: New Technology Revolutionizes Army's Principles of Sustainment*, U.S. Army (Aug. 31, 2022), https://www.army.mil/article/259621/autonomous_vehicles_new_technology_revolutionizes_armys_principles_of_sustainment.

[63] David Vergun, *DOD Adopting Commercial Technology to Control Unmanned Ground Vehicles*, Dept. of Defense (Dec. 6, 2022), https://www.defense.gov/News/News-Stories/Article/Article/3237210/dod-adopting-commercial-technology-to-control-unmanned-ground-vehicles/.

[64] John Rosevear, *Self-driving Truck Startup Kodiak Robotics Wins $50 Million Deal to Help Develop Driverless Army Vehicles*, CNBC (Dec. 6, 2022), https://www.cnbc.com/2022/12/06/kodiak-wins-50m-deal-to-develop-driverless-army-vehicles.html.

[65] National Defense Authorization Act for Fiscal Year 2024, H.R. 2670, 118 Cong. § 267 (2023), https://www.congress.gov/bill/118th-congress/house-bill/2670/text/rds.

IV. Conclusion

The further deployment of autonomous trucks and other AV technologies will vastly increase safety on our roadways and generating substantial job creation and supply chain benefits. However, to ensure those benefits are realized here in the United States, we must preserve American leadership in the AV industry. I thank the Subcommittee for its leadership on these important issues. AVIA looks forward to serving as a resource for technical and policy questions on this subject and working with you to make safe autonomous vehicles a reality for Americans nationwide.