NOVEMBER 22, 2021

Gallup Mobility Investment District Report and Delivery Plan

City of Gallup
Greater Gallup Economic Development Corporation

GLDPARTNERS | GLOBAL LOGISTICS DEVELOPMENT PARTNERS

GLDPARTNERS

Contents

Executive Summary 3
Gallup Mobility Investment District Report and Action Plan 7
Overview 7
New Mexico Mobility Strategy 7
Next Generation Truck Technologies in Gallup 8
Gallup's Competitive Advantage 9
Truck Segment Overview 9
Commercial Truck Manufacturers 10
The Future of the Trucking Industry 11
Policy Action: New Mexico HB 270 12
NM Mobility Laboratory 12
New Mexico Mobility Strategy Recommendations 15
Gallup Mobility Investment Plan 17
Gallup Mobility Investment District 18
Truck Testing and Development Complex 19
Truck Mobility Complex/Gallup TradePort 19
Truck Technology Testing Corridors 19
Short-Term Actions 21
Mid-Term Actions 21
Industry Reaction to the GMID 21
Ports Interest 22
Press Interest 22
Project Execution 23
Gallup Mobility Investment Plan: Funding Options 23
Mobility Testing and Development Complex 24
Going Forward: Implementation of the Gallup Mobility Investment Plan 25
Gallup Mobility Investment District Implementation Strategy 26
Appendix A – Gallup Testing and Development Facility, Corridor Terminus Hub Cost Estimate 27
Appendix B - Gallup Mobility Investment District – Targeted Industry Analysis 28
Appendix C - Abbreviations and Acronyms 47

Executive Summary

Following the completion of the New Mexico Mobility Strategy (NMMS) and the identification of a recommended mobility hub in Gallup, a review with the Greater Gallup Economic Development Corporation (GGEDC) led to interest to advance the region as mobility leader in the State. Based upon Gallup's location as the gateway to New Mexico on Interstate 40 and its long history as the center of logistics and transportation for Northwest New Mexico, it is appropriate for Gallup to take on the leadership role in adopting new transportation technologies in New Mexico. Toward developing the Gallup Mobility Investment District (GMID), GGEDC crafted the scope of this project to be a City of Gallup economic development initiative to create assets that will support long-term investment and jobs in the City and the wider region.

Working from the direction recommended in the NMMS, the focus of this project is to establish Gallup as an important hub for the testing, development and deployment of new truck technologies.

- To help guide the project, GGEDC created an Autonomous Working Group comprised of civic and business leaders. This group has met a number of times with GLDPartners to review and vet the recommendations.
- During the project, GLDPartners also met with City leaders including the City Manager, Mayor and Council to review the scope of the project and recommendations. In addition, GLDPartners met with County officials and other business leaders to explain the project and receive feedback.
- During the project, GLDPartners reviewed over 15 local planning documents including the City's Transportation Plan, Planning and Zoning Plans, and General Plan to understand issues related to the development of a community mobility strategy. Broadly speaking, GLDPartners found that as proposed, the GMID would not require significant adjustments to City planning documents or ordinances. The key issues that were identified related to the following:
    - The updated Gallup Transportation Plan should take into account the anticipated GMID and Truck Mobility Complex,
    - Separate from the GMID, the updated Gallup Transportation Plan should discuss how the City should embrace community-oriented mobility solutions such as the deployment of transit services,
    - Since the market focus of the GMID is specifically on heavy truck products and highway testing, there will be no anticipated impact to City streets, with the exception of modest amounts of truck traffic moving from I-40 to the testing complex.
- GLDPartners was to provide input on and provide advice for the upcoming Gallup Airport Feasibility Study and Air Service analysis.
- GLDPartners also helped structure and participated in the GGEDC Mobility Roundtable which was an important event where local leaders, State officials, and mobility industry representatives gathered virtually to discuss mobility and the potential for development in Gallup.

At the outset of the project, GLDPartners recommended that the testing complex be built at the Gallup Municipal Airport on land that was owned by the City. From past experience on similar projects, it was envisioned that the testing complex could coexist with the Airport's operation and create economic value from otherwise underused City-owned property. The Airport property was chosen as an ideal asset due to its long linear dimensions and because it was close to an I-40 interchange. During the course of the project, the FAA indicated that though this use may be acceptable to them, they would require an updated Airport Layout Plan to be completed and submitted for their approval. In addition to the cost for preparing this, this process would likely require 12-18 months so it was determined that the mobility project should considering alternative locations. If the Airport asset cannot be used and there are no other suitable

publicly owned properties, then a private asset will need to be considered. This will have cost implications and will require a willing owner to sell or lease property. Other locations have not yet been formally considered by the City or GGEDC.

Recommendations:

Related to the City of Gallup

1. Pursue USDoT Regional Accelerator Designation for the Truck Mobility Complex – This is a one-time opportunity to establish the project as part of a short-list of nationally significant projects. The RIA program is a new and a quite unique effort created by the federal government to identify projects that can have national significance. The government intends to support these projects with grant funding (potentially to $3M) over the first three years, but the real underlying intent is to become a project partner and support with direct construction investments. GLDPartners has successfully structured a logistics mobility RIA project in its California Inland Port project and USDoT has indicated that they'd like to replicate it elsewhere in the country. If the proposal were submitted in partnership with the Port of Los Angeles, given the current attention to national supply chain challenges the proposal would likely be considered favorably.
    a. With an intersection at the Port of Los Angeles, we believe that USDoT will react well to a two-corridor proposal from New Mexico. This would require a joint proposal and coordination of twin projects on I-40 and I-10. If submitted with State support and PoLA partnership, this would be a very enticing proposal to USDoT.
    b. Bring private players in as supporters and future partners
2. Develop a Testing and Development Complex (TDC) in the City, with accommodation for various testing environments, an administration building and client/tenant buildings.
    a. Fully built out, this facility would require approximately 200 acres of land but could be launched on a smaller parcel of approximately 100-125 acres of land. Proximity to the Interstate highway is critical and the site should be relatively flat, with access to utilities, and have a elongated configuration to allow for development of a 7000' straightway.
    b. Construction funding will be required by the State, with some support from the City. The City should provide the land and fund project planning/development costs leading to construction and launch of operations.
3. Establish a national-scale truck testing corridor with Gallup as the hub, and extending westward to the Ports complex in Los Angeles, and to the east to Albuquerque.
    a. Port of LA partnership - This will be a long-distance autonomous truck and zero-emission truck corridor with origin-destination points in Los Angeles and Gallup.
    b. State of NM partnership - This will be a short/medium autonomous truck and zero-emission truck corridor with origin-destination points in Gallup and Albuquerque.
    c. State of NM designation – It's important that the State formally designate I-40 as a testing corridor, this allowing a stronger platform for attracting testing business and would establish New Mexico's bona fides in the mobility sector. This action is also be very important for formalizing the relationship with the Port of Los Angeles.
4. Begin planning for development of Truck Mobility Complex – This project will evolve from the business relationship and market strength developed by the TDC and it should take the first steps toward advancement at the point that the TDC is funded and under engineering and after the Port of Los Angeles testing corridor is launched. In this regard, the project can shape and take advantage of the momentum and business standing that will have been established over the next year. If the project were successfully received by the USDoT for RIA designation, the project would have the US government as a project partner and would be funded through its planning period.

Due to investment through direct funding and via USDoT's financing programs , the project would receive funding support from the federal government for its development.

5. Create an operating structure to manage the TDC facility – It is important to understand that the TDC will be a living entity whose success will depend on its business success in attracting and sustaining testing and development business activity. This will require experienced capacity to manage business development and business relationships, and ongoing facility operations.
6. Business Development/Targets – In the near-term, prepare actions for developing clients for the Testing and Development Complex. This business development function is associated with the management of the facility and should be handled within that management group. The economic development potential for long-term manufacturing and production as well as logistics investment will follow companies using the testing and development complex, and should begin to take shape upon the opening of the TDC in approximately 18 months.
7. Workforce Development – Begin working with local workforce development organizations to design training programs and curriculum in conjunction with both the high schools and post-secondary institutions to prepare workers for technician positions in the mobility sector. This skill training will be valuable for positions in the testing and development of truck autonomy as well as in the industries that are identified in the Target Industry Analysis.
8. Begin action/delivery program in November, 2021
    a. Secure GLDPartners as a delivery partner in the capacity of development strategy manager; to prepare USDoT RIA proposal, develop Port of Los Angeles partnership, advance the Testing and Development Complex plan/engineering, begin formal actions to develop testing clients, prepare operating entity and coordinate actions with the State (for RIA proposal and corridor designation)
    b. Create first stage of partnership with the Port of Los Angeles to allow for: 1) demonstration to the State of the depth and gravity of the opportunity and to support funding for the Testing and Development Complex, 2) to support the designation and development of the Testing Corridor, and 3) to support the proposal to USDoT for RIA designation.
    c. Agree on plan to submit USDoT RIA proposal for the Truck Mobility Complex which will likely have a submission deadline in early February, 2022. This will require more than a grant application, rather the submission will require a detailed roadmap and business plan for the development of the Truck Mobility Complex.
    d. Advance land acquisition for the Testing and Development Complex. It is important to have secured the land by the time a funding request is made for State funding. If this were to occur in the 2022 Legislative Session, land should be secured in the next few months.

<u>Related to the State</u> – these recommendations were made for the NMMS and action would contribute to the success of the Gallup Mobility Investment District. If the State were to not advance action on these recommendations it may negatively limit the project's long-term success but the project can stand on its own and sustain a degree of success without State actions.

1. In conjunction with the City of Gallup and Dona Ana County, pursue USDoT Regional Accelerator Designation for the Truck Mobility Complex – This is a one-time opportunity to establish the project as part of a short-list of nationally significant projects. The RIA program is a new and a quite unique effort created by the federal government to identify projects that can have national significance. The government intends to support these projects with grant funding (potentially to $3M) over the first three years, but the real underlying intent is to become a project partner and support with direct construction investments. GLDPartners has successfully structured a logistics

mobility RIA project in its California Inland Port project and USDoT has indicated that they'd like to replicate it elsewhere in the country. If the proposal were submitted in partnership with the Port of Los Angeles, given the current attention to national supply chain challenges the proposal would likely be considered favorably.

   a. With an intersection at the Port of Los Angeles, we believe that USDoT will react well to a two-corridor proposal from New Mexico. This would require a joint proposal and coordination of twin projects on I-40 and I-10. If submitted with State support and PoLA partnership, this would be a very enticing proposal to USDoT.
   b. Bring private players in as supporters and future partners.

2. Declare New Mexico's Strategy to Develop as National Mobility Leader – The State should proclaim New Mexico as a new competitor in the mobility sector.
3. Create and Fund Mobility Investment Delivery Structure – The State should consider creating a specialized mobility delivery entity that would be a joint venture including State, local government partners and automotive/technology industry partners to develop and operate various mobility assets around the State.
4. Mobility Investment Incentives – Develop hubs for mobility technology investment and support with highly targeted incentives to support economic development versus key competition
   a. With local government and private investment partners, plan and develop mobility investment sites near to testing hubs to support permanent R&D centers, production and supply chain investment.
   b. Develop applied incentives to support private production investment, some examples:
      i. In-state tuition at any New Mexico public higher educational institution to all employees and their families of companies that establish an autonomous vehicle testing and development program
      ii. Sales tax exemption for 5 years on equipment and materials used in a research and development operation connected with the testing and development of mobility technologies
      iii. Transferable tax credit available to New Mexico VCs making debt or equity capital investments in start-up or developing companies testing mobility technologies in New Mexico.
      iv. A discretionary grant program available to companies that make investments in facilities for R&D, production/assembly, or supply chain management.
      v. A special discretionary grant program could be offered for mobility companies that undertake crossover technology investment - from ground mobility to aerospace mobility.
5. Binational Mobility Zone - Coordinate with Mexican government and State of Chihuahua regarding an integrated auto supply chain proposition, with focus on the linkage for both border and interior New Mexico assets
6. Develop and Create a Specialized National Hub for Aerospace/Ground Mobility – Develop a partnership with the Air Force Research Laboratory to pursue investments from companies with technology and corporate interest to bridge wheeled mobility and aerospace mobility applications.
7. Strengthen the Automotive Technology-Related Academic Offer – The New Mexico Higher Education Department should offer support to the community colleges to ensure that their programs are aligned with industry requirements.
8. Improve Business Travel Connectivity to Important Domestic & Global Automotive Technology Hubs – Develop increased commercial passenger air service to key research and supply chain centers in Silicon Valley, Los Angeles, Detroit and New York, and then for efficient onward

connections to Japan, South Korea, China, Taiwan, UK, Germany and France. For Gallup, in the intermediate term it is important to have passenger service to a switching hub for onward connections.

9. Create a National Epicenter for Emerging Mobility Technology Companies – Establish the State as a center for small technology companies in the mobility sector. This would help to monetize New Mexico's special federal research assets and focus attention on smaller technology businesses.
    a. Create and support specific program collaboration between federal laboratories and technology small business
    b. Offer small businesses direct support in understanding the public sector procurement market for mobility products
    c. Match out-of-state entrepreneurs to venture financing and develop collaboration with larger partner companies already involved in the NM Mobility Laboratory

Gallup Mobility Investment District Report and Action Plan

In 2020, GLDPartners was retained by the New Mexico Economic Development Department to develop a New Mexico Mobility Strategy (NMMS). To the extent possible, the project's scope was to position the State as a leading player in the rapidly growing new global mobility sector. By advancing New Mexico's mobility strategy, the State's goal was to support industry to bring practical and safe mobility solutions to its communities, and to create the opportunity for investment attraction and economic development. A core assumption for this project was that the pace of change and growth in the mobility sector would create significant new research and development, production, and supply chain investment projects and that an integrated strategy could establish New Mexico as a realistic competitor.

Overview

New Mexico Mobility Strategy

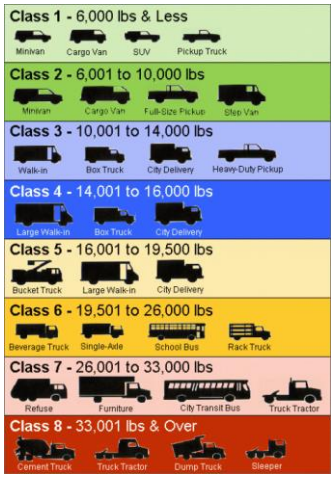
The NMMS called for the State and its partners to develop and deliver a product that uniquely stands out versus the competition and to create an especially compelling business proposition that would meet the needs of the industry in a manner that is different, better and more durable than its competition. The strategy called for the creation of the New Mexico Mobility Laboratory which would be composed of mobility hubs in Gallup, Albuquerque and Southern New Mexico. This integrated statewide mobility product would create a one-of-a-kind offer for automotive OEMs and technology companies to support their testing and product development requirements with the ultimate objective of positioning New Mexico to become a center of the emerging automotive technology sector.

Until the 2021 New Mexico Legislative Session, the State of New Mexico had lagged in the US in regard to developing regulation, policy, and investment strategy to support research and development and to accommodate the requirements of the mobility sector. Other states have devised and implemented specialized regulations to support testing on public roads and clarified licensing and permitting requirements. Some states have issued executive orders pertaining to these issues, but in all, over 44 states had devised some standards or policy. Fortunately, in the 2021 legislative session, HB 270 passed which updates the New Mexico transportation statutes to include autonomous vehicles and commits NMDoT to promulgate rules which will allow for autonomous vehicle testing on New Mexico highways.

In the NMMS, it was recommended that a series of actions and assets be developed in the Gallup region. The recommended Gallup specialization was to create a primary focus on heavy and medium-weight cargo transportation equipment. Gallup's concentration on next-generation truck technologies could capitalize on its location, access to highway infrastructure, direct linkage to the busiest ports complex in North America (Los Angeles and Long Beach) and for easy same-day multistate highway testing. Supporting the development of truck mobility technology (both autonomy and advanced propulsion) with specialized infrastructure could provide value and attract investment from technology developers and manufacturers of automobiles. Gallup could have the chance to create a specialized niche offering that could stand-out to industry.

Next Generation Truck Technologies in Gallup

Technological advancements have set the stage for a massive disruption to the existing trucking industry. With their promise of increased safety, improved productivity and lower costs, autonomous guidance technology in long haul, mid-mile and last mile trucking will significantly alter the shape of the trucking industry. Similarly, tremendous advancement in electric and hydrogen powertrains have created a new propulsion system paradigm that will reduce long-term operating costs and have an enormous and positive impact on air quality by reducing harmful emissions.



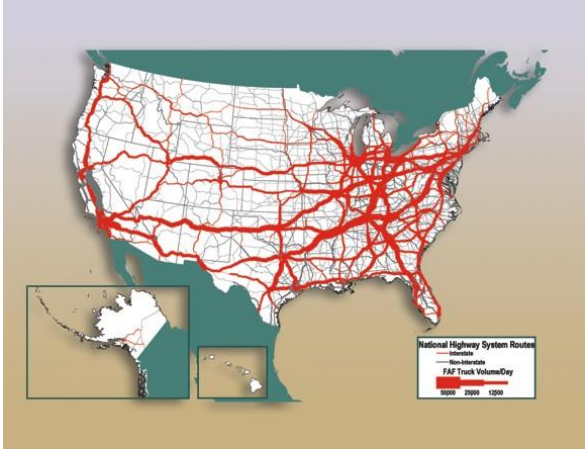
In recent years, the autonomous vehicle eco-system has increasingly shifted its attention to truck technology applications, specifically Class 8 tractor-trailers. Below, we illustrate the various truck equipment classifications ranging from Class 1 through Class 8, beginning with small personal trucks through large commercial vehicles.

The stakes for getting there first in the large commercial truck market are enormous. While much of the public is captivated by stories about driverless cars, analysts and economists believe the development and adoption of autonomous vehicles will be much swifter in the heavy-trucking market.

The economics for the trucking industry in terms of cost savings, as well as enabling new services, is more compelling than for consumer vehicles. Drivers, for example, account for about 33 percent of trucking operating costs and eventually, self-driving trucks will just be a set of wheels, a frame, an engine and a computer. This will allow manufacturers to scale down the size and weight of the truck, allowing carriers to haul heavier loads and higher rates per trip. McKinsey is projecting that full autonomy could cut operating costs by 45% in the US alone, where the $800B trucking industry transports 70% of the nation's consumable goods. McKinsey is also projecting that fully autonomous trucks, which are not subject to hours-of-service regulations, will also be able to drive up to 20 hours a day, enabling greater utilization (today's trucks are less than 60% utilized) and a fleet reduction of up to 20%.

More companies are deploying autonomous trucks on public roads which puts them well on their way to commercialization. While some of these routes are still for demonstration purposes only, others are regular revenue-generating runs with paying shippers. Granted, all these trucks currently have safety drivers on board, but shippers' willingness to entrust to autonomous technology their cargo and logistics networks—and the safety of fellow road users—speaks to market confidence.

Gallup's Competitive Advantage



Gallup is physically located along the I-40 interstate corridor, which is the most heavily trafficked cross-country interstate highway in the United States. This USDoT map depicts truck traffic flows on major and connecting arterials and associated data indicates that over the whole of the national system, I-40 carries more truck traffic than any other transcontinental highway. This is largely due to I-40 providing efficient truck supply chain connectivity between the Southern California market (and the seaports complex at Los Angeles/Long Beach) and Midwest, Mid-Atlantic and Northeast US consumption and production markets. According to NMDoT statistics, the I-40 segment that runs through Gallup carries over 6,000 trucks per day and is the busiest truck segment in the State of New Mexico.

Gallup presents itself as an ideal location for specifically Class 8 tractor-trailers to perform both closed course testing and public highway testing. Trucking is the dominant mode of freight transport to, through and from the New Mexico. In fact, trucks carry over 70% of the nation's freight on a tonnage basis and virtually all goods consumed in the United States are shipped by truck for at least part of their trip to the consumer. Because of the issues of driver shortages, time in service restrictions and most importantly trucking's impact on the environment, the goods movement sector is the logistics sector that is moving most rapidly to adopt new technologies. Heavy-duty freight trucks are disproportionate contributors to pollution. Most are powered by diesel engines that, especially in older models, can emit high levels of particulates, nitrogen oxides, and other pollutants.

Over the next 5-10 years, market adoption will accelerate for deployed autonomous truck and electric and hydrogen trucks and this will occur at varying paces. Autonomous trucking holds promise in an industry that has increasingly struggled to secure enough long-haul drivers and to contain costs. Autonomous trucking will initially be centered around 1) high density long-haul point to point routes between urban markets, and 2) mid or last mile applications, especially on repetitive routes. There are currently a substantial number of highway trials now underway between technology developers, truck OEMs and major shippers refining the technology, with early long-haul point-to-point applications expected to begin in the next few years and accelerating to become a significant portion of some high-volume long-haul markets. We are now beginning to see real-world commercial deployment of autonomous truck services in the mid and last mile segments, with significant growth expected over the next two decades.

In the Southwest US, Waymo-Via is testing Paccar Peterbilt trucks running from Dallas west to El Paso and Dallas east to Houston. This will help the company spread out operations in Texas across the I-10 and I-20. The location is well situated to support long-haul routes across state borders and connect with Waymo's Phoenix operations center. Also, the Ryder System and Ike Robotics are testing on the Dallas-Houston corridor and Tu Simple is collaborating with UPS to run a fleet of autonomous trucks hauling goods between freight depots in Phoenix, Tucson, Los Cruces, Dallas, El Paso, Houston and San Antonio.

Truck Segment Overview

Truck Technology (Powertrain + Autonomy)

In the powertrain technology space, advances in electric and hydrogen propulsion systems have defined a radical transformation of the trucking industry that is occurring now and will accelerate over the next five years. Both legacy truck OEMs and new-entrant technology companies and manufacturers have brought or are now bringing a raft of new products to market in the Class 8 heavy truck category and in specialty and light and medium-duty trucks.

Electric truck powertrain technology for last mile and mid-mile deployments has evolved quickly and is becoming the preferred technology by fleets, witness Amazon's investment in and purchase of 100,000 vehicles from Rivian a start-up located in Michigan. Amazon is just now deploying the first of those vehicles in Los Angeles, acting on its goal to operate a carbon neutral fleet by 2040.

Another player in this medium duty electric truck category is Workhorse who is building vehicles for others including UPS and FedEx. Heavy truck electric powertrain technology is also developing quickly with companies like BYD, Daimler Trucks, Paccar, Scania, Tesla and Volvo bringing new products forward. According to a Forbes article, the total cost of ownership for electric freight trucks could be 50% cheaper than for diesel trucks by 2030, generating billions in savings. Plunging costs, ever-increasing battery range, and an expanding fast charging network are creating an on-ramp to an electrified trucking future.

Autonomous trucks are best suited to long-distance highway driving, while it is expected that humans will be needed to navigate freight carriers on local streets and handle non-driving tasks for some years to come. Many industry experts and technology developers expect that self-driving trucks will soon be deployed on the open highway, but that it will take far longer (perhaps several decades) before driverless trucks will be able to routinely navigate local streets packed with cars, pedestrians, cyclists, road work, and other unexpected challenges. Additionally, humans will also be needed to handle the many non-driving tasks that drivers currently perform, such as coupling tractors and trailers, fueling, inspections, paperwork, communicating with customers, loading and unloading, etc.

The most likely scenario for widespread truck autonomy adoption involves local human drivers bringing trailers from factories or warehouses to a truck mobility center located on the outskirts of metropolitan regions near to a major highway exit. Here, they will swap the trailers over to autonomous tractors for long stretches of open highway driving between major supply chain points. At the other end, the process will happen in reverse: a human driver will pick up the trailer at a truck mobility center and take it to the final destination.

There are dozens of companies currently engaged in the research and product development of the technology components and integrated whole truck system products to support autonomous trucks. This list includes large legacy OEMs such as Daimler Trucks and PACCAR, to new small technology companies such as Einride. Much of this development is occurring in the US, but the there is substantial development happening in Europe and Asia as well.

Commercial Truck Manufacturers

Daimler Trucks - Owner of the Freightliner, Mercedes Benz, Mitsubishi Fuso, Western Star, and BharaBenz truck brands, Daimler Trucks is the world's largest commercial truck manufacturer and has been pursuing autonomous trucking for over five years. In 2019, they bought a majority stake in self-driving tech firm Torc Robotics, which has Level 4 autonomous technology. In 2020, Daimler released the Freightliner Cascadia, the first heavy-duty production commercial truck in the market with Level 2 autonomy.

Volvo Trucks - The world's second-largest truck manufacturer, which owns Renault Trucks, Mack Trucks, and UD Trucks brands, as well as separate JVs with Dongfeng and Eicher, signed a multi-year partnership in Jun 2019 with Nvidia to develop an autonomous driving system for commercial vehicles. In 2018 Volvo partnered with FedEx to demonstrate a 3-truck platoon and in the same year it announced its own - electric vehicle called Vera, designed for shorter, repetitive assignments (e.g., hauling goods between logistics centers and ports). Volvo has also announced a dedicated business group called Volvo Autonomous Solutions, focused on moving large volumes on pre-defined routes for customers.
Navistar - Commercial truck manufacturer Navistar is collaborating with VW/TRATON (which owns 17% of Navistar) through a strategic alliance to develop autonomous tech. 70% of Navistar's heavy Class 8 trucks now include at least one automated system (e.g., lane-keeping, crash mitigation, advanced cruise control).
Paccar - Owner of the Kenworth, Peterbilt, and DAF Trucks brands, Paccar is reportedly making trucks with Level 4 autonomy and "auto-docking" features that should be ready "within the next few years. This work is taking place at the Paccar Innovation Center in the Silicon Valley.
Ford Otosan - Ford's Turkish subsidiary Ford Otosan unveiled its F-Vision autonomous electric truck concept last year, designed as a Level 4 vehicle with platoon capability and connectivity.
ZF Friedrichshafen - German car parts & systems manufacturer ZF Friedrichshafen announced it would invest $14B+ in automation and electric tech until 2023. ZF affirms that, in the early stages, autonomous trucks are best suited for closed environments like freight terminals and ports.
Tesla Motors - Tesla plans to integrates its Autopilot technology into the Tesla Semi electric trucks promised to come to market in 2020, in a semi-autonomous mode. However, their CEO recently announced that after several previous delays, supply-chain problems have caused Tesla to once again push out its estimated date for production of its battery-electric Class 8 Semi truck until 2023. Several large companies — e.g., PepsiCo, Walmart, JB Hunt — have placed pre-orders.
PlusAI - Founded in 2016, autonomous truck manufacturer PlusAI has already passed a $1B valuation. The company has deep connections with China and has announced joint ventures with China's oldest truck manufacturer to produce a Level 4 truck in 3-5 years. PlusAI is using Nvidia chips in its vehicles.
Rivian - Electric automaker Rivian, made headlines with an order from Amazon for 100,000 vans by 2024, but is also working on autonomous vehicles from its San Jose and Irvine locations. Its R1T pickup and R1S SUV launched in 2020 have autonomous controls and its current goal is to bring Level 3 autonomy to its vehicles.
Einride - Swedish autonomous vehicle startup Einride makes T-Pods which has no driver cabin and is powered by the Nvidia Drive platform. This vehicle is smaller than a traditional truck but intended to carry freight. Einride's vehicles have Level 4 autonomy and are remotely controlled from miles away (with one operator supervising up to 10 pods). T-Pods have been operating on public roads since May 2019. Einride is currently targeting the US market.

The Future of the Trucking Industry

All future freight transportation solutions will need to be more affordable, efficient, clean, and safe to meet customer needs and broader societal demands. Technology and fuel choices will be essential for meeting the varying needs of commercial truck customers. Multiple fuel options, including natural gas, propane, electricity, hydrogen and diesel, will all play a role in future commercial truck markets. Research work in areas such as high efficiency engines, advanced domestically sourced fuels, connected and automated vehicle systems, electrified drivetrains, and hydrogen fuel cells will lay the groundwork to create these future transportation solutions.

The integration of autonomous trucks into the massive over the road logistics system will have a major impact on what are now substantial constraints on moving freight between 300 and 1,000 miles. The use of new truck technology will also allow the trucking industry to move over longer distances, including massive volumes moving to and from the major gateway seaports. This dynamic will provide alternatives to moving freight by rail.

Policy Action: New Mexico HB 270

With the passage of HB 270, New Mexico joined over 44 other states in enacting legislation or issuing executive orders regarding the testing and or deployment of autonomous vehicles. So far, the Federal Government has failed to enact regulations, so it has been left up to individual state governments to begin to enact policies. AVs have the potential for tremendous safety benefits, but it will be decades until all vehicles on the road will be autonomous, and perhaps they never will. Until then, autonomous vehicles will need to share the road safely with human drivers.

HB 270 allows for the testing of autonomous vehicles on the highways but stops short of allowing autonomous vehicles to operate without restriction on the roads of New Mexico which includes interstates, US and State highways. But the legislation very clearly creates a framework for vehicle testing and by its passage indicates that the State is willing to make appropriate investments in the technology of highway networks to facilitate communication involving autonomous vehicles, and to enable the operation of autonomous vehicles to be safe and efficient. This legislation has sent a message to the industry that it welcomes their investment

The legislation also allows for another freight movement innovation being tested on US highways, platooning which is using the improved driving systems that are currently employed in trucks to allow for trucking rigs to arrange in formations. These formations, which are controlled by computers, communicate with one another, and follow closely behind other trucks in their fleet. It is all made possible through telematics: the sending, receiving and storing of information via telecommunication devices to the trucks. The result is a line of heavy vehicles heading in the same direction, one after the other.
Platooning is a real cost-saver in terms of fuel consumption and emissions. The combined line of trucks works to combat wind resistance and traffic congestion. It also works as a safety feature for the public as well. Instead of many trucks dotted all over the roads, this method creates a single, predictable file of large vehicles. A good example of this in practice is the work done by Peloton. The company is specializing in platoon technology and has proven fuel savings of 4.5% for the lead truck, and 10% for the following truck. The US Department of Transportation estimates that congestion on our highways costs the freight industry $60B annually. Exploiting connected vehicle platooning should have an impact on lowering these costs. For several years, Peloton has been testing platooning on the I-10 corridor, Utah and Florida.

NM Mobility Laboratory

Background: New Mexico Mobility Strategy and the Competition

Several states have made efforts to address the industry from a regulatory perspective, but few have truly defined an integrated plan to regulate, support development and deployment, and production investment. Due to the legacy presence of the automotive industry in Michigan , the State of Michigan has invested substantial resources to develop global-standard testing and development infrastructure, but even this is fairly limited in scope. A number of states including Pennsylvania, California, Nevada and

Utah have focused specifically on what automotive and technology companies can and cannot do in the context of testing products on public roads.

A few states have advanced work to support testing and development at publicly financed facilities (Florida and Ohio), but even in these situations there is fairly little overall research/economic development strategy associated with these projects.

Facility	Location
American Center for Mobility	Ypsilanti, Michigan
M-City	Ann Arbor, Michigan
GoMentum Station	Concord, California
SunTrax	Lakeland, Florida
California AutoTech Testing and Development Center	Atwater, California
Smart Mobility Advanced Research Test	Logan County, Ohio

Mobility Sector Company Requirements

Supporting their evolutionary engineering and product development, companies are generally researching and innovating inside their labs and then testing in the field. From the results of field tests, iterative recalibrations are done to hardware and changes to software are made – then quickly back to field testing, and this cycle repeats many times until satisfaction with the product and its performance is reached. This process goes on for months and in some cases for years and creates a frenetic pace of lab-to-field work, then back to lab for technical adjustments and then the process repeats over again.

Product research and development is defined around three different kinds of testing facility requirements. The first level of core research and product development is conducted in the technology lab, the second level of testing is done in the field but in a controlled, purpose-designed closed course environment, and the third level of testing and product development is carried out on public roads in a real-world environment.

NM Mobility Laboratory Components

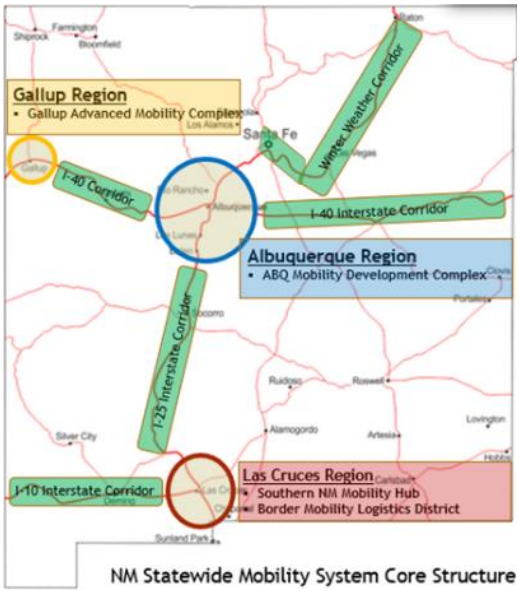
As proposed, the full NM Mobility Laboratory is comprised of a system of assets that would be variably valuable for companies that are involved in the development of core technology and applied products for the wide mobility industry. Taken together with all of its components, the NMMS would create a package that would create a system that is far and away beyond any other state. If fully implemented, New Mexico would be recognized as an important player in the global mobility sector and over time the State would become a hub for investment from the sector.

As was detailed in the NMMS, the main components of the Laboratory are:

1. On and off public road testing – closed-course and public road environments
2. Changes to regulatory regulations, one-stop system for multiple road environments

3. Dedicated expertise for supporting testing, development and certification
4. Special incentives for in-State investments and research presence

The NMMS recommended that three mobility hubs be developed, each with a different focus. Additionally, the highway corridors that connect these three hubs would also be part of the overall system. The strategy would create an array of assets that would focus on both truck and passenger vehicle development and deployment. Hubs were proposed in Gallup, Albuquerque and in the Las Cruces region. In terms of cargo movement technologies, the Strategy sought to take advantage of the two transcontinental Interstate highway corridors, with assets along both I-10 and I-40.



Albuquerque Mobility Hub

Characteristics: This would be an anchor to the Statewide product offer and function as a hub, connecting I-10 to I-40 via I-25. The Albuquerque Mobility Hub would offer the following:

- Access to a complex public road system in a large-sized urban region road system; including a downtown grid, international airport and university district
- Urban transit and transportation routes for senior centers, libraries, local government services centers, passenger rail access points and the Sunport
- Direct urban and extra-urban access to the East-West I-40 transcontinental highway tier and connectivity to Arizona and Texas
- Direct urban and extra-urban access to the North-South I-25 interstate highway and connectivity to Colorado, Texas and Mexico
- A purpose-designed closed-course testing complex providing a secure environment and use of customized multi-zone testing and development zones, buildings for onsite product development and collaboration space with federal labs, other companies and universities, secure and high-capacity uplink data transmission infrastructure
- Corridor Terminus Depot for highway testing
- Albuquerque Mobility Investment District sites for supporting investment in R&D, production and logistics

Gallup Mobility Hub

Characteristics: The Gallup Mobility Hub would provide a specialty product with a focus on truck technologies, providing the following:

- Direct access to the East-West I-40 transcontinental highway tier and connectivity to Arizona and Texas
- Closed course testing and development specifically focused on truck autonomy and powertrain technologies
- Truck Mobility Complex, for supporting real-world deployment of truck autonomy, cargo handling and support for zero-emissions powertrains
- Near access to New Mexico/Arizona border and easy testing in both states
- Corridor Terminus Depot for I-40 ABQ-Gallup highway testing and for long-run rural route testing
- Secure and high-capacity uplink data transmission infrastructure

- Gallup Cargo and Mobility Investment District sites for supporting investment in R&D, production and logistics

Southern New Mexico Mobility Hub

Characteristics: The Southern New Mexico Mobility Hub delivers a critical asset for the overall system. The Southern New Mexico Mobility Hub would offer the following:

- Access to a complex public road system in a medium-sized urban/rural region road system; including a downtown grid and university district
- Direct urban and extra-urban access to the East-West I-10 transcontinental highway tier and connectivity to Texas
- Direct urban and extra-urban access to the North-South I-25 interstate highway and connectivity to Colorado, Texas and Mexico
- Specialty Center: Automated Cargo Handling/International Border
  - 30-acre purpose-designed closed-course New Mexico Cargo Handling Automation Testing Complex at Dona Ana County Airport/UPRR Rail Intermodal facility
  - Border Mobility Test Corridor for cargo transportation from border to nearby warehouse facilities and to Airport/Intermodal
- Secure and high-capacity uplink data transmission infrastructure
- Corridor Terminus Depot for highway testing
- Southern New Mexico Mobility Investment District sites for supporting investment in R&D, production and logistics

New Mexico Mobility Strategy Recommendations

The following recommendations were made to the State to advance the State's Mobility Strategy:

Declare New Mexico's Strategy to Develop as National Mobility Leader

The Strategy suggested that the Governor issue an Executive Order that: 1) proclaims New Mexico's intentions to become a national leader in mobility with a focus on public safety, air quality improvements, and economic development, and 2) calls for the Autonomous Vehicle Committee be reconstituted to consider regulatory actions. Gallup's initiative around its mobility development project has led to HB270 and attracted some national attention.

Create and Fund Mobility Investment Delivery Structure – A specialized mobility delivery entity should be established that would be a joint venture including State, local government partners and automotive/technology industry partners to develop and operate the NM Mobility Laboratory. Among other responsibilities, the entity will have the following functions for: 1) developing business relationships with technology companies and OEMs, 2) defining necessary State policy changes and/or investments, 3) developing and operating closed-course testing and development facilities and corridor terminus hubs, 4) developing an investment plan and partnerships for key clean energy and telecommunications infrastructure and pay specific attention to gaps in the current infrastructure. Mobility assets would operate on a self-sustaining basis by generating private revenues.

Gallup: GMID is moving forward, but larger issues will need State involvement

New Mexico Regulatory Action - By the actions of the Autonomous Vehicle Committee, establish a program for the testing and development of automated vehicle technologies on public roads within the State of New Mexico. The intent of this process is to create a collaborative, constructive, and expedient pathway for the testing of automated vehicles in New Mexico while maintaining a safe environment for all who use New Mexico's transportation systems and facilities.

Gallup: Completed

Mobility Investment Incentives – Develop hubs for mobility technology investment and support with highly targeted incentives to support economic development versus key competition

- With local government and private investment partners, plan and develop mobility investment sites near to testing hubs to support permanent R&D centers, production and supply chain investment
- Develop applied incentives to support private production investment, some examples:
  - In-state tuition at any New Mexico public higher educational institution to all employees and their families of companies that establish an autonomous vehicle testing and development program at one of the locations of the New Mexico Mobility Laboratory
  - Sales tax exemption for 5 years on equipment and materials used in a research and development operation connected with the testing and development of mobility technologies through the New Mexico Mobility Laboratory
  - Transferable tax credit available to New Mexico VCs making debt or equity capital investments in start-up or developing companies testing mobility technologies in New Mexico. The tax credit could be equivalent to 20% of the qualifying investment and carried forward for 5 years.
  - A discretionary grant should be made available to companies that make investments in facilities for R&D, production/assembly, or supply chain management. The grant would provide funding for a portion of the costs of developing the facility if it is located in one of the New Mexico Mobility Laboratory hub regions and with appropriate levels of job creation.
  - A special discretionary grant could be offered for mobility companies that undertake crossover technology investment - from ground mobility to aerospace mobility for investments in research and development, production, assembly or supply chain management.

Gallup: Gallup should lead effort to adopt incentives

Binational Mobility Zone - Coordinate with Mexican government and State of Chihuahua regarding integrated auto supply chain proposition

Gallup: Does not apply

Develop and Create Specialized National Hub for Aerospace/Ground Mobility – Partner with the Air Force Research Laboratory through their Hyperspace Challenge initiative to pursue investments from companies with technology and corporate interest to bridge wheeled mobility and aerospace mobility applications.

Gallup: Should be reviewed later based on plans for commercial air service at Gallup Airport

Strengthen the Automotive Technology-Related Academic Offer – The ability to attract highly skilled individuals is a critical element to a mobility company's success and attraction and retention of world class talent exerts a tremendous influence over the performance of their operations. New Mexico's continued commitment to the education and workforce development system is a major incentive in competing for a mobility company's investment. Educational institutions at all levels at all levels will need to develop a solid partnership between industry and academia to develop a strength in designing academic programs that meet industry needs. Training and education for the AV industry intersects between math, mechanical engineering and electrical engineering. The New Mexico Higher Education Department should offer support to the community colleges to ensure that their programs are aligned with industry and to develop programs for computer science, cybersecurity, information technology (IT)/data management, software/design, which are currently disciplines that do not have sufficient offerings. Support should also be offered to K-8th grade students, especially in supporting science, technology, engineering and mathematics (STEM) programs.

Gallup: Important issue for Gallup and addressed in the Targeted Industry Study

Improve Business Travel Connectivity to Important Domestic & Global Automotive Technology Hubs – Develop increased commercial passenger air service to key research and supply chain centers in Silicon Valley, Los Angeles, Detroit and New York, and then for efficient onward connections to Japan, South Korea, China, Taiwan, UK, Germany and France. For domestic service, it is highly important to have a diversity of air service options, with a preference for early morning, early afternoon and early evening

flights (depending on destination). Increased commercial passenger service to ley locations is important to/from Albuquerque but also to/from Gallup and Las Cruces.
Gallup: An issue for Gallup, air service development to key hubs is critical
Create a National Epicenter for Emerging Mobility Technology Companies – Establish New Mexico as a setting that caters to the growth of small technology companies in the mobility sector.

- Create and support specific program collaboration between federal laboratories and technology small business (e.g., AFRL's Hyperspace Challenge)
- Offer small businesses direct support in understanding the public sector market, purchasing products to showcase to other local/state governments, provide procurement guidance
- Match out-of-state entrepreneurs to venture financing
- Develop collaboration with larger partner companies already involved in the NM Mobility Laboratory

Gallup: Gallup can consider the first element for an incubator for emerging mobility technology companies

Gallup Mobility Investment Plan

Gallup's Initiative and State of New Mexico Support

Following the development of the New Mexico Mobility Strategy, the Greater Gallup Economic Development Corporation made a decision to implement recommendations outlined for the Gallup region. With GLDPartners, GGEDC worked to customize and refine the recommendations into a more detailed Gallup Mobility Investment Plan. This Investment Plan was undertaken with support from the US Department of Commerce/Economic Development Administration and centered around forward planning for the Gallup Airport and surrounding area.

Developed over the past six months, the Gallup Mobility Investment District plan provides more specific detail to the market niche and investment infrastructure that should be developed in Gallup. Focusing on the truck niche and Gallup's location along I-40, the GMID will be the first regional component to be implemented from the New Mexico Mobility Strategy. The GMID can be undertaken on its own and reach success but would be more successful if it were developed within an overarching NM Mobility Laboratory strategy.

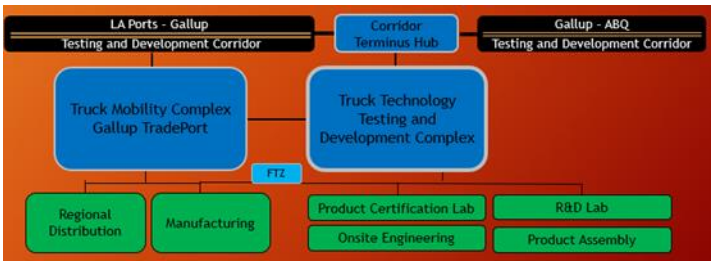
Through its development, the GMID has been reviewed with the City of Gallup, City Council and a specially created oversight/advisory committee (Autonomous Working Group). This Strategy has also been developed with input from and coordination with the NMDoT. With the Department, a series of updates have been carried out for State legislative committees and the State Transportation Commission. Led by GGEDC and with coordination and support from the Department and GLDPartners, a Mobility Roundtable was held in early 2021. The Mobility Roundtable included a number of private companies and community representatives and reviewed key issues for the State and Gallup. One of the issues reviewed was the need for legislation at the State level to outline the State's interest in supporting the mobility industry and to prescribe standard requirements necessary to undertake testing and development on public roads throughout the State.

The timing for developing this is fortuitous as advancing deployment of technologies on this important corridor are an important part of solving the current national supply chain challenges. Those challenges are extraordinarily large and have created chaos in global markets and supply chains and throughout the US economy. Due to this, high levels of attention from Washington are being paid to short-term and longer-term solutions. Given there is little existing national strategy to address such issues, the White House and USDoT are now at this time urgently requesting projects that can help alleviate these conditions.

With NMDoT and State legislative staff, GGEDC worked on legislation that would address these issues. Led by Representative Patty Lundstrom, an industry committee was assembled to help refine the details of this legislation. HB 270 was passed into law by the Legislature in 2021 and now provides a strong foundation for advancing the wider NM Mobility Strategy. Following the passage of HB 270 and with actions being considered in Gallup, New Mexico has begun to receive attention from industry.

Gallup Mobility Investment District

The Gallup Mobility Investment District seeks to position New Mexico as an important component of a national transport/logistics/supply chain system. As planned, the GMID would be seen by industry as a national model for cargo transport efficiency, particularly around autonomous cargo movement technologies, clean powertrain technologies, and as a next-generation logistics center.



As structured, the GMID would attract investment to the Gallup region and would support wider State transportation and economic development objectives. The GMID capitalizes on its westward-facing strategic I-40 location and one-day driving distance from the LA seaports complex and would be built to position Gallup as a national hub for medium and heavy-duty truck testing, development, deployment and production investment. The GMID proposition would capitalize on the I-40 gateway location to establish Gallup as a strategic link in a developing advanced national supply chain corridor. This corridor will be the most heavily travelled supply chain corridor in the United States, linking Asian markets through the seaports in Los Angeles and onward into the country's heartland.

The main elements of the GMID are focused on these areas

- Truck propulsion and vehicle automation
- Research + testing + development + certification
- Engineering & product development, assembly
- Truck mobility anchor

The Gallup Mobility Investment Plan is designed to support positioning Gallup and the State of New Mexico for new investment. Toward that, four project components are designed to establish the region as a center for the mobility industry for research and development, real-world testing, deployment and investment attraction.

Truck Testing and Development Complex – The heart of the GMID is an off-road testing and development complex for Class 6-8 trucks. In this secure complex, OEMs and autotech companies will utilize various purpose-designed infrastructure zones, including straightaway, low-speed maneuvering, lane-change and merging. Companies will have access to secure high-capacity data uplink, meeting space, shop and storage space. The TTDC will produce a revenue stream as client companies will pay fees to access the infrastructure. Acknowledging that there will be operating costs for the facility (including, staffing, utilities, insurance, marketing, etc.) the TTDC should offset those costs by its revenue stream.

Corridor Terminus Hub – Supported by State of New Mexico designation of I-40 as a truck testing and development corridor, a special-purpose facility will support these activities. This facility will include electric and hydrogen fueling infrastructure for trucks doing testing between Gallup and Albuquerque, and later between Gallup and Los Angeles. The facility would include support facilities including meeting, data uplink and restrooms.

The estimated cost to develop the Truck Testing and Development Center and Corridor Terminus Hub facility would be approximately $18M plus soft costs and a 10% contingency factor, or $21.6M total. (See detail in Appendix A)

Truck Mobility Complex/Gallup TradePort - Building on the success of the Port to New Mexico Testing and Development Corridor, a next-generation trucking/cargo handling complex will be developed. The Gallup Truck Mobility Complex will be the first element of a transcontinental corridor stretching from the Ports complex in Los Angeles into midwest and east coast markets. The Gallup TMC will be a modern version of a truck stop, but with the following key distinctions:

- Will be developed as a clean energy fueling/charging hub and an element of a port-to-market highway corridor system
- It will specifically be designed to accommodate autonomous truck movements, technology calibration and repair and cargo handling
- Is designed as a cargo handling/transfer point to support a strategic logistics hub, with integrated warehousing developed onsite

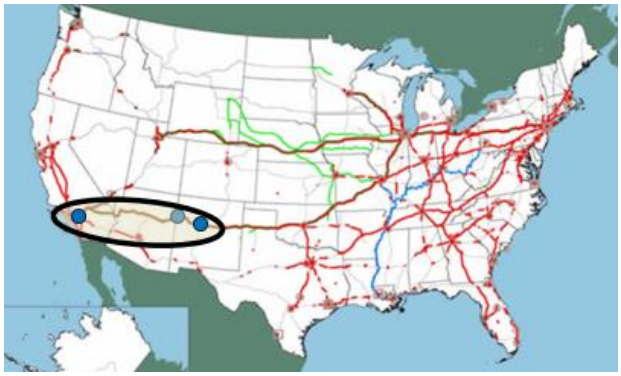
This project would be implemented as a public-private partnership but would largely be driven by private investment. Investment would be concentrated in the following areas: 1) industrial property, retail, trucking services, and energy production/distribution. A strategic business plan must be developed by GGEDC and its local/State partners. This business plan would yield a specific investment prospectus which would be taken to the market as a formal solicitation for a range of partners in the above areas.

Truck Technology Testing Corridors - An important component of the Gallup Mobility Investment Plan is the integration of testing and development on the State's Interstate highway system. Specifically, the GMIP would provide access to a designated mobility testing corridor on I-40, extending eastward to Albuquerque and westward, toward Los Angeles and the seaports complex (Ports of Los Angeles and Long Beach). I-40 is a uniquely important national trucking corridor carrying more truck traffic through its overall length than any other east-west transcontinental highway corridor. On the west end of the corridor is the Los Angeles region and the major global logistics hub at the ports complex.

Gallup - to - Albuquerque

LA Ports Complex - to - Gallup

Gallup is located in a strategic location along this corridor, being at the limit of the hours-of-service rule from the ports complex. The entire testing corridor is 795 miles long, over a long segment (Gallup to Los Angeles: about 650 miles) and a short segment Gallup to Albuquerque: 127 miles).



Gallup to Albuquerque Corridor - The short segment offers short-haul testing and the ability to conduct one day testing with a turnaround and return to base. This segment would offer OEMs and tech company suppliers an ability to utilize the off-road testing complex alongside public-road real world testing. At the Gallup Mobility Testing Complex, trucks would access the Corridor Terminus Hub infrastructure for charging/fueling electric or hydrogen powered vehicles. The Terminus Hubs would also offer a secure uplink for data transmission. NMDoT has indicated an interest to formally designate the New Mexico portions of the testing corridor. This may include special signage, road markings and would be promoted by marketing and promotion.

Port to New Mexico Testing and Deployment Corridor – In tandem with the Ports of Los Angeles and Long Beach and NMDoT, a long-distance testing and development corridor will be established. The 668-mile segment between the Ports complex and Gallup will be the core component of an eventual transcontinental autonomy and zero-emission truck corridor. The seaports complex handles over 35,000 trucks per day, with many of those leaving the Ports for domestic supply chain points throughout the US. With practically all of these trucks powered by diesel engines, this heavy flow of commerce poses significant air quality health problems for the Los Angeles region. For this reason, the Ports, LA Metro and the State of California have made very significant policy and investment decisions to evolve the trucking fleet from high-polluting diesel power to electric and hydrogen power. Due to the size of the market and these public policy decisions, California is creating a significant market for OEMs to bring new technology to market. Given that NM has similar objectives to support clean energy transportation, there is a synergy between the two states.

We envision a partnership between Gallup/New Mexico and the seaports/California for a multi-phase zero emission/autonomous truck corridor. Over the first three years, the corridor would support testing and development of truck powertrain and autonomy technology. By the nature of the evolution of the industry, this would include real world cargo handling tests. After three years, the testing corridor would begin to evolve to a real-world deployment freight corridor, with specialized infrastructure assets at the Ports and in Gallup. At Gallup, the main asset would be the Truck Mobility Complex. This port corridor connectivity could also create a unique competitive advantage for Gallup by designating the Gallup Truck Mobility Complex as a Foreign Trade Zone. International goods could be moved through the Port of Los Angeles and shipped directly to Gallup Truck Mobility Complex FTZ. There would be no import duties levied until the goods leave the zone. While in the FTZ the goods could be stored for distribution or could be used in a manufacturing, assembly, or processing operation. This could be attractive to an Asian manufacturer who is importing parts to the US to be used in manufacturing a final product. This activity could be conducted in the zone and potentially have the final product taxed at a lower rate than its individual parts.

This initiative with the San Pedro seaports would be extraordinarily interesting to the federal government and could be seen as national model for supporting the migration to clean and autonomous heavy trucks.

A project like this would be seen as an essential type of element for addressing the now recognized deficiencies in the US supply chain infrastructure.

In terms of phasing of the corridors, we suggest the following:

Short-Term Actions (and extending over 3 years)

- First priority is to position the project as of national significance and valuable in context of national supply chain system; submit proposal to USDoT in January, 2022
- Develop partnership between Gallup, State of NM for designating the Gallup-ABQ segment as a testing and development truck corridor
- Develop partnership between Gallup, State of NM and the Los Angeles Ports for a flagship truck testing, development and cargo handling corridor
- The focus of this corridor would be to support real-world road testing for both autonomous truck technologies and zero-emission truck powertrain technologies
- Gallup would utilize the Corridor Terminus Hub infrastructure as support for this corridor
- Arrange business meetings with Port of Los Angeles executive leadership trucking company/operators

Mid-Term Actions

- Capitalizing on the foundation that will have been laid with establishing the testing corridor between the Ports and Gallup, the development of the Truck Mobility Complex would be undertaken
- Coincident to the planning and development of the TMC and resulting from the success of the Gallup-LA ports testing corridor, develop a multi-layer port/inland TMC partnership structure
    - Including states + ports + OEM truck manufacturers + logistics operators
    - Gallup/State of NM should lead partnership structure and develop core project proposition
    - Develop operating protocols and core infrastructure requirement
    - Hub for clean energy and autonomous truck cargo transfer, maintenance, fueling/charging
    - Would be core for logistics-enabled investment district
    - Could be twinned with a I-10 TradePort project; develop proposal for federal support: designate as nationally important project and invest funds

The cost of these corridor projects are modest and would largely involve public policy coordination between public bodies in California and New Mexico.

Industry Reaction to the GMID

In working to gauge industry reaction to the GMID and its testing and development offer, GLDPartners spoke to twenty-five companies including truck OEMs, truck technology developers/suppliers and hybrid truck technology/trucking services companies. As was fundamental to gain corporate reaction and insight, these conversations were held with an agreement that their corporate name and all substantive interaction would be held in complete confidence. For about half of the interviews, GLDPartners was either forced to sign a new non-disclosure agreement or relied on an existing non-disclosure agreement. It is important to recognize that these companies generally operate in a very highly competitive environment and that they will not typically share any information about their product development, testing and engineering strategy, etc. with any third-party.

The GMID was received well by a number of companies that indicated the prospect of a full state mobility product was very intriguing to a number of these companies due to the specific nature of the product offer being contemplated in Gallup. As was described to companies, the Gallup Mobility Investment District will be designed to appeal to a certain niche of the mobility spectrum and it was this special focus that was uniquely intriguing to the companies. For companies that would use the testing and development infrastructure, they've indicated that they need to see a tangible product but that facilities custom designed for their use would be very welcome. They did indicate that they'd like to be involved in some of the design and specification planning and most indicated that projects such as these are not traditional "public works" projects, but rather are specialized testing and development assets.

Key points made by industry officials were:

- It's very important that states and communities understand the sector's special needs and they have hopes to develop public sector partners
- The industry has a strong need for additional locations/facilities to undertake testing
- There was interest shown about NM's wide interest and approach to mobility
- They appreciated that they would have direct access to policy decision-makers
- OEMs were interested in a combined test/development setting that was within a business-friendly environment
- One firm said they will set-up a testing/showcase center and could consider NM, but otherwise wouldn't have thought of it as an option
- Another firm said they would consider building/investing in a proprietary testing asset adjacent to the multi-user main testing campus
- The Truck Mobility Complex received high attention from investors, OEMs, energy producers, and trucking companies
- Most said that time is of the essence, the needs are now

Ports Interest

Working together with Gallup, the Ports in the Los Angeles area have indicated a strong interest to support streamline supply chain development. They will be concerned about the green energy credentials of the project (a positive) and also the how automation will be embedded in a corridor strategy linking the Ports with New Mexico. There will be some concern about how to handle/message the issue of automation as that is a challenge with labor unions. They suggested that the Los Angeles region would likely welcome efforts to streamline transportation through their region.

Press Interest

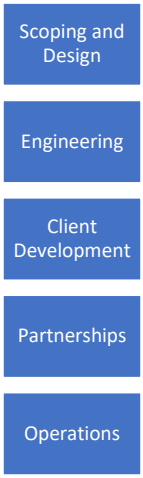
The project has received some press attention in the form of articles in several trade publications. This article entitled "Next -generation rail and truck corridor to reshape freight movement" appeared in Automotive World in July 2021 and described how projects in California and New Mexico were setting examples for how automation and clean energy powertrain systems were being harnessed at new, modern logistics hubs.

July 28, 2021

Next-generation rail and truck corridor to reshape freight movement

Project Execution

Taken as a whole, the Gallup Mobility Investment Plan is a significant undertaking, and its success will require a well-structured sustained implementation plan. As this project continues, Gallup would be leading a project that is outsized for a local community, especially a small community. The components of the project include work in the following areas: infrastructure scoping and design, facility engineering, client development and the creation of business partnerships. The GMID will produce operational facilities and it will therefore be critical that GGEDC is clear on how these facilities will be managed. Without a clear strategy for ongoing management, the GMID will not attract and keep client companies and the project(s) will not reach their full financial success. The projects in the GMID will be dependent on support and involvement from a range of partners. It is certain that the active participation from the State of New Mexico is a very important success factor. Assuming the project is centered in the City of Gallup, the City will be an integral partner, and involved in coordinating land use, off-campus roads, zoning and interfacing in related economic development activities. GGEDC is the subject matter partner and should lead interactions with industry and coordinate an overall economic development strategy



Funding:

- Core funding will be required from the State
- Light support from local government
- Federal government should be formally propositioned to support the Corridor and TMC development

Delivery Tools:

- These projects are by their nature joint ventures with private industry
- It is critical to have tools that enable public and private resources can be joined and combined for advancing public objectives; this will likely require creating authorities for local/state government to create and execute joint projects with private investment partners
- P3 legislation will be important to enable this and make it clear to private interests that the State of New Mexico and local government partners are serious about executing key mobility transportation projects
- It is plausible to attract private investment; it is important to be clear as to the role for private partners and to have the tools to enable receiving private funds to support the overall objective of the community
- We suggest that a state legislative initiative be undertaken at the first instance to allow narrow-definition authority for mobility public-private projects
- Affirmative State legislative P3 authority combined with several packaged and investable projects will produce a high-visibility message to risk capital investors and mobility companies that New Mexico is a serious player, both in the mobility development space but also throughout the wider investor spectrum

Gallup Mobility Investment Plan: Funding Options

To carry out the Gallup Mobility Investment Plan, it is important that GGEDC consider both the capital and operating requirements of the overall project. Alongside this, it is also important that GGEDC and its public partners understand and take mitigation measures to address the business risks that may be present at the outset or later into the project in order to avoid financial loss or reputational loss.

In terms of funding, we will look at the various elements of the project separately.

Mobility Testing and Development Complex

- Operating - This project element will be planned to operate as a self-sustaining facility, that is with proper planning and management, the complex will generate revenues and these revenues will offset the operating expenses. There is a potential for the facility to generate a net revenue surplus. Revenues will be derived from fees generated by the use of the test complex. Operating expenses will include staffing, facility maintenance, utilities, insurance, and other operational costs. To assure that the project meets a breakeven (or better) net operating income, it is vital that: 1) the facility be successfully marketed to industry, 2) maintain close client development and relationships for sustaining business, and 3) undertake careful oversight of operating expenses. If well-operated, a facility of the dimension that is anticipated could generate revenues of between $1M and 2M annually. This range assumes relatively high facility utilization with companies paying between $1500 and $3000 per day for use of testing facilities. At full utilization with 1-2 companies per day using the TDC and with utilization of the Corridor Terminus Hub, the facility could generate revenues in excess of its expenses. Direct operating expenses are scalable with the level of business activity and should range from $300,000 to $600,000 per year. In addition, the TDC will need to budget for ongoing facility maintenance and a fund should be established for this purpose. Facility construction funding will be structured to support most of the operating maintenance costs over the first decade of operations and the start-up operational period. To the extent that the facility is developed in tandem with one or several anchor users, project financials could potentially be even stronger.

- Capital Funding – The project will cost approximately $18-21M (if done in tandem with the Corridor Terminus Hub) to develop, inclusive of land, horizontal road facility improvements, security fencing, utility extensions, etc. It is expected that the full amount of these funds will be invested by public sources, likely local and State government as a strategic investment in economic development. It needs to be noted that a project such as this located in Gallup, New Mexico will not be able to have its operating revenues pay in full both operating expenses and debt on the full capital investment. There are also several possible federal sources of investment for a project such as this, including (in full or in part) from the US Department of Commerce, US Department of Transportation, US Department of Agriculture and the US Department of Energy. Especially combined with other elements of the Gallup Mobility Plan, this project could be positioned to receive funds from the following sources:

  USDoC
  - Build Back Better Challenge
  - Public Works and Economic Adjustment Assistance Programs including CARES Act Funding (coal impacted communities)
  - Build2Scale; innovation and tech commercialization (likely 2022)
  - Public Works Program

  USDoT
  - Regional Accelerator
  - RAISE
  - State Transportation Innovation Councils Incentive Program and Accelerated Innovation Deployment Program (would be partner with NMDoT for demonstration project)

  USDoA
  - Rural Economic Development Loan and Grant program (likely for such elements as for a small business incubator)
  - Community Facilities Direct Loan & Grant Program (possible airport/road improvements)
  - Rural Business Development Grants (Feb, 2022)

USDoE

- NEXTCAR - Next-Generation Energy Technologies for Connected and Automated On-Road Vehicles (would be developed through partner university)
- RANGE - Robust Affordable Next Generation Energy Storage Systems (would be developed through partner university)
- Office of Energy Efficiency and Renewable Energy (EERE) Vehicle Technologies Office (VTO) and Hydrogen and Fuel Cell Technologies Office (HFTO) – partners on "SuperTruck 3" program
- Low Greenhouse Gas Vehicle Technologies Funding Opportunity (VTO) – demonstration projects
- VTO Sponsored Research (would be in conjunction with corporate or university partner for applied onsite research)
- Hydrogen and Fuel Cell Technologies Office (HFTO) (would be in conjunction with corporate or university partner)

Going Forward: Implementation of the Gallup Mobility Investment Plan

Implementing the Gallup Mobility Investment District will establish Gallup and New Mexico as a national player in the next generation of mobility in the United States. Going forward, the successful implementation of the GMID will require a deliberate and sustained business plan that integrates the following factors:

1. Public Partnerships for National Model - Careful coordination with the State of New Mexico for approaching the federal government about support for model mobility projects, for the designation and development of the I-40 testing corridor, the positioning of the State as a national leader, partnership with the Port of Los Angeles
2. Public Infrastructure – Make strategic public investments in public infrastructure, specifically in the Testing and Development Facility and Corridor Terminus Hub assets
3. Private Investment - A sophisticated business strategy that blends private investment in the Truck Mobility Complex and involvement with trucking industry interests
4. Sustained Business Development - Given all of the above, develop and carry out a sustained business development strategy to key companies in the following areas: vehicle manufacturers, technology companies, cargo transportation service providers and telecom and clean energy infrastructure investors
5. Active Ongoing Management – Success will not be achieved without a well-managed operating entity that has a keen understanding of the mobility and automotive industry and developing technologies. Testing and development and corridor testing facilities will require a well-managed system that is client/partner-oriented and operates to efficient business standards

Public Partnerships for National Model

Public Infrastructure

Private Investment

Sustained Business Development

Active Ongoing Management

The following outline breaks down the GMID Strategic Implementation Plan as shaped by Short-Term, Middle-Term and Extended-Term Action periods. This project will need a high degree of industry, investor and partner interaction, and will require a highly choreographed implementation program. GGEDC will need to lead or create a capable structure that can take concepts forward and deliver projects. This project will likely attract a significant amount of public and private investment and there will be a substantial business responsibility to assure all partners success.

It is critical that GGEDC and its public partners are clear from the beginning about how delivery will occur and this includes clarity about roles and responsibilities.

Gallup Mobility Investment District Implementation Strategy

Short-Term Actions (0-4 Months)

1. Identify/secure ability to site TDF
2. Secure Testing and Development Facility (TDF) project funding from State of NM and City
3. Structure, launch and promote I-40 NMDoT Testing Corridor designation (State of NM)
4. Begin to action Port of LA partnership
5. Structure Federal funding plan with partners and develop proposals within program timeframes
6. Develop applied P3 State legislation

Middle-Term Actions (5-18 months)

1. Develop operating structure/plan
2. Pass applied P3 legislation
3. Secure land for TDF
4. Complete TDF project plan/engineering
5. Begin/complete TDF construction
6. Finalize Port of LA and trucking partners agreement in support of the Port-Gallup corridor
7. Launch 1st stage truck corridor testing to/from Port of LA
8. Prepare detailed Truck Mobility Complex business plan, develop site strategy, preliminary engineering/cost development, develop P3 structure and preliminary partner agreement
9. Develop investment prospectus for TMC and correspondent TMC industrial zone
10. Circulate investment prospectus and secure TMC partner, correspondent with forthcoming federal support

Extended-Term Actions (19-36 months)

1. Complete Truck Mobility Complex delivery plan, secure P3 agreements, initiate detailed infrastructure planning
2. Launch 2nd stage truck corridor testing (more partners, expanded service, now some through routes)
3. Begin/complete construction of TMC core infrastructure (24-36 months)
4. Begin/complete construction of first industrial/logistics development (30-36 months)

Appendix A – Gallup Testing and Development Facility, Corridor Terminus Hub Cost Estimate

Gallup Mobility Testing Complex				
Preliminary Development Cost Estimate				
Development Item		**Quantity**	**Units**	**Total**
Test Track 2 Lanes/Shoulders		**7,700**	**LF**	**5,000,000**
Urban/Suburban Test Track Circuit		**12,300**	**LF**	**3,500,000**
Drives and Parking Areas		**9,600**	**SY**	**1,300,000**
Security Fencing/Gate		**9,600**	**LF**	**500,000**
Administration and Shop Building		**10,000**	**SF**	**2,000,000**
Truck Fueling/Diesel Tank/Dispensers		**1**	**LS**	**300,000**
Truck Fueling Electric Charging		**1**	**LS**	**2,100,000**
Truck Fueling Hydrogen Tank/Dispensers		**1**	**LS**	**3,000,000**
Water Line Extension to Admin Building		**1,000**	**LF**	**100,000**
Septic Tank System for Admin Building		**1**	**LS**	**50,000**
Electric Power to Admin Building		**1,000**	**LF**	**100,000**
Telcom to Admin Building		**1,000**	**LF**	**50,000**
Total Preliminary Cost				**18,000,000**
Project Soft Costs (Engineering, etc.)				**1,800,000**
Contingency				**1,800,000**
Project Total Construction Cost (net of land value)				**21,600,000**

Appendix B - Gallup Mobility Investment District – Targeted Industry Analysis

The Gallup target industry analysis reviews, verifies and recommends mobility/autonomous industry targets for research and development, production and manufacturing activities. As autonomous technologies are becoming a staple of the global economy, a mobility innovation industry has developed. This industry is rooted in software, robotics, energy recovery systems (ERS), lithium-ion batteries, power cells, electrical power systems, renewable/alternative fuels, and engine control systems, all of which open the door for job creation and the development of regional economic growth. This industry can give recognition to the Gallup region as a player in the rapidly growing market for advanced technology in the autonomous vehicle space.

Target industry analyses do not exist in a vacuum. They rely on an understanding of the opportunities and challenges unique to the region and to the cycles of the national economy. By design, they are action oriented. They identify specific industries suitable for recruitment and expansion and provide specific guidance for leveraging assets and addressing challenges. Success is measured by knowing what industries can thrive in Gallup, New Mexico.

In the New Mexico Mobility Strategy (NMMS), a customized competitiveness/core competency assessment model was developed that illustrated how New Mexico would compete for mobility industry investment against five of the perceived leading mobility technology regions in the country. This model was based upon the competitiveness of the traditional business climate, an educated technology workforce that understands R&D business practices, universities and community colleges/technical schools with strong STEM curriculums, quality of life with reasonable costs of living, and a regulatory environment that supports the testing and development of autonomous vehicles. These variables illustrated how various location factors specifically influence the industry's location decisions for both testing and production and identified New Mexico's location strengths and areas for improvement. All the variables considered in the competitiveness assessment pointed out, that despite its size relative to the leading mobility technology centers in the country, New Mexico as a state has the attributes to support the mobility technology industry:

- More scientific and technical workers per capita than any other state in the nation
- Strong pool of software and programming talent
- A history of electronics manufacturing supported by a skilled workforce

- Good airport connections
- A deep R&D and innovation culture
- Extremely high levels of R&D investment
- A competitive business climate
- A western US location offering connectivity to the Silicon Valley
- A supportive education system
- Excellent supply chain multi-modal connectivity through rail, road and air

The competitiveness assessment compared the major metropolitan areas of San Jose, Pittsburg, Detroit, Phoenix, and Orlando with the State of New Mexico. The Gallup proposition for this industry is not designed to compare itself with these major metropolitan areas or attempt to measure up to them, but rather to compete for a niche sector of the industry, the testing of heavy duty autonomous trucks. Gallup needs to strategically use the identified strong state assets as a platform from which to launch its proposition. The competitiveness assessment did identify several specific areas that Gallup would need to improve upon to enhance their competitiveness:

- Strengthen the automotive technology-related academic offer to prepare the workforce to perform in the auto-tech industry. The jobs in auto-tech are ideal for middle-skill jobs, as each part of the eco-system require the use of electromechanical equipment assemblers, and mechanical engineering technicians that seek their talent from vocational school and certificate programs.
- Proactively work with state officials to increase the reputation of the state-wide education system. Currently the State of New Mexico is ranked 51st in the country for the quality of the public education system. Unfortunately, rankings play a big role in shaping the opinions of potential employers as they look for communities in which to make investments. There needs to be an aggressive PR campaign waged by the State to profile the successes of the state-wide education programs and ensure companies that the education system is producing a highly qualified workforce.
- Ensure that there are adequate housing options in Gallup for newly locating employees. Housing availability and affordability are critical elements in attracting new businesses. There needs to be a combination of housing options including multifamily rental units for single people as well as single family homes.
- New Mexico and specifically Gallup will not be an obvious choice for the testing and development of mobility projects. As such, Gallup will need to confidently assert itself to industry decision-makers by demonstrating a keen knowledge and understanding of the pressures on the industry, and also offering a set of business specific solutions such as the testing facilities.
- Make infrastructure investments to support the testing and development phase of the industry
- Work with NMEDD and the Legislature to create a mobility industry specific incentive program as outlined in the NMMS. The LEDA Economic Development Ordinance could be an option for creating incentives for the mobility eco-system in Gallup. Qualified entities include manufacturers and assemblers of products as well as warehouse and distribution operations. The testing and development of autonomous vehicles does not fit into these existing categories but should be discussed with NMEDD to have it become an allowable activity under the LEDA ordinance.
- Ensure that the telecommunications infrastructure in Gallup can support the advanced telecom needs of the mobility sector

As a region, Gallup is positioned to pursue a portion of this economic activity and accommodate the industry's growth through multiple avenues, including the manufacturing, testing, and implementation of

autonomous technologies in both hardware and software, a progressive public policy environment, and existing plans for mobility solutions.

Gallup is not the only region in the country that is targeting the mobility industry. Other states and cities such as Ohio, Michigan and Texas are increasingly looking for ways to attract the emerging autonomous vehicle (AV) eco-system as they become aware of the economic development opportunities that these technologies can offer as well as the broad-based job creation potential. The regions that welcome the testing and development of the industry will have a jump start on the ability to create new tech clusters and eco-systems, which will anchor these jobs to their area for decades to come. But experience and pending legislation is telling us that some communities are looking for a tax windfall from the new disruptors, while others are positioning their community to be at the forefront of development. There is no doubt that regulation will play a material role into decisions where technology is implemented and thus will impact where the subsequent projects, such as data centers, office/programming hubs, connected distribution, AV depots, etc. are located. Burdens that can seem mundane — such as the placement, height, and appearance of cell towers or 5G nodes, or excess fees for placement of fiber cables — can have a substantial effect against implementation and Gallup is encouraged not to attempt to tax or regulate the industry beyond the provisions of HB 270.

As the development of autonomous systems continues to grow, the traditional vehicle ecosystem is quickly being transformed. The new ecosystem is both complex and rapidly changing and full of many players, old and new, with different responsibilities. Each day there are new entrants and partnerships being announced. Numerous categories of legacy manufacturers, operators and integrators are being significantly impacted by the advent of vehicle autonomy. The autonomous vehicle industry is being defined by technological advancements and is shaped by both insourced and outsourced technology solutions. No longer is the main dynamic a few original equipment manufacturers (OEMs) such as Ford and GM, but rather now a larger ecosystem of technology firms and production suppliers are the important players.

The barriers to this new mobility industry sector are going to be a lot lower than for entrants to the traditional vehicle supply chain market, which will mean more suppliers and more rapid innovation throughout the system. The last few years have seen a rush of investment into businesses that are supporting the development of AVs.

Some well-established technology companies like Nvidia have experienced meteoric growth in their stock market value since they embraced AVs. They now power virtually all the major AV manufacturers from high end consumer brands like Tesla, BMW and Volvo, to new low-cost entrants from China. In the commercial vehicle sector, Nvidia's collaboration with Paccar has already driven growth for the truck maker. A recent earnings announcement stated that "PACCAR's investments include autonomous driving and truck platooning, truck connectivity, augmented reality (AR), and an integrated software platform."

The semiconductor industry has benefited for decades from the digitalization of vehicles and driving in general, but autonomous cars represent a sophisticated blend of computer power and artificial intelligence for navigating the countless number of real-world driving scenarios…in real time. Autonomous vehicles rely on semiconductors, chips, for all their electric functions. Chips are the enabling hardware for all the information technology and software functions, and they facilitate the process of data gathered by sensors in order to make real time driving decisions. Chipmakers that can integrate auto-vision, Internet of Things connectivity, and AI processing, among other key features, will have the edge.

Intel, which is one of the largest semiconductor companies in the world, has a large presence in New Mexico where they develop and manufacture technologies that optimize semiconductor packaging, memory and connectivity. However, in the US their autonomous tech development facilities are in California, Oregon, and Arizona.

Intel is currently collaborating with Waymo and numerous other companies on their autonomous vehicle testing and development. Mobileye which was acquired by Intel in 2017 is leading the company's efforts in autonomy. They have formed an Automated Driving Group and have become a leading company in computer vision, machine learning and mapping for autonomous driving.

Even businesses that are traditionally part of the automotive supply chain themselves are moving to take advantage of the AV opportunity. Bosch, Continental, Magna and Delphi are all investing heavily into autonomous vehicle R&D.

The Autonomous Vehicle Eco-System as an Economic Development Target

- **The vehicle:** It starts, of course, with a vehicle, which is the first layer of the autonomous ecosystem. While the myriad of technologies inside the vehicle enables the vehicle to drive itself, it is fundamentally no different than any other vehicle. The vehicle is a chassis with wheels and seats and is designed to carry passengers and freight. However, the vehicle in the autonomous eco-system now may require 8,000 parts compared to 30,000 parts for a gasoline car. The targets in this sector are the vehicle OEMs that are committed to the development of an autonomous vehicle such as Ford, GM, BMW, PACAR, Daimler, Volvo, etc
- **Automotive and freight system vendors:** The next layer in the ecosystem is the packaging of self-driving technologies that drive the vehicle. The targets in this sector are the companies that are congregating technologies into the computer that becomes the brains of the vehicle. These are the subsystem integrators (Bosch, Continental, Magna International, Denso, etc.)that combine their hardware and software to provide functionality in the OEM's vehicles. They produce what is called the AV Stack for autonomous vehicles. The AV stack is the computer that receives input from sensors, cameras, radars, maps, and other sources and makes decisions to accelerate, steer, turn, and brake; this takes the place of a human driver
- **Telecommunication companies:** Telecom and communications systems will be crucial to the shared, autonomous ecosystem, which will require a transformation of the supporting infrastructure to connect vehicles to other vehicles, and vehicles to infrastructure, handling high-volume data reliably and securely. It's an opportunity to roll out the next generation of mobile networks, with much faster speeds and far less latency.
- **Data aggregators:** These companies will collect the driving environment data from a variety of sources and then process that data into info that is sent back to the vehicles
- **The technologies (autotech companies):**
    - Sensing
    - Development tools
    - Processing
    - Data
    - Processing
    - Position navigating
    - Software, systems engineering

- Cybersecurity

Even though this entire autonomous vehicle ecosystem is an economic development target, Gallup's population, rural location and small labor shed will hinder its ability to create a competitive advantage for a large vehicle manufacturing/assembly facility or for subsystem integrators that require hundreds of employees in a facility. Better opportunities will be created from the innovators in AV technology, both hardware and software, which will play an increasingly critical role in the new autonomous vehicle supply chains being formed and are not currently linked to the traditional OEM supply hubs.

Changes in Facility Location Philosophy

The effect of the reliance on very complex technologies has begun to reshape the landscape of the transportation industry, including where it has facilities and supply chain locations. As companies are finding it easier to establish manufacturing facilities in a new location further from the traditional automotive parts supply chain, location decisions are being driven less by pure cost and more by access to talent and research hubs. This has created new opportunities for regions that have never had a presence in the automotive industry. In particular, there is tremendous opportunity in the US West region for three reasons: 1) access to Asian supply chain systems is critical so proximity to the key West Coast ports is essential, 2) lower costs and friendly government is important, particularly state and local governments that understand the needs of the industry as it goes through a period of dramatic change, and importantly 3) relative proximity to Silicon Valley has become paramount as this region has emerged as the true global center for automotive technologies.

NAICS Changes to Reflect the Autonomous Vehicle Sector

Currently there is very little information available on any of the industry sectors that are part of the autonomous vehicle eco-system and there is no North American Industry Classification System (NAICS) that adequately captures the sector and the ecosystem that is developing around it. NAICS is the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy. NAICS is reviewed every five years to determine what, if any, changes are required, and the next review is currently underway and the results will be available in January 2022.

It is anticipated that when the classification update is issued in January 2022, this industry will be reflected in NAICS code 541715 - Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology). However, the various component manufacturers will still be categorized within their existing NAICS codes, but these codes will not break out the job descriptions, employment numbers, and salaries that are attributable specifically to the autonomous vehicle sector. As an example, under battery manufacturing for electric/autonomous vehicles, it only breaks out statistics for electric parts for combustion engines. This makes it very difficult to represent the current state of the industry and its future potential.

Given the autonomous vehicle systems industry cluster is one that features many niche categories, little comparative historical data is available to identify workforce and private sector growth trends and related opportunities. However, much research and forecasting has been done and continues to progress as these underlying subsectors rapidly evolve which GLDPartners will use as the foundation for this analysis.

Marketing to the Industry

- Gallup will not see success by solely implementing a broad or generic marketing strategy for this industry sector, instead direct and customer-specific business development will be required, complemented by a supportive and professional brand.

    - Delivery of the business proposition should have high levels of sophistication and specificity, including a dossier summary of the target company's supply chain and a set of specific suggestions offering location, transportation, labor and overall operational and transport cost advantages
- Produce highly developed business propositions for direct business development activity
- Assure well-located property assets are available for delivery
- Attend to issues that are identified as challenges in the competitiveness assessment
- Generate a seamless business partnership between Gallup economic development, local government, and State government

Workforce

It is clear the future of truck automation will offer new employment opportunities but will require a set of additional skills. To maintain and improve the workforce, all players in the mobility eco-system will need to cooperate on curriculum development, internship and apprenticeship opportunities, and other paths to reskilling and upskilling. New components and systems will require upskilling workers throughout the supply chain—from engineering and design to software development to those on the factory floor and in repair shops. For example, truck operators will need to supplement their existing capabilities with competencies in logistics, information technology and other areas. The education and professional development of technicians in the mobility fields is pivotal to the future of transportation. Without the suitable education and training for technicians and ITS professionals, the technology advancements for vehicles and automation will not be deployed to the fullest extent.

The transportation industry in collaboration with several community colleges in Michigan have created a new classification, Mobility Technician, which incorporates the skill sets that will be necessary for a new basic position in the mobility industry. The skills developed for this technician position will also be valuable for future opportunities in Gallup for the manufacturing and production of the components that will be used in the new autonomous vehicles which will be based upon sensors, radar, etc.

Mobility Technicians

The industry has created a new classification, mobility technician, which is actually a combination of:

- Industrial Engineering Technician
- Electrical and Electronics Installer and Repairer
- Automotive Specialty Technician (Mechanic)
- Electronics Engineering Technician

The soft skills that are necessary:

- Verbal & Written Communication
- Adaptability & Flexibility
- Critical & Analytical Thinking
- Team Focus & Collaboration

The most frequent existing community college programs that are taught for this industry are:

- Automotive technology (engine performance, chassis technology, drivetrain technology, and electronics)
- Computer information systems and computer programming

- Cybersecurity
- IT/data management and software/design
- Some form of engineering (computer, electronics, mechatronics, industrial, and systems), and computer aided drafting. Programs like mechatronics (which blends electrical and mechanical engineering), give students an opportunity to repair and perform maintenance on computer operated machinery and other autonomous systems that will soon be very commonplace.
- Autonomous truck operations is a program that is currently being offered at Pima Community College in Tucson, Arizona.
- At the present time there is not sufficient demand in the community colleges to provide more mobility specific programs, but the institutions surveyed are very confident that as more auto tech companies begin to do business in their regions, they have the ability to ramp up course offerings very quickly.

The job description most used by companies is based on the tasks of an Electrical/Engineering Technician

- Read blueprints, wiring diagrams, schematic drawings or instructions for assembling electronics units; apply knowledge of electronic theory & components.
- Identify and resolve equipment malfunctions, work with manufacturers / field representatives to procure replacement parts.
- Test electronics units using standard test equipment; analyze results to evaluate performance and make adjustments.
- Adjust or replace defective or improperly functioning circuitry or electronics components.
- Assemble, test or maintain circuitry or electronic components per instructions, technical manuals or knowledge of electronics (using hand or power tools).

Workforce will be one of the most critical elements of a Gallup business proposition to the mobility industry. GGEDC working through their Greater Gallup Industrial Workforce Program and collaborating with CBEWD and Ready New Mexico must design a customized workforce training component specifically for the mobility industry that will include both job training and recruiting functions.

Economic Development Targets for Gallup, McKinley County, New Mexico

The industry targets that have been selected as economic development targets for Gallup are based upon a thorough review of the entire autonomous vehicle eco-system and are targets that we believe will present Gallup with the best opportunity for success in attracting this industry. Success in these attraction efforts is contingent on the development of a competitive testing and development complex that will introduce Gallup to the industry. Gallup currently has no name recognition or history in the legacy vehicle industry. The trucking testing and development complex coupled with the passage of HB 270 will earn Gallup a name in the industry.

Manufacturing of Electric Vehicle Batteries

- As supply chains globally remain in distress, automakers are spending billions to localize production of battery cells to meet what's expected to be a rapid adoption in electric vehicles.
- Other than Tesla, the country's electric vehicle sales leader, automakers in the US have been reluctant to invest in battery cell production until recently.
- Based upon a rolling five year average of announced investments, Alix Partners, a US consulting firm in the automotive space, expects companies to invest $330 billion in the next five years throughout the electric vehicle supply chain globally.

Two revolutions are happening side-by-side in the vehicle industry: the transition to electric power and the rise of autonomous vehicles. Self-driving vehicles may use more energy than people-driven cars to power sensors and computers for safe navigation. On the other hand, they drive more smoothly than humans do, which would reduce energy use.

Some analysts have suggested that these increased power needs are significant enough to drastically reduce vehicle range thus eliminating the possibility of electric autonomous vehicles. Instead, these analysts claim autonomous vehicles must be gas-electric hybrids. However, recent research by Carnegie Mellon University suggests that energy-efficient software and aerodynamic hardware will make for more eco-friendly self-driving cars and that electric power can supply enough energy for an autonomous vehicle without a significant decrease in range.

As the industry moves, these two technologies, electric power and autonomy, will begin to work in tandem and should give a number of Silicon Valley start-ups and subsidiaries an advantage as they are already making substantial progress.

Global environmental and regulatory push is driving rapid electric vehicle growth. Sales and production of electric vehicles (EVs) continue to accelerate globally, with double-digit annual growth expected over the next decade. To keep the expansion and development of EVs charging ahead, vehicle manufacturers, automotive suppliers and governments are plugging in more investment to regional supply chain and gigafactory networks for lithium-ion (Li-ion)batteries. As the battery represents 30% or more of the total value of a vehicle, established OEMs and suppliers (not to mention governments) are interested in taking control of the supply chain rather than see profits and jobs shift to other players and locations.

Li-ion battery technology is critical to improving the driving range of electric vehicles and to reducing the costs of plug-in, rechargeable powertrains compared to gasoline-powered vehicles. However, with demand for EVs rising faster than predicted before the Covid-19 pandemic, the supply and cost of materials like lithium and cobalt have tightened, while many vehicle manufacturers have become dependent on a few li-ion battery suppliers. Meanwhile, with a large share of the value chain based in Asia and especially China, carmakers and automotive suppliers are in a race to develop battery factories and supply chains across Europe and North America, too.

Without enough battery capacity, the US risks falling behind in the race for vehicle electrification. Without a well-developed and secure battery supply chain, EV production in the US will be dependent on the supply of components from mostly Asia. This will be very similar to what is currently being demonstrated by the semiconductor shortage.

The battery supply chain will become increasingly localized. Both China and the EU are set to see significant growth in battery production. The US and North America are behind in investment but earlier this year, the Biden administration announced Executive Order 14017, which directed government agencies to assess global battery supply chains to understand domestic vulnerabilities and opportunities. Since then, the administration has also published a guide on investments and R&D efforts to support bolstering the domestic supply chains. This blueprint outlines major goals that are meant to secure long-term competitiveness for the US as a major player in the battery value chain. Objectives range from mineral extraction, battery cell design R&D, and sustainable methods of recycling and reuse.

Overall, the US has certain advantages and disadvantages in the global playing field. The country has vast natural resources, a large amount of capital, and skilled labor. However, it has a lack of centralized federal approaches to supply chains and a high cost of labor and manufacturing. Historically, the US has relied on private sector market forces to drive development and innovation forward for battery technology. Based on the published blueprint, there appears to be a larger emphasis on the role of the public sector and regulatory frameworks to continue carving out a competitive edge for the US.

OEMs will seek to have a diversity of battery cell suppliers. They need a multi-sourcing model as well as being able to enter into JVs and other investments to build their own cells and components in-house. This will allow an OEM to remain competitive as well as control costs and quality. OEMs want to have control of their battery supply chain. Ultimately, the li-ion battery may not be the only solution, but right now it is the industry's best bet. Certain new technologies such as lithium-sulfur and solid-state batteries as well as hydrogen fuel cells could eventually prove themselves, but then they will all be a part of the electric power strategy.

Structure of an EV battery

Li-ion batteries, like many high-tech goods, have a complex supply chain in which production can be broken into three stages, and those stages can be completed in different locations.

Cell Manufacturing	Module Manufacturing	Battery Pack Assembly
• Cathode • Anode • Electrolyte	• Cells placed in a case attached to terminals	• Modules • Electrical connections • Cooling equipment

Market Projections

Frost and Sullivan is projecting that the global Li-ion battery materials market will reach over $51 billion by 2027 from $18.75 billion in 2020. This market is projected to be the largest economic development target in the United States at this time. In fact during the week of October 17th, Toyota and Proterra announced that they will be building EV battery manufacturing facilities.

Site Location Strategy

As previously noted, there are three stages to the battery production process which can be bifurcated, allowing a company to locate the processes in different locations. Realistically, it is probable that the entire process would be located in one facility. However, there are examples of the cell manufacturing located in one facility while the module manufacturing and battery pack assembly are located together in another location.

The crucial site location components of the battery location strategy are:

- Superior transportation and logistics networks with access to international deep-water ports
- Stable, cost-efficient, and clean power supply
- Availability of a large real estate tract that can enable a desirable rate of return on investment
- Friendly tax, regulatory and strong pro-business environment
- Established complimentary industries such as e-mobility, solar and semiconductor
- Generous state and local incentives
- Available workforce capacity
- Strong workforce development programs

- Foreign Trade Zone
- Willingness by state and local leaders to get aggressive in the deal-making process
- Direct access to the political powers-that-be in the state capital

Target Lithium-ion Battery Manufacturers
LithiumWerks
Location: Round Rock, TX
LithiumWerks manufactures Lithium-ion batteries for fully electric, hybrid, and plug-in hybrid electric vehicles & trains. The company wants to build North America's largest plant for the production of cathode powder and electrodes for lithium batteries. Site selection for the plant is underway and is expected to be completed by the fourth quarter of 2021. The plant will be a quantum leap forward for North American cell manufacturers and represent two important steps in the North American lithium-ion battery supply chain. LithiumWerks is a Dutch company and its US headquarters is located in Round Rock, TX.

American Battery Solutions
Location: Springboro, Ohio
The company engineers, develops, and manufactures high-quality lithium-ion batteries and battery systems to serve electric vehicles (EV), electrified transportation, motive, industrial, and commercial markets.

Clarios
Location: Milwaukee, Wisconsin
Clarios, known previously as Johnson Controls Battery, Inc., is a global energy storage company that creates and manufactures advanced battery technologies for all types of vehicles. They have just announced a shift in resources to improve battery technology for electric and autonomous vehicles, including trucks.

Valence Technology, Inc.
Location: Austin, Texas
Valence Technology, Inc. is a leader in the development and commercialization of Lithium-ion polymer rechargeable batteries. They are headquartered in Austin, TX.

Enerdel, Inc.
Location: Indianapolis, Indiana
EnerDel is developing Lithium-ion battery (LIB) solutions for automotive manufacturers that will improve the performance, fuel-efficiency and cost of hybrid electric vehicles.

Panasonic Energy of North America
Location: Sparks, Nevada
Panasonic is a leading supplier of batteries offering advanced cell manufacturing and product technologies, and one of the broadest lines of primary and rechargeable batteries in the industry. The company supported Toyota's groundbreaking hybrid models and, most recently, helped power Tesla's dominance in the consumer electric vehicle space. The US Headquarters is located in Sparks, NV.

LG Chem Michigan Inc.
Location: Manchester, Michigan
Korea's LG Chem is the world's number 1 lithium-ion battery manufacturer by capacity. They have

agreements to supply Volkswagen, General Motors (Chevy), Ford, Geely (Volvo), Renault Nissan Hyundai Kia, and others. LG Chem is currently building a manufacturing facility in Lordstown, Ohio through its joint venture with General Motors and has also agreed to build a second cell manufacturing plant for GM in Tennessee.

SKBattery Company, America
Location: Commerce, Georgia
SK Battery Company is a Korean company that produces lithium-ion batteries for mass production. They have signed supply contracts with major global automakers, Hyundai Motor Group, BAIC Group and Daimler AG. They have located a battery manufacturing facility in Georgia and recently announced plans to be a second plant also in Georgia. Their US headquarters is located in Commerce, GA.
Recommendations
To be prepared to compete for this investment, GGEDC should actively initiate and strengthen relationships with companies through the national battery trade associations. By participating in committees and activities of the associations, GGEDC will become more familiar with the industry in general as well as interacting directly with companies and demonstrating opportunities for manufacturing in Gallup.

- NAARBratt International
  Promotes the development and commercialization of electrochemical energy storage technology and the revitalization of advanced battery manufacturing in North America.
  Web Site: www.naatbatt.org
- The International Lithium Alliance
  Is the focal point for the lithium industry, providing global leadership on all major strategic issues affecting the industry
  Web Site: www.lithiumalliance.org

Participate in industry specific trade shows, although the effectiveness of this tactic is often debated.

- The Battery Show : North America's largest and most comprehensive advanced battery manufacturing trade show, The Battery Show is a forum for advanced battery technology for electric & hybrid vehicles, utility & renewable energy support, portable electronics, medical technology, military, and telecommunications.
  Web Site: www.thebatteryshow.com/en/home.html

Schedule a visit to the Tesla/Panasonic battery gigafactory in Nevada. By seeing firsthand an operating facility, GGEDC will have a much better understanding of how a battery manufacturing facility operates which will help them prepare a more sophisticated business proposition to a battery manufacturer.

Economic Development Opportunities in the Advanced Sensor Technologies Sector
Sensors
Autonomous vehicles would be impossible without sensors: they allow cars to monitor their surroundings, detect oncoming obstacles, and safely plan their routes. In combination with automotive software and computers, they will soon allow the automation system to take over full control of the vehicle, thereby saving drivers a significant amount of time by doing tasks in much more efficient and safe ways. Given the fact that the average driver spends approximately 50 minutes in a car daily, just imagine how valuable autonomous vehicles could be for the fast-paced world we live in. Autonomous vehicles rely on sophisticated algorithms running on powerful processors. These processors make second-by-second decisions based on real-time data coming from an assortment of sensors. Millions of test miles have refined the technology and driven considerable progress – but there is still a way to go. The majority of

today's automotive manufacturers most commonly use the following three types of sensors in autonomous vehicles: cameras, radars, and lidars.

Cameras

Cameras are the most commonly adopted sensor in a vehicle today. Since 2018, all new vehicles in the US are required to fit reversing cameras as standard. Any car with a lane departure warning system (LDW) will use a front-facing camera to detect painted markings on the road.

Autonomous vehicles are no different. Almost all vehicles in development today feature some sort of visible light camera for detecting road markings – many feature multiple or panoramic cameras for building a 360-degree view of the vehicle's environment and a broader picture of the traffic conditions around them. Today, 3D cameras are available and utilized for displaying highly detailed and realistic images. These image sensors automatically detect objects, classify them, and determine the distances between them and the vehicle. For example, the cameras can easily identify other cars, pedestrians, cyclists, traffic signs and signals, road markings, bridges, and guardrails.

Unfortunately, these camera sensors are still far from perfect. Poor weather conditions such as rain, fog, or snow can prevent cameras from clearly seeing the obstacles in the roadway, which can increase the likelihood of accidents. Additionally, there are often situations where the images from the cameras simply aren't good enough for a computer to make a good decision about what the car should do. For example, in situations where the colors of objects are very similar to the background or the contrast between them is low, the driving algorithms can fail.

Radar Sensors (Radio Detection and Ranging)

Radar sensors make up a crucial contribution to the overall function of autonomous driving: they send out radio waves that detect objects and gauge their distance and speed in relation to the vehicle in real time. As with cameras, many ordinary cars already have radar sensors as part of their driver assistance systems – adaptive cruise control, for example.

Radar works best at detecting objects made of metal. It has a limited ability to classify objects, but it can accurately tell you the distance to a detected object. However, unexpected metal objects at the side of the road, such as a dented guard rail, can provide unexpected returns for development engineers to deal with. However, unlike camera sensors, radar systems typically have no trouble at all when identifying objects during fog or rain.

Where radar really falls short is that the radar sensors used in today's vehicles only correctly identify between 90% and 95% of pedestrians, which is not enough to ensure safety on the road. There are also other issues with the radar not being able to accurately determine the height of an object. Fortunately, there are a wide variety of new radars being developed for use in autonomous vehicles.

LiDAR (Light Detection and Ranging)

LiDAR is one of the most hyped sensor technologies in autonomous vehicles and has been used since the early days of self-driving car development. LiDAR sensors work similar to radar systems, with the only difference being that they use lasers instead of radio waves. A hugely versatile technology, it is increasingly being used in a wide range of applications. LiDAR systems emit laser beams at eye-safe levels. The beams hit objects in the environment and bounce back to a photodetector. The beams returned are brought together as a point cloud, creating a three-dimensional image of the environment.

This is highly valuable information as it allows the vehicle to sense everything in its environment, be it vehicles, buildings, pedestrians or animals. Hence why so many development vehicles feature a large 360-degree rotating LiDAR sensor on the roof, providing a complete view of their surroundings. These two advantages make autonomous vehicle manufacturers such as Google, Uber, and Toyota choose lidar systems.

While LiDAR is a powerful sensor, it's also the most expensive sensor in use. Since rare earth metals are needed in order to produce adequate LiDAR sensors, these sensors are much more expensive than radar sensors used in autonomous vehicles. The systems required for autonomous driving can cost well beyond $10,000, while the top sensor being used by Google and Uber costs up to $80,000. Yet another problem is that snow or fog can sometimes block LiDAR sensors and negatively affect their ability to detect objects. However, there are many researchers and startups working on new LiDAR technologies, including solid-state sensors, which are considerably less expensive.

At this point in time, there is no preferred sensor for use in autonomous vehicles. All of these technologies are complementary and there is no one sensor modality that can address all the necessary requirements. Many AV companies are opting for a combined solution which combines the respective strengths of both LiDAR and radar. For example, Waymo's next-generation self-driving system uses a complete sensor suite — cameras, radar, and even LiDAR for a total AV solution.

This is a new and emerging industry in the economy and as these technologies continue to be developed, demanded, and integrated on a national and global level, there will be a need for advanced sensor manufacturing facilities to produce these devices.

Site Location Strategy

Advanced sensor establishments utilize a wide variety of the newest technology like 3-D printing, digital manufacturing, and robotics and need to be sure they will have reliable internet and other connections so that broadband infrastructure is a very critical element in siting a facility. Other important components of their facility strategy include:

- Industrial zoning
- Water/sewer infrastructure and capacity
- Access to transportation
- Electricity infrastructure (redundant and multiple phases)
- Natural gas infrastructure
- Existing buildings with high ceilings
- Fast track plan review, permitting and building inspection is an incentive that is especially important to this industry and has significant value by accelerating production schedules
- Land with little due diligence concerns

Target Companies in Advanced Sensor Technologies

Velodyne LiDAR

Location: San Jose, California

Velodyne LiDAR is a technology company that manufactures sensor products and real-time LiDAR sensors. It offers light detection and ranging scanners.

Luminar

Locations: Palo Alto, California; Colorado Springs, Colorado and Orlando, Florida.
Luminar is working with the world's top 15 automotive companies as part of their global autonomous development programs, including Volvo Cars, Toyota Research Institute, and VW/Audi's subsidiary, AID.

AEye
Location: Dublin, California
AEye develops advanced vision hardware, software, and algorithms that act as the eyes and visual cortex of autonomous vehicles.

Ouster
Location: San Francisco, California
Ouster builds high-resolution lidar sensors for use in autonomous vehicles, robotics, and many other applications using its unique multi-beam flash lidar design. On October 25th, Ouster announced the acquisition of Sense Photonics and formally established Ouster Automotive, a division of Ouster, which will focus on driving mass-market adoption of digital lidar in consumer and commercial vehicles.

Baraja
Locations: Offices in Sydney, Australia; China and the US.
Baraja is a 3D machine vision systems manufacturer. It has invented a new type of LiDAR called Spectrum-Scan which delivers the highest performance available to address the challenge of self-driving cars. It was founded in 2016.

Quanergy Systems
Location: Sunnyvale, California
Quanergy Systems is a technology company that was founded in 2012 and offers smart sensing solutions. It is the leading provider of time-of-flight LiDAR sensors and perception software for real-time capture and processing of 3D spatial data and object detection, identification, classification and tracking.

Aeva
Location: Mountain View, California
Aeva has developed a new sensing & perception paradigm for autonomous machines. Its technology brings together the best of vision, depth, and motion sensors into a single product with superior performance

Cepton Technologies
Location: San Jose, California
Cepton Technologies is an electronics company that provides 3D sensing solutions designed for LiDAR products for automotive, industrial, and mapping markets.
markets.

Recommendations

- Actively strengthen relationships with companies through national trade associations. Participate in committees and activities of the associations to become more familiar with the industry in general as well interacting with companies and demonstrating opportunities for manufacturing in the Gallup region.
    - A3 Association for Advancing Automation
      www.automate.org
    - Sensors Converge

www.sensorexpo.com

- Establish workforce development programs and career pathway programs that are directly connected to the types of occupations and skills needed to serve this industry. These skill sets will be very valuable in New Mexico as there are currently opportunities through-out the state for people to use these skill sets.
- Work with New Mexico universities all over the state as well as the national laboratories to see if there are opportunities to coordinate internships and apprenticeships to create direct connections between where the innovation is occurring and where the manufacturing could locate.
- Ensure that Gallup has both the state-of-the-art infrastructure and broadband that will be critical for any advanced sensor manufacturing firm. Conduct an inventory of existing and needed infrastructure and make upgrades as necessary to ensure manufacturing establishments of all kinds have access to reliable and state of the art broadband and cell service.
- Recognize that this could be a long-term opportunity that will require investment in the form of incentives, R&D funding, and network development. This will not be an overnight success but will require patience and ongoing attraction work.

Economic Development Opportunities in Mobility Cybersecurity

Protecting autonomous vehicles from hackers is of paramount concern to federal and state governments, manufacturers, and service providers. After *Wired* magazine ran a story in 2015 showing just how simple it was for several ethical hackers to infiltrate a Jeep's software, makers of smart cars began taking automotive cybersecurity seriously. The hackers were able to remotely seize control of the vehicle as it cruised at 70 mph, which resulted in Chrysler recalling 1.4 million cars.

In other examples, in 2019, an anonymous hacker accessed several commercial fleets internationally and was able to shut the engines down and access user information. Also is the same year ethical hackers, accessed a Tesla Model 3 computer in only a few minutes by hacking into the vehicle's onboard entertainment browser. In 2020, the same researchers that breached the Tesla installed malicious code in a Lexus NX300.

As vehicle technologies advance, the security of data collected by vehicle computers and the protection of on-board systems against intrusion are becoming more prominent concerns. Many of the sensors and automated components providing functions now handled by the driver will generate large amounts of data about the vehicle, its location at precise moments in time, driver behavior, and vehicle performance. The systems that allow vehicles to communicate with each other, with roadside infrastructure, and with manufacturers seeking to update software will also offer portals for possible unauthorized access to vehicle systems and the data generated by them.

If hackers could use more than a dozen portals to enter even a conventional vehicle's electronic systems, it is frightening to consider all the ways that an autonomous vehicle could be breached. The airbag, the lighting system, and the tire pressure monitoring system (TPMS) are just a few ways an existing vehicle can be breached.

The AI systems of an autonomous vehicle are working non-stop to recognize traffic signs and road markings, to detect vehicles, estimate their speed, to plan the path ahead. Apart from unintentional threats, such as sudden malfunctions, these systems are vulnerable to intentional attacks that have the specific aim to interfere with the AI system and to disrupt safety-critical functions.

Adding paint on the road to misguide the navigation, or stickers on a stop sign to prevent its recognition are examples of such attacks. These alterations can lead to the AI system wrongly classifying objects and could cause the autonomous vehicle to perform some dangerous actions.

However, the consequences of hacking an autonomous commercial vehicle are even more substantial when factoring the function, they serve in complex global supply chains. Commercial vehicles carrying high-value goods could prove more lucrative in the eyes of hackers in comparison to hacking a passenger vehicle. Fleets used in a logistics function will definitely be at a greater risk for a cyber-attack when transporting industrial equipment, hi-tech electronics, and pharmaceuticals, when the value of the product can be so high. That will affect businesses and revenue.

The global automotive cybersecurity market is dominated by major players such as Robert Bosch (Germany), Continental AG (Germany), Harman International (US), Denso Corporation (Japan), Aptiv (Ireland), Karamba Security (Israel), SafeRide Technologies (Israel), Arilou Technologies (Israel), GuardKnox(Israel), etc. These companies have secure distribution networks at a global level and offer a wide range of cybersecurity products for traditional as well as electric and autonomous vehicles. These companies have adopted strategies of new product development, expansions, collaborations, partnerships, and acquisitions to gain traction in the market. Collaborations were the most adopted strategy. The size of the total market is projected to grow from USD 1.9 billion last year to USD 4.0 billion by 2025.

Countries like the US and UK have already passed legislation to ensure car manufacturers meet a minimum standard for their vehicles. Some of the policies includes: Privacy by Design, Transparency, which means controlling how personal data is used, consent, location data, security of personal data and more.

Many companies are doing extensive research and testing before pushing out any cars to the market to ensure that they are safe for the public. For example, Waymo's self-driving cars have been tested for over 10 million miles on public roads in the US. There's also groups like the Automotive Information Sharing & Analysis Center (Auto ISAC) that are proactively sharing information about security issues related to autonomous vehicles. While there are definitely things to be concerned about, the risks are being looked at extensively by governmental and private entities looking to mitigate these risks. It is important to note that the focus on cybersecurity research is equally strong in both industry and in academia.

Facility Location Requirements

- Resilient reliable and affordable power
- Robust telecommunications connectivity
- Availability of secure and affordable office space
- Workforce is critical

Target Companies in Cybersecurity

Digital.ai

Location: Plano, TX

How it's using cybersecurity in autonomous vehicles: Digital.ai develops cybersecurity tools for many industries, including automotive. Using binary level code obfuscation, data encryption and real-time cyber threat alerts, the company helps thwart attacks on a car's software.

Industry Impact: Digital.ai has developed a suite of cybersecurity solutions for a large consumer and industrial vehicle manufacturer. All of the carmaker's dealerships protect their smart cars with secure apps that handle everything from data protection to performance analytics.

Mocana
Location: San Jose, California
How it's using cybersecurity in autotech: Mocana develops mobile app cybersecurity solutions for the automotive industry. Its end-to-end automotive cybersecurity system features software that allows for secure "over-the-air" and "over-the-web" firmware updates to a car's operating system. Industry impact: Mocana's software tools help protect the integrity of everything from a car's navigational cameras to its power steering and infotainment system.
Aptiv
Location: Dublin, Ireland
How it's using cybersecurity in autonomous vehicles: Aptiv develops software and computing platforms for self-driving vehicles. The company's cybersecurity tools protect everything from a car's infotainment system to its wiring.
Industry impact: Aptiv has formed a joint venture with Hyundai Motor Group called Motional. Motional is developing and commercializing SAE Level 4 vehicles – autonomous vehicles that perform all driving tasks which they are currently testing. Motional is based in Boston, with teams in Pittsburgh, Las Vegas, Santa Monica, Singapore, and Seoul. The newest office, Seoul, serves as a key technology hub and testing location.

Dellfer
Location: Novato, California
How it's using cybersecurity in autonomous vehicles: Dellfer is an automotive cybersecurity startup focusing on coding for autotech software. The company's embedded code helps IoT-enabled cars battle cyber-attacks throughout a car's system. No Internet connection is needed to update critical patches. Instead, the company deploys code execution paths at runtime for security enforcement. **Industry impact:** Dellfer partnered with DENSO, the world's second-largest mobility provider, to help install Dellfer's IoT cybersecurity tools in a wider range of vehicles.

Argus Cyber Security
Location: Tel Aviv, Israel; North American headquarters is in Bloomfield, MI
How they are using cybersecurity in autonomous vehicles: Argus provides commercial smart vehicles with anti-cyber-attack tools like connectivity and in-car network protection that safeguard everything from a vehicle's infotainment center to the communication networks that run between its software and hardware.
Industry impact: Continental now integrates Argus' cybersecurity solutions into all of its connected vehicle electronics.

NVIDIA
Location: Santa Clara, California
How they are using cybersecurity in autonomous vehicles: NVIDIA uses AI-powered data processors and chips to operate and protect self-driving cars. The company's software and cloud-based technologies help autonomous vehicles securely learn and relay driving data.
Industry impact: The NVIDIA deep learning systems have been used by Tesla, Mercedes-Benz, Audi, Toyota and Volkswagen to power and protect self-driving vehicles.

GuardKnox
Location: Ramla, Israel
How they are using cybersecurity in autonomous vehicles: GuardKnox creates coding architecture for autonomous cars that operates everything from the general vehicle systems (including sensors) to tools that enhance a car's user experience (infotainment systems, center consoles, etc.).
Industry impact: Porsche enlisted GuardKnox to improve cybersecurity in its new line of vehicles. The German carmaker says the new technology will protect against hacking attacks and act as a foundation for "real-time customization of the vehicle."

Harman
Location: Stamford, Connecticut
How they are using cybersecurity in autonomous vehicles: Harman partnered with IBM to develop the Harman SHIELD, which protects key entry points of a car's network from hackers. In addition, it continuously performs a threat analysis to determine which points are most vulnerable at any given moment.
Industry impact: Harman revealed the Ignite 3.0, an automotive-based assistant for cars, at the CES conference in Las Vegas. It's backed by the company's SHIELD cybersecurity infrastructure.

Intertrust
Location: Sunnyvale, California
How it's using cybersecurity in autonomous vehicles: Intertrust makes products that help personalize drivers' cybersecurity needs and overall experience. Some of the company's products include tools that protect a vehicle's infotainment center, prevent unauthorized entry and stop the gathering of personal data.
Industry impact: One of Intertrust's main software products, whiteCryption, speeds up and safeguards content delivery to drivers. Another tool, Personagraph, encrypts a driver's personal data.

Recommendations
Begin to create a skilled workforce by creating interest in the cybersecurity industry and its employment opportunities. Although younger students and millennials have grown up with computers being second nature to them, most of them are unaware of what cybersecurity is all about. Not being exposed to classes or information about cybersecurity means they've had little or no opportunity to understand what a career in cybersecurity entails. With so few students attending colleges, universities, and IT institutions with the goal of a career in cybersecurity, there are even fewer grads to recruit. If more school and college-aged students are made aware of the rewards and opportunities in cybersecurity, they may be more likely to choose a career path within the field.

Reach out and collaborate with a national program that is accessible in New Mexico which is The National Centers of Academic Excellence in Cybersecurity (NCAE-C) program and is managed by the National Cryptologic School at the National Security Agency. Federal Partners include the Cybersecurity and Infrastructure Security Agency (CISA), the Federal Bureau of Investigation (FBI), the National Institute of Standards and Technology (NIST),National Initiative on Cybersecurity Education (NICE), the National Science Foundation (NSF), the Department of Defense Office of the Chief Information Officer (DoD-CIO), and US Cyber Command (CYBERCOM). The mission of the National Centers of Academic Excellence in

Cybersecurity (NCAE) program is to create and manage a collaborative cybersecurity educational program with community colleges, colleges, and universities throughout the country.

Participating schools in New Mexico are:

- Central New Mexico Community College
- Eastern New Mexico University - Ruidoso
- New Mexico Tech
- University of New Mexico
    - Install a function in the Gallup Testing and Development Facility where companies can safely research, test and develop solutions for the cybersecurity of autonomous vehicles
- Actively Collaborate with Associations:
    - Auto -ISAC-Automotive Information Sharing and Analysis Center
      This is an industry-driven community to share and analyze intelligence about emerging cybersecurity risks to the vehicle, and to collectively enhance vehicle cybersecurity capabilities across the global automotive industry, including light- and heavy-duty vehicle OEMs, suppliers and the commercial vehicle sector.

The Alliance for Automotive Innovation which represents the manufacturers producing nearly 99 percent of cars and light trucks sold in the U.S. The newly established organization, a combination of Global Automakers and Alliance of Automobile Manufacturers, includes motor vehicle manufacturers, original equipment suppliers, technology and other automotive-related companies and trade associations. Establish a working relationship with the Cyber Engineering Research Institute (CERI) at Sandia National Laboratory. CERI is a virtual organization spanning Sandia's two main sites. New Mexico's CERI facility — the Cyber Engineering Research Laboratory — is located in the Sandia Science & Technology Park in Albuquerque. CERI focuses on exploratory research in cybersecurity and facilitates partnerships with academia and industry in order to push the frontiers of science and grow the next generation of cybersecurity talent.

Appendix C - Abbreviations and Acronyms

AFRL	Air Force Research Laboratory
AI	Artificial Intelligence
Auto-ISAC	Automotive Information Sharing and Analysis Center
AV	Autonomous Vehicle
CBEWD	Community Education/Workforce Development, University of New Mexico, Gallup
CERI	Cyber Engineering Research Institute
EU	European Union
EV	Electric Vehicle
FTZ	Foreign Trade Zone
GMID	Gallup Mobility Investment District
IOT	Information of Things
IT	Information Technology
ITS	Intelligent Transportation Systems
LDW	Lane Departure Warning System
LEDA	Local Economic Development Act
Li-ion	Lithium-Ion
NAICS	North American Industry Classification System
NMMS	New Mexico Mobility Study
OEM	Original Equipment Manufacturer
P3	Public Private Partnership
R&D	Research and Development
RIA	Regional Infrastructure Accelerator
SAE	SAE International (Society of American Engineers)
TDC	Testing and Development Complex
TDF	Testing and Development Facility
TMC	Truck Mobility Complex
TTDC	Truck Testing and Development Complex
TPMS	Tire Pressure Measuring System
USDoC	United States Department of Commerce
USDoA	United States Department of Agriculture
USDoE	United States Department of Energy
VC	Venture Capitalist
VW	Volkswagen AG