February 15, 2022
Alicia Chambers, Executive Secretariat
National Institute of Standards and Technology
100 Bureau Drive
Gaithersburg, MD 20899

Re: Notice and Request for Information, Study to Advance a More Productive Tech Economy, Docket No. 211116-0234

Dear Ms. Chambers,

The Autonomous Vehicle Industry Association ("Association"), an organization of leading autonomous vehicle ("AV") companies, welcomes the opportunity to provide a response to the National Institute of Standards and Technology's ("NIST") request for information ("RFI") on a "Study to Advance a More productive Tech Economy," which was published in the Federal Register on November 22, 2021.[1]

By way of background, the Association is comprised of the world's leading technology, ridesharing, trucking, and automotive companies. Our mission is to realize the benefits of autonomous vehicles (i.e., SAE Levels 4 and 5-capable vehicles) and support the safe and rapid deployment of this technology. AV technology has the ability to revolutionize delivery services at all levels, from local deliveries of food and packages to the cross-country movement of freight. With its broad array of technical expertise and experience in the technology, automobile, and transportation network sectors, the Association appreciates the opportunity to provide NIST with greater insight into the AV industry and the opportunities presented by unmanned delivery services, which the RFI identifies as an emerging technology area of interest to NIST.[2]

The deployment of unmanned delivery services promises not only reduced costs for consumers, but also the ability to move goods more easily and improve access to food, medicine, and other goods for underserved communities. Unmanned delivery via AVs can significantly reduce the cost of deliveries for consumers, with some pilots costing only $5.95 per grocery delivery, compared to the added costs of between $10 and $20 charged by existing delivery services.[3] Unmanned delivery services can also improve access to fresh food for 14 million low-income households, with roughly 70% of the total low-income population living in food

[1] Notice of Extension of Comment Period on Study To Advance a More Productive Tech Economy, 87 Fed. Reg. 4564 (Jan. 28, 2022), https://www.federalregister.gov/documents/2022/01/28/2022-01528/study-to-advance-a-more-productive-tech-economy.
[2] As AVIA focuses on motor vehicles that meet SAE Levels 4 and 5 our comments will not discuss smaller sidewalk-based delivery vehicles (known as personal delivery devices) or other devices that do not use roadways.
[3] 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.

deserts.[4] AVs can help create expansive delivery networks that provide a lifeline to the elderly, people with disabilities, and others, bringing the world to them at lower cost and increased efficiency. Trucking, which delivers sixty-five percent of U.S. consumable goods to market, could also benefit from autonomy, with the implementation of full autonomy in the trucking sector expected to reduce operating costs by about 45%—resulting in savings between $85 billion and $125 billion.[5] AVs also hold potential environmental benefits, as numerous companies are already using battery electric vehicles ("EVs") or gasoline-electric hybrids for their AV fleets, and adoption of EVs is increasing. A study by Steer found that autonomous, electric local delivery vehicles could avoid more than 400 million tons of CO2 from 2025-2035.[6]

Responses to NIST's Request for Information

I. Technology Development

The RFI requests information on the federal government's role in the development of unmanned delivery services, amongst other emerging technologies. This includes information on which agencies have jurisdiction or influence over the technology, current and future industry needs regarding federal support and regulation, and the current state of regulation over the industry.

A. Federal Agencies with Jurisdiction over Unmanned Delivery Services

The RFI states that NIST is seeking greater awareness of the federal agencies that have jurisdiction over emerging technologies, or with which industry interacts on related issues. The primary agencies with jurisdiction over unmanned delivery services are the U.S. Department of Transportation's ("USDOT") National Highway Traffic Safety Administration ("NHTSA") and the USDOT's Federal Motor Carrier Safety Administration ("FMCSA"). As the agency tasked with regulating the safety of motor vehicles, NHTSA has oversight authority over the design and operation of motor vehicle-based unmanned delivery vehicles. NHTSA is also charged with generating and enforcing the Federal Motor Vehicle Safety Standards ("FMVSS"), which dictate design and safety rules for motor vehicles, including those used for unmanned delivery services. Larger commercial motor vehicles are also regulated by the FMCSA via the Federal Motor Carrier Safety Regulations ("FMCSR"), which touch on both equipment for commercial motor vehicles and safety rules for commercial motor vehicle operators (many of which may not apply to automated driving systems). In addition, the Federal Communications Commission ("FCC") and the National Telecommunications and Information Administration ("NTIA"), through their

[4] Sola Lawal, *Serving America's Food Deserts*, MEDIUM (July 15, 2020), https://medium.com/nuro/serving-americas-food-deserts-a7442e922053.

[5] Aisha Chottani, et al., *Distraction or disruption? Autonomous trucks gain ground in US logistics*, MCKINSEY & CO. (Dec. 10, 2018), https://www.mckinsey.com/industries/travel-logistics-and-infrastructure/our-insights/distraction-or-disruption-autonomous-trucks-gain-ground-in-us-logistics.

[6] STEER, *supra* note 3 at XV.

management of radio spectrum that automated vehicles may use to communicate, can influence the development of the industry, as can agencies such as the Cybersecurity & Infrastructure Security Agency ("CISA")[7] and NIST, through standards setting and other technical programs.

B. Federal Role in Fostering the Adoption of Unmanned Delivery Services and Expanding Economic Opportunities

Two ways in which the federal government can foster the adoption of unmanned delivery services is through targeted funding opportunities and encouraging the testing and deployment of unmanned delivery systems. Funding opportunities can include pilot programs and ensuring that manufacturers of unmanned delivery systems are eligible for similar incentives and programs as are other vehicle manufacturers. As a means of encouraging the adoption of unmanned delivery services, the federal government itself could partner with industry to adopt these technologies for its own use. Government agencies have already proven their interest in emerging transportation technologies, exemplified by a 2019 U.S. Postal Service pilot that used AV trucks to carry mail between Phoenix and Dallas,[8] and a 2021 National Park Service pilot program that used AVs to carry visitors in Yellowstone National Park.[9] Federal agencies can use unmanned delivery services directly, such as by carrying medicine or medical equipment on VA hospital campuses, or the government could encourage (through technical assistance or financial aid) organizations receiving federal funding to adopt unmanned delivery services as part of their operations.

C. *Current and Future Needs in Standards Development*

As an industry built on emerging technologies, standards processes for unmanned delivery services are developing. One primary need for the further development of standards is collaboration between industry, standards setting organizations, and regulators. Such cooperation will ensure that standards meet their intended goals while accommodating the flexible development of emerging technologies.

D. Existing Standards for Unmanned Delivery Systems

There are several important standards forums that can influence AVs and unmanned delivery services. SAE International is an important source for automotive standards, including

---

[7] *Autonomous Vehicle Security*, CYBERSECURITY & INFRASTRUCTURE SEC. AGENCY, https://www.cisa.gov/autonomous-vehicle-security (last visited Jan 25, 2022).

[8] Heather Somerville, *Self-Driving Trucks Begin Mail Delivery Test for U.S. Postal Service*, REUTERS (May 21, 2019), https://www.reuters.com/article/us-tusimple-autonomous-usps/self-driving-trucks-begin-mail-delivery-test-for-u-s-postal-service-idUSKCN1SR0YB.

[9] *Automated Shuttle Pilot*, YELLOWSTONE NATIONAL PARK, https://www.nps.gov/yell/learn/management/automated-shuttle-pilot.htm (last visited Jan 25, 2022).

SAE J3016, which defines the levels of motor vehicle automation.[10] The International Organization for Standards ("ISO") also sets relevant standards, such as Functional Safety (ISO 26262),[11] which deals with safety-related electrical and/or electronic systems in road vehicles. Additionally, as indicated above, the USDOT plays a role in setting standards that can impact unmanned delivery systems, primarily through the FMVSS and FMCSRs.

E. Public-Private Investment Partnerships and Investment Needs

Public-private partnerships ("PPP") could be a useful tool in expanding the deployment of AV-based unmanned delivery systems. Such partnerships could be used to not only meet the needs of specific communities, but also to provide new opportunities to deploy AV-based delivery services and increase public awareness of AVs and their capabilities. For example, a PPP could help establish delivery routes within a community for local small businesses or food banks, helping residents gain better access to food, providing needed revenue to local businesses, and building greater public awareness and trust in AVs.

F. Existing Legislation and Regulation

There is currently no federal legislation specifically regulating AVs, although generally applicable federal vehicle standards do apply, and the federal government has acknowledged that existing federal standards do not preclude the deployment or commercialization of AVs. States have authority to impose requirements related to operation of motor vehicles on roads as well as licensing and insurance, and in the context of AV operation different state approaches have led to regulatory inconsistency. For example, California, Arizona, and Texas, each takes a different approach to AV testing and deployment. California has established a permitting system that sets requirements for testing and deployment of passenger AVs, while prohibiting testing and deployment of heavy-duty AVs.[12] Texas, on the other hand, allows for the operation of an AV without any permit, but operators are held responsible for the safe operation of AVs and compliance with state traffic laws.[13] As a result of this patchwork of state laws, the same AV is subject to a range of different regulations depending on where it is operated. This limits the ability of AV developers and manufacturers to deploy these innovative technologies across state boundaries and presents unique challenges for the operation of autonomous heavy-duty vehicles in interstate commerce.

---

[10] *Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles - J2016_202104*, SAE, https://www.sae.org/standards/content/j3016_202104/ (last visited Jan 25, 2022).
[11] *ISO 26262-1:2018 Road Vehicles - Functional Safety*, ISO, https://www.iso.org/standard/68383.html (last visited Jan 25, 2022).
[12] *Autonomous Vehicles*, CA DEP'T OF MOTOR VEHICLES, https://www.dmv.ca.gov/portal/vehicle-industry-services/autonomous-vehicles/ (last visited Jan 25, 2022).
[13] *See* TEX. CODE. ANN. § 545.45 (2017).

Federal regulations can also pose barriers to the development of AVs and unmanned delivery services, especially for services that rely on novel vehicle designs. Certain vehicles, such as those designed to deliver goods and not carry passengers, may not require equipment that is assumed by human centric FMVSS requirements. Such delivery vehicles do not necessarily have a human operator on board, and they do not require rear view mirrors, seatbelts, or airbags, as they will never have a human driver or passenger. Under current law, a manufacturer can seek an exemption from NHTSA from complying with certain FMVSS if they can show the vehicle is at least as safe as a compliant vehicle, but this exemption covers only 2,500 vehicles a year.[14] This 2,500-vehicle cap severely undermines the AV industry's ability to deploy at scale and restricts the potential for unmanned delivery services to operate efficiently across the country. NHTSA has existing authority to modernize the FMVSS and establish standards that recognize the differences between AVs and traditional vehicles, but NHTSA has yet to modify standards to address AVs and other emerging technologies.

II. Technology Applications & Utilization

NIST's RFI also requests information on the applications and utilization of unmanned delivery systems.

A. *Industry Utilization of Unmanned Delivery Services*

The industrial applications of AVs and unmanned delivery services hold an array of potential benefits. From long haul commercial vehicles transporting goods across the county, to last-mile deliveries bringing packages to people's curbs, unmanned delivery services can help create a more efficient distribution network. At the local level, for example, Domino's has utilized several different AVs to automate pizza delivery,[15] while other AVs were used to deliver medical supplies and combat food insecurity during the COVID-19 epidemic.[16] To highlight a few examples, Cruise delivered over one million meals to food-insecure families in San Francisco,[17] TuSimple used autonomous tucks to deliver more than 3.5 million pounds of food (2.7 million meals) for food banks in Arizona,[18] and Nuro vehicles helped the Houston Food Bank feed people in Texas.[19] AVs and small unmanned delivery vehicles could be used to

---

[14] *See* 49 U.S.C. § 30113 (2021).
[15] Darrell Etherington, *Ford and Domino's to Deliver Pizza Using Self-Driving Cars in New Test*, TechCrunch (Aug. 29, 2017), https://techcrunch.com/2017/08/29/ford-and-dominos-to-deliver-pizza-using-self-driving-cars-in-new-test/; https://selfdrivingdelivery.dominos.com/en.
[16] *Coronavirus: Innovative Automotive Technologies - A Letter to Stakeholders*, Nat'l Highway Traffic Safety Admin. (Apr. 10, 2020), https://www.nhtsa.gov/coronavirus-resources-nhtsa/coronavirus-innovative-automotive-technologies.
[17] Dan Ammann, *Introducing Cruise for Good*, Medium (Apr. 23, 2021), https://medium.com/cruise/introducing-cruise-for-good-8ebf9bfdaf4a.
[18] *Hunger-Free AZ News*, Ariz. Food Bank Network (Summer 2020), https://azfoodbanks.org/wp-content/uploads/2020/09/AzFBN_S20_Newsletter_DIGITAL.pdf.
[19] Lawal, *supra* note 4.

transport medical supplies, blood, and even organs around medical center campuses and between hospitals, or to transport materials at ports or within warehouses, further streamlining the distribution of goods.

B. *Strengthening Regional Innovation Centers Across the United States*

Building on existing bases of technological and industrial talent can serve as a helpful tool in AV development. Early AV developments have occurred in regions with major universities, while states like Texas and Arizona have been able to successfully attract AV developers by removing barriers to testing and deployment and offering a steady climate. Workforce development can further support regional innovation centers, as trained technicians, mechanics, and others will be needed to help build and maintain AVs and automated driving systems. AV companies have already begun encouraging workforce development through partnerships with community colleges, such as Nuro's program with De Anza Community College, which was designed to prepare the next generation of autonomous fleet technicians.[20] The initiative, which will include more locations in the near future, includes a free tuition option, access to paid internships and part time work, and preferences for full time jobs and full benefits upon graduation. Another example is TuSimple's work with Pima Community College, which established an AV certificate program to prepare drivers for new jobs such as training AV systems as test drivers, operating the AV in situations where autonomous driving is not suitable, and remotely monitoring the system from a command center.[21] A regional innovation center seeking to build out a local AV industry will need to leverage workforce development while establishing clear and consistent state AV laws.

C. *Current Marketplace Landscape, Projected Changes to the Marketplace, and Long-term Trends with the Adoption of Unmanned Delivery Services*

The demand for delivery services has grown exponentially in the last two years, due in large part to the disruptions caused by the COVID-19 epidemic. In the ten months between February and December of 2020, deliveries through U.S. delivery applications nearly doubled.[22] Parcel deliveries are growing as well, from 15 billion in the U.S. in 2019 to 20 billion in 2020.[23]

---

[20] *Autonomous and Electric Vehicle Technician Pathway*, De Anza College, https://www.deanza.edu/autotech/av#:~:text=A%20New%20Career%20Pathway%20With,nation%20%E2%80%94%20for%20De%20Anza%20students (last visited Jan. 28, 2022).

[21] Linda Baker, *TuSimple and Pima Community College Launch First-Ever AV Certificate Program for Truck Drivers*, Freight Waves (June 13, 2019), https://www.freightwaves.com/news/tusimple-and-pima-community-college-launch-first-ever-av-certificate-program-for-truck-drivers.

[22] *Global Food Delivery Trends 2018 vs. 2021*, Edison Trends (Sept. 22, 2021) https://trends.edison.tech/research/global-food-delivery-2021.html.

[23] *Parcel Shipping Index 2021*, Pitney Bowes, https://www.pitneybowes.com/content/dam/pitneybowes/us/en/shipping-index/parcel_shipping_index_ebook_final.pdf (last visited Jan 25, 2022).

Unmanned delivery services can help serve this increased demand while driving down the costs of delivery.

AVs have the potential to transform the marketplace for delivery services and reduce the cost of goods for consumers by dramatically reducing the overall cost of deliveries. Some AV pilot programs have demonstrated a cost of only $5.95 per grocery delivery, down from $10-20 in added costs for existing delivery services; this could help expand access to affordable delivery, creating over three million new jobs by 2035 as retailers and delivery providers expand their services, according to a study by Steer.[24] Autonomous trucking also presents an opportunity for substantial decreases in the cost of goods. A 2018 report found that sixty-five percent of U.S. consumable goods are transported by truck, and the implementation of full autonomy in the trucking sector stands to decrease operating costs by about 45%—resulting in savings between $85 billion and $125 billion.[25] Estimates indicate that economy-wide AV trucking adoption alone would raise earnings of all US workers by between $203 and $267 a year, while creating 26,400 to 35,100 jobs a year, depending on how quickly it can be adopted.[26] Other projections indicate the adoption of AVs would increase access to jobs within a metropolitan area by 45% by 2040.[27]

D. Risks and Long-term Trends in Supply Chains within Unmanned Delivery Services

As with other aspects of the technology industry, AVs and unmanned delivery services are dependent on computer chips, which have been in short supply over the last two years. Recent trends toward greater production capacity for chips here in the U.S. and abroad are encouraging, and progress toward greater chip production overall will help the AV industry as it moves toward large-scale production and deployment.

E. Foreign Capability and Capacity with Unmanned Delivery Services

The deployment of AVs and unmanned delivery services is an international effort, with developers across the world working to bring AV technologies to market.

China. China's government is investing heavily in developing autonomous vehicles as part of its strategy to overtake and replace foreign market leaders. The Chinese government has prioritized AV development and included AVs in the Made in China 2025 strategic initiative,

---

[24] STEER, supra note 3 at XI.
[25] Chottani, et al., *supra* note 5.
[26] U.S. DEP'T OF TRANSP., FWHA-JPO-21-847, MACROECONOMIC IMPACTS OF AUTOMATED DRIVING SYSTEMS IN LONG-HAUL TRUCKING (2021), https://rosap.ntl.bts.gov/pdfjs/web/viewer.html?file=https://rosap.ntl.bts.gov/view/dot/54596/dot_54596_DS1.pdf.
[27] RICHARD EZIKE ET. AL., WHERE ARE SELF-DRIVING CARS TAKING US? 6 (2019), https://ucsusa.org/sites/default/files/attach/2019/02/Where-Are-Self-Driving-Cars-Taking-Us-web.pdf.

which encourages local governments to open roads for testing.[28] 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.[29] In 2020, Apollo Go, backed by China's leading search engine Baidu, was authorized to launch a pilot of the first paid AV taxi (or "robotaxi") service in Beijing,[30] and has also begun public tests in Shanghai.[31] Many other Chinese companies are investing in AV technology and testing, including Huawei, Pony.ai, WeRide.ai, Didi Chuxing, and Momenta.

Singapore. Singapore is ranked #1 in the world in regard to AV readiness[32] and has launched an autonomous commuter bus available to residents for a small fee.[33] The government of Singapore has also opened over 620 square miles of road for AV testing, and has set a target of having AV bus service to three new towns by the end of 2022.[34]

Germany. Germany passed a law in 2021 that amended the national road traffic law to create an approval framework for L4+ capable vehicles.[35] Mobileye is testing vehicles in Munich,[36] and in 2021, Argo AI and Volkswagen announced they would commence on-road testing in Germany with an intended launch date for AV commercial delivery and micro-transit services in 2025.[37]

United Kingdom. In 2021, the United Kingdom ("UK") legalized automated lane keeping systems (SAE Level 3), and on January 26, 2022, the Law Commission of England and Wales, along with the Scottish Law Commission released a joint report recommending new laws to regulate AVs in Great Britain.[38] The UK government also touted a report last year that AVs

---

[28] Michael Dunne, *China Races for Global Leadership in AVs*, Axios (Oct. 27, 2018), https://www.axios.com/china-races-for-global-leadership-in-autonomous-vehicles-6a3a8059-d170-47e6-87d5-fbb6fa8e738b.html.

[29] Rita Liao, *China's Robotaxis Charged Ahead in 2021*, TechCrunch (Jan. 14, 2022), https://techcrunch.com/2022/01/14/2021-robotaxi-china/.

[30] *Id.*

[31] Rebecca Bellan, *Chinese Tech giant Baidu Begins Publicly Testing Apollo Go Robotaxis in Shanghai*, TechCrunch (Sept. 14, 2021), https://techcrunch.com/2021/09/13/chinese-tech-giant-baidu-begins-publicly-testing-apollo-go-robotaxis-in-shanghai/.

[32] KPMG International, 2020 Autonomous Vehicles Readiness Index 12 (2020), https://home.kpmg/xx/en/home/insights/2020/06/autonomous-vehicles-readiness-index.html.

[33] Eileen Yu, *First Commercial Autonomous Bus Services Hit Singapore Roads*, ZDNet (Jan. 25, 2021), https://www.zdnet.com/article/first-commercial-autonomous-bus-services-hit-singapore-roads/.

[34] KPMG International, *supra* note 32 at 12.

[35] Jack Ewing, *How Germany Hopes to Get the Edge in Driverless Technology*, N.Y. Times (July 14, 2021), https://www.nytimes.com/2021/07/14/business/germany-autonomous-driving-new-law.html.

[36] Kyle Hyatt, *Intel's Mobileye Goes for an Autonomous Spin Around Munich*, CNET: Roadshow (Dec. 15, 2020), https://www.cnet.com/roadshow/news/mobileye-self-driving-munich-demonstration/.

[37] Andrew Hawkins, *VW Will Start Testing its Argo AI-powered Self-driving Vans in Germany this Summer*, The Verge (May 12, 2021), https://www.theverge.com/2021/5/12/22430813/vw-argo-autonomous-delivery-ride-pooling-germany.

[38] Law Comm'n of England and Wales & Scottish Law Comm'n, Automated Vehicles: Summary of Joint Report (2022),

could generate £41.7 billion and 40,000 skilled jobs by 2035 for the UK, and the country has invested £200 million into British AV startups.[39] AV testing is already underway across the country with backing from the UK government, universities, technology companies, and research institutions.

France. The French Council of Ministers passed an ordinance on April 14, 2021 amending the French road traffic law to allow L4+ deployment.[40] Late last year, the French government also approved a Level 4 AV shuttle to carry passengers on public roads.[41] Further, France has indicated it will implement its own L4+ type approval requirements by September 2022, if the EU has not done so already.

Japan. Japan enacted a Road Transport Vehicle law in 2020 recognizing AVs and establishing an inspection regime and permit system.[42]

Conclusion

The Autonomous Vehicle Industry Association is encouraged by NIST's interest in unmanned delivery services and AVs, as the technology has the promise to transform the movement of goods nationwide. The adoption of AVs for local, regional, and interstate deliveries of goods will make it easier than ever for consumers to obtain the goods they need quickly and efficiently. AVs can help correct existing deficiencies in the supply chain and provide underserved communities access to previously unavailable goods. With proper support and appropriate regulation, the federal government has the opportunity to help foster this industry and encourage its growth. The Association looks forward to further discussions with NIST on the future of the autonomous vehicle industry.

Sincerely,

---

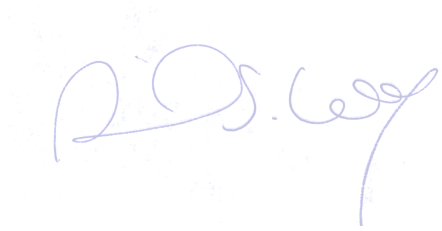
https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jsxou24uy7q/uploads/2022/01/AV-Summary-25-01-22-1.pdf.

[39] *UK on the Cusp of a Transport Revolution, as Self-driving Vehicles Set to be Worth Nearly £42 billion by 2035*, GOV.UK (Jan. 13, 2021), https://www.gov.uk/government/news/uk-on-the-cusp-of-a-transport-revolution-as-self-driving-vehicles-set-to-be-worth-nearly-42-billion-by-2035.

[40] Johnna Crider, *France is Preparing for the Arrival of Autonomous Driving*, CLEANTECHNICA (July 4, 2021), https://cleantechnica.com/2021/07/04/france-is-preparing-for-the-arrival-of-autonomous-driving/.

[41] David Rogers, *Europe's First Fully Autonomous Vehicle to Carry People in Toulouse*, GLOBAL CONSTRUCTION REV. (Nov. 29, 2021), https://www.globalconstructionreview.com/europes-first-fully-autonomous-vehicle-to-carry-people-in-toulouse/.

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



Ariel S. Wolf
General Counsel
Autonomous Vehicle Industry Association