

TRANSFORMING MOBILITY

OUR OPPORTUNITIES

- Providing safe and accessible transportation without any of the distractions or impairments of a human driver
- Deploying upgradeable all-electric, self-driving shared vehicles in fleets, through Cruise, that can operate for much longer than personal vehicles
- Integrating multiple mobility breakthroughs—such as autonomy, sharing and electrification—into a single vehicle, accelerating the acceptance and adoption of each
- Creating new urban mobility solutions, such as last-mile delivery, and other transportation-related businesses
- Working toward regulation to address the advent of commercial self-driving technologies

OUR CHALLENGES

- Building trust and understanding among customers for advanced automated driving systems
- Developing commercially viable business models for shared mobility solutions

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Transforming Mobility



GM envisions a future where we can enjoy the benefits of vehicle use—freedom, convenience and comfort—while minimizing risks such as crashes, emissions and congestion.

Over the past decade, GM has built a strong leadership position in vehicle electrification and connectivity. And along with Cruise, the self-driving company majority owned by GM, we are building a similar position in self-driving vehicles. A significant part of our vision is enabling self-driving transportation in city centers, which is why our close collaboration with Cruise in San Francisco is so exciting. Cruise thinks about AV technology not just as a service, but as a platform. Ridesharing and delivery are uses of that platform. These technologies will help us achieve our vision of zero crashes, zero emissions and zero congestion—all at the same time.

Outside of cities, it is important to understand that crashes, emissions and congestion are linked in many ways. According to the Federal Highway Administration, traffic incidents—including vehicle crashes—cause about one-quarter of all congestion in the United States. Recurring peaks in demand—most notably, daily commute periods—account for about half of all congestion. Moreover, as a function of traffic volumes, congestion grows nonlinearly. This tells us that improvements in vehicle safety and strategies for smoothing travel demand peaks, even just at the margins, can help meaningfully reduce congestion, its costs to society and associated emissions reduction from vehicles spending less time on the road. AVs will

be part of the answer, potentially reducing the crashes that can bring traffic to a standstill and that cost almost 1.25 million lives annually in the U.S. That's why AVs are potentially the most significant change that will affect modern mobility, bringing enormous societal benefits, the most visible of which may be dramatic increases in road safety.





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Self-Driving Vehicles



Self-driving vehicles are on the brink of disrupting the automotive industry. Cruise, the self-driving company majority-owned by GM, is helping chart the course of transforming transportation in cities.

Cruise is the only company with access to the capital and engineering talent necessary to bring self-driving vehicles safely to scale. Unlike other companies that are retrofitting conventional vehicles with autonomous technology, or designing their own vehicles for the first time, GM's relationship with Cruise brings expertise in automotive design, engineering, manufacturing, safety testing and proven quality methods refined over more than a century. GM is and remains the first automaker to use mass-production auto assembly line methods for self-driving vehicles, which occurs at our assembly plant in Orion Township, Michigan.

Every Cruise AV test vehicle is also an EV that is derived from the Chevrolet Bolt EV. Introducing these technologies in tandem accomplishes multiple goals, including increasing acceptance of EVs and encouraging buildout of EV charging infrastructure. In addition, there are benefits to integrating AV technology into an EV—as opposed to a conventional or hybrid vehicle—from an engineering perspective.

Today, Cruise is making rapid progress to deploy self-driving vehicles that offer a great user experience, operate with zero emissions, and, most importantly, are safe to ride in. The journey to commercialization is

being made in close collaboration with key technology collaborators. In 2019, Honda announced an investment of approximately \$2 billion over 12 years to help develop a purpose-built AV, as well as to explore global opportunities for commercial deployment of the Cruise self-driving vehicles.

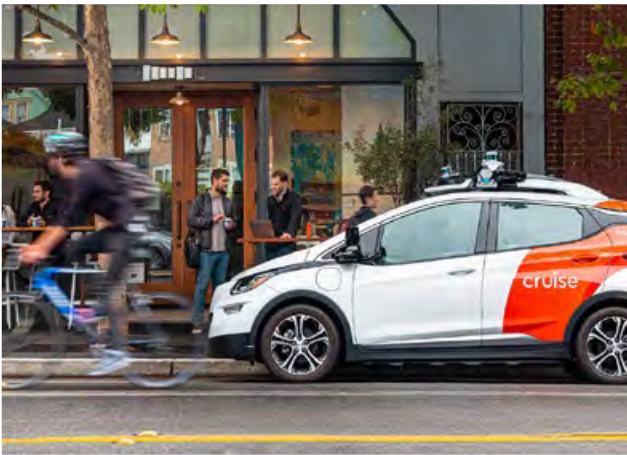
Similarly, in early 2021, Cruise and GM announced a long-term strategic relationship with Microsoft to accelerate the commercialization of self-driving vehicles. The companies will bring together their software and hardware engineering excellence, manufacturing know-how and partner ecosystem to transform transportation.

To unlock the potential of cloud computing for self-driving vehicles, Cruise will leverage Azure, Microsoft's cloud and edge computing platform, to commercialize its unique self-driving vehicle solutions at scale. Microsoft, as Cruise's preferred cloud provider, will also tap into Cruise's deep industry expertise to enhance its customer-driven product innovation and serve transportation companies across the globe through continued investment in Azure.

Clearing a Testing Milestone

Thanks to a permit from the California Department of Motor Vehicles, and after more than five years of rigorous vehicle testing over 2 million miles of driving, and countless hours of hard work from thousands of dedicated Cruise and GM engineers and support teams, in 2020, Cruise began operating self-driving vehicles on the streets of San Francisco without a driver behind the wheel. The permit made Cruise the first self-driving vehicle company to operate a vehicle without a driver behind the wheel in a major U.S. city.

Over the past five years, Cruise has conducted nearly all testing in one of the most complex environments in the world—downtown San Francisco. Here, test vehicles regularly confront situations such as unprotected left turns, construction zones, cyclists and pedestrians, and experience more than 40 times greater complexity than they would find testing in simple suburban settings.



Beyond the complex environments to which Cruise submits their self-driving vehicles daily, engineers have created machine learning-driven simulations that allow the AV software to “drive” in an infinite number of simulated environments, gaining experience more quickly than could be possible on the roads. Cruise also used simulation to develop the Sensor Placement Tool, which determines the optimal placement of sensors to create overlapping, 360-degree coverage around every Cruise vehicle.

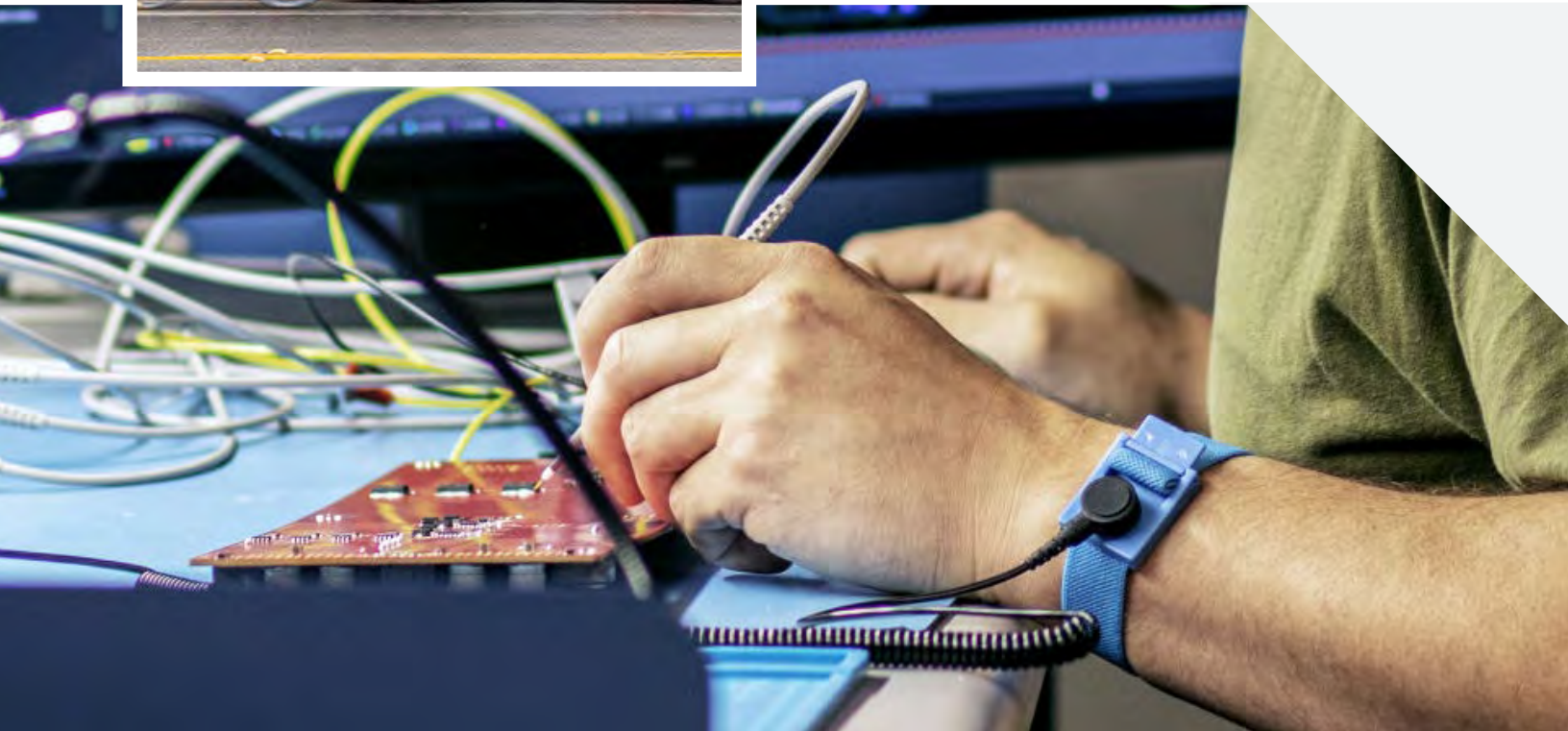
2M+

AV test miles driven by Cruise to date.

Our Purpose-Built AV

In 2020, Cruise introduced the Cruise Origin, a purpose-built, all-electric and shared self-driving vehicle. The Cruise Origin represents several aspirations for the future of mobility: a vehicle that is shared, autonomous, electric and, above all, safe to operate.

The Cruise Origin will operate without an internal combustion engine, a gas tank—or a driver. In its place, the vehicle will have more space for passengers and will operate in ridesharing fleets. To ensure reliability, the vehicle has built-in redundancy to eliminate single



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points of failure across sensing, computing, networking and power. With no backup human driver, Origin uses purpose-built sensors and computers to deliver exceptional performance. It will be equipped with software that Cruise AVs have been testing and refining for years on the streets of San Francisco.

Origin is the result of a collaboration between Cruise, GM and Honda. Cruise focused on the self-driving technology itself, as well as the service's customer-facing design. GM has been focused on Origin's flexible all-electric platform, as well as manufacturing scale. And Honda, a Cruise investor and engineering collaborator, is helping to come up with creative engineering solutions.

Shared Mobility Models

The concept of "shared" extends beyond the Cruise Origin and is, in fact, expected to be a hallmark of Cruise AVs, a further reflection of the changing nature of transportation. The global population, particularly in cities, is growing rapidly. By 2030, the world is projected to have 39 megacities with more than 10 billion inhabitants. At the same time, we recognize that most privately owned vehicles spend most of their

time unused—and ride-sharing currently represents only a small fraction of vehicle miles driven in the U.S.

This presents opportunities to use vehicles more efficiently: decreasing the number of cars on the road, but also increasing utilization rates of those that remain by more people riding in them. Taking this another step, when passengers choose to ride together in shared cars or shuttles, they increase efficiency and reduce congestion even further.

Our customers not only understand these benefits—they are demanding them. The changes brought by the COVID-19 pandemic notwithstanding, there is a new desire for transportation access that doesn't necessarily include traditional ownership models. Although many of those models will remain strong in large parts of the U.S. and around the world, people everywhere, and especially the growing population in urban areas, are eager for a different type of relationship with transportation. This shift provides us with a tremendous opportunity to offer personalized, premium, on-demand solutions that connect customers to the people, places and moments that matter to them.



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Reimagining our urban landscapes means healthy, creative dialogues across multiple stakeholder groups—starting with people and leveraging the expertise in governments, companies and nonprofits. Our commitment to developing the future of cities is solidified by being a signatory to the Shared Mobility Principles for Livable Cities, a framework developed by a working group of international nongovernmental organizations to guide urban stakeholders and decision-makers. We have also experimented with peer-to-peer car-sharing and deploying EVs in high-mileage, shared-used applications. In these ways, we are advancing a mobility model that is helping make cities more livable and sustainable.

GM: Advocating Self-Driving Vehicle Safety Policy

Our self-driving vehicles undergo the same rigorous safety and durability testing as other GM production vehicles. Vehicle development fully addresses all 12 safety elements in the National Highway Traffic Safety Administration (NHTSA) voluntary guidance, Automated Driving Systems 2.0—A Vision for Safety. These are outlined in GM's first Self-Driving Safety Report, describing how safety is integrated into the development, testing and deployment of the Cruise AV.

Across the country at the state and federal levels, regulators and legislators are actively considering how to help foster and shape the evolution of AVs. GM is committed to a transparent and active collaboration with policymakers in this process. In particular, we are focused on discussing our mobility offerings with city officials across the U.S. and around the world, given that urban settings are the environment in which many of our advanced technologies will provide the most robust applications and value.

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A Delivery Fleet for Good

Among the ways Cruise responded to COVID-19 was by helping their neighbors in San Francisco, including local food banks looking for ways to scale their delivery and reach more households while people were sheltered in place. To support these crucial organizations, Cruise volunteered their all-electric, self-driving fleet to deliver meals across the city. Throughout the year, their test vehicles made over 100,000 contactless deliveries of groceries and meals to San Francisco's most vulnerable and underserved populations.



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Driver Assistance Technology

For GM, the move toward advanced driver assistance systems begins with Super Cruise, the world's first true hands-free driver assistance technology for enabled roads and available to drivers on more than 200,000 miles of roads in the United States and Canada.

The system allows drivers to remove their hands from the steering wheel, provided the driver maintains attention on the road ahead—a task supported by a driver attention system. LiDAR map data, GPS and a network of camera and radar sensors help keep the vehicle in its lane.

Initially introduced on the Cadillac CT6, an enhanced version of Super Cruise is available on the 2021 Cadillac CT5, CT4 and Escalade, and will launch on the GMC Sierra 1500 Denali in late model year 2022. Super Cruise will be available on 22 vehicles by the end of 2023, including the 2022 Chevrolet Bolt EUV and the GMC HUMMER EV.

An enhanced version of Super Cruise features new Lane Change on Demand functionality that allows the system to change lanes when requested by the driver and when certain conditions are met. The system provides information

such as “looking for an opening” or “changing lanes” to keep the driver informed on the status of a lane change or to let drivers know when a Lane Change on Demand is not possible. We made improvements to both our software and hardware. This included improving rear-facing sensors and advanced software algorithms so that the system can confidently track vehicles approaching from the rear. As a result of these improvements, as well as the inclusion of richer map data, we are able to ensure that Super Cruise will hold in its current lane and only change when a sufficient gap exists. The enhanced version of Super Cruise is made possible by GM's Vehicle Intelligence Platform, which provides the required electrical bandwidth and data processing power. Super Cruise is just one example of the increasingly capable driver-assist technologies available on our conventional vehicle portfolio.

85%

of current CT6 owners said they would prefer or only consider a vehicle equipped with Super Cruise.

7M

miles driven using Super Cruise.

22

vehicle models equipped with Super Cruise globally by the end of 2023.



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Urban Solutions



The World Economic Forum estimates that demand for urban last-mile delivery, fueled by e-commerce, will grow by 78% by 2030, leading to a 36% increase in delivery vehicles in the world's top 100 cities—further exacerbating urban congestion.

At the same time, this increase in demand is expected to cause delivery-related carbon emissions to rise by nearly one-third. The pandemic has only accelerated demand, as e-commerce has become a lifeline to goods and services that many people are no longer willing or able to access in person.

Logistics companies, which manage fleets of many thousands of vehicles, are on the front lines of these challenges, rising to meet demand while addressing the associated increases in emissions and congestion. GM's Global Innovation organization approached this situation through the lens of our zero-zero-zero vision, imagining what it would take to transform delivery and logistics for an all-electric future. Our solution: BrightDrop, an ecosystem of electric first-to-last-mile products, software and services to empower companies to move goods more efficiently. BrightDrop is designed to help businesses lower costs, maximize productivity, improve employee safety and freight security, and operate more sustainably with products that work together intelligently and with zero emissions.

The first products in the BrightDrop range include the BrightDrop EP1, an electric-propelled pallet that helps reduce the time and physical effort required for couriers to get goods from the delivery van to the front door. The pallets are designed for optimal loading into delivery vehicles and can be tethered together for larger drops,

helping to reduce errors, secure packages, reduce the strain on drivers and enable more efficient delivery. Made available in early 2021, EP1 pallets travel in the EV600—an electric light commercial vehicle built for the delivery of goods and services over long ranges. It will combine zero-emissions driving, powered by the Ultium Platform, with a range of advanced safety and convenience features. Supporting these products will be a suite of fleet management tools that enable owners to monitor battery life, vehicle location and more.

One of BrightDrop's first customers is FedEx Express, which has already conducted a pilot using the EP1. During the pilot, FedEx Express couriers handled 25% more packages per day than they could without EP1s, and reported that the pallets were easy to maneuver and reduced physical strain. BrightDrop and FedEx Express are continuing to pilot EP1 technology, and will begin receiving EV600 vehicles later in 2021.

Addressing Congestion Through Public Policy

According to the Texas A&M Transportation Institute, total delays and costs associated with congestion across the United States have grown in recent decades. Studies focused on specific states or regions identify similar trends. For example, in Massachusetts, automobile commute times increased about 10% between 2008 and 2017. In California, state data show that the number of

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hours vehicles spent traveling below 35 miles per hour on state highways more than doubled over the same time period. This has cost the economy as much as \$1 trillion annually in lost productivity due to traffic slowdowns of workers and goods.

GM is optimistic about the ability of innovations in connectivity—most notably vehicle-to-vehicle and vehicle-to-infrastructure communication—and autonomous vehicle technology to optimize traffic flows and reduce accidents, both potential contributors to easing congestion. As noted elsewhere in this report, GM is hard at work developing and commercializing the technology to enable these advances. At the same time, GM recognizes the potential contributions of policy-driven approaches to meeting congestion challenges. Many cities and states are already exploring these policies, finding that there could be a variety of ways to improve mobility for their residents. For example, cities across the U.S. are supporting new mobility options to ease gridlock on streets and highways. Shared-mobility platforms, such as carsharing and ridehailing; and micromobility solutions like e-bikes, and thoughtfully designed last-mile urban delivery solutions, can complement legacy transit systems to relieve streets and highways of vehicles and give people choices for travel that better fit their trip types and needs.

Ultimately, transit services, intelligent curb management and well-developed bike lanes and sidewalks, as well as developing forward-looking regulatory structures that support shared and

micromobility operators can be part of an all-of-the-above strategy that complements driving, eases the introduction of new technologies and services, and facilitates less congested travel across all modes. That is why GM has advocated for regulatory frameworks that support carsharing, e-bike and new urban delivery ventures, and why we see value in investments in broader transit and transportation infrastructure.

Some cities are also beginning to explore policies that manage transportation demand, including congestion pricing—charging a flat or variable fee to vehicles that drive in a specific area or zone. Evidence from early-adopter cities around the world suggests that congestion pricing can be effective in reducing traffic volumes and delays and increasing average travel speeds. Other options, such as telecommuting incentives, may prove effective and align with the mass shift to remote work that has occurred during the COVID-19 pandemic. As part of a comprehensive approach that includes new technologies, demand management through pricing and incentives—when strategically and thoughtfully implemented—could play a valuable role in mitigating congestion in urban areas.

GM has a well-established track record of engagement with innovative city and mobility initiatives, from the Smart Cities Challenge in Columbus, Ohio, to targeted carsharing partnerships in underserved neighborhoods in Detroit. As cities continue to explore ways to tackle congestion in their communities, GM looks forward to building on this foundation through partnerships and constructive dialogue with stakeholders, pilot projects and other efforts that seek to leverage public policy to realize our vision of a future in which people can enjoy the freedom, convenience and comfort of vehicle use in cities free of congestion.

This sets the stage for deploying connected vehicle technology to improve safety and relieve congestion by one day allowing vehicles to communicate with one another and the infrastructure. Equally important, this has provided us with an understanding and appreciation that offering a vehicle with the latest technology is only meaningful when it is seamlessly integrated, as well as consistent and relevant to our customers.

