POLICY BRIEF · FEBRUARY 2026

From Waivers to Scale: How BVLOS Modernizes America's Low-Altitude Infrastructure

SAFE

COALITION FOR
Reimagined Mobility

Table of Contents

Executive Summary

Drones are no longer a niche technology—they are reshaping industry and national security. But, in the United States, commercial adoption is constrained by rules designed for short-range flights and regulatory pathways built for traditional aviation. Today, most commercial drones must remain within the operator's line of sight, preventing drones from delivering on some of their most valuable applications. Operators can apply for waivers to fly farther, but the process is slow, expensive, and inconsistent—creating a patchwork system that limits scale and planned investment.

The Federal Aviation Administration's proposed Beyond Visual Line of Sight (BVLOS) rule is intended to replace this patchwork with a more standardized framework. However, as currently drafted, the rule does not enable the scalable ecosystem envisioned by the *Unleashing American Drone Dominance* Executive Order, which calls for the safe integration of uncrewed aircraft, commercialization of drone technologies, and stronger domestic manufacturing and exports of trusted systems.[2] This gap is not just a commercial problem. Because drones are dual-use and are reshaping modern warfare globally, a stalled commercial sector also weakens U.S. defense readiness, industrial capacity, and innovation.

While industry and other stakeholders address technical fixes through formal public comments, this brief establishes the economic and societal 'why', providing the justification for a truly functional BVLOS rule.[3] Framing the intent of BVLOS through—*resilience, scale and competitiveness*—SAFE's Coalition for Reimagined Mobility (Remo) demonstrates how BVLOS can strengthen U.S. readiness in three key areas:

- **Critical infrastructure:** Routine long-distance drone inspections can reduce costs, improve safety, and catch failures earlier across energy, agriculture, and transportation networks.
- **Public safety and services:** BVLOS enables faster drone-as-first-responder programs, disaster mapping, and medical logistics that are impossible under strict line-of-sight rules.
- **Industrial and workforce competitiveness:** Clear BVLOS rules create a demand signal for U.S.-made drones, software, and services—supporting domestic manufacturing, skilled jobs, and a trusted supply chain.

This policy brief draws on interviews with twenty subject-matter experts from leading drone companies and public agencies, spanning manufacturing, operations, industrial policy, and regulatory affairs. It is supplemented by ReMo's analysis of qualitative and quantitative data across energy infrastructure, agriculture, delivery, medical logistics, disaster response, and public safety.

For policymakers, the FAA and other relevant federal agencies, the ask is clear:

- **Finalize Parts 108 and 146 in a Workable Form, on a Predictable Timeline.** Press for a risk-tiered, performance-based BVLOS framework that reduces reliance on bespoke waivers without imposing unnecessary compliance burden.
- **Drive Interoperability as a Condition of Scale.** Use federal standards, procurement, and grant requirements to prevent "walled gardens" by ensuring BVLOS operators, public safety, and participating agencies can share intent, deconflict, and verify conformance keeping implementation industry-led and competitive while standardizing the interoperability layer for nationwide operations.
- **Anchor a Trusted Domestic Drone Industrial Base.** Pair BVLOS regulatory certainty with federal buying power and focused incentives to scale manufacturing and supply chains of U.S. and allied drones and critical components, translating demand into domestic production capacity and resilience.

---

[2] U.S. President, Executive Order 14307, "Unleashing American Drone Dominance," *Federal Register* 90, no. 111, June 11, 2025.

[3] Federal Aviation Administration. "Normalizing Unmanned Aircraft Systems Beyond Visual Line of Sight Operations." *Federal Register* 90, no. 150, August 7, 2025. Note: the FAA terms BVLOS as any unmanned aircraft system (UAS) operation where the aircraft is not in the direct visual line of sight of the remote pilot in command.

What is BVLOS?

Put simply, Beyond Visual Line of Sight (BVLOS) allows a drone operator to fly further than can be seen with their own eyes, while still maintaining safety. BVLOS relies on a mix of sensors, cameras, automation, and networked data to keep the aircraft clear of other traffic, people, and obstacles.

Today, most U.S. drone operations are limited to visual line of sight (VLOS) under Part 107 rules. Part 107 works for multiple use cases, including photoshoots or a crew inspecting a single tower, but it does not scale to the more meaningful impacts of drones. These include long linear inspections, routine *Drone as First Responder* coverage, time-critical medical logistics, and cost-effective service to rural communities. Missions that require flying beyond where an operator can see the drone often fly over many miles or on automated schedules.

The FAA's draft BVLOS framework is meant to move these activities from one-off waivers into a predictable rule set.

> **Part 108** would create a purpose-built operating and airworthiness framework for routine BVLOS. It would specify what kinds of drones, organizations, and procedures are acceptable without going through the current case-by-case exemptions that are time-consuming, cost upwards of $100,000 and remain highly restrictive and bespoke to each applicant. This waiver model is already showing strain, BVLOS approvals increased roughly twenty-two-fold from 2020 to 2023, tying up FAA resources that could be better directed toward oversight and implementation.[3]

> **Part 146** adds a digital layer, certifying automated data service providers (ADSP) that help multiple operators safely share the same low-altitude airspace through standardized intent and location sharing, deconfliction, and real-time situational awareness across fleets.

However, BVLOS is not a niche delivery program. It sets the United States on the path for the efficient use and management of its low-altitude airspace, with direct implications for infrastructure resilience, economic competitiveness, and national-scale deployment. The BVLOS framework sets the conditions for routine, scalable operations across infrastructure, public safety, and logistics by pairing operational permission with a trusted digital coordination layer.

Impact Area 1: Secure and Enable Resilient Critical Infrastructure

Routine BVLOS operations can convert today's inspections into persistent, data-rich oversight of the assets, systems, and networks deemed critical infrastructure.[4] The biggest near-term gains are in utilities, energy, and food systems. Interviewees emphasized that the economic case already exists because many of these sectors pay for high-cost, higher-risk manned inspections today. The missing element is a predictable BVLOS rule that allows scaled, repeatable drone operations.

Protect Energy Infrastructure with BVLOS Monitoring

Power, oil and gas, and pipelines are the backbone of the modern U.S. energy economy, and they break in ways that are expensive and dangerous. In the power sector alone, outages cost the economy an estimated $150 billion per year, driven by storms, aging assets, and growing demand.[5] BVLOS doesn't replace strengthening or rebuilding infrastructure, but it can sharply reduce the time, cost, and risk of finding key issues.

> *"BVLOS is a transformational technology shift. It delivers two core outcomes for our business and customers, lower operations and maintenance costs and higher service reliability. And it adds a third, safer operations, putting drones where we don't want to put people and reducing field risk."*
>
> – Representative, large U.S. electric utility

Today, many utilities and line operators rely on helicopters and ground crews to inspect long corridors. That model is costly, energy and time intensive, and exposes workers to hazards like low-altitude flying, climbing, and roadside work.[6] Industry comparisons put helicopter line inspection at roughly $1,200–$1,500 per mile versus ~$200 per mile

[3] U.S. Department of Transportation, Office of Inspector General, *FAA Faces Challenges in Ensuring the Safety of Drone Operations beyond Visual Line of Sight*, Audit Report no. AV2025034. 2025.

[4] Cybersecurity and Infrastructure Security Agency, "Critical Infrastructure Sectors," CISA, 2026.

[5] Bongumsa Mendu and Nhlanhla Mbuli, "State-of-the-Art Review on the Application of Unmanned Aerial Vehicles (UAVs) in Power Line Inspections: Current Innovations, Trends, and Future Prospects," *Drones* 9. October 11, 2025.

[6] Jen Boyer, "A Sector in Flux: Utility Helicopter Operators Discuss Challenges & Changes," *Vertical Mag*, February 17, 2025

with drones, making high-cadence inspection economically realistic once routine BVLOS is available.[7]

The electric power industry is already one of the heaviest adopters of drones, using multiple sensors, including thermal and LiDAR, to assess mechanical defects, hotspots, and vegetation risk across large geographies.[8] Early experience with drone-based inspections for these electric utilities report up to seventy percent reductions in inspection costs and up to ninety percent reductions in revenue lost to downtime.[9] Under a rules-based BVLOS regime, those savings can scale from isolated pilots to routine, corridor-scale programs that cover hundreds or thousands of miles per year.

In oil and gas, similar corridor-level planning is replicable. An autonomous inspection provider with a nationwide BVLOS waiver operates up to thirty dock-based Oil and Gas Inspection (OGI) drones simultaneously, enabling daily leak surveys across large networks of wells and pipelines from a single remote operations center.[10] For natural gas and liquid pipelines, BVLOS supports more routine leak detection and repair prioritization. Legacy ground-based laser programs may cover 50 to 100 miles per day, while aerial infrared programs can reach 200 to 400 miles per day, moving operators closer to system-wide daily coverage and faster repair cycles.[11] Recent federal direction toward advanced leak-detection programs only increases the policy pull for this kind of higher-cadence, technology-enabled monitoring.[12]

At scale, these BVLOS-enabled inspection programs increasingly rely on AI-enabled computer vision to analyze large volumes of historical imagery and sensor data. The Virginia Department of Energy uses drones for abandoned mine hazard mitigation, capturing aerial documentation of landslides and mine openings and using thermal imagery to identify hot spots in coal waste piles. In steep Appalachian terrain, line-of-sight constraints routinely force operators to break surveys into multiple flights (e.g., mapping efforts spanning almost 1,700 acres require multiple missions, with fixed-wing operations only covering roughly 250 acres per flight), increasing time, image stitching complexity, and the need to reposition crews around difficult terrain.[13] Routine BVLOS would reduce this operational fragmentation while improving safety, and paired with AI-based change detection it enables earlier fault identification, trend analysis, and more predictive risk management over long asset timelines (mining permits can last up to 25 years).

BVLOS also changes the operating model. Utilities report shifting from one-off walking and driving contracts to more structured drone service models, where automation lets a small number of remote pilots oversee multiple assets or sites in parallel, a one-to-many structure that is only viable when BVLOS is normalized.[14] At the same time, early adopters suggest a hybrid posture is likely to persist. Pacific Gas and Electric Company, one the largest utility companies in the United States, recently logged 30,000 contracted helicopter hours alongside 300,000+ drone inspections in a single year, indicating that BVLOS will expand coverage and cadence without eliminating crewed aviation altogether.[15]

Part 108 is what makes this shift repeatable. It allows operators to design standardized BVLOS inspection concepts, including heavier drones and dock-based systems, without relying on bespoke waivers for each geography or mission profile. Part 146 then ensures those flights can safely coexist with other users of low-altitude airspace, including public-safety and logistics operators, through intent sharing and strategic deconfliction. Together, they turn use cases like corridor inspections from one-off innovation projects into a predictable part of how the United States monitors and maintains its most important assets.

More broadly, BVLOS economics increasingly hinge on what happens after the flight. Interoperable data services and standardized digital infrastructure can convert large volumes of inspection imagery and sensor data into predictive maintenance and smarter repair prioritization across large grid and pipeline territories.[16] Visual line of sight proves the use case, BVLOS scales it into routine, data-rich energy-security operations that lower cost,

---

[7] Marc Sallinger, "Xcel Energy Using Drones to Inspect Power Lines, Reducing Risk of Wildfires," *CBS News Colorado*, April 11, 2024.

[8] Nick Rymer and Andrew J. Moore. "A Review of Unmanned Aerial Vehicle Technology in Power Line Inspection." Technical report, National Institute of Aerospace and NASA Langley Research Center, 2021.

[9] Khristopher Poleo, et al. "Estimating the Impact of Drone-Based Inspection on the Levelised Cost of Electricity for Offshore Wind Farms, " Results in Engineering, March 2021; and Bongumsa Mendu and Nhlanhla Mbuli, "State-of-the-Art Review on the Application of Unmanned Aerial Vehicles (UAVs) in Power Line Inspections: Current Innovations, Trends, and Future Prospects," *Drones* 9. October 11, 2025.

[10] Percepto, "Oil & Gas: Autonomous Drone Solutions for Critical Infrastructure," 2026.

[11] U.S. Environmental Protection Agency, *Directed Inspection and Maintenance and Infrared Leak Detection*, 2010; and U.S. Environmental Protection Agency, *Aerial Lidar Methane Detection (LaSen)*, 2019.

[12] Pipeline and Hazardous Materials Safety Administration, "U.S. Department of Transportation Advances Rule to Modernize Gas Pipeline Methane Emissions Detection Requirements," news release, May 5, 2023.

[13] ReMo Interview, Daniel Kestner and Jesse Whitt, Abandoned Mines Land program, Virginia Department of Energy, December 4, 2025.

[14] ReMo interview, large U.S. energy utility company, November 6, 2025.

[15] Chris Courtney, "How Pacific Gas and Electric Company Uses Unmanned Aircraft to Augment Services in California," *Vertical Magazine*, November 12, 2025.

[16] Darryl Jenkins. *An Introduction to The Economics of Flying Beyond Visual Line of Sight (BVLOS).* Drone Economics, LLC, 2024.

reduce risk, and improve reliability across the U.S. energy system. The same operating logic applies beyond energy.

The combination of predictable BVLOS authority under Part 108 and a shared digital coordination layer under Part 146 enables scale wherever operations are low-altitude, time-sensitive, geographically dispersed, and constrained by today's visual-line-of-sight rules. These conditions define agriculture, public safety, and logistics as much as they do energy infrastructure.

Modernize Farm Operations with BVLOS Sensing and Data

Food and agriculture sit at the center of the U.S. economy, representing roughly five to six percent of the GDP, about one in ten workers, and nearly a third of U.S. cropland.[17] Even modest gains in safety and precision scale quickly.

Today, large-scale crop protection leans heavily on manned aerial application. Crop dusters fly fast, low, and close to obstacles to hit narrow treatment windows.[18] While this makes them efficient for very large fields, it also causes low-flying collisions to be a leading cause of accidents in ag aviation, as otherwise airworthy aircraft strike wires, trees, or the ground during operations below 500 feet.[19, 20] In 2023 alone, ag aviation recorded a dozen fatalities and is on a per capita basis, one of the most dangerous occupations in aviation—roughly twice as risky as general aviation—with risk borne primarily by pilots during seasonal surges when demand spikes and duty days stretch.[21]

Drones are emerging as a complementary tool, especially in smaller, fragmented fields surrounded by trees, power lines and uneven terrain, conditions common going east of the Mississippi River and in mixed-production regions.[22] Upfront, the economics lower the barrier to entry. Manned aerial sprayers cost between $100,000 and $2 million to acquire, operate, and maintain, while commercial spray-drone setups typically fall below $150,000, with lower fuel and maintenance costs.[23] On the economics of application, per-hectare costs are broadly comparable—approximately $18–$40/ha for drones and $17–$49/ha for manned aircraft, depending on scale and region. However, drone savings come less from the platform itself and more from precision application of chemicals and water.[24] Field trials report fifty to eighty percent reductions in chemical use (in line with see-and-spray manual application) and water use can drop to 2 gallons per acre compared to almost 20 gallons per acre with tractor-based applications.[25]

"I think of drones and manned aircraft as different sizes of hammers. Manned aircraft are very efficient, they move faster and carry more chemicals, they are like a sledgehammer that can go in and knock it out. But when you are dealing with smaller fields bordered by trees and power lines, you don't need a sledgehammer, you need a small nail hammer. That's where a drone is the right tool."

- Lukas Koch, Kelly Hills Unmanned Systems

At the upper end of the market, heavy-lift electric spray aircraft show what BVLOS-enabled scale can look like. The U.S.- designed and manufactured, world's largest autonomous electric crop protection aircraft certified for commercial use can carry roughly 70–80 gallons of chemicals and spray on the order of 200–240 acres per hour.[26] While not every farm or terrain requires that capacity, it illustrates how BVLOS unlocks a continuum from small multirotors in tight fields to large electric spray aircraft covering hundreds of acres per hour, expanding options for farmers while reducing pilot exposure to CFIT risk.

[17] United States Department of Agriculture, National Agricultural Statistics Service, *Farms and Farmland: 2022 Census of Agriculture Highlights*. 2024; and Nadia Delavarpour et al., "A Review of the Current Unmanned Aerial Vehicle Sprayer Applications in Precision Agriculture," Journal of the ASABE, January 2023 at 703–721.

[18] Note: Crop dusters are specialized aircraft that spray pesticides, fertilizers, and sometimes seed over wide areas to protect and enhance yields.

[19] Scott Bretthauer, "Agricultural Aviation Accidents: A Synopsis of 2023 Accidents and an In-depth Review of Accidents from 2013-2022," *Agricultural Aviation Magazine*. Winter 2024.

[20] Note: The FAA defines these collisions as Controlled Flight into Terrain (CFIT), an unintentional collision with terrain or an obstacle, typically because the pilot is unaware of the hazard until too late. Wire strikes are the most common cause, and roughly half of CFIT accidents in a typical year are fatal. Federal Aviation Administration, "Controlled Flight into Terrain (CFIT): Information for Pilots and Aviation Professionals," January 2022.

[21] National Transportation Safety Board, "Aviation Accident Database and Synopses," 2026; and Scott Bretthauer, "Agricultural Aviation Accidents – A Synopsis of 2024 Preliminary Data and Review of 10-Year Accident Trends," *Agricultural Aviation Magazine*. Winter 2025.

[22] ReMo interview, Lukas Koch, Kelly Hills Unmanned Systems, November 3, 2025.

[23] Nadia Delavarpour et al., "A Review of the Current Unmanned Aerial Vehicle Sprayer Applications in Precision Agriculture," Journal of the ASABE, January 2023 at 703–721.

[24] Adauto Rocha Jr., *Economics of Drone Ownership for Agricultural Spray Applications*, University of Missouri Extension, 2025; and Ginger Rowsey, "Agricultural Drone Spraying Taking Off," *Farm Progress*, August 6, 2025.

[25] ReMo Interview, Lukas Koch, Kelly Hills Unmanned Systems, November 3, 2025.

[26] Pyka, "Pyka Unveils Pelican 2: The World's Largest Autonomous Crop Protection Aircraft," PR Newswire, February 10, 2025.

BVLOS is what turns these precision gains from niche to normal. Many farms have hills, trees, and valleys, so a drone that is just over a ridgeline can be "out of sight" and therefore illegal to operate under strict VLOS rules. With BVLOS-capable, longer-endurance platforms that can fly nearly an hour, operators can cover much larger acreages in a single mission. Clear regulatory guidance on training, insurance, and liability for higher-value systems lets them react quickly to disease or pest outbreaks and treat only where needed.[27] The same tools also give agronomists, who are in high-demand but short-supply, far more efficient scouting capacity, allowing one expert to assess many more acres in a day.[28] One widely cited example is a first-generation farmer in North Carolina who used targeted, drone-applied fungicide to achieve corn yields three times the U.S. average, illustrating how timing and precision can matter as much as total coverage.[29]

In short, VLOS has demonstrated that agricultural drones are technically viable, while BVLOS enables those systems to operate safely at corridor and farm scale. This shift reduces pilot risk, lowers capital and operating costs for many operators, and enables more precise, lower-input production across the U.S. food system.

Impact Area 2: Drive Innovation to Deployment at a National Scale

Once BVLOS is routine, drones can move beyond inspections into on-demand response and delivery at scale. A workable BVLOS framework enables public-safety agencies, hospitals, surveyors, utilities, and retailers to run repeatable aerial missions without rebuilding approvals for each site. Common digital coordination standards (e.g., sharing basic flight intent and handling conflicts consistently across systems) let these operations scale safely in denser airspace—so a local DFR program or a medical-sample route can expand into regional networks rather than remaining a one-off pilot.

Extending Situational Awareness for First Responders and Law Enforcement

BVLOS is the shift that turns drone-as-a-first responder (DFR) programs from valuable pilots into core public-safety infrastructure. For law enforcement, the most compelling early pattern is not just better aerial visibility, but faster triage, smarter dispatch at scale, and reducing risk to first responders.[30] Since launching DFR in 2017, the Chula Vista Police Department (San Diego County, California) has used drones to respond to 18,000+ calls for service. In 4,156 of those, the remote operator determined no officer was needed, preserving patrol capacity for higher-risk incidents.[31] Drones also arrive much faster. In 2023, they reached priority-one calls in 3.6 minutes, compared with 9.9 minutes for patrol officers.[32]

Early results from Texas show the model is replicable. In March 2025, Irving PD (Dallas County, Texas) integrated DFR into its Real-Time Crime Center to offset staffing gaps and improve response. In a short initial window, drones assisted with fifty-five arrests, cleared more than one-hundred-and-forty calls, and cut priority-one response times by approximately twenty-three percent during peak hours.[33] This is the operational logic of BVLOS-enabled DFR at a pilot scale, rapid scene awareness and risk screening before humans step into uncertainty.

The broader domestic public-safety landscape also indicates why a workable, standardized BVLOS pathway

[27] ReMo Interview, Will Dawson, Agricultural Drone Initiative (ADI), October 22, 2025.

[28] Ibid

[29] John Hart, "World Record Dryland Corn Yield Reached in North Carolina," *Farm Progress*, January 23, 2023; and Chris Bennett, "Corn Yield Record Shattered by Farmer's 459.51 Dryland Bushels," AgWeb, January 12, 2023.

[30] North Texas UAS Safety and Integration Task Force, Irving Police Department presentation. October 28, 2025.

[31] John Argumaniz, "The Use of Unmanned Aircraft Systems by Law Enforcement: A Leadership White Paper," Bill Blackwood Law Enforcement Management Institute of Texas, June 2024.

[32] Ibid

[33] North Texas UAS Safety and Integration Task Force, Irving Police Department presentation. October 28, 2025.

would have an outsized impact. A review of Southern California use-cases shows how policy constraints shape operational reality. The LAPD's tightly restricted program deployed drones only five times in 2021, while Chula Vista's more permissive framework enabled roughly 4,400 DFR deployments that same year.[34] Even within the same state, this gap shows drones as occasional tactical assets versus routine responders. Scaling DFR nationally will require consistent operating rules paired with strong privacy and governance safeguards.[35]

For disaster response, the research and field experience point in the same direction. Drones are already useful across distinct phases, but systematic scale depends on BVLOS and digital integration. A review of fifty-two studies between 2009 and 2020, found four dominant applications—mapping and damage assessment (the largest share), search and rescue, transportation, and training—indicating the biggest value is still rapid situational awareness and life-safety support.[36]

That pattern was visible during the 2025 Central Texas flash floods, when TxDOT rapidly deployed drones with heat sensors and LiDAR for search and recovery and for infrastructure inspection in constrained, dangerous terrain.[37] Yet the scale lesson was as much digital as aeronautical. The surge in imagery and video quickly overwhelmed local storage, forcing emergency cloud procurement and underscoring the need for standardized, interoperable data infrastructure alongside flight integration (see Figure 1).[38]

Taken together, BVLOS can professionalize and normalize public-safety drone use, but only if the BVLOS rule is structured to enable these operating concepts at scale. Similarly, a national security company described its evolution from fixed cameras to mobile patrols and then to drones for outdoor perimeter security, with BVLOS previously the main constraint to scale.[39] The security firm's current model offers remote piloting for customers that don't want to build their own operations centers, plus a subscription that bundles equipment, insurance, maintenance, and compliance into a predictable monthly service. In some deployments, supplementing ground security staff with a drone-supported model, saves roughly $100,000 per year while improving perimeter coverage.[40] If Part 108 is implemented in a feasible way, paired with clear, interoperable coordination expectations, these service models could expand safely, complementing existing public-safety and security

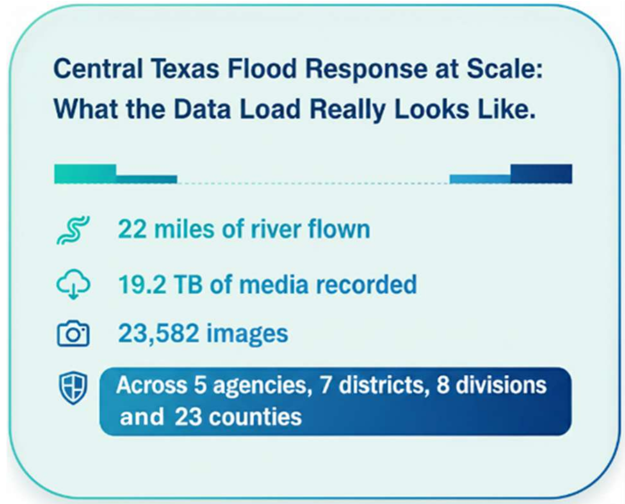

Figure 1: Data storage load from drone operations in Central Texas by TxDOT

workforces while keeping a human in the loop for judgment and intervention.

Stepping back, federal policy is pointing in the same direction. The BVLOS ARC and draft rule explicitly treat public safety, disaster response, and search-and-rescue as core BVLOS value categories that should move from waiver-based experiments to routine operations under a standardized rule set.[41] The policy task is to finalize BVLOS rules that enable routine DFR, and require a common way for drones to share their plans and avoid conflicts—so public agencies and private operators can scale safely in the same low-altitude airspace. A prioritization framework—similar to emergency-vehicles right-of-way on roads—could deconflict low-altitude traffic and grant precedence to time-critical public-safety missions.

BVLOS Corridors for Packages, Patients and Communities

BVLOS turns first- and last-mile logistics from scattered pilots into a scalable system for both consumer and healthcare delivery, but only if rules and digital coordination keep pace with community acceptance, privacy, and nuisance concerns.

For retail, the impact is less about a single *killer app* and more about a new operational architecture. efficient retailer-to-aircraft handoffs, automated loading, and distributed maintenance are what make high-frequency

[34] Weynand, Lacey L. *Public Safety Agencies and UAV Technology: A Review of Uses*. Gettysburg, PA: Gettysburg College, 2022.

[35] Ibid

[36] Sharifah Daud, et al. "Applications of Drone in Disaster Management: A Scoping Review." *Science & Justice* 62, n (2022): 30–42.

[37] Jim Magill, "Drones Join the Front Lines in Deadly Texas Hill Country Flood Response," *DroneLife*, July 21, 2025.

[38] ReMo interview, Erika Kemp, Texas Department of Transportation (TxDOT), October 8, 2025. Figure 1 datapoints provided by TxDOT.

[39] ReMo interview, Ryan Smith, Titan Security, October 29, 2025.

[40] Ibid

[41] Federal Aviation Administration, *Unmanned Aircraft Systems Beyond Visual Line of Sight Aviation Rulemaking Committee: Final Report*, 2022, 45–48.

drone delivery a real logistics layer rather than a novelty.[42] The market is meaningful but bounded, operators estimate drones could enable sub-30-minute service and capture roughly ten to thirty percent of existing delivery demand once location and density constraints are factored in.[43] This would expand coverage in geographies and item categories that are costly to serve by ground, without implying a full replacement of ground delivery staff. But scale needs guardrails to sustain public trust and adoption, with clear rules for low-altitude traffic management, privacy, and fair competition.[44]

BVLOS is what enables the operating model shift. Early analysis indicated a single drone delivery can cost roughly $13.50 when each aircraft requires dedicated, local oversight—though this number keeps going down as operators scale.[45] Routine BVLOS allows centralized remote supervision and higher utilization, potentially enabling one operator to oversee multiple drones and driving per-package costs down to roughly $2.00. At that level, drones move from a niche premium to a financially sustainable, widely deployable last-mile option.

In addition, healthcare illustrates why BVLOS is not just a convenience but is time-critical infrastructure.[46] The West Texas-based Matador Unmanned Aircraft System (UAS) Consortium has run drone tests along existing industrial corridors (rail, telecom and transmission lines), to move blood samples and, eventually, organs. Labs and transplant teams need rapid turnaround, and drones can be a lifesaver in a West-Texas region that is largely rural and lacks specialized healthcare, with a drive to a Tier 1 medical facility averaging 250 miles.[47] These shipments are time-critical and biologically sensitive, and they often fall outside standard commercial shipping windows in rural areas.

For organ transplants, the bias is structural. Many patients with end-stage organ disease never reach the waiting list because referral and evaluation are resource-intensive, and rural distance barriers sharply reduce the odds of completing the process—contributing to over 100,000 deaths annually in the United States.[48] Blood samples are also a limiting step for transplant matching, which includes multiple testing procedures that depend on rapid lab turnaround. However, commercial flights are not 24/7, and the practical shipping window often closes by late afternoon, while ground routes are slow and weather dependent.[49] The current cost is stark. Charter flights can run $10,000–$25,000 per trip, while specialized hand couriers can be $1,000 per run but take double to triple the time.[50] Drones are not yet priced at scale in this region, but a stable Part 108 framework would let operators design hub-and-spoke medical routes with predictable compliance burdens. The consortium's work also underscores the need for heavier-lift aircraft than typical consumer delivery drones. A kidney including the required packaging and ice can weigh approximately 20–25 pounds, placing organ logistics closer to regional cargo operations than to lightweight retail packages. This is exactly the kind of higher-risk and-value mission a risk-tiered BVLOS rule is meant to support.[51]

Beyond transplant logistics, medical delivery is a larger part of the public-benefit story. Nearly one in five Americans live in rural areas that are often medically underserved, with long drives to a hospital and limited pharmacy hours.[52] Drones can reduce this access gap, but scaling requires operational parameters including authentication to prevent fraud, HIPAA compliance, clear accountability for who stocks and removes drugs, and state-board alignment with FAA rules.

In Kansas, the Community HealthCare System (CHCS) rural network has tested long-range medical deliveries, moving an Automated External Defibrillator (AED) over thirty miles, while building a business case for reimbursement through Medicare. CHCS also trains local police, EMS and fire personnel as pilots to reduce personnel costs—pushing infrastructure and operating costs to below $5 per capita with additional users defraying costs since drones may sit underutilized for 90 percent of the time.[53] BVLOS capacity alone is not enough. Standardized medical payload handling, chain-

[42] ReMo interview, a last-mile delivery platform, October 22, 2025.

[43] Emma Roth, "Walmart is bringing drone deliveries to 1.8 million more Texas households," The Verge. January 9, 2024.

[44] Ramsay Eyre, *Regulating Drone Delivery Networks*, Journal of Law and Mobility. 2025.

[45] Andrea Cornell, et al, "Drones Take to the Sky, Potentially Disrupting Last-Mile Delivery," McKinsey & Company, *Future Air Mobility Blog*, October 25, 2021

[46] Olga Rodrigues et al., "The Use of Unmanned Aerial Vehicles (UAV) on Delivering Biological Samples for COVID-19 and Tuberculosis Diagnosis: A Scoping Review," *Journal of Personalized Medicine*. September 6, 2025.

[47] Organ Donation Alliance, "The Future of Organ Transportation: Launching the Matador UAS Consortium," July 11, 2023.

[48] Abderahman Rejeb et al., "The Management of Drones in Humanitarian Logistics: A Systematic Review and Future Research Directions," *Complexity*, February 2022.

[49] ReMo interview, Kevin Myers and Jessica Kirkendall, LifeGift, November 6, 2025. Note: Organs must be transplanted quickly after recovery; hearts and lungs last just 4–6 hours, while more resilient organs like kidneys are viable from 24–36 hours, making speed and reliability decisive.

[50] Ibid

[51] Ibid

[52] Connie A. Lin et al., "Drone Delivery of Medications: Review of the Landscape and Legal Considerations," *American Journal of Health-System Pharmacy*, February 2018.

[53] Community HealthCare System, "Kansas Completes First Long-Range Medical Drone Delivery," August 15, 2025; and North Texas UAS Safety and Integration Task Force, John Fitzthum: Community HealthCare System presentation, December 2, 2025.

of-custody, and data safeguards are part of deployment at scale, not afterthoughts.

Tribal region innovation adds an important equity and resilience dimension. The Choctaw Nation of Oklahoma is the third largest federally recognized tribe and spans 11,000 square miles.[54] It is the first tribal government certified as a public aircraft operator and has invested in an Emerging Aviation Technology Center to test drones in reducing risk of injury, improving productivity, and assisting first responders in southeastern Oklahoma.[55] It is an instructive complement to large corporate delivery networks, showing BVLOS supporting place-based models where geography, road safety, and health access converge.

A workable Part 108 framework would allow high-value logistics missions like retail delivery, blood-sample shuttles, and organ corridors to become routine at scale, while Part 146 provides the shared digital layer that lets those flights safely coexist with public-safety and infrastructure operations in the same low-altitude airspace.

Impact Area 3: Anchor a Competitive, Trusted Dual-Use Drone Industrial Base

As the FAA moves toward a standardized BVLOS framework, other federal actions are reshaping the environment for domestic drone operation and production. The Federal Communications Commission's *Covered List* update—adding foreign-manufactured UAS and UAS-critical components on a going-forward basis after an interagency national-security determination—signals that trusted supply chains are a prerequisite for market access.[56] Importantly, this action targets future authorizations and procurement pathways. It does not automatically ground existing fleets but can constrain the pipeline of new approvals and deployments for covered equipment.

In this new environment, BVLOS becomes a pivotal demand-side lever if the final rule is reformed for scaled operations. Supply-chain trust requirements can narrow hardware options, but without predictable rules for routine and scalable operations, demand for compliant systems remains fragmented and difficult to forecast. This weakens the business case for domestic manufacturers, component suppliers, and technology providers. A stable BVLOS framework would send a clear market signal that the United States is ready to support high-volume, commercially scaled drone operations aligned with both aviation safety and national security priorities, catalyzing investment in U.S. airframes, sensors, batteries, autonomy stacks, and manufacturing capacity.

BVLOS: The Regulatory Catalyst for Investment and Strategic Co-Creation for a Secure Supply Chain

The U.S. low-altitude economy is constrained more by regulatory friction than by aircraft capability. Advanced operations today are routed through a patchwork of exemptions, waivers, and certification pathways. A 2025 audit found FAA approvals for BVLOS operations rose from 1,229 in 2020 to 26,870 in 2023, spanning Part 107 waivers, air-carrier certificates, and exemptions, even as the number of commercial drones will cross one million by 2027.[57] Most BVLOS waivers nonetheless remain tied to a specific operator and use case, locking the market into a case-by-case model rather than a scalable one.

[54] Choctaw Nation of Oklahoma, "Choctaw Nation Opens State-of-the-Art Facility to Boost Emerging Aviation Technology," June 18, 2025.

[55] Ibid.

[56] Federal Communications Commission, "FACT SHEET: FCC Updates Covered List to Include Foreign UAS and UAS Critical Components on Going Forward Basis," December 22, 2025.

[57] U.S. Department of Transportation, Office of Inspector General, *FAA Faces Challenges in Ensuring the Safety of Drone Operations beyond Visual Line of Sight*, Audit Report no. AV2025034, 2025.

> *"Type certification became a multi-million-dollar, multi-year process, not because the technology wasn't ready, but because the regulatory pathway was unclear and kept changing. What should have taken months stretched into four years…that's why Part 108 matters, it moves drones away from aircraft-style certification and toward a BVLOS framework."*
>
> – Representative, industrial autonomous inspection company

The costs of the current system show up as a direct market-entry tax, particularly for small and medium firms. One U.S. drone startup highlighted their customers having to secure both a Section 44807 exemption and a Part 137 certificate to operate its aircraft, with the exemption process taking almost a year and costing up to $100,000 once legal, testing, and human resources are included.[58] This highlights a troubling pattern where a U.S. startup has more demand overseas but relatively few domestic deployments due to regulatory constrictions. A delivery operator described Part 135 as a scaling pathway that can require up to $1 million in consultants, testing, and documentation before meaningful expansion is possible.[59] When such approvals are bespoke, expensive, and slow to come by, growth predictably shifts towards jurisdictions with clearer, standardized (or lax) rules.

This is why Part 108 is industrial policy as much as aviation policy. It reduces duplicative and recurring costs and makes corridor-scale inspections, hub-and-spoke logistics, and drone-in-a-box networks financeable and predictable. Part 146 then reduces integration friction by standardizing low-altitude intent sharing and deconfliction, enabling a competitive ecosystem of digital services rather than bespoke point solutions.

Even with a rules-based pathway, trusted-sourcing constraints and component costs will determine whether operators can procure compliant fleets at scale. China-based firms dominate the U.S. consumer drone market—often estimated at approximately ninety-five percent—reflecting the cost and scale advantages of vertically integrated, state-supported ecosystems.[60] [61] By contrast, U.S. and allied manufacturers attempting to shift supply chains face severe challenges including limited component availability, import and compliance frictions, and higher input costs—especially for batteries and other critical subsystems.[62] As a result, building a trusted, dual-use industrial base will require targeted incentives and scaling support, not just procurement preferences or import restrictions.

China's advantage in drones is in its industrial density and component ecosystems. Hubs like Shenzhen city are home to more than 1,700 drone and drone-component companies with an annual output value of 96 billion yuan (more than $13 billion USD).[63] It is the product of decades of ecosystem buildout since the city became a Special Economic Zone in 1980.

That density matters because drones are downstream of critical minerals, processing and refining for which remains highly concentrated. China alone processes between 70 to 90 percent of the world's lithium, nickel, cobalt, rare earths and other key minerals essential for drone batteries, brushless motors, permanent magnets, carbon fiber, sensors and electronics.[64] Restrictions on foreign systems can tighten trusted-sourcing requirements, but they do not create a domestic alternative on their own. A workable BVLOS framework is what makes trusted sourcing investable by converting one-off pilots into steady, forecastable demand for compliant systems.

Civil BVLOS scale can drive production learning and supplier volume, helping close the cost differential between U.S. drone systems and competing mass-produced alternatives. The Department of War's Replicator initiative is focused on rapidly fielding large numbers of affordable, expendable autonomous systems—driving costs down while stress-testing supply chains at scale.[65] Recently declassified efforts such as the Low-Cost UAS (LUCAS) program reverse-engineered designs (including the Iranian Shahed drone) to reach sub-

[58] ReMo interview, a U.S. drone manufacturer, October 21, 2025. Note: Section 44807 is a case-based exemption that allows the FAA to exempt certain aircraft and operations, primarily to enable early commercial UAS operations. Part 137 is the FAA's agricultural aircraft operations certificate, often needed for commercial crop-spraying and ag missions.

[59] ReMo interview. a last-mile delivery platform, October 22, 2025. Note: Part 135 is the FAA air-carrier certification process that imposes airline-style requirements for commercial drone operations.

[60] Dominic Mathew, "Beyond Takeoff: Policy Strategies to Build the Infrastructure Future for Advanced Air Mobility," Coalition for Reimagined Mobility, February 2024, at 16.

[61] Coalition for Reimagined Mobility (ReMo). *Securing the ICTS Supply Chains*. Comment submitted to U.S. Department of Commerce, Bureau of Industry and Security, April 30, 2024.

[62] Ibid

[63] Legislative Council Secretariat, Hong Kong, "Promoting Low-Altitude Economy in Shenzhen and the United States," May 16, 2025; and Qin Mei and Matthew Barocas, "Visit to a Shenzhen Tech Market: Imitation Before Innovation," Center for Strategic and International Studies, October 23, 2023.

[64] SAFE, "Trading Tensions: Navigating Policy Tools for a Diverse Critical Minerals Supply Chain," October 2024.

[65] Brookings Institution, "Replicator and Beyond: The Future of Drone Warfare," transcript of event held in Washington, DC, August 21, 2025.

$40,000 price points and enable high-volume production.[66] Civil BVLOS demand provides the steady commercial pull that can sustain these investments and translate prototypes into durable manufacturing capacity.

Workforce: The Bridge to Industrial Outcomes

Workforce development is the connecting layer between BVLOS policy and a functioning industrial base. Part 108 shifts responsibility from the individual pilot to the operator organization, which makes employer-led training, maintenance programs, quality assurance, cybersecurity, and operational control scalable.

In 2024, the FAA reported 427,598 Part 107 remote pilots, with forecasts suggesting nearly 100,000 new remote pilots by 2029.[67] If Part 107 was the on-ramp for small UAS work, Part 108 will turn today's ad hoc drone duties into scaled, aviation-grade careers with clearer ladders, safer work, and higher wages.[68]

"We saw the first wave being part 107, and.... we have been waiting for a decade for this secondary wave to come in."

– Alex Mirot, Unmanned Safety Institute

Early anchor sectors such as utilities view this as a standardized pathway to move from "a lineman with a drone in the truck" toward having an enterprise-level flight department capable of corridor-scale inspections and highly automated drone-in-a-box networks that can supplement or replace costly, higher-risk helicopter work.[69]

State models show what this looks like in practice. The Texas Department of Transportation (TxDOT) built district-level pilot capacity for bridge inspection, construction monitoring, and emergency operations, using a 10-week hybrid training program with a community college partner.[70] It includes two weeks of in-person instruction co-taught by community-college UAS instructors and TxDOT program managers and four weeks of remote learning that includes supervised flying where trainees are issued a practice drone and must log flight hours before completing the program.[71] As one-to-many BVLOS operations normalize, employers will shift from incidental drone use with little pay differential to dedicated roles. One training provider estimated a $20,000–$30,000 salary bump compared to current secondary-duty roles.[72]

The workforce angle also strengthens industrial resilience. As BVLOS networks scale, maintenance shifts from a 'return to the manufacturer for repairs' system to localized maintenance hubs—creating technician pipelines and place-based jobs that fit community-college credentials and build durable support capacity for both civil and dual-use demand.[73]

---

[66] Paul Iddon, "By Reverse Engineering Shahed Drone, U.S. Gives Iran A Dose of Its Own Medicine," *Forbes*, December 7, 2025.

[67] Federal Aviation Administration. *FAA Aerospace Forecast: Fiscal Years 2025–2045*, 2025.

[68] ReMo interview, Alex Mirot, Unmanned Safety Institute, October 2, 2025.

[69] ReMo interview, large U.S. energy utility company, November 6, 2025.

[70] ReMo interview, Erika Kemp, Texas Department of Transportation (TxDOT), October 8, 2025.

[71] Paul Wheeler, et al, "Implementation of Uncrewed Aircraft Systems Operational Capabilities: A Guide," National Cooperative Highway Research Program, The National Academies Press, 2025 at 69.

[72] ReMo interview, Alex Mirot, Unmanned Safety Institute, October 2, 2025.

[73] ReMo interview, a last-mile delivery platform, October 22, 2025.

A National Digital Layer: Safe Deconfliction, Shared Benefits

Part 146: A National Digital Layer Scaling the Low-Altitude Economy Without Breaking the NAS

The U.S. National Airspace System (NAS) is the world's busiest and comprises the infrastructure and airspace that enable safe and efficient flight.[74] It faces the critical challenge of integrating new aircraft types and supporting required digital and physical infrastructure. Part 146 is best understood as the digital scaling companion to the BVLOS operating rule, proposing Automated Data Service Providers (ADSPs) support an operator's ability to comply with FAA requirements like intent sharing, deconfliction and conformance.[75] Part 146 as a software layer also complements the FAA's $12.5 billion push to modernize air traffic control (ATC) systems.[76]

The urgency behind this digital layer is already visible in the operational baseline. The FAA estimated 38.4 million UAS flights in 2024 across recreational and Part 107 users, a volume that makes informal or purely manual coordination increasingly brittle.[77] The same survey estimates that Part 107 operators alone conducted over 16.6 million flights in 2024, underscoring that commercial activity is now a large, persistent share of the low-altitude ecosystem.[78] As flight volumes increase, the safety case for strengthen the case for standardized intent sharing, deconfliction, and conformance becomes more intuitive.

In response, industry has already put together parts of this future ahead of rulemaking. In the Dallas-Fort Worth area, for high-density clusters, operators and OEMs shifted from ad-hoc communications to deconflict with an industry-led structured Unmanned Traffic Management (UTM) system.[79] According to the FAA, strategic deconfliction, including pre-flight intent sharing is a key scaling mechanism in the Part 146 framework. Public safety and commercial operators are increasingly converging inside this ecosystem, offering an early blueprint for how mixed-use airspace governance can work in practice.

The long-range strategic value of Part 146 is that it also functions as a testbed for modernizing the NAS beyond small drones. The FAA's UTM ConOps traces the concept's evolution from NASA-industry work beginning in 2013–2014 into a federated, digitally mediated approach to low-altitude traffic management.[80] As advanced air mobility (AAM) evolves, the same capacity logic applies at higher speeds and higher consequence. A national demand analysis cited a conservative scenario in which almost 82,000 daily AAM passengers could be served by as many as 4,000 new aircraft across the United States.[81] This is the inflection where ADSPs stop being a drone-only construct and become part of the broader aviation modernization agenda.

Taken together, Part 146 is the operational trust layer that ensures BVLOS scale does not get ahead of coordination capacity. It brings a rules-based foundation to services the industry has already begun to operationalize in dense markets, converts informal deconfliction into auditable infrastructure, and helps the FAA move toward a more automated, interoperable approach to managing growing volumes of mixed low-altitude activity. In short, Part 146 is how the low-altitude economy scales without compromising the safety and performance expectations of a well-functioning NAS.[82]

---

[74] Government Accountability Office, "Key Provisions in the 2024 Reauthorization Act and Related GAO Work," May 15, 2025.

[75] Federal Aviation Administration, "Normalizing Unmanned Aircraft Systems Beyond Visual Line of Sight Operations," *Federal Register* 90, no. 150, August 7, 2025.

[76] Senate Committee on Commerce, Science, and Transportation, *FAA's Plan for ATC Modernization: Evaluating Progress, Delivering Results*, 119th Congress, December 12, 2025.

[77] Federal Aviation Administration. *CY 2024 Small Unmanned Aircraft Systems Survey Report*. 2025 and ReMo interview, a medical logistics operator, November 12, 2025.

[78] Ibid

[79] DroneTalks. "How Zipline is advancing UTM with the Dallas-Fort Worth project and global airspace integration." YouTube video, 12:43. February 13, 2025; and Federal Aviation Administration. "FAA Makes Drone History in Dallas Area," Medium. July 15, 2024.

[80] Federal Aviation Administration. *Drone Integration: Concept of Operations*. May 2025.

[81] National Academies of Sciences, Engineering, and Medicine. *Advanced Air Mobility: A Primer*, Appendix A. 2024 at 96; and Rohit Goyal, et al. *Urban Air Mobility (UAM) Market Study*, National Aeronautics and Space Administration. October 5, 2018.

[82] Sally French, "What is Part 146? The digital backbone of FAA's new BVLOS drone rule." *The Drone Girl*, August 8, 2025.

Conclusion

The central BVLOS policy question is how to operationalize scale safely and predictably. Doing so modernizes how the United States inspects infrastructure, responds to emergencies, and delivers critical services by treating low-altitude airspace as a national capability with real economic and public-safety stakes.

The value case is already clear across the three impact areas. BVLOS strengthens resilience of critical infrastructure, enables scale beyond just package delivery and helps anchor a domestic industrial base. In practice, which means replacing waivers with rules, siloes with interoperability, and uncertainty with a clear demand signal for trusted American BVLOS capability.

Policy Recommendations

- **Finalize Parts 108 and 146 in a Workable Form, on a Predictable Timeline.** Press for a risk-tiered, performance-based BVLOS framework that reduces reliance on bespoke waivers without imposing unnecessary compliance burden.
- **Drive Interoperability as a Condition of Scale.** Use federal standards, procurement, and grant requirements to prevent "walled gardens" by ensuring BVLOS operators, public safety, and participating agencies can share intent, deconflict, and verify conformance keeping implementation industry-led and competitive while standardizing the interoperability layer for nationwide operations.
- **Anchor a Trusted Domestic Drone Industrial Base.** Pair BVLOS regulatory certainty with federal buying power and focused incentives to scale manufacturing and supply chains of U.S. and allied drones and critical components, translating demand into domestic production capacity and resilience.

Acknowledgements

This report was led, researched, and written by Dominic Mathew, Manager, Transportation Policy and Strategy, ReMo. We thank Paul Ruiz, Senior Director of Policy; Addison Trupp, Staff Assistant, Public Affairs; Leslie Hayward, Senior Vice President of Public Affairs and Avery Ash, CEO of SAFE; and Rachel McCleery, Executive Director, ReMo, for their review, guidance, and editorial support throughout.

We also thank the following individuals and organizations whose insights informed the report: Will Dawson, Agricultural Drone Initiative; James Grimsley, Choctaw Nation; Liz Forro and Lisa Ellman, Commercial Drone Alliance; Lukas Koch, Kelly Hills Unmanned Systems; Kevin Myers and Jessica Kirkendall, LifeGift; Jesse Chen, Lone CypressAI; Ernest Huffman, North Texas UAS Safety and Integration Task Force; Erika Kemp, Texas Department of Transportation; Ryan Smith, Titan Security; Alex Mirot, Unmanned Safety Institute; Daniel Kestner and Jesse Whitt, Virginia Department of Energy.

Additional interviews were conducted with representatives of a major U.S. electric utility, a last-mile delivery platform, an industrial autonomous inspection company, a U.S. drone manufacturer, a commercial drone delivery operator, and a medical logistics operator (all anonymized).

SAFE

COALITION FOR
Reimagined Mobility
Transportation Policy that Puts People First

SAFE is an action-oriented, nonpartisan organization committed to transportation, energy, and supply chain policies that advance the economic and national security of the United States, its partners, and allies. Since 2005, SAFE has worked with its Energy Security Leadership Council—a peerless coalition of current and former Fortune 500 CEOs and retired four-star admirals and generals—to support secure, resilient, and responsible energy solutions. Learn more at **SecureEnergy.org**

The Coalition for Reimagined Mobility (ReMo), an initiative of SAFE, advances policies and solutions to develop and scale advanced transportation technologies for a 21st-century mobility system that is safe, secure, and efficient. ReMo convenes stakeholders and conducts research and education campaigns to drive economic growth, strengthen national security, and spur innovation that improves how people and goods move. Learn more at **ReimaginedMobility.org**