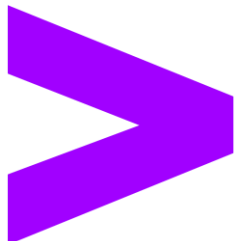


The Impact of BVLOS Drone Integration in the United States

December 2025
Commissioned by



**SMALL UAV
COALITION**
*A Partnership for
Safety & Innovation*

Foreword

The Small UAV Coalition commissioned Accenture to study potential impacts of beyond visual line-of-sight (BVLOS) drone use cases in the U.S.

The purpose of this document is to assess and estimate the near-term economic and societal impact potential of BVLOS drone use cases in the United States across key retail & package delivery, civic interest, aerial survey, and agriculture use cases. We set out to quantify the largest areas of opportunity for BVLOS usage, based on markets and use cases that have received the most study or that are gaining momentum in early pilots, or in programs launched in other countries. This means that the use cases we focus on in this study are non-exhaustive, and that there are other pockets of value that exist that were not considered in this study. We expect these impacts to grow in time as BVLOS drone operations scale in the U.S.

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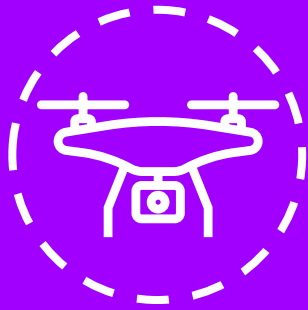
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EXECUTIVE SUMMARY



What if BVLOS drone usage were enabled in the United States?



Scaled BVLOS drone deployment could lead to significant annual impacts...

\$67-69B in cost savings

through operational efficiencies

\$18B in new sales

through increased reach and lower costs

882 lives saved

through better data and response times

The benefits of BVLOS drone deployments in the United States

Beyond Visual Line-of-sight (BVLOS) drone deployment can transform package delivery, healthcare, public safety, infrastructure monitoring, and agricultural operations. Countries across the globe are leveraging BVLOS operations today as regulatory constructs in markets like Australia have unlocked growth. The U.S. has yet to enact a regulatory framework allowing for safe and routine BVLOS operations. BVLOS drone operations, however, have the potential to yield significant benefits for business, consumers, and society when integrated at scale in the U.S.ⁱ

Benefits for businesses

Cost Savings

Drones could save **\$60.4-62.1B** by enabling efficient operations and augmenting humans in the field.

Increased Sales

Increased efficiencies from drones can lower prices, generating **\$18.4B** in potential increased sales.

Time Savings

Drones can save businesses **36.4M hours, or \$965.7M** annually in time value, due to increased operational efficiencies.

Benefits for consumers

Cost Savings

Consumers can save **\$817.3M**, due to lower prices from reduced operational costs to businesses.

Time Savings

Drone deliveries can save consumers **\$644.7M** in time value by reducing avoidable pickups.

Benefits for society

Increased Safety

Drones can increase worker safety, reducing the likelihood of **158.9K** job-related injuries and illnesses, and **822** mortalities a year, by supporting hazardous tasks.

Congestion

Drone deliveries can reduce the amount of **vehicle miles travelled by 194.4M**, saving **24.8M hours (\$497M)** annually in time from traffic reduction.

Emissions Impact

Drones can reduce **106.4K tons** of carbon and abnormal methane emissions (equivalent to **removing 46K cars from the road** and 4 coal-fired plants).

Executive Summary

Drones have the potential to transform retail & package delivery, civic interest, aerial survey, and agriculture sectors, among other sectors, but their impact potential is limited without a regulatory framework that enables BVLOS operations at scale. Other countries are already leveraging BVLOS deployments due to more advancements in their regulatory frameworks while the U.S. continues to consider regulations to create such a framework. Enabling this technology could have significant and wide-ranging impact, including:

- **Retail & Package Delivery:** BVLOS drones can enable faster and more efficient delivery services, reducing delivery times and costs – and potentially impacting the prices
- **Civic Interest:** BVLOS drones can drive life-saving and cost saving impact by reducing disaster response mission times and costs significantly and increasing victims’ probability of survival
- **Aerial Survey:** BVLOS drones allow for comprehensive and detailed mapping of large areas at a cost significantly lower than preferred methods today, improving data accuracy and efficiency in surveying and monitoring land, infrastructure, and environmental changes
- **Agriculture:** BVLOS drones can optimize crop monitoring and management by covering vast fields quickly, leading to better yield predictions, resource management, and overall agricultural productivity

Exhibit 1

The potential impact of BVLOS drone deployments was analyzed across 4 industries and 3 impact areas

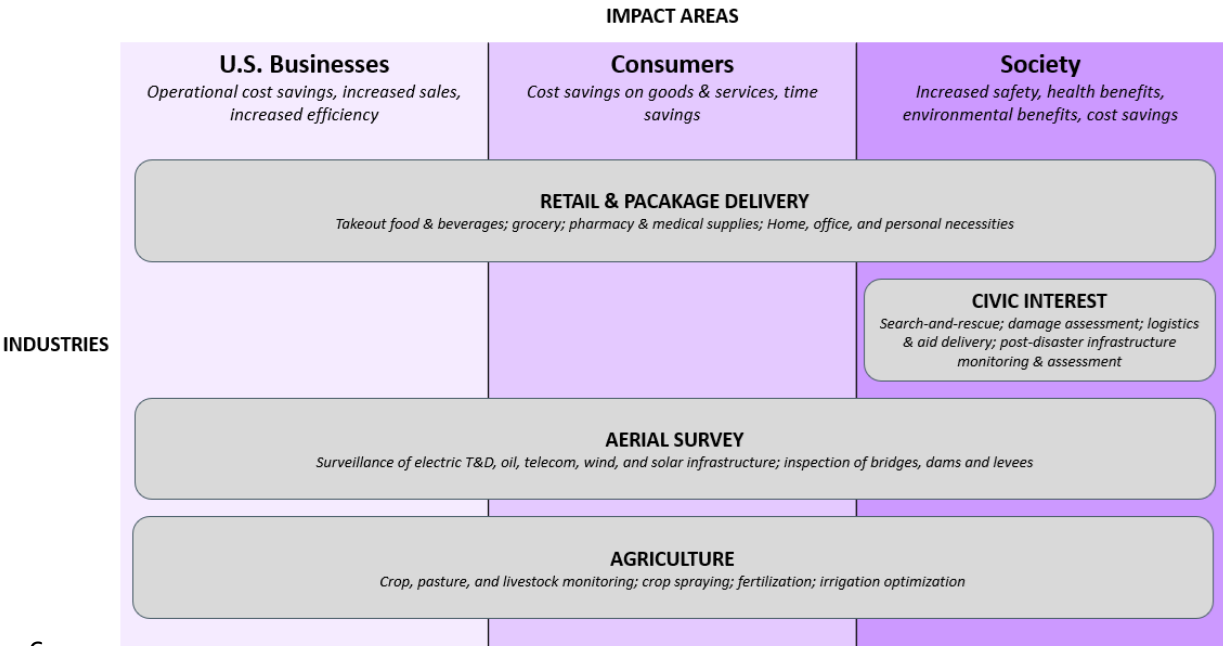


Exhibit 2

Potential 2030 per annum benefits of BVLOS drone deployments in the United States

Benefit	Detail	Impact	
		Low Estimate	High Estimate
For businesses			
Cost savings	Reduced operational costs	\$20.7 B	\$22.5 B
	Cost savings on resources		\$39.7 B
	Time savings		\$965.7 M
Increased sales	Increased sales from more competitive pricing (b/c of reduced production costs)		\$18.4 B
For consumers			
Cost savings	On products & services (from anticipated reduced pricing due to operational efficiencies)		\$817.3 M
	Time savings (on takeout order pick-ups replaced by drones)		\$644.7 M
For society			
Cost savings	From reduced healthcare burden		\$3.3 B
	On environmental cleanup (e.g. oil spills prevented)		\$140 M
	Damage Assessment and search & rescue		\$2.46B
	Time savings (from reduced road congestion)		\$497 M (24.8M hrs)
	Job-related injuries, accidents & illnesses prevented		158.9K
Increased safety	Lives saved		882
	Infrastructure reliability	Communications reliability (people impacted)	1.4 M
Environmental benefits	Harmful emissions (carbon monoxide and abnormal methane) reduction (tons)		106.4 K
	Reduction in water contaminants (tons)		3.1 M
	Water saved (tons)		21.5 B

BVLOS DRONE USAGE ABROAD



BVLOS drone deployment abroad

Outside of the U.S., BVLOS drone deployments are increasingly becoming more common for package delivery, medical supplies delivery, search-and-rescue, and agriculture. Some countries, like Australia, South Korea, and Japan, are already beginning to realize the benefits of integrating BVLOS drones for specific use cases.

Exhibit 1.1

Overview of countries leveraging BVLOS drone deployments (non-exhaustive)

Country	Key Use Case(s)
Australia	Package delivery
Canada	Search-and-rescue (wildfires), cargo delivery for hospitals, border surveillance, nighttime facility security
Belgium	Infrastructure (below-ground technical galleries networks) inspection, search-and-rescue / 5G network restoration, large event security, port operations management
Ghana	Medical supplies delivery (e.g. vaccines) to remote areas
Germany	Port operations management, utilities infrastructure inspection
Ireland	Cargo and medical supplies (e.g. insulin) deliveries, agricultural monitoring,
Japan	Agricultural crop spraying
Norway	Road surveillance, construction site inspections, forest and agriculture surveillance
Rwanda	Medical supplies (e.g. blood) delivery to remote areas
South Korea	Agricultural crop spraying

Source: Accenture research & analysis

Retail & Package Delivery

Australia already successfully launched BVLOS package delivery at scale in several cities, realizing benefits of time and cost savings.ⁱⁱ Meanwhile, countries like Rwanda and the UK are beginning to leverage BVLOS deployments for medical supplies delivery, with Rwanda using drones at scale for blood delivery, and the UK experimenting with moving blood between two London hospitals, which has shortened transport time to two minutes.ⁱⁱⁱ

CASE STUDIES

Wing is helping scale drone deliveries in multiple cities across Australia^{iv}

Wing has developed a robust drone delivery network in Melbourne, Victoria, and Queensland, and notably has entered into a partnership with DoorDash to help with grocery and takeout food deliveries. Delivery time has been significantly reduced, with drones arriving in minutes after takeoff, due to their ability to avoid road congestion. Additionally, approvals secured from Australian regulators for BVLOS deployment at scale have enabled efficient operations where one pilot is responsible for overseeing up to 50 drones, where previously multiple cars would need to be responsible for handling those deliveries, significantly bringing down delivery costs.

Drones are expanding rural access to life-saving medical products in Rwanda^v

More than 80% of Rwanda's population lives in rural areas, which have historically had limited access to healthcare. Today, more than 75% of Rwanda's blood supply outside of the capital is now delivered by drone, meaning blood is now delivered in as little as 15 minutes as opposed to multiple hours. Additionally, after implementing drone delivery, a 2022 Lancet study found that blood product expiration was reduced significantly.

Civic Interest

Governments and relief organizations abroad are exploring BVLOS drone deployments for search and rescue. For example, the UK Department of Transport and a mountain rescue team launched a trial in Scotland's hills to facilitate rescue missions, while North Shore Rescue in Canada's British Columbia have been successfully using thermal drones to more quickly find lost hikers.^{vi}

CASE STUDY

Scottish Mountain Rescue is using drones to cut down search time and create mobile pop-up networks in areas without signal^{vii}

In Angus, Scotland, a team of mobile connectivity and drone specialists has demonstrated the ability to use flying drones as a moving connectivity bubble to aid with search-and-rescue missions. Mountain search and rescue often struggles with a lack of mobile connectivity, which means rescue teams have limited ability to communicate with each other or share information. BVLOS drone deployments allow for rescue teams to maintain contact, and also allow for faster search of wide areas without deploying as many rescue teams, saving time (and therefore increasing the rate of the lost hiker's survival) and reducing risk to mountain rescue teams.

Aerial Survey

Countries like the U.K., Belgium, and Germany are looking to save money and increase safety on critical infrastructure inspections by reducing labor cost on the actual inspections, and by better identifying and stopping potential hazards from turning into expensive disasters. A British water company is already deploying drones to reduce leaks, while researchers in Germany have designed a real-time capable drone to inspect critical infrastructure like energy plants and bridges more effectively, efficiently, and safely.^{viii}

CASE STUDY

One of Britain's largest water companies is realizing significant cost savings by leveraging drones for pipe bridge and industrial inspections^{ix}

Severn Trent Water is leveraging VLOS drone deployments to enhance operational efficiency and safety in pipe bridge and industrial inspections. Drones equipped with infrared sensors are better able to find leaks in hard-to-reach places, but new U.K. rules around BVLOS drone deployments are expected to significantly increase the effectiveness of drones by allowing them to cover more distance. Severn Trent Water aims to reduce the number of leaks by 15% in 2025, and cut the amount of water lost through leaks by 2045. The company has also already realized over \$1 million in savings in its first year on inspections, and it expects this number to grow significantly as BVLOS deployments are enabled.

Agriculture

South Korea and Japan have already established themselves as first-movers in using BVLOS drone deployments for crop spraying, creating major efficiencies in agricultural production. Meanwhile, Ireland has allowed for self-authorization of BVLOS operations, allowing companies to begin BVLOS deployment for use cases like dairy cattle herd monitoring.^x

CASE STUDIES

30% of pesticides spraying operations in South Korea are performed by drones

In South Korea, efficient farming practices are key, given that only 17% of the country's total land area is classified as farmland, and that the farming industry is suffering from a labor shortage.^{xi} Currently, an estimated 30% of pesticide spraying in South Korea is performed with drones.^{xii} Drones have been able to provide a variety of benefits, such as improved navigation of terraced rice fields and orchards in hilly and mountainous areas. Previously, workers had to navigate these fields with backpack sprayers, as traditional ground operations were unable to access these areas, which was hazardous to their health.^{xiii} Additionally, drones allow for greater precision, which has allowed South Korean farmers to save on chemical costs, increase crop yield through more targeted treatment, and cut labor costs in half due to the reduced time and personnel needed for rice spraying operations.^{xiv}

Scientists in Ireland leverage drones to optimize grazing for dairy cows

The \$5.8 billion-dollar Irish dairy industry is known for its high-quality products from grass-fed cows.^{xv} Currently, workers must make physical observations about pasture and grass growth, but this process is lengthy and the subjectivity of observers often skews the outcome.^{xvi} Researchers at Teagasc, UCD and DCU are testing the use of drone imaging with machine learning models to optimize grazing patterns, finding that predictive models based on a photograph are resulting in 95% accuracy when compared to physical observations. Predictive models have already reduced the amount of supplemental food that needs to be purchased due to overgrazing by allowing farmers to make more informed decisions, while drones significantly reduce labor required to capture data required to feed the models and remove subjectivity.^{xvii}

1.

RETAIL & PACKAGE DELIVERY



Drone delivery fills the last mile delivery gap

The package delivery sector is growing, driven by consumers' desire for convenience and speed. In the U.S. in 2024, there was a total of \$315 billion in sales for delivery of meals, grocery, pharmacy and medical items, and personal / household supplies.^{xviii} The food delivery market is expected to grow almost 10% by 2032, and a report from Pitney Bowes predicts the parcel delivery market could grow as much as 36% by 2030.^{xix} While the growth in delivery opens up new opportunities for conventional businesses, last-mile delivery typically poses a number of challenges, such as high operating costs for businesses, increased traffic congestion and emissions, and inability to meet time constraints.^{xx}

Drones can help address last-mile delivery challenges and create a number of benefits for small, time-sensitive deliveries

Leveraging drones for last-mile deliveries reduces delivery costs, leading to top and bottom-line growth for businesses, and cost savings for consumers. This means that many businesses that were unable to provide delivery service, namely due to high costs, may be able to do so with drones. Additionally, replacing a portion of existing ground deliveries with drones can drive a variety of downstream societal effects, such as increased road safety and emissions reduction from the resulting decrease in traffic congestion, and healthcare cost savings from increased access to pharmacy and medical products. However, these benefits will not provide any meaningful impact if BVLOS drone operations cannot be integrated into last-mile delivery at scale.

Delivery drones have already begun to drive impact in the U.S. in trials and incrementally expanding operations. Today, most of these use cases require FAA waivers or exemptions to fly beyond visual line of sight. Accenture’s analysis suggests that, should this activity continue under the current regulatory environment, BVLOS drones would impact less than 1% of retail activity in the U.S. by 2030. Were the FAA to create rules enabling BVLOS flights, we expect drones could impact as much as 9% of retail activity in the U.S. in the next 5 years.

Exhibit 1.2

Potential 2030 per annum benefits of BVLOS drones in last-mile delivery^{xxi}

Benefit	Detail	Impact	
		Status quo (Drone use by FAA waiver)	BVLOS-enabling rules adopted
For businesses			
	Reduced delivery costs	\$54 M - \$200.2 M	\$648.6 M - \$2.4 B
	Increased sales from higher conversion due to cheaper deliveries	\$670 M - \$711.7 M	\$8.3 B
For consumers			
	Reduction in delivery costs	\$58.3 M	\$699.6 M
	Time saved	\$53.7	\$644.7 M
For society			
Healthcare savings	Savings from reduced medication abandonment	\$277 M	\$3.3 B
Increased safety	Road accidents prevented	42	504
	Crash-related fatalities prevented	3	34
Congestion reduction	Time saved from hours sitting in traffic	\$41.4 M	\$497 M
Environmental benefits	Carbon emissions reduction (g)	1.7 B	20.3 B

Benefits to Businesses

Delivery drones have the potential to increase revenue for businesses by reducing delivery costs, which can allow for lower comprehensive prices for consumers, and in turn can lead to increased sales. Many businesses rely on logistics partners that charge 15%-30% of orders for the last-mile delivery.^{xxii} While consumers do pay for the delivery, there is shared incentive for efficiency as consumers, businesses, and those third party services may still be covering a portion of those costs, leading to margin erosion.^{xxiii}

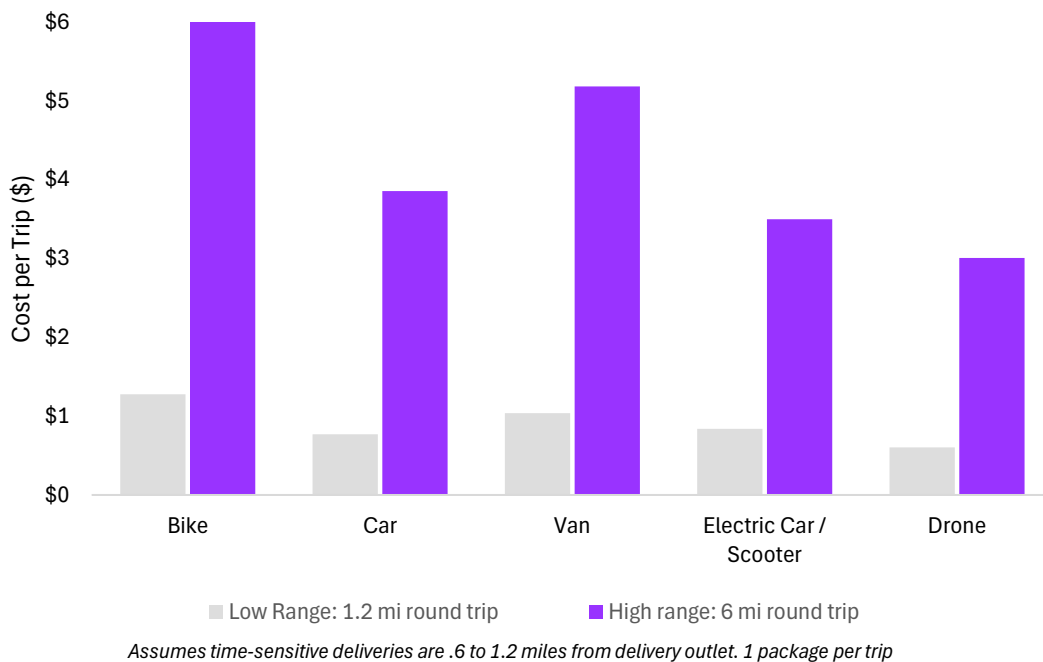


Above: Wing's highly automated, lightweight drone completes a residential delivery for a Walmart customer in Dallas-Fort Worth.

Drones are less expensive than electric and gas-powered vehicles for short, time-sensitive deliveries.^{xxiv} According to Accenture’s analysis, this means businesses have the potential to save as much as \$2.4 billion annually in delivery costs,^{xxv} which may allow some businesses to lower the price of delivery for consumers. Studies have shown that 90% of consumers will abandon their online shopping carts before checkout if shipping costs are too high.^{xxvi} Accenture’s analysis of total potential increased throughput based on lower shipping costs could lead to a lower rate of abandonment, meaning drone deliveries can generate \$8.3 billion more in sales for businesses.^{xxvii}

Exhibit 1.4

By 2030, with BVLOS rules established, drone delivery has the potential to be the cheapest delivery method for urgent, small packages^{xxviii}



Benefits to Consumers

Reducing delivery costs to businesses enables some businesses to offer more competitive delivery costs to consumers, making deliveries more accessible to more people, and even potentially reducing the number of ground transportation pickups, which leads to both money and time savings.



Above: The Amazon Prime Air MK30 delivery drone takes off at a Prime Air Drone Delivery Center.

As previously mentioned, studies have shown that more than 90% of customers said they are likely to abandon an online purchase if it involves high shipping costs, indicating customer sensitivity to delivery cost.^{xxix} Drone deliveries provide a cost-competitive alternative delivery method and additional delivery options beyond traditional ground-based methods. Drones could reduce the price of deliveries by 7-14% for businesses, which may result in almost a \$700 million reduction in consumer per annum delivery costs if businesses lower delivery costs at the same rate, based on Accenture’s analysis.^{xxx}

Drones can also lead to overall time savings for consumers by replacing or augmenting a portion of trips consumers would make in their own vehicle. Studies have indicated that 40% of consumers would be willing to pay for drone deliveries^{xxxi}, which indicates that over 32,000 per annum hours could be saved by replacing pickups with drone deliveries, translating to 11 hours saved annually per person using drone deliveries at scale.

Benefits to Society

Drone deliveries also offer a variety of societal benefits, due to the increased speed and convenience they offer by avoiding roads, as well as their lower level of emissions relative to cars and vans. By replacing a portion of deliveries that use ground transportation and by adding new economic activities that do not require deliveries to occur over the road, drones can reduce the number of vehicles on the road—leading to downstream benefits for the uninvolved public such as reduced traffic congestion and road accidents—as well as lower carbon emissions. Additionally, more convenient medication deliveries can lead to a lower rate of prescription abandonment, thus reducing the incidence of adverse events and hospitalizations, and the costs associated with them.

Improving healthcare



Above: Wing partnered with Apian and the U.K.'s National Health System (NHS) in central London to deliver blood samples between Guy's Hospital and St. Thomas' Hospital to speed diagnoses and improve patient care.

One out of every four new prescriptions is abandoned and never picked up, according to a Harvard Medical School, Brigham and Women's, and CVS Caremark Study.^{xxxii} This translates to 46 million patients leaving their prescription at the pharmacy every month.^{xxxiii} Drone delivery can help pharmacies improve patient care by overcoming transportation barriers and ensuring timely access to medication, even after initial stocking issues. This service reduces prescription abandonment, which boosts medication adherence and helps prevent adverse health effects. Accenture estimates that by removing significant barriers, BVLOS delivery drones can create almost \$3.5 billion in annual healthcare cost savings.

Exhibit 1.7

Pharmacy prescriptions abandoned and reasons for abandonment^{xxxiv}

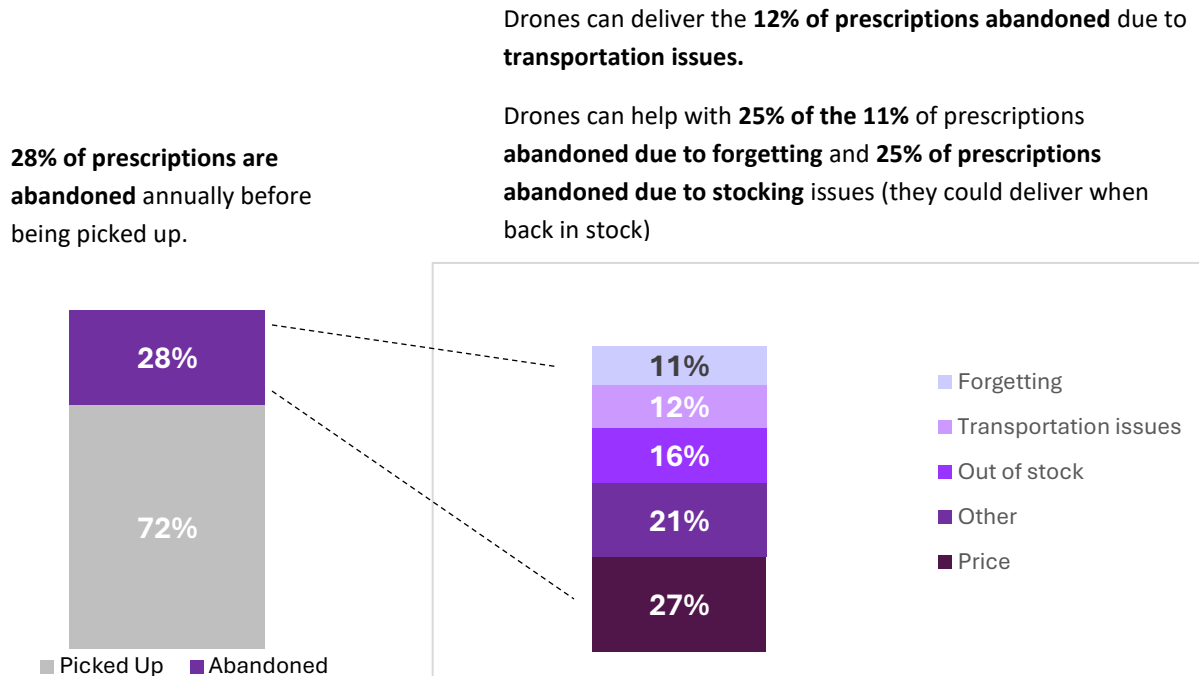


Chart is based off 4,000-person survey conducted by GoodRX (see endnote in chart header). Respondents could select more than one option or leave blank; percentages may not sum to 100.

In addition to delivering prescriptions, drones can provide a faster method to deliver life-saving, time-sensitive medical supplies, such as defibrillators, and can be used for blood and organ transportation.^{xxxv} Drones can access hard-to-reach communities and bypass traditional traffic to expand access to emergency supplies.^{xxxvi} These impacts are not quantified in Accenture's analysis, but have the potential to yield substantial public benefit in the coming years.

Improved road safety

Almost 5 billion vehicle miles traveled in the U.S. every year are due to last mile deliveries.^{xxxvii} Additionally, there are over 44,000 traffic-related deaths, with 13,000 road accidents involving delivery drivers each year in the U.S.^{xxxviii} Drones deliveries, substituting for a portion of these miles, as well as a portion of miles travelled by consumers to pick up their orders, can decrease congestion and improve safety, by potentially reducing per annum ground transportation distance travelled by over 194 million miles. This would lead to almost \$500 million in time savings from reduced hours sitting in traffic, and over 500 road accidents prevented.^{xxxix}

Environmental benefits

In 2022, almost 2 billion metric tons of greenhouse gases were emitted from the U.S. transportation sector, which is nearly 30% of the total U.S. greenhouse gas emissions.^{xi} Carbon dioxide emissions have a variety of negative downstream effects to society, including increased health risk. Air pollution accounts for premature deaths due to issues like cardiovascular disease, stroke, respiratory infections, and lung cancer.^{xii} Drones emit dramatically less emissions than cars and vans do per mile, at just over 160 grams per mile^{xliii}, versus 350-540 grams per mile compared to cars and vans.^{xliiii} Accenture's analysis found that drones could reduce total carbon emissions by 20.3 billion grams, or 22,400 metric tons, in one year, leading to cleaner and healthier air. To contextualize, this translates to removing 46,000 cars from the road annually.

2.

CIVIC INTEREST

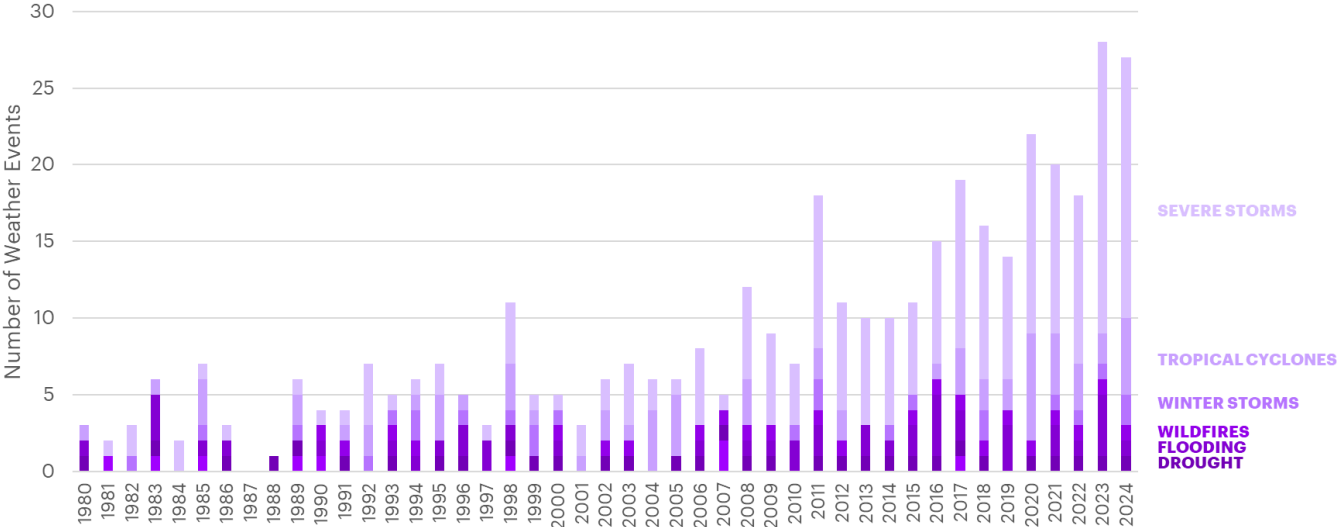


Drones can drive potential public safety impact

In the U.S. today, public safety and emergency response organizations are under mounting pressure. Critical pillars of the first responder ecosystem are reporting significant understaffing and rising burnout – including EMS, fire, and police.^{xliiv} At the same time, the need for emergency services and support is growing. The National Centers for Environmental Information is tracking a sharp rise in “billion-dollar weather and climate disasters” domestically since 1980.^{xlv}

Exhibit 2.1

United States Billion-Dollar Disaster Events (1980-2024)



Source: National Centers for Environmental Information

Drones can ease the burden on first responder communities and drive significantly improved outcomes in Civic Interest use cases

Drones offer significant benefits to civic interest missions in the U.S. by participating in public safety, emergency response, and disaster recovery use cases. In early pilot programs, they have shown an ability to improve search and rescue efforts with faster victim detection, support post-disaster assessments through rapid aerial imagery assessment, and deliver critical supplies when roads and access are blocked. Drones can also restore communications in disaster zones, assist firefighting with real-time situational awareness, monitor large crowds to prevent incidents, and accelerate investigations through high-resolution mapping. These capabilities have immediate potential to reduce response times, save lives, and lower operational costs across multiple emergency scenarios. Without a regulatory framework that allows for routine BVLOS operations, these benefits are severely stunted by restrictions that require an operator to maintain visual line of sight of the drone or pursue FAA waivers process.

Benefits to Society

The civic interest category of drone use cases focuses on the potential for drones to drive impact on missions that serve public safety, emergency response, and disaster recovery – prioritizing human impact over commercial profit. Unlike retail or logistics drones, these systems are valued for their capability to drive life-saving impact, reduce injuries, and accelerate the restoration of critical services. Deploying drones in an expanded, beyond visual line of sight capacity for civic interest use cases will save time and money and increase disaster survivability odds for communities across the U.S. For disaster response use cases in particular, these systems can act as a force multiplier for first responders – saving critical minutes and hours that make the difference for people in distress and those coming to aid them.

For public safety agencies, when there's potential for danger, an intelligent and full-picture understanding of the surrounding area is of critical importance. Lack of information results in greater risk for first responders and the communities they serve. Drone as First Responder (DFR) exists to change and improve outcomes before tragedy strikes. It's about more than just technology — it's about harnessing innovation to safeguard lives, enhance public safety, and promote better decision-making. When first responders encounter the unknown, the most precious resources are time and information. The unique aerial vantage points gained by leveraging DFR give stakeholders the critical information they need to uncover hidden dangers, reduce cognitive load, and make informed decisions that lead to life-saving outcomes.

Exhibit 2.2

Total potential per annum benefits of leveraging drones for civic interest use cases in the United States^{xlvi}

Benefit	Detail	Impact
For society		
Cost savings (per year)	Damage Assessment and search & rescue – Reduced costs vs. helicopter/ground patrols through faster imagery collection and fewer personnel hours	\$2.46B
Lives saved	Search & Rescue – Reduced time to locate victims, increasing survival rates through faster detection	779 Lives
Comms restoration	Deployment of tethered and untethered BVLOS UASs providing network coverage to people impacted by weather events	Potential to impact 1.4M to 6.7M people per year



Above: The RQX-3 "Raven" in a disaster report test flight.

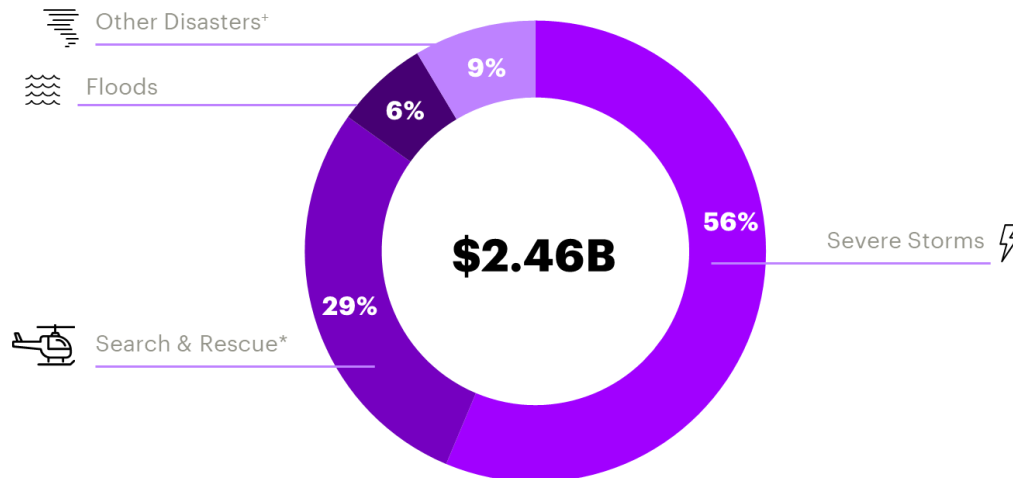
BVLOS drone operations have the potential to save U.S. communities billions of dollars annually

In post-disaster scenarios, damage assessment and search and rescue are critical for mobilizing response resources and initiating recovery. Traditionally, this work is performed via ground teams (both on foot and in vehicles) or manned aircraft (commonly helicopters), which can be costly, slower to deploy, and hazardous. Drones have the potential to drive impact in disaster recovery in several key areas:

- 1. Search & Rescue:** BVLOS drones with thermal sensors can shorten search times significantly, cutting the need for helicopters and reducing the size of ground teams, allowing for redeployment of those assets to more areas of need.
- 2. Damage Assessment:** After natural disasters, FEMA and insurers spend heavily inspecting damaged properties, a process drones can accomplish quicker and cheaper, leading to more effective and efficient recovery.
- 3. Logistics & Aid Delivery:** Drones can deliver supplies like medicine, water, and radios when ground routes are blocked, reducing reliance on helicopters and convoys – this improves delivery of emergency services when time counts the most.
- 4. Infrastructure Monitoring Assessment & Restoration:** Post-disaster inspections of power lines, levees, and pipelines are significant challenges that BVLOS drones can meet. Drones can restore critical telecommunications infrastructure to directly support first responders and disaster victims.

Exhibit 2.3

Potential impact of deploying drones in disaster response use cases in the U.S.^{xlvii}



Source: Accenture research & analysis

*Search and rescue counts above include missions attached to other disaster types

+Other disasters include natural and human disasters (wildfires, earthquakes, hazmat, security – a full accounting is available in the appendix)







According to Accenture’s analysis, BVLOS drones, substituting for ground or aerial disaster relief missions, have the potential to save billions of dollars in the U.S. annually for agencies and communities.

Unleashing BVLOS drones to support disaster relief has the potential to save thousands of lives each year in the U.S.

Beyond the potential financial implications of BVLOS drone operations for disaster relief, there is significant potential for drone technology to quickly and meaningfully drive life-saving impact across the U.S. Search and Rescue (SAR) is one of the most high-potential life-saving applications of drones – with thousands of documented interactions each year. The chance to increase area coverage with thermal imaging technology, economically improve access to remote and dangerous terrain, and integrate real-time delivery of potentially life-saving survival supplies holds significant potential societal benefit. Based on this technology and an analysis of the ability to significantly improve average time-to-victim, drones have the potential to save hundreds of lives annually.

Exhibit 2.4

Potential public safety impact of deploying drones in disaster response use cases in the United States

Disaster types	Disaster Event	Annual Fatalities	BVLOS Life-saving Potential*
Human	 Search & Rescue	2,500	588
Natural	 Hurricane	114	27
	 Floods	113	27
	 Earthquake	62	15
	 Wildfire	12	3
	 Other Sever Weather**	255	60
Total		3,056	779

Source: Accenture research & analysis

*Accenture’s methodology for determining potential BVLOS life-saving uplift is outlined in the appendix

**Other severe weather includes storms not classified hurricanes and tornados

Governments and relief organizations abroad are exploring BVLOS drone deployments for search and rescue. In the UK, the Department of Transport, in a pilot with a mountain rescue team, found that drones could cut in half the search times of whole, trained human teams. ^{xlviii}

CASE STUDY

Drones have already shown life-saving potential in search and rescue across the United States

1. Malibu, California – 78-Year-Old Man with Early-Onset Dementia^{xlix}

- **Incident:** In December 2024, a 78-year-old man with early-onset dementia went missing after walking to fetch his mail.
- **Drone Intervention:** Malibu Search and Rescue deployed multiple drones – using onboard infrared heat-seeking technology – to help locate the missing man.
- **Outcome:** Malibu SAR detected a "significant heat signature" in dense brush near the road. Ground teams found the man alive but suffering from cold-related illness and confusion. He was rescued in time for medical care.

2. Fond du Lac County, Wisconsin – Lost 3-Year-Old in Cornfield^l

- **Incident:** In September 2024, A 3-year-old boy went missing in a 100-acre cornfield.
- **Drone Intervention:** Fond du Lac County Police deployed a thermal imaging drone to help cover the large search area.
- **Outcome:** Less than an hour after arriving on the scene, the drone located the boy's heat signature in the field – the boy was rescued 16 minutes after detection.

3. Louisiana – 10-Year-Old Girl Found in Woods^{li}

- **Incident:** In September 2024, a 10-year old girl, went missing after she sleepwalked into dense woods near her home in rural Louisiana
- **Drone Intervention:** The owner of a local drone company volunteered a platform equipped with thermal imaging to aid in the search
- **Outcome:** After a 24-hour search – including helicopters and hundreds of volunteers – the drone was able to find the girl and operators deployed a rescue team.

4. Pensacola Beach, Florida – Teenage Girl Drowning in Rip Current^{lii}

- **Incident:** In May 2025, a teenage girl was caught in a rip current with no lifeguards on duty, unable to swim back to shore.
- **Drone Intervention:** A local fisherman used his drone to rig and drop a flotation device to the swimmer.
- **Outcome:** The fisherman piloted the drone and flotation device to the swimmer, which helped her stay afloat until first responders arrived. First responders credited the fisherman and drone with saving the girl's life.

Major weather events impact communications services for millions in the U.S. each year, and BVLOS drones have the potential to improve service restoration

Natural disasters and weather events have significant potential to disrupt communications networks in the U.S. Recent hurricanes, storms, and wildfires have left millions without these services, often for days at a time. These service disruptions can have widespread negative impacts, including lost 911 access, delayed rescues, hindered aid distribution, and stranded survivors. Current, ground-based solutions to these problems – such as cell on wheels (COWs) and satellite trucks – can be effective, but are subject to road and infrastructure availability that is difficult to guarantee in the aftermath of significant disasters.

Drones operating beyond visual line of sight have the potential to significantly improve communications service restoration. Gains in response time and deployment scalability via fleet flights could lead to meaningful and potentially life-saving outcomes for millions of Americans.

Exhibit 2.5

BVLOS drones have the potential to provide faster coverage to millions of people impacted by weather-related comms disruptions

Americans likely to experience a >24hr comms service loss as a result of a weather event

Storm Category	Count (per year)	Impact potential (# people)	
		Low Estimate	High Estimate
Hurricane	3 – 5	900,000	4,500,000
Severe Storm Event	15 – 20	225,000	1,500,000
Wildfire	90 – 130	243,000	676,000
SUM		1,368,000	6,676,000

Source: Accenture research & analysis

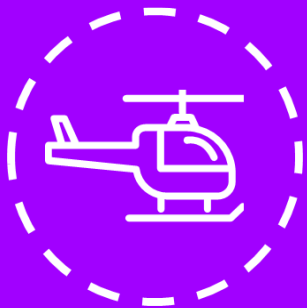
Telecom companies are already exploring solutions to quickly restore communications services to impacted citizens and support emergency workers. Verizon has been deploying tethered drones outfitted with cellular nodes, supporting first responders and search and rescue teams after weather events.^{liii} Its new platform - HAWK (High Altitude Wireless Kennewhat) – is a tethered system that flies small cell solutions up to 300 feet AGL, providing an airborne network solution.



Above: A Verizon drone provides cellular coverage to support first responders in Sanibel Island, Florida, after Hurricane Ian in October 2022.

3.

AERIAL SURVEY





















Drones can unlock efficiencies in U.S. infrastructure

Today, U.S. infrastructure is facing several challenges across the country. New technology innovation – chiefly the rise of artificial intelligence – is driving increasing demand for power and connectivity. At the same time, increased incidence of adverse weather events cause a greater number of outages and disruptions. Against this backdrop, critical pillars of the U.S. infrastructure ecosystem are old and decaying. A 2024 analysis found that 31% of transmission lines and 46% of distribution infrastructure are beyond its useful life.^{liv} Pipeline infrastructure, too, is aging. A federal analysis recently found that more than 60% of U.S. fuel pipelines were built before 1970.^{lv} The American Society of Civil Engineers (ASCE), in grading U.S. infrastructure, gave several critical pieces of the U.S. infrastructure puzzle poor marks.^{lvi}

Exhibit 3.1

2025 ASCE U.S. Infrastructure Report Card

Infrastructure Category	Grade
 Ports	B
 Rail	B-
 Broadband	C+
 Solid Waste	C+
 Bridges	C
 Hazardous Waste	C
 Inland Waterways	C-
 Drinking Water	C-
 Public Parks	C-
 Aviation	D+
 Dams	D+
 Energy	D+
 Levees	D+
 Roads	D+
 Schols	D+
 Wastewater	D+
 Stormwater	D
 Transit	D

Today, a significant portion of these critical infrastructure networks are patrolled and inspected by helicopters and fixed-wing aircraft that spot heat anomalies, leaks, corrosion, scour, and encroachments before they become outages or incidents.

Drones – particularly deployed beyond visual line of sight – hold significant opportunity to drive efficiency gains, cost savings, and better outcomes across several key categories.

BVLOS drone usage can significantly impact aerial surveillance costs at key U.S. infrastructure sites

Exhibit 3.2

Potential per annum benefits of leveraging drones for aerial survey use cases^{lvii}

Benefit	Detail	Initial Estimate
For businesses		
Electric T&D Line Surveillance	Potential savings on surveillance costs	\$970M
Pipeline Surveillance	Potential savings on surveillance costs	\$8,190M
Telecom Tower Surveillance	Potential savings on surveillance costs	\$160M
Bridge Inspection	Potential savings on bridge inspection costs	\$4,610M
Wind and Solar Inspection	Potential savings on wind/solar inspection costs	\$500M
For Society		
Pipeline Surveillance	Reduction in environmental spill societal impact	\$140M
	Reduction in abnormal methane release	2B cf/yr
Telecom Tower Surveillance	Reduction in on-the-job injuries	3,600 injuries
	Reduction in on-the-job fatalities	9 fatalities



While these estimates are significant in the near term, the U.S. is poised to make investments in critical infrastructure in coming years – either by necessity to repair or upgrade old and existing equipment, or to support coming technology-driven demand driven by AI and associated power demands. As the U.S. infrastructure footprint grows over time, so will the potential impact for drones to drive efficiency and impact.

Electric transmission & distribution line surveillance

The U.S. energy system includes more than 600,000 miles of transmission lines and 5,500,000 miles of distributions lines that need to be monitored and patrolled to ensure public safety, maintain grid reliability, prevent equipment failures and outages, and manage vegetation that can cause serious hazards like fires and power interruptions. Today, aerial patrols make up a significant piece of the surveillance picture, particularly for transmission lines. Drones deployed beyond visual line of sight have the potential to significantly reduce costs of line surveillance across the U.S.

Exhibit 3.3

Savings potential of BVLOS drone electric T&D line surveillance

Impact Category		Potential Impact	Detail
	Transmission Infrastructure Inspection	\$800M	<ul style="list-style-type: none"> The roughly 642,000 miles of transmission power line infrastructure in the US is inspected annually, and much of this inspection activity, today, is performed by aircraft – whether fixed wing or helicopter. These modes are highly costly and there is significant potential for BVLOS drones to perform this work more quickly and efficiently.
	Distribution Infrastructure Inspection	\$130M	<ul style="list-style-type: none"> The roughly 5.5 million miles of distribution power line infrastructure in the US is inspected less frequently. A given mile of line will be inspected, on average, once every 4 years. These inspections are more often performed by ground teams – with less per mile cost savings potential than transmission infrastructure.
SUM		\$930M	

Beyond cost savings, there is significant potential for BVLOS drones to increase the productivity and safety of line surveillance. Drones bring in richer data (via RGB/IR/LiDAR technology), fewer truck rolls and helicopter hours, lower worker exposure – supporting storm readiness and rapid post-event triage. Similarly, lower cost drone inspections can support regulatory alignment, improving the cadence of and quality of evidence for vegetation and asset inspections (e.g., NERC FAC-003, state rules).

Indeed, in many infrastructure inspection and surveillance uses operators find that the BVLOS cost structure is so transformative that inspection frequencies can be increased by as much as 6x. If this were true for T&D inspection frequency, the implied cost saving potential would balloon to \$5.6B, as well as creating the potential for early break detection and avoided power outage.

Some utilities are already piloting drone inspections of lines and infrastructure to great effect.

CASE STUDY

Xcel Energy realizes significant cost reduction from drone asset inspections

In 2018, the FAA granted BVLOS authorization to Xcel Energy to survey a portion of its transmission lines near Denver, Colorado. The company estimated after early testing that flying drones beyond line of sight will eventually cost between \$200 and \$300 per mile compared with helicopter flights that cost an average of \$1,200 to \$1,600 per mile. This more recent effort follows a 2015 pilot program where Xcel received authorization use drones to inspect thousands of miles of power lines and gas pipelines, but only at low altitudes and over its own property.^{lviii} By deploying drones beyond visual line of sight, Xcel has been able to increase service reliability with more frequent inspections (gathering better data) This program has also enables better and faster storm damage response. Group operations president Kent Larson reported "with drones we can go out, survey an area, quickly assess it. We'll know what kind of equipment to bring when we go out there, what kind of materials, and our restoration processes will be much quicker."



Above: An Xcel drone used to support asset inspections.

Pipeline surveillance

Pipeline infrastructure is another significant part of the U.S. infrastructure picture. According to the Pipeline and Hazardous Materials Safety Administration (PHMSA) there are 229,000 miles of hazardous liquid pipeline and 300,000 miles of gas transmission pipeline in the U.S.^{lix} These lines transport crude oil and refined products like gasoline and diesel, as well as highly volatile liquids, carbon dioxide, and ammonia, across long distances to refineries and markets. These pipeline networks are crucial for the national economy, delivering fuels from production sites to processing facilities and then to consumers via a system of gathering, transmission, and distribution lines.

Exhibit 3.4

Savings potential of BVLOS drone pipeline surveillance




Impact Category	Potential Impact	Detail
 Hazardous Liquid Pipeline	\$7.44B	<ul style="list-style-type: none"> The roughly 229,000 miles of hazardous liquid pipeline in the US with a strict set of inspection requirements. This infrastructure is required to be inspected at least once every 2 weeks (26 times annually). Today, much of this work is done via aircraft working in tandem with ground teams – a costly process that BVLOS drones could significantly improve across the country.
 Gas Transmission Pipeline	\$0.75B	<ul style="list-style-type: none"> There are some 300,000 miles of gas transmission pipeline in the US with a significantly more relaxed inspection requirement (2 times annually). Like hazardous liquid pipeline, this infrastructure is inspected by a mix of air and ground-based teams today.
SUM	\$8.19B	

Aerial surveillance is the primary method used to inspect pipeline infrastructure in the U.S. today. BVLOS drone technology has the potential to significantly reduce the cost burden of inspecting pipeline infrastructure annually.

Beyond potential cost savings, there is a significant environmental impact of abnormal pipeline gas releases due to accidents. In the U.S., an average of nearly 2 billion cubic feet of gas is unintentionally released each year –an environmental impact of running 4 coal-fired power plants for a year.^{lx} The Environmental Protection Agency (EPA) calculates a social cost of methane, valued at \$1,600/ton^{lxi} - meaning the environmental impact of pipeline accidents is on the order of \$136M/year.

Exhibit 3.5

Savings potential of BVLOS drone pipeline surveillance

Societal Impacts of Pipeline Spills in the US/year		
Gas Spill/year	Impact	Societal Cost
		
2 billion cubic ft	Yearly output of 4 coal-fired power plants	\$136M/year



Because of its significantly lower cost structure, drone surveillance has the potential to shift the surveillance paradigm for pipelines in the U.S. Several operators conducting drone surveillance have increased patrol frequencies to weekly or sometimes daily missions. An energy construction company deploying drone surveillance, Datumate, reported a customer in Texas who, by increasing surveillance frequency, was able to detect unusual soil subsidence near a river crossing that was invisible from ground level. Investigation revealed early-stage erosion threatening pipeline support. Because the drone was able to detect the anomaly, the company launched a preventative repair (cost: \$75,000) and avoided a potential failure (cost: \$8.5M).^{lxii}

Telecom Tower Inspection

U.S. telecom infrastructure is an increasingly critical part of the national ecosystem. According to the Wireless Infrastructure Association (WIA), there are more than 248,000 macrocell sites across the country and 154,000 cell towers that require frequent maintenance and inspection to keep networks up and running.^{lxiii} Traditional inspection and maintenance for this equipment is costly and dangerous. Towers can rise hundreds of feet above the ground, are often located in remote, hard-to-reach locations, and carry a risk of radiation exposure to technicians. Drones within visual line of sight of the operator are already being deployed as a cost-effective work around to legacy processes. BVLOS holds potential to drive efficiency even further for these use cases:

Exhibit 3.6

Savings potential of BVLOS drone telecom tower inspection

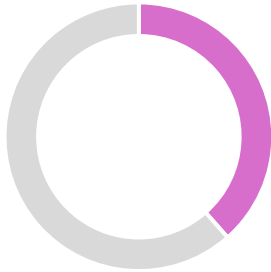
Impact Category		Potential Impact	Detail
	Macrocell Sites	\$127M	<ul style="list-style-type: none"> In the US today there are roughly 248,000 microcell sites and 142,000 cell towers that require inspection and maintenance to support network reliability and to ensure federal regulatory compliance Today, much of this work is performed by manned teams with dangerous and time consuming manual climbs to inspect and repair key equipment More and more, drones (within visual line of sight) are being deployed to do this work more quickly and safely BVLOS drones have the potential to add more efficiency to this process by allowing operator teams to inspect multiple pieces of infrastructure simultaneously and by cutting down on travel time to and from sites.
	Cell Towers	\$73M	
SUM		\$200M	

In addition to the financial implications and efficiency gains, deploying more drones in telecom tower inspection has significant potential to decrease on the job injuries and fatalities. These can include falls from great heights, electrical hazards, hazards associated with hoisting personnel and equipment with base-mounted drum hoists, inclement weather, falling object hazards, equipment failure, and structural collapse of towers. According to the Bureau of Labor Statistics, roughly 3,600 nonfatal injuries and illnesses occur each year in telecom installation and repair work.^{lxiv} OSHA reported an average of 8.5 fatalities per year at communication tower worksites from 2013 to 2016.^{lxv}

Bridge Inspection

Exhibit 3.7

39% of U.S. Bridge Infrastructure built before 1970



- US bridges built before 1970
- US bridges built after 1970

Bridge infrastructure in the U.S. is declining. In a 2025 report by the American Society of Civil Engineers, just 44% of U.S. road bridges were classified in “good” condition – despite roughly \$40B in recent infrastructure investment under the Infrastructure Investment and Jobs Act (IIJA).^{lxvi} Many of these structures are more than 50 years old – with 39% being built before 1970.

Railway bridges in the U.S. face similar challenges. A recent study by the Howard Center for Investigative Journalism at Arizona State found that just six inspectors from the Federal Railroad Administration are responsible for oversight and safety of the roughly 70,000 railroad bridges in the country.^{lxvii} Clearly, bridge infrastructure health could benefit from an inspection force multiplier to ensure safety for the public at large, and BVLOS drones have the potential to drive significant value.

Exhibit 3.8

Potential impact of BVLOS drones on bridge inspection in the U.S

Impact Category		Potential Impact	Detail
	Road Bridges	\$3.84B	• There are roughly 623,000 road bridges in the US that require inspection – on varying schedules – with most inspected once every 2 years. Bridge inspections are costly exercises and there is evidence drones can drive thousands of dollars in cost savings per inspection.
	Rail Bridges	\$0.78B	• The roughly 69,000 rail bridges in the US are inspected annually based on Federal Railroad Administration estimates. Drones have similar per inspection potential to drive cost savings here.
	SUM	\$4.61B	

CASE STUDY

North Carolina DOT and Skydio partner on bridge inspection^{lxviii}

In October 2020, the North Carolina Department of Transportation (NCDOT) secured a statewide FAA waiver to fly beyond visual line of sight (BVLOS) for bridge inspection – without visual observers or expensive detect-and-avoid systems. The approval relied on a safety case co-developed by NCDOT and Skydio and leveraged “infrastructure masking,” which enabled safe BVLOS flights underneath and within bridge structures where manned aircraft cannot operate safely. The waiver allowed NCDOT to drive significant efficiencies in a highly complex infrastructure environment.

Operationally, the waiver equipped NCDOT’s bridge program – responsible for ~13,500 bridges – to replace hazardous rappels and costly snooper trucks with autonomous inspections. Skydio’s system allowed inspectors to capture close-in imagery around piers, girders, and columns with greater precision and repeatability. By removing the need for visual observers at each site and enabling pilots to operate in tight, occluded spaces, the waiver reduced field staffing requirements while improving coverage and data quality.

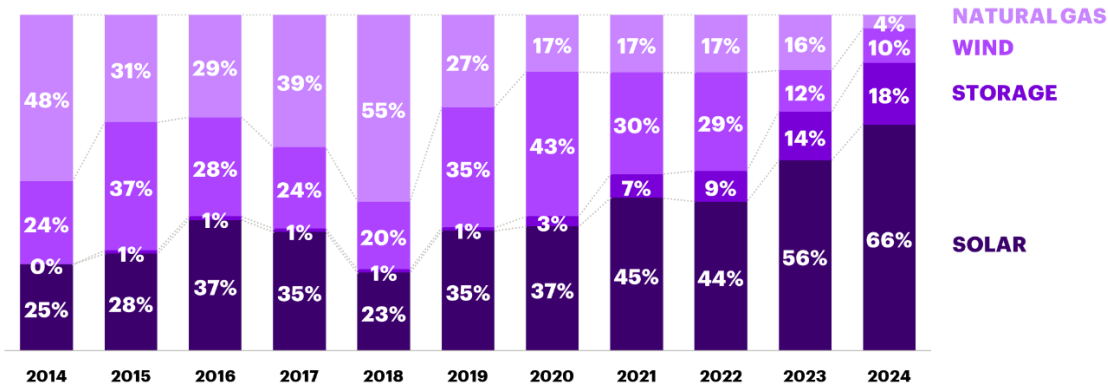
Early results and industry benchmarks indicated meaningful cost and safety gains. The American Association of State Highway and Transportation Officials (AASHTO) performed an analysis suggesting up to 75% lower taxpayer cost per bridge inspection when agencies shifted from traditional access methods to drones, plus as much as \$14,600 saved per inspection in avoided traffic and social disruption – benefits that scaled across NCDOT’s statewide portfolio. Beyond North Carolina, the waiver established a replicable regulatory pathway for other transportation agencies, building on prior BVLOS precedents and accelerating a shift to faster, less intrusive, and safer infrastructure assessments.

Wind Turbine & Solar Panel Inspection

Renewable energy infrastructure in the U.S. is advancing quickly as energy needs rise and both public and private sectors demand more of their power from clean sources. Solar energy alone accounted for 66% of new electric generation capacity added to the U.S. grid in 2024.^{lxix}

Exhibit 3.9

US Annual Additions of New Electric Generating Capacity*



*Each year between 0% and 6% of new capacity comes from “other” sources – not represented above
Source: Solar Energy Industries Association^{lxix}

With this new renewable infrastructure build comes a significant set of challenges:

- Environmental & weather damage:** Both solar panels and wind turbines are exposed to the elements, leading to damage that degrades performance and asset life. For solar, accumulation of dust, debris, and snow can block sunlight, while extreme weather can cause physical damage to panels. Wind and other harsh conditions, especially in offshore locations, cause blade erosion, cracks, and corrosion that need to be monitored.
- Safety & accessibility:** Inspecting and maintaining solar and wind systems poses significant risks to workers and sites and can be difficult to access. Solar technicians are exposed to falls from rooftops, electrical hazards, burns from hot panels, and repetitive stress injuries. Turbine technicians work at extreme heights in confined spaces and must contend with high-voltage electrical equipment and heavy machinery.
- Operational costs:** While maintenance can prolong asset life, operating expenses can increase due to the complexity and location of the work. Repairing or replacing components and specialized equipment is expensive. Remote or offshore locations of these platforms require costly logistics and specialized tools.

BVLOS drones have potential to drive significant inspection and maintenance efficiencies for renewable energy infrastructure by expanding coverage and speed, driving significant safety and cost savings gains, and improving data quality and adding analytics capabilities.

Wind and power infrastructure makes up a significant portion of the US power ecosystem today – with more than 76,000 active wind turbines^{lxxi} These large machines require significant inspection each year to guard against structural defects and wear and tear – as well as weather damage. Substituting drones for this dangerous work can save significant costs, time, and reduce the risk of injury each year.

Exhibit 3.10

Potential annual cost savings for drone inspection of U.S. wind turbines

Turbine count	76,051
Annual “visual” inspections	2.5
Visual inspection drone cost savings	\$350
Annual “full” inspections	1
Full inspection drone cost savings	\$1,750
Total potential cost savings	\$200M

Today there are more than 5 million solar installations across the country.^{lxxii} Utility-scale solar installations often contain vast arrays of panels that can be difficult and costly to inspect.

Exhibit 3.11

Potential annual cost savings for drone inspection of solar infrastructure

Current Solar Capacity	255.4 GW
Share of utility scale	70%
Drone inspection cost savings/MW	\$1,717
Annual inspections	1
Total potential cost savings	\$307M

While the cost savings potential of BVLOS drones to drive efficiency in solar and wind power inspection and maintenance annually, there are other, potentially more significant value drivers that drones can enable:

Fewer truck rolls, more coverage per day

Early testing suggests large potential increases in inspection area covered daily. BVLOS removes the need to keep the aircraft within the pilot's sight or to leapfrog visual observers, so one crew can scan entire solar blocks (up to 500 hectares/day) or multi-turbine strings before battery swaps—cutting labor and mobilization time. This order of magnitude efficiency increase could lead operators to radically increase inspection schedules, potentially catching faults earlier and further driving down expensive repair and part replacement costs.

Less outage time per inspection

Traditionally, wind turbine inspections could keep units offline for hours, even days for rope/crane/climb-based work. Modern drone-based wind power inspections have shown to keep turbines offline for as little as 30 minutes. Wind power, operations & maintenance costs can make up 25 to 35% of Levelized Cost of Energy (LCOE), so shaving outage time and rework materially matters.^{lxxiii} In solar, thermal BVLOS passes find strings/modules fast, so crews fix faults sooner.

Earlier defect detection avoids major repairs

Catching blade leading-edge erosion, lightning damage, or laminate defects early can help avoid five- and six-figure events (repairs/replacements) at wind and solar sites. Deploying BVLOS drones at increased inspection rates can significantly improve the probability of catching problems early and cheaply.



Above: A Skydio X10 performing autonomous routine inspection of an electric substation.

4.

AGRICULTURE



The case for drones in the agriculture industry

Over half of the 2.26 billion acres of land in the U.S. is comprised of cropland and grassland pasture and range, and the agriculture sector contributed over \$1.5 trillion to the U.S. GDP in 2023.^{lxxiv} However, factors like natural resource depletion, soil erosion, labor shortages, and rising costs of products like fertilizer mean that farms are increasingly struggling with productivity.^{lxxv}

In the USDA’s Agricultural Resource Management Survey (ARMS), farmers reported at least one soil resource concern on 49% of their fields, which can contribute to lower crop yields.^{lxxvi} Soil-related concerns include erosion, soil compaction, and poor drainage, and are all problems that are aggravated by common practices such as crop spraying, chemical fertilization, and irrigation.^{lxxvii} Cattle farmers are also struggling with margins, due to shrinking herd sizes, unpredictable weather, and higher input costs.^{lxxviii} Drones can help optimize resources, cut costs, and increase productivity through a variety of agricultural use cases.

Exhibit 4.1

Overview of key BVLOS drone agricultural use cases

	Use Case
Crops ^{lxxix}	Monitoring for nutrient deficiency, disease, and water stress
	Higher precision crop spraying (fungicides, pesticides, etc.)
	Fertilizer application (to optimize fertilizer usage and application timing)
	Cover crop seeding
Livestock	Disease identification
	Herd monitoring and counting (to observe behavior, identify disease, perform headcount)
	Pasture inspection (assess condition, identify overgrazing or plant stress)

BVLOS drone usage can increase farm profitability by creating operational efficiencies, optimizing resources, and increasing yield via enhanced monitoring

Exhibit 4.2

Potential per annum benefits to farms for leveraging drones for agricultural use cases^{lxxx}

Benefit	Detail	Per Annum Impact	
For businesses			
Crops	Cost savings on fertilization	Dollars saved on fertilizer	\$10.74 B
	Cost savings on crop spraying	Dollars saved on crop spraying operations (excl. chemicals used)	\$739.93 M
		Dollars saved on crop spraying chemicals	\$12.21 B
	Irrigation optimization	Dollars saved on irrigation	\$16.73 B
		Water saved (metric tons)	21.47 B
	Increased yield from enhanced monitoring	Increased sales	\$9.6 B
		Increased yield (metric tons)	45.2 M
	For consumers		
	Reduced prices from higher yield	Dollars saved on produce	\$117.7 M
	For society		
Environmental & health benefits	Reduction in chemical groundwater contaminants (tons)	1.28 M	
	Reduction in communities with unsafe levels of nitrate in drinking water	510	
	Reduction in money needing to be spent on tap water treatment	\$1.2 B	
	Reduction in harmful chemical topsoil contaminants (tons)	1.83 M	
	Reduction in farmworker pesticide-related illnesses	154,800	
For businesses			
Livestock	More effective herd monitoring	Cost savings on cattle disease prevention	\$177.25 M
		Increased sales from cattle herd preservation	\$459.85 M
	More efficient pasture inspection	Time savings on pasture inspection	\$965.7 M

Benefits of leveraging drones for crops

Drone fertilizer spraying can save farms billions of dollars on fertilizer usage

Current methods of fertilizer spraying are time-consuming, and they often result in uneven distribution or overuse of fertilizers. Only about 65% of nitrogen fertilizer applied to crops is actually absorbed, while the rest runs off into water supplies and natural environments.^{lxxxix} In addition to costing farms additional money, fertilizer overuse also results in water contamination and soil erosion,^{lxxxix} the U.S. alone is responsible for 11% of the world's nitrogen pollution.^{lxxxix} Drones can cover 30 times more distance a day than a knapsack sprayer, and they can collect data via sensors to map out the soil and apply only the amount of fertilizer the crops need, when they need it.^{lxxxiv} As a result, according to Accenture's analysis, drone fertilizer spraying has the potential to reduce the amount of fertilizer used from 26 million tons per annum, to 18.2 million tons, saving \$10.7 billion annually.

Drone deployments can save hundreds of millions of dollars annually on crop spray operations and billions on chemical usage



Above: A Hylio AG-230 in flight over a field.

Nearly 30% of cropland is treated with chemicals like fungicides and pesticides via aerial spraying with fixed wing planes and helicopters, as it is significantly faster than ground spray methods for large areas, and it is minimally disruptive to the crops and soil. Additionally, aerial spray methods can reach terrain that ground operations cannot, such as areas where there is dense foliage or wet soil.^{lxxxv}

Drones offer a cost-effective, and higher precision alternative. Drones could reduce spray applications by up to \$5 per acre versus custom hiring a crop duster.^{lxxxvi} A large industrial farm may spray as many as 75,000 acres annually^{lxxxvii}, meaning that a single farm could save over \$380,000 annually just on spray operations alone, and significantly more on the chemicals themselves.

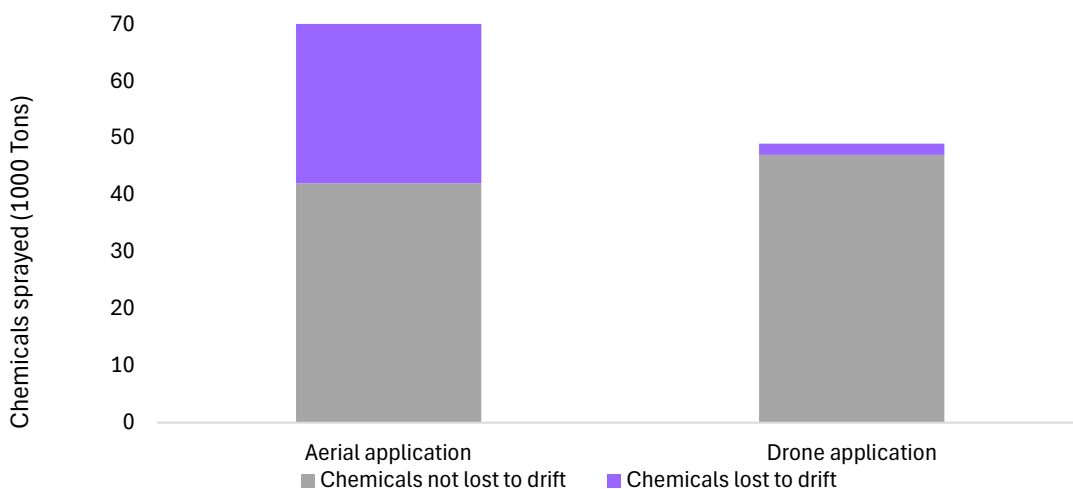
With current spray methods, 35 thousand tons (70 million pounds) of crop spraying chemicals are lost to chemical drift annually, which leads to wasted money, less effective pesticide application, and negative impacts to human health and the environment.^{lxxxviii} Using drones for spray applications can save 20-35% of fungicide versus other aerial application methods like crop dusters, and up to 60-80% of fungicide versus ground spraying operations, as drones are able to fly at lower altitudes for more accurate spray patterns, and enhanced drone cropland monitoring enables precision dosing.^{lxxxix}

According to Accenture’s analysis, drones can save 21 thousand tons of chemicals annually compared to crop dusters, and 108 thousand tons of chemicals annually compared to ground spraying operations. This translates to an annual cost savings of over \$12 billion.

Exhibit 4.3

Chemicals sprayed annually if aerial applications were replaced by drone application^{xc}

Drones vs. crop dusters



Reducing chemicals usage creates significant environmental and health benefits



Above: A Hylio AG-272 agricultural drone in flight over a cornfield.

In addition to wasting money, chemical drift also adversely affects both the environment and human health. It is estimated that there could be as many as 300,000 cases a year of pesticide-related illness among farmworkers, caused by both chemical drift and exposure to chemicals from backpack spraying.^{xcv} Pesticide-related illness can have long-term effects on health, even causing reproductive disorders, cancer, and pulmonary disease.^{xcvi} Drones minimize worker contact with chemicals, and reduce chemical drift by over 30,000 tons, meaning BVLOS drone deployment could lower the incidence of illness by over 150,000 cases a year.

Pesticides, herbicides, fungicides, and chemical fertilizers also have lasting impacts on soil and groundwater. It is estimated that 7% of chemicals applied leach to aquifers.^{xcvii} As a result, drinking water for humans and livestock can become contaminated with nitrates, causing nitrate poisoning.^{xcviii} It is estimated that 1,700 communities in the U.S. have drinking water with above the legal limit of nitrate set by the federal Safe Drinking Water Act, or over 10 parts per million of nitrate. Not only does this increase risk of cancer, according to the National Cancer Institute, but over two thirds of these communities do not have water treatment systems in place, which can cost \$3.5 million to build.^{xcix} By reducing fertilizer usage, there is a potential to help over 500 communities have safer drinking water, and potentially save \$1.2 billion in costs to build treatment systems.

Additionally, 10% of chemicals applied remain in the topsoil, leading to high pollution and soil erosion.^{cx} By reducing the amount of chemicals and fertilizers applied annually, drones can decrease the amount of water contaminants by over 1.2 million tons and the amount of topsoil contaminants by over 1.8 million tons.

BVLOS drone operations have the potential to save US farms billions annually on irrigation

Drones can also reduce water costs to farms by providing for more targeted irrigation. Drones equipped with sensors can detect when crops are under water stress so farmers can act accordingly, therefore removing the need for unnecessary irrigation and reducing water usage by 20%.^{xcvii} Currently, almost 500 thousand gallons of water are used per acre in irrigation, and almost 60 million acres of cropland are irrigated in the United States.^{xcviii} This means that drone usage can reduce water consumption by almost 6 trillion gallons and save almost \$17 billion in water costs.

Drone deployment for crop monitoring more accurately identifies plant stress, leading to targeted interventions and billions of dollars in increased yield

Drones equipped with sensors and imaging capabilities can detect changes in crop conditions, such as nutrient deficiencies or water stress, that may have been missed otherwise in a standard field check, allowing for targeted interventions. Additionally, more precise fertilizer and pesticide or herbicide spraying can provide the optimal amount of chemicals required for plant growth, while minimizing negative effects to soil. As a result, experts speculate that crop yields can be increased by 5%, or by over 45 million tons.^{xcix} Even accounting for potential price decreases due to higher yields, this increase in production could lead to \$9.6 billion in increased annual sales to farms.

Benefits of leveraging drones for livestock

Drones can save ranchers millions of hours annually on herd monitoring, while increasing accuracy of reports

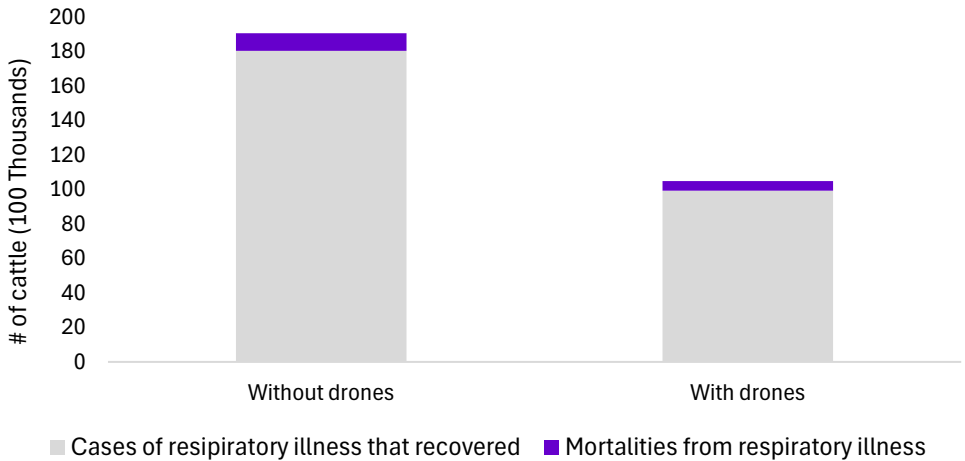
Ranchers can spend 6-12 hours weekly on counting herds and inspecting pastures to understand the precise headcount, health, and grazing patterns.^c Drones equipped with cameras can reduce time spent on inspections by 70%, and increase the quality of assessment by generating footage that is analyzed in real-time to gauge headcounts and flag issues and anomalies with the herd or pastures.^{ci} Drones, coupled with AI analysis, can reduce the incidence of lost cattle by nearly 80%, and increase pasture lifespans by 10-15%, which reduces the need to reseed or purchase additional food due to overgrazing. The speed at which drones can gather high-quality data for analysis means that ranches save over 36 million hours of labor annually on inspections.

Drones for cattle herd monitoring helps identify and contain disease, saving hundreds of millions in treatment costs and increasing product outputs

Bovine respiratory disease affects over 20% of all cattle, as it can be challenging to identify cases early enough to prevent disease spread.^{cii} In order to minimize herd losses, farmers spend over \$50 million annually on treating cattle for respiratory illness. Drones equipped with thermal imaging cameras can monitor herds and quickly detect sick cattle by identifying increased body temperature. As a result, bovine respiratory disease can be more quickly detected and contained, leading to a 45% reduction in disease incidence.^{ciii} This translates to over \$177 million saved annually in treatment costs.

Exhibit 4.4

Incidence of bovine respiratory illness and related mortalities with and without BVLOS drone monitoring



Improved detection and management of bovine respiratory disease also lead to fewer cattle lost to illness. Currently over 1 million cattle are lost annually to bovine respiratory disease; 55% of feedlot cattle are lost to the disease a year, while nearly 30% of non-predator deaths of all cattle are due to the illness. Drone monitoring of cattle herds can nearly cut the number of disease-related mortalities in half, leading to almost \$450 million in increased sales due to better herd preservation.

Appendix

Retail & Package Delivery

Developing scenarios for drone delivery in 2030

We determined 2 potential scenarios for drone uptake in 2030, based on technical and operational parameters: a drone adoption scenario if today’s status quo was maintained (assumed 0.75% adoption in all addressable use cases), and a scenario of drone adoption with BVLOS-enabling rules in place (9% adoption in all addressable use cases).

Before performing our impact calculations, we first needed to size the potential drone last-mile delivery market.

Sizing the drone last-mile delivery market

We sized the last-mile delivery market across 4 relevant retail categories (as shown in Exhibit A.1), leveraging a variety of secondary sources. To do so, we first determined the number of transactions and transaction size for each category.

A.1 Determining the number of transactions by retail category

Retail Category	2024 Retail Sales (\$) ^{civ}	Avg Transaction Size ^{cv}	# of Transactions in 2023 (M) ^{vi}	Growth Forecast ^{cvi}	# of Transactions in 2030 (M)
Takeout food & beverages	\$95,000,000,000	\$28.50	3,333,333,333	10.30%	6,002,495,179
Grocery	\$258,500,000,000	\$142.00	1,820,422,535	10.30%	3,278,123,247
Pharmacy & medical	\$692,900,000,000	\$30.00	23,096,666,667	4.30%	29,734,124,612
Household, office, and personal supplies	\$67,500,000,000	\$272.00	248,161,765	10.33%	447,606,699

A.2 Assumptions around delivery distance, weight, and time sensitivity ^{cvi}

Distance Assumptions

Distance from outlet (mi)	% of households
< 0.6	25%
0.6 - 3.0	40%
3.0 - 5.0	25%
6+ mi	10%

Time sensitivity assumptions

Retail Category	Time-Sensitive (<1 hr)	Same Day	Standard (>1 day)
Takeout food & beverages	100%	0%	0%
Grocery	20%	60%	20%
Pharmacy & medical	45%	37%	18%
Household, office, and personal supplies	2%	40%	58%

Size distribution assumptions

Category	Size Distribution		
	Small (<5 lbs)	Medium (5-10 lbs)	Large (>10 lbs)
Takeout food & beverages	85%	7%	8%
Grocery	40%	27%	33%
Pharmacy & medical	89%	8%	3%
Household, office, and personal supplies	49%	38%	13%

A.3 Determining the share of transactions delivered^{cix}

Retail Category	Current transactions delivered (%)	2030 projected transactions delivered (%)	Projected delivery growth
Takeout food & beverages	44%	47.47%	1.16%
Grocery	33%	55.34%	9.00%
Pharmacy & medical	25%	35.14%	5.70%
Household, office, and personal supplies	20%	32.09%	8.20%

Share of transactions in drone accessible areas ^{cx}	
% of deliveries in high density urban areas (e.g. downtown Manhattan)	3%
% of deliveries in non-high density urban areas	97%

Estimated count of drone deliveries	
Total addressable market	479.9M
Status quo (drone use by FAA waiver)	3.6M
Enabling rules adopted	43.2M

Overview of all benefits (Total addressable opportunity)

In order to calculate the benefits of BVLOS drone integration in last-mile delivery for our 2 scenarios, we first needed to determine the total addressable opportunity for each impact calculation. We could then multiply these calculations by 0.75% and 9% to determine the impact with today’s status quo maintained, and with BVLOS-enabling rules, respectively.

A.4 2030 Total addressable opportunity for all impact calculations (methodology for each calculation is laid out in the following sections)

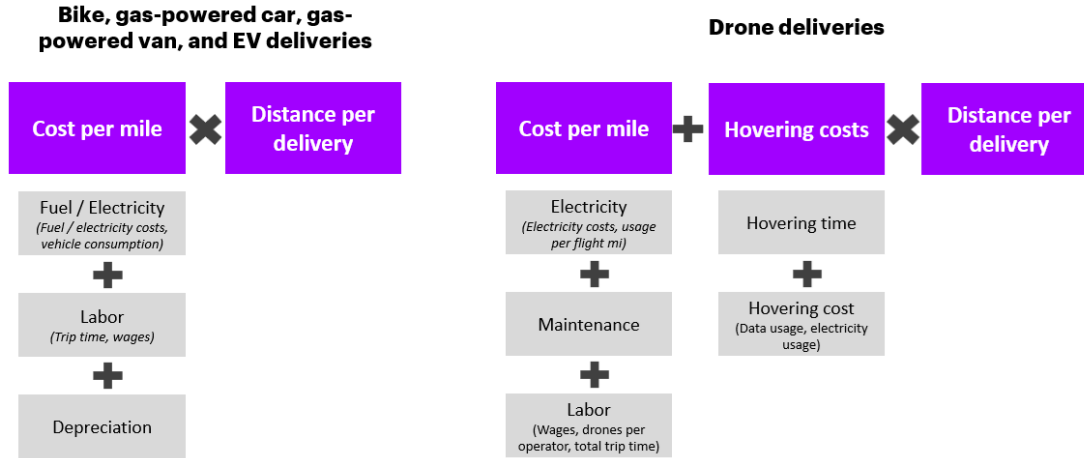
Benefit	Detail	Impact
For businesses		
Increased revenue	Reduced delivery costs incurred	\$7.2 B - \$26.7 B
	Increased sales from higher conversion due to cheaper deliveries	\$89.3 B - \$94.9 B
For consumers		
Money saved	Reduction in delivery costs	\$5.2 B - \$10.3 B
Time saved	Time saved from avoided takeout pickups (value of time)	\$7.2 B
For society		
Healthcare savings	Savings from reduced medication abandonment	\$37 B
Increased safety	Road accidents prevented from reduced cars on the road	5,602
	Crash-related fatalities prevented	379
Congestion reduction	Time saved from hours sitting in traffic	\$5.5 B
Environmental benefits	Carbon emissions reduction (g)	225.5 B

Benefits for businesses

Calculating reduced delivery costs incurred

In order to calculate the reduced delivery costs incurred, Accenture first calculated the cost per delivery for drones versus other common delivery methods (bike, gas-powered car, gas-powered van, electric car) for the Time-Sensitive delivery category, as we assumed that drones would only be used for single-package deliveries, due to weight constraints.

A.5 Methodology for calculating the cost per delivery for time-sensitive deliveries



A.6 Inputs and assumptions for calculating cost per delivery of current delivery methods

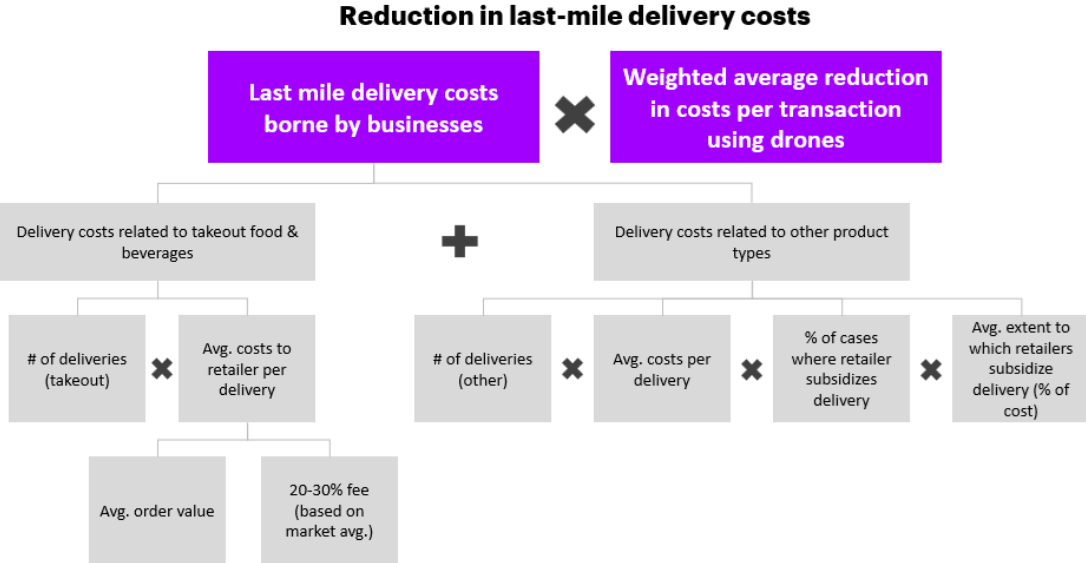
Inputs		Sources & Assumptions
Fuel / Electricity	Fuel / electricity cost	<ul style="list-style-type: none"> AAA, <i>Fuel Prices</i> (2025) Car and Driver, <i>How Much Does It Cost to Charge and Electric Vehicle</i> (2025)
	Milage (gas or electricity consumption per mi)	<ul style="list-style-type: none"> Car and Driver, <i>How Much Does It Cost to Charge and Electric Vehicle</i> (2025) Websites: Toyota, Honda, Tesla, Chevrolet U.S. Department of Energy, <i>Average On-Road Fuel Economy for Medium/Heavy Trucks Ranged from 4.0 mpg to 10.1 mpg in 2021</i>
Labor costs	Driver salary	<ul style="list-style-type: none"> Indeed.com FreshBooks, <i>How Much to Charge for Delivery? A Small Business Owner's Guide</i> (2025)
	Trip speed	<ul style="list-style-type: none"> Calculated by average vehicle speed and distance travelled per trip
Maintenance costs	Maintenance costs	<ul style="list-style-type: none"> DirectCarBuying.com Experian.com
Trip Distance	Distance travelled per trip	<ul style="list-style-type: none"> All Time-Sensitive deliveries consist of an out-and-back delivery, and are estimated to be 0.6-3 miles away from the delivery outlet. Delivery distance is 1.2-6 miles total. Accenture commissioned by Wing, <i>Faster, Safer, Greener: The Potential Impact of Delivery Drones in the Dallas-Fort Worth Metroplex</i> (2021)

A.7 Inputs and assumptions for calculating cost per delivery for drone deliveries

Inputs		Sources & Assumptions
Electricity	Electricity cost	<ul style="list-style-type: none"> USDOT Intelligent Transportation Systems Joint Programs Office
	Battery life	<ul style="list-style-type: none"> Grepow, <i>Some Common Sense about Delivery Drones</i> (2024) Expert interviews
Maintenance	Maintenance costs	<ul style="list-style-type: none"> Estimated annual maintenance is 20% of capital cost (\$2,000 for delivery drone); based on market research and Accenture analysis

Labor	Operator salary	<ul style="list-style-type: none"> ZipRecruiter.com
	Trip time (Flight time + hovering time)	<ul style="list-style-type: none"> Flight time based on drone speed (from expert interviews) and distance travelled per trip ARK INVEST, <i>How Can Amazon Charge \$1 for Drone Delivery?</i> (2015)
	Drones per operator	<ul style="list-style-type: none"> 30 drones per operator, based on expert interviews
Hovering	Hovering time per trip	<ul style="list-style-type: none"> ARK INVEST, <i>How Can Amazon Charge \$1 for Drone Delivery?</i> (2015) Expert interviews
	Electricity cost	<ul style="list-style-type: none"> USDOT Intelligent Transportation Systems Joint Programs Office
	Battery life (hovering)	<ul style="list-style-type: none"> Autelpilot, <i>How Long Can a Drone Stay in the Air?</i> (2024)
	Data cost & usage	<ul style="list-style-type: none"> ARK INVEST, <i>How Can Amazon Charge \$1 for Drone Delivery?</i> (2015)
Trip distance	Distance travelled per trip	<ul style="list-style-type: none"> Leveraged assumptions on trip distance from table A.5

The final calculations on total reduction in delivery costs were then calculated using the following methodology:



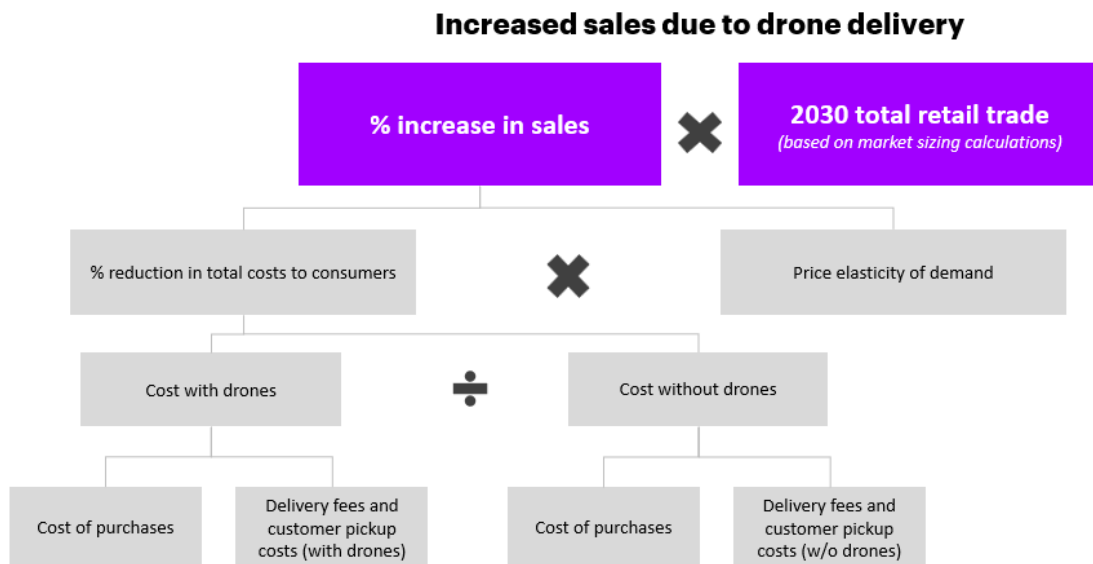
A.8 Inputs and assumptions for calculating decreased costs to businesses

	Inputs	Sources & Assumptions
Takeout food & beverages	# of deliveries (takeout)	<ul style="list-style-type: none"> Based on market sizing calculations
	Avg. order value	<ul style="list-style-type: none"> Based on market sizing
Other product types	# of deliveries	<ul style="list-style-type: none"> Based on market sizing calculations
	Avg. costs per delivery	<ul style="list-style-type: none"> Weighted average of non-takeout food & beverage categories from market sizing

	% of cases where retailer subsidizes delivery	<ul style="list-style-type: none"> 95% based on Accenture analysis and McKinsey, <i>Great Service—but who's paying?</i> (2022)
	Avg. extent to which retailers subsidize delivery	<ul style="list-style-type: none"> 10% based on Accenture analysis and McKinsey, <i>Great Service—but who's paying?</i> (2022)

Calculating increased sales from cheaper deliveries

To calculate increased sales from cheaper deliveries, we assumed that reduction in delivery costs to businesses is proportional to delivery costs to consumers. We then performed the following calculations.



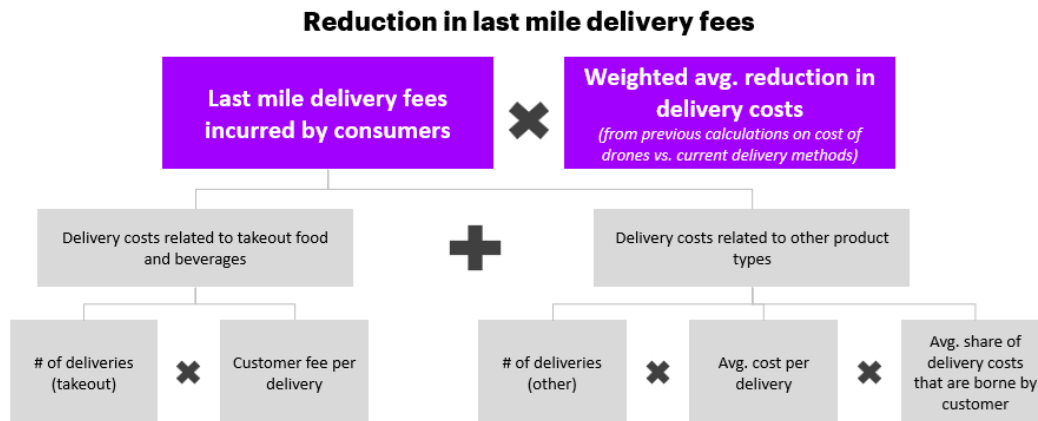
A.9 Inputs and assumptions for calculating increased sales due to cheaper deliveries

Inputs		Sources & Assumptions
Cost with drones	Cost of purchases	<ul style="list-style-type: none"> Based on market sizing
	Delivery fees and customer pickup costs (with drones)	<ul style="list-style-type: none"> Obtained from earlier analysis on estimating change in delivery cost
Cost without drones	Cost of purchases	<ul style="list-style-type: none"> Based on market sizing
	Delivery fees and customer pickup costs (w/ drones)	<ul style="list-style-type: none"> Obtained from earlier analysis on estimating change in delivery cost
Price elasticity of demand		Elasticity of 0.76, based on: <ul style="list-style-type: none"> Supermarkets elasticity of 0.6, obtained from Andreyeva (2010) <i>The Impact of Food Prices on Consumption: A Systematic Review of Research on the Price Elasticity of Demand for Food</i>. American Journal of Public Health (as cited in Accenture commissioned by Wing, <i>Faster, Safer, Greener: The Potential Impact of Delivery Drones in the Dallas-Fort Worth Metroplex</i> (2021) This elasticity measure is conservative as it does not measure the additional intangible value of increased convenience (aside from pickup time saved) and greater choices, which would also be expected to increase retail sales

Benefits for consumers

Calculating cost savings from reduced delivery costs

In order to estimate cost savings to consumers, we assumed that their delivery fee would be proportional to the delivery cost decrease for businesses to use drones.



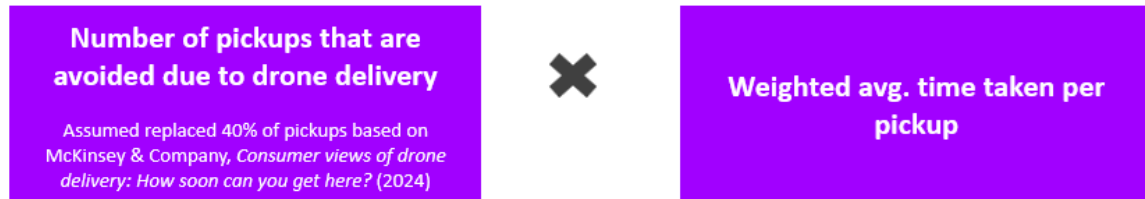
A.10 Inputs and assumptions for calculating reduction in last-mile delivery fees

Inputs		Sources & Assumptions
Takeout food & beverages	# of deliveries (takeout)	<ul style="list-style-type: none"> Based on market sizing calculations
	Customer fee per delivery	<ul style="list-style-type: none"> 15-20% fee based on Upmenu, <i>Delivery Fee for Restaurants (What Is It & How Much to Charge)</i> (2025)
Other product types	# of deliveries	<ul style="list-style-type: none"> Based on market sizing calculations
	Avg. costs per delivery	<ul style="list-style-type: none"> Obtained from earlier analysis of cost of delivery for each mode
	Avg. share of delivery costs that are borne by customer	<ul style="list-style-type: none"> 90% based on 50Folds, <i>Average Shipping Cost per Order</i> (2025)

Calculating time saved from avoided pickups

In order to calculate the time savings from pickups that could be avoided due to lower delivery costs with drones, we assumed the total trip time for a customer pickup would be comparable to the total trip time for a time-sensitive delivery (as we calculated in our earlier analysis to calculate labor costs for time-sensitive deliveries).

Time saved due to pickups avoided due to drone delivery



Benefits for society

Calculating healthcare cost savings from reduced medication abandonment

To calculate healthcare cost savings from reduced medication abandonment, we first needed to understand the reasons for prescription abandonment, to determine how drones could help reduce abandonment. Two common reasons for abandonment are transportation issues and forgetting.^{cxii} We determined that drones deliver 100% of prescriptions that were abandoned due to transportation issues, 25% of prescriptions that were abandoned due to stocking issues (by delivering to the patient once the medication comes back in stock, assuming they were unable to come back to the pharmacy to do so) and that they could deliver 25% of prescriptions

that were abandoned due to being forgotten.^{cxii} We then determined the total cost savings leveraging the following inputs.

A.11 Inputs and assumptions for calculating reduction in healthcare costs due to reduction in prescription abandonment

Inputs		Sources & Assumptions
Abandoned prescriptions per year	Total # abandoned prescriptions per year	<ul style="list-style-type: none"> 34,200,000 prescriptions according to TechTarget, <i>Minimizing Prescription Abandonment and Nonadherence with Digital Tools</i> (2023)
	% of prescriptions abandoned due to transportation issues	<ul style="list-style-type: none"> 12% according to GoodRX, <i>Nearly Third of Americans Aren't Filling Their Prescriptions Because of High Costs</i> (2025)
	% of prescriptions abandoned due to stocking issues	<ul style="list-style-type: none"> 16% according to GoodRX, <i>Nearly Third of Americans Aren't Filling Their Prescriptions Because of High Costs</i> (2025)
	% of prescriptions abandoned due to forgetting	<ul style="list-style-type: none"> 11% according to GoodRX, <i>Nearly Third of Americans Aren't Filling Their Prescriptions Because of High Costs</i> (2025)
	Cost of non-adherence per patient	<ul style="list-style-type: none"> \$28,806 according to TailoreMed, <i>The Real Costs of Medication Nonadherence</i> (2022)
Cost of prescription abandonment	Avg. # prescriptions per patient	<ul style="list-style-type: none"> 4, according to <i>Older Americans Are Prescribed More Medications Than Ever</i> (2024); SingleCare, <i>Prescription drug statistics 2025</i> (2025); The John A. Hartford Foundation, <i>Reducing the Proportion of Older Adults Who Take Inappropriate Medications: Key Opportunities to Achieve Healthy People of 2030 Goals</i>

Calculating road accidents and crash-related fatalities prevented from reduced vehicle miles travelled

The reduction road accidents and resulting mortalities was calculated by estimating the VMT (vehicle miles travelled) avoided, due to replacement by drone delivery (either by replacing ground delivery transportation or customer pickups).

A.12 Inputs and assumptions for calculating reduction in road crashes and crash-related fatalities

	Inputs	Sources & Assumptions
Crashes prevented from ground transportation deliveries replaced by drone	# of delivery driver road crashes per year	<ul style="list-style-type: none"> NationalWorld, <i>Worst US states for delivery driver accidents</i> (2025)
	Annual last mile distance travelled	<ul style="list-style-type: none"> Accenture research and analysis, based on Accenture commissioned by Wing, <i>Faster, Safer, Greener: The Potential Impact of Delivery Drones in the Dallas-Fort Worth Metroplex</i> (2021)
	# of delivery driver road crashes per 100 VMT	<ul style="list-style-type: none"> Calculation based on road crashes per year and annual last mile distance travelled
	Total VMT avoided with drone deliveries	<ul style="list-style-type: none"> Calculation based on # of deliveries per year, distance per delivery, and % of deliveries replaced by drone (based on market sizing calculations)
Crashes prevented from avoided pickups	# of road crashes per year per VMT	<ul style="list-style-type: none"> Calculation based on total VMT and total number of crashes from NSC Injury Facts, <i>Motor Vehicle</i> (2025)
	Total VMT avoided by replacing pickups with drones	<ul style="list-style-type: none"> Calculation based on number of pickups avoided with drone delivery; assumption that distance per pickup is the same as the distance per delivery
Mortalities prevented from ground transportation deliveries replaced by drone	Delivery driver crash-related mortalities per year	<ul style="list-style-type: none"> Waple & Houk Law, <i>Why Delivery Truck Drivers Have One of the Highest Rates of Injuries and Fatalities Among All Occupations</i> (2024)
	Delivery driver crash-related mortality rate per 100 VMT	<ul style="list-style-type: none"> Calculation based on mortalities per year and annual last mile distance travelled
	Total VMT avoided with drone deliveries	<ul style="list-style-type: none"> Calculation based on # of deliveries per year, distance per delivery, and % of deliveries replaced by drone (based on market sizing calculations)
Mortalities prevented from avoided pickups	# of crash-related fatalities per VMT	<ul style="list-style-type: none"> Calculation based on traffic deaths per year and total VMT from IIHS, <i>Fatality Facts 2023</i> (2025)
	Total VMT avoided by replacing pickups with drones	<ul style="list-style-type: none"> Calculation based on number of pickups avoided with drone delivery; assumption that distance per pickup is the same as the distance per delivery

Calculating time saved from reduced hours sitting in traffic

To calculate time savings from reduced traffic, we assumed that a 1% reduction in VMT would result in a 1.9% reduction in total delay hours.^{cxiii} We also leveraged the assumption that Americans spend 4 billion hours sitting in traffic per year to calculate the number of hours saved, and the assumption that the cost of traffic delay time per hours is \$20 to get to the value of time saved.^{cxiv}

Calculating carbon emissions reduction

In order to calculate total carbon emission reductions, we determined the emissions per mile by delivery vehicle type, and then calculated the average emissions per trip for current delivery vehicles versus drone deliveries (leverage distance assumptions previously determined for time-sensitive deliveries). We then determined the total emissions reduction based on the number of trips (ground transportation deliveries and pickups) replaced by drone deliveries and average emissions per trip.

A.13 Emissions assumptions by vehicle type

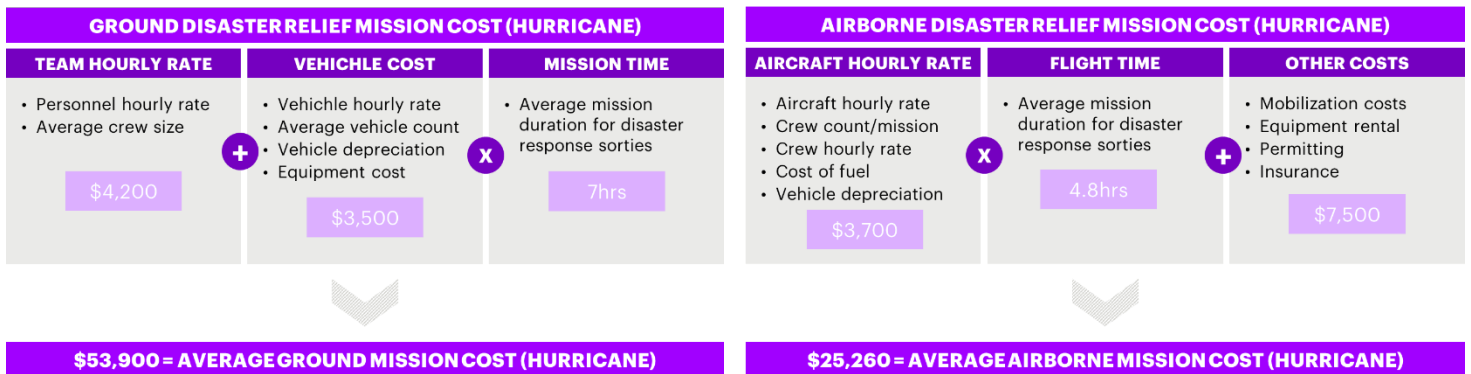
Inputs		Sources & Assumptions
Current delivery vehicle types	Bike	<ul style="list-style-type: none"> 0 g / mi
	Gas-powered car	<ul style="list-style-type: none"> 350 g / mi based on MIT Climate, <i>Are electric vehicles definitely better for the climate than gas-powered vehicles?</i> (2022)
	Gas-powered van	<ul style="list-style-type: none"> 540 g / mi based on ClimeCo, <i>Calculation Methods</i> (2025)
	EV	<ul style="list-style-type: none"> 200 g / mi based on MIT Climate, <i>Are electric vehicles definitely better for the climate than gas-powered vehicles?</i> (2022)
Drone delivery		<ul style="list-style-type: none"> 168 g / mi based on Constantine Samaras and Joshuah Stolaroff, Enbridge, <i>Delivering packages with drones might be good for the environment</i> (2025)

Civic Interest

Modeling drone impact on search and rescue & damage assessment

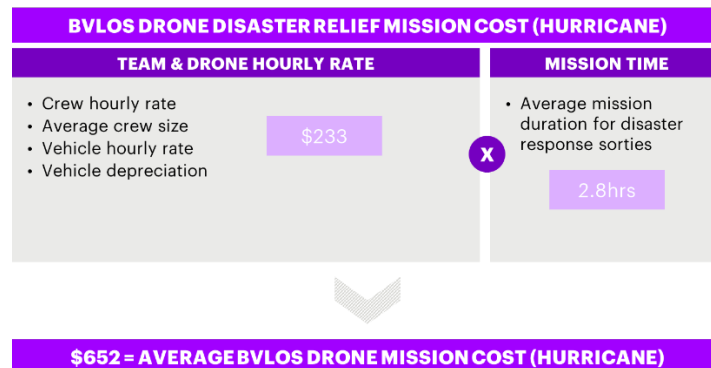
Our modeling for the cost saving implications of BVLOS drones on search & rescue, damage assessment, logistics & aid delivery, and infrastructure monitoring in post-disaster use cases depended on calculating the cost of mission for air- and ground-based first responder units today, and then comparing that cost to the potential BVLOS impact. That difference was applied to the number of missions necessitated by large disasters of all kinds in the US each year. The tables below are samples of the per-mission costs assumptions for hurricanes (other disaster types – including both natural and human causes – had unique per mission assumptions that varied based on expected costs and mission times).

A.14 Determining the average mission cost for aerial and ground teams

















Next, we estimated the associated cost to run BVLOS drone missions as a substitute to aerial and ground missions.

A.15 Determining the average mission cost for BVLOS drones



With these estimates of mission cost, we then set out to determine how many addressable missions drones could feasibly operate in the aftermath of various disasters in the US each year. Many mission types, of course, are not addressable for drone platforms as a substitute for ground and traditional air support teams. Infrastructure and building assessments, for instance, frequently require boots on the ground inspection to ensure safety standards are met. Similarly, air lift missions that require significant payload capacity to carry victims to safety are not suitable substitutes for drones. In many cases, though, drones can act as a force multiplier for these heavier manned missions and can significantly increase the efficiency of those missions. Our team factored this substitution effect into our analysis.

A.16 Determining addressable BVLOS mission counts per disaster per year in the US

Disaster Types	Disaster Event	Mission Count
Human	 Search And Rescue*	45,000
	 Security	300
	 Hazmat	200
	 Industrial	50
	 Urban	40
	 Transportation	15
	 Explosive	10
	 Radiological	2
Natural	 Meteorological	38,000
	 Floods	5,800
	 Tornadoes	3,500
	 Earthquakes	2,000
	 Drought	10
	 Volcano	5
Total		94,932

Source: Accenture research & analysis

Applying an assumption that 60% of missions above are ground-based, and 40% are air-based, we arrive at the final potential cost saving impact estimate of \$2.46B/year.

Modeling drone life-saving potential in post-disaster scenarios

We began an analysis of drone life-saving potential by gathering data on annual fatalities in the US across a number of disaster types:

A.17 Determining annual fatalities across disaster event types in the US

Disaster Event	Annual Fatalities
Search & Rescue	2,500
Hurricane	114
Flood	113
Earthquake	62
Wildfire	12
Other Severe Weather	255
TOTAL	3,056

Search & rescue fatality counts include data from maritime and coast guard, national parks, and other land sources (including state/county data).

To calculate the potential for BVLOS drones to save additional lives, the following methodology was used:

1. Survival Probability Equation

The gain in survival probability from reducing time-to-find is modeled as:

$$\Delta S = 1 - e^{(-h \cdot \Delta t)}$$

Where:

- **ΔS** = absolute survival increase for a given scenario (fraction, later expressed as percentage points).
- **h** = hazard rate (per hour), i.e. the risk of death per hour while the person remains unfound.
- **Δt** = time reduction from using BVLOS drones (hours saved vs. baseline).
- **Weights** = mission mix fractions (proportion of cases falling into each environment type: water, wilderness, urban, other).
- **Weighted ΔS** = category $\Delta S \times$ weight.
- **Overall ΔS** = sum of weighted ΔS across categories.

2. Step-by-Step Base Case (-40% time-to-find)

Parameters

- Baseline time-to-find = 10 hours
- Δt (time saved with drones) = **4 hours**
- Hazard rates (**base set**):
 - Water = **0.10/hr**
 - Wilderness = **0.045/hr**
 - Urban = **0.020/hr**
 - Other = **0.040/hr**
- Mission mix weights:
 - Water = **50%**
 - Wilderness = **20%**
 - Urban = **10%**
 - Other = **20%**

Category Calculations

- Water:
 $\Delta S = 1 - e^{(-0.10 \cdot 4)} \approx \mathbf{0.33}$ (33%)
Weighted $\Delta S = 0.33 \times 0.50 = \mathbf{0.166}$
- Wilderness:
 $\Delta S = 1 - e^{(-0.045 \cdot 4)} \approx \mathbf{0.16}$ (16%)
Weighted $\Delta S = 0.16 \times 0.20 = \mathbf{0.032}$
- Urban:
 $\Delta S = 1 - e^{(-0.020 \cdot 4)} \approx \mathbf{0.08}$ (8%)
Weighted $\Delta S = 0.08 \times 0.10 = \mathbf{0.008}$
- Other:
 $\Delta S = 1 - e^{(-0.040 \cdot 4)} \approx \mathbf{0.15}$ (15%)
Weighted $\Delta S = 0.15 \times 0.20 = \mathbf{0.030}$

Weighted Sum

- Total = $0.166 + 0.032 + 0.008 + 0.030 = \mathbf{0.235}$
- Expressed in percentage points: **+23.5 pp** survival lift.
- For every 1,000 deaths \approx **235 additional survivors**.

We applied this result to our estimated fatalities/year to arrive at an estimate of drone life-saving potential:

A.18 Determining annual BVLOS drone annual life-saving potential

Disaster Event	Annual Fatalities	BVLOS Drone Lives Saved
Search & Rescue	2,500	588
Hurricane	114	27
Flood	113	27
Earthquake	62	15
Wildfire	12	3
Other Severe Weather	255	60

Aerial Survey

Modeling drone impact on aerial survey potential cost savings

Our modeling for the cost saving potential of BVLOS drones on select aerial survey use cases is outlined below. In general, these estimates depend on infrastructure data (line miles, pipeline miles, bridge counts, and tower counts), the costs and inspection cadences that exist today, and the potential cost savings BVLOS drones could drive. The tables below are samples of the assumptions used to arrive at potential cost saving estimates.

Calculating potential electrical line inspection savings

Line Type	Cost Savings (per mile)	US Line Miles	Inspection Frequency	Potential Savings (per year)
Transmission	\$1,250	642,000	1	\$0.80B
Distribution	\$80	5,500,000	0.25	\$0.13B
			SUM	\$0.93B

Calculating potential pipeline inspection savings

Pipe Type	Cost Savings (per mile)	US Line Miles	Inspection Frequency	Potential Savings (per year)
Hazardous Liquid	\$1,250	229,000	26	\$7.44B
Gas Transmission	\$1,250	300,000	2	\$0.75B
			SUM	\$8.19B

Calculating potential cell tower inspection savings

Tower Type	Tower Count	Cost Savings (manned)	Cost Savings (VLOS)	Inspections (per year)	Inspection Share (manned v VLOS)	Potential Savings (per year)
Macrocell Site	248,050	\$2,600	\$1,500	0.25	50%	\$127M
Cell Tower	142,100	\$2,600	\$1,500	0.25	50%	\$73M
					SUM	\$200M

Calculating potential bridge inspection savings

Bridge Type	Bridge Count	Cost Savings (BVLOS)	Inspection Frequency	Potential Savings (per year)
Road Bridge	623,000	\$11,250	0.55	\$3.84B
Rail Bridge	69,000	\$11,250	1	\$0.78B
			SUM	\$4.61B

Agriculture

Our impact calculations for drone usage in agriculture are based off of the Total Addressable Market (TAM), which assumes that drones reach 100% adoption in the scenarios where there could be positive impact to use them. The purpose of this approach is to emphasize the positive impact that drones have on the agriculture industry. For the purposes of this study, we focused on the highest impact use cases for drones in agriculture, based on Accenture research and expert interviews. Use cases are divided into uses for crops and uses for livestock.

A.19 Overview of key BVLOS agricultural use cases

	Use Case
Crops ^{cxv}	Monitoring for nutrient deficiency, disease, and water stress
	Higher precision crop spraying (fungicides, pesticides, etc.)
	Fertilizer application (to optimize fertilizer usage and application timing)
	Cover crop seeding
Livestock	Disease identification
	Herd monitoring and counting (to observe behavior, identify disease, perform headcount)
	Pasture inspection (assess condition, identify overgrazing or plant stress)

Crops

Calculating cost savings on fertilization

One of the key benefits of leveraging drones for crop fertilization is due to their ability to precisely apply fertilizer where and when needed, which can lead to significant savings in fertilizer used. We calculated the total cost savings by determining the amount and cost of fertilizer currently used, and the expected reduction of fertilizer usage using drones.

A.20 Inputs and assumptions for calculating cost savings on fertilizer usage

Inputs		Sources & Assumptions
Current fertilizer usage	Amount of fertilizer used per year	<ul style="list-style-type: none"> USDA Economic Research Service
	Cost of fertilizer per ton	
Reduction in fertilizer usage with drones		<ul style="list-style-type: none"> 30% based on Herogra Especiales, <i>Fertilization using drones</i> (2023)

Calculating reduction in drinking water contaminants due to decreased fertilizer usage

It is estimated that 1,700 communities in the U.S. have drinking water with over 10 parts per million of nitrate, which is above the legal limit set by the Safe Drinking Water Act, largely due to overuse of fertilizers.^{cxvi} We then calculated the effect of fertilizer reduction on the number of communities with unsafe drinking water by determining the number of communities affected per ton of fertilizer used, and multiplying that value by the previously calculated fertilizer reduction number. We also leveraged the assumptions that it costs about \$3.5 million to build a treatment water treatment system for nitrate removal, and 67.94% of households with over the legal limit of nitrate in their drinking water have no treatment system^{cxvii}, in order to determine the cost savings created by reducing the number of communities that would need to build a treatment system for their water.

Calculating crop savings on crop spraying

We can break down cost savings on crop spraying into two different pieces: cost savings on operations (excluding chemical costs), and cost savings on chemicals used, due to drones' ability to apply more precisely and their ability to be used in conjunction with sensors to identify areas most in need of spraying.

Operationally, drones are expected to be less expensive than current aerial spraying operations (e.g. crop dusting planes). Currently, there are 144,800,000 acres of land sprayed per year by aerial application (including cropland, pasture & rangeland, forest land, and land sprayed for public health / mosquito control), so we can assume that drones could be used instead of crop dusters for these 144,800,00 acres.^{cxviii} We next determined the cost of using drones versus crop dusters per acre—the cost savings per acre was then multiplied by the number of acres sprayed to get to the total operational cost savings. The majority of farms that use crop dusters custom hire a duster (instead of purchasing one)^{cxix}, therefore we compared the cost of buying a drone for spray operations, versus the cost of custom hiring a crop duster.

A.21 Inputs and assumptions for calculating cost savings per acre of drones vs. crop dusters

Inputs	Sources & Assumptions
Cost per acre to custom hire a crop duster	<ul style="list-style-type: none"> \$12.50, based on University of Missouri Extension, <i>Economics of Drone Ownership for Agricultural Spray Applications</i> (2025)
Cost per acre of drone spraying (assuming farms buy their own drone)	<ul style="list-style-type: none"> \$7.39, based on University of Missouri Extension, <i>Economics of Drone Ownership for Agricultural Spray Applications</i> (2025). This study assumed the cost per acre for a farmer (who it expects to spray 1,000 acres a year) is \$12.27, while a custom operator's (who it expects to spray 4,000 acres a year) cost per acre is \$7.39. This study assumes custom operators have a larger scale of operations, and therefore can have reduced costs on maintenance, batteries, insurance, and housing. For our study, we assumed that large-scale industrial farms would be more similar to custom operators, according to large farms' expected spraying acreage per year in <i>The Life of a Farmer, Why Do We Spray?</i> (2013)

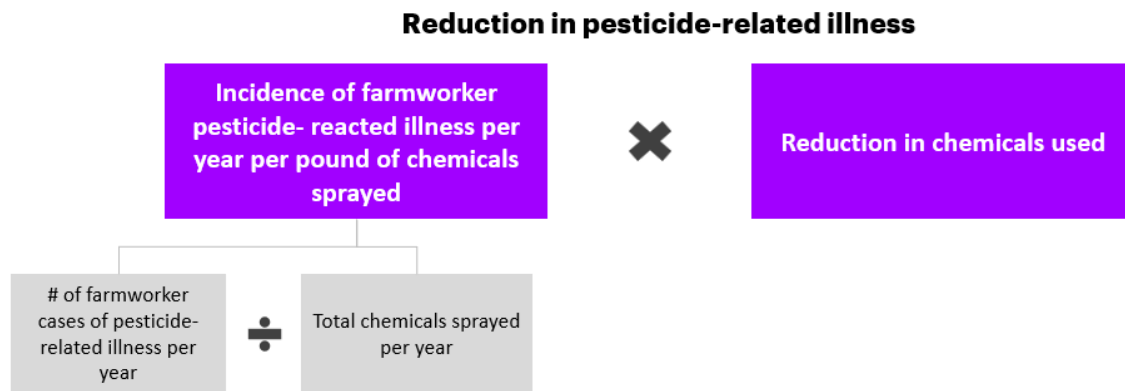
Next, we calculated the cost savings on chemicals used. It is expected that drones can reduce the amount of chemicals used by 30% in comparison to crop dusting, and by 60% in comparison to ground spraying operations.^{CXX} We then determined the amount and cost of chemicals used annually by crop dusters and by ground-spray operations, which we used to calculate the total cost savings on chemicals if drones were to replace all spraying operations.

A.22 Inputs and assumptions for calculating chemical usage and cost with crop dusters and ground spraying operations

Inputs	Sources & Assumptions
Total amount of chemicals sprayed annually	<ul style="list-style-type: none"> Nathan Donley and Robert Bullard, Brookings, <i>US pesticide regulation is failing the hardest-hit communities. It's time to fix it</i> (2024)
Avg. cost per pound of chemicals sprayed per ton (includes pesticides, herbicides, fungicides)	<ul style="list-style-type: none"> Calculation based on total amount of chemicals sprayed annually and total spent annually on chemicals (according to NASS, <i>U.S. Farm Production Expenditures, 2022</i> (2023)
% of chemicals sprayed by crop dusters	<ul style="list-style-type: none"> 28%, based off of input that 28% of cropland is sprayed aerially, according to National Agricultural Aviation Association, <i>Aerial Application of Crop Protection Products Is An Essential Tool for American Farmers</i> (2025)
% of chemicals sprayed by ground operations	<ul style="list-style-type: none"> Calculation based on percentage of cropland sprayed by crop dusters

Calculating the reduction in pesticide-related illnesses among farmworkers from using drones for spraying operations

As we mention in the report, minimizing chemicals used in spray operations reduces the instance of chemical drift and pesticide-related illness among farmworkers from contact with chemicals.



A.23 Inputs and assumptions for calculating reduction in pesticide-related illness

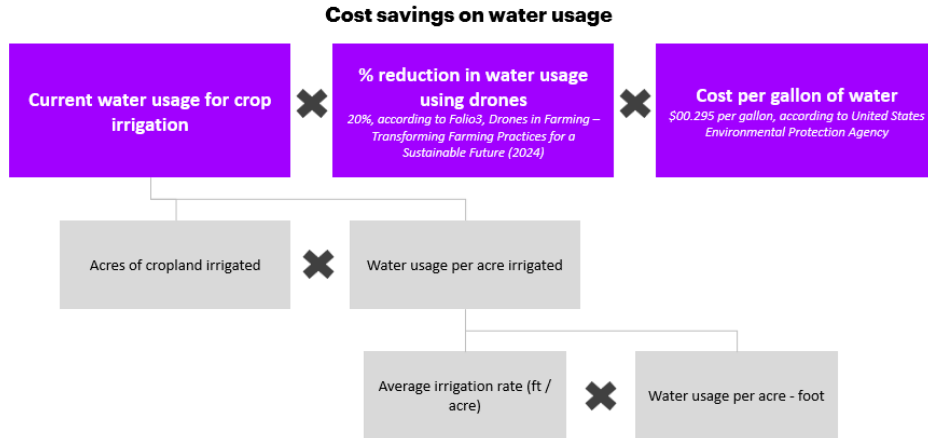
Inputs		Sources & Assumptions
Incidence of farmworker pesticide-related illness per pound of chemicals sprayed	# of farmworker cases of pesticide-related illness per year	300,000, according to Nathan Donley and Robert Bullard, Brookings, <i>US pesticide regulation is failing the hardest-hit communities. It's time to fix it</i> (2024)
	Total amount of chemicals sprayed annually	Nathan Donley and Robert Bullard, Brookings, <i>US pesticide regulation is failing the hardest-hit communities. It's time to fix it</i> (2024)
Reduction in chemicals sprayed		As previously calculated

Calculating environmental benefits from using drones for fertilizer application and chemical spraying

Limiting chemical and fertilizer usage, as cited in our report. These benefits include reducing the amount of harmful chemicals leaching into groundwater, and the amount of chemicals left in the topsoil. As we mention in the report, it is estimated that 7% of chemicals applied leach to aquifers, and 10% of chemicals applied remain in the topsoil.^{cxxi} We multiplied the sum of the previously calculated reduction in chemicals and fertilizer used with drones, by 7% and 10% to calculate the reduction in chemicals leaching to aquifers, and the reduction in chemicals left in the topsoil, respectively.

Calculating cost savings on irrigation

Drones equipped with sensors can better identify crops under water stress, which allows for more targeted irrigation, and therefore savings of water, and the resulting cost savings associated with water conservation.



A.24 Inputs and assumptions for calculating current water usage for irrigation (without drones)

Inputs		Sources & Assumptions
Water usage per acre irrigated	Average irrigation rate (ft / acre)	<ul style="list-style-type: none"> USDA Economic Research Service
	Water usage per acre-foot	
Acres of cropland irrigated		<ul style="list-style-type: none"> Folio3, <i>Drones in Farming – Transforming Farming Practices for a Sustainable Future</i> (2024)

Calculating increased crop yield

Drones equipped with sensors and imaging capabilities can detect changes in crop conditions, such as nutrient deficiencies or water stress, that may have been missed otherwise in a standard field check, allowing for targeted interventions. Additionally, more precise fertilizer and pesticide or herbicide spraying can provide the optimal amount of chemicals required for plant growth, while minimizing negative effects to soil, such as erosion or compaction. We leveraged the assumption that drone usage can increase crop yields by 5%, which is a conservative estimate based on numbers we pulled from multiple studies.^{cxii} We applied this 5% yield to production values from the USDA crop production report in order to calculate the crop yield increase in tons. We applied a 5% yield increase across the aggregate production for the 8 key crop categories from the report:

- **Grains and hay:** corn, wheat, barley, rice, hay, rye, oats, millet, sorghum
- **Oilseeds:** cottonseed, canola, flaxseed, mustard seed, peanuts, soybeans, rapeseed, safflower, sunflower
- **Cotton, tobacco, and sugar crops:** cotton, sugarbeets, sugarcane, tobacco
- **Dry beans, peas, and lentils:** Chickpeas, dry edible beans, dry edit peas, lentils
- **Potatoes and miscellaneous:** Hops, mushrooms, potatoes, peppermint oil, spearmint oil
- **Citrus fruits:** Grapefruit, lemons, oranges, tangerines and mandarins
- **Noncitrus fruits:** Apples, apricots, avocados, berries, cherries, coffee, dates, grapes, kiwi, nectarines, peaches, papayas, pears, plums
- **Nuts and miscellaneous:** Almonds, hazelnuts, macadamias, pecans, pistachios, walnuts

We assumed that the unit price of crops would decrease if the yield increased, thus we then calculated the expected price decrease for each crop category. We then multiplied the decreased unit price for each crop category by the increased yield.

A.25 Crop category unit prices and expected price decrease due to increased yield with drones

Inputs		Sources & Assumptions
Price per unit (yield without drones)	Grains and hay	Production numbers from USDA production reports
	Oilseeds	
	Cotton, tobacco, and sugar crops	
	Dry beans, peas, and lentils	
	Potatoes and miscellaneous	
	Citrus fruits	
	Noncitrus fruits	
	Nuts and miscellaneous	
Price decrease due to increased yield (% decrease in price per 1% yield increase)	Grains and hay	1.84, based on corn price decrease determined in Carl Zulauf, University of Illinois farmdoc, <i>Yield and Price Change from Planting to Harvest: How Strong is the Relationship?</i> (2015)
	Oilseeds	0.86 based on soybeans price decrease determined in Carl Zulauf, University of Illinois farmdoc, <i>Yield and Price Change from Planting to Harvest: How Strong is the Relationship?</i> (2015)
	Cotton, tobacco, and sugar crops	1.35 based on average of corns and soybeans in Carl Zulauf, University of Illinois farmdoc, <i>Yield and Price Change from Planting to Harvest: How Strong is the Relationship?</i> (2015) and price elasticity of demand assumptions from Pat Hatzenbuehler, Ag Proud.com, <i>Crop price elasticity: What it is and why it matters</i> (2023)
	Dry beans, peas, and lentils	0.86 based on soybeans price decrease determined in Carl Zulauf, University of Illinois farmdoc, <i>Yield and Price Change from Planting to Harvest: How Strong is the Relationship?</i> (2015)
	Potatoes and miscellaneous	1.35 based on average of corns and soybeans in Carl Zulauf, University of Illinois farmdoc, <i>Yield and Price Change from Planting to Harvest: How Strong is the Relationship?</i> (2015) and price elasticity of demand assumptions from Pat Hatzenbuehler, Ag Proud.com, <i>Crop price elasticity: What it is and why it matters</i> (2023)
	Citrus fruits	
	Noncitrus fruits	
	Nuts and miscellaneous	

Calculating reduced prices for consumers due to higher crop yields

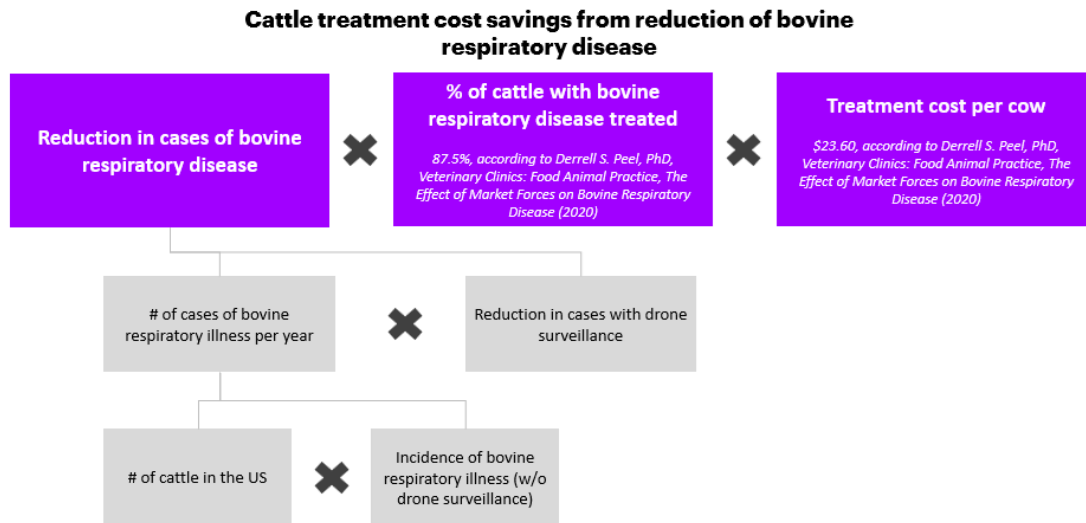
We then leveraged the price unit decreases determined in the previous section to calculate the cost savings for consumers. To make this assumption, we assumed that the price per ton would directly flow through to consumer prices. In order to calculate total cost savings for consumers, we only included the crop categories that a consumer would eventually buy (therefore we excluded “grains and hay,” “oilseeds,” and “cotton, tobacco, and sugar crops”). For each crop category included, we performed the following calculations:

(Price without drones x 5% yield increase) - (Price with drones x 5% yield increase).

Livestock

Calculating benefits of improved herd disease identification

As we mention in our report, drones equipped with sensors can help with early identification of bovine respiratory disease among cattle, leading to cost savings from treatment, and increased sales from reduced mortalities from respiratory disease.



A.26 Inputs and assumptions for calculating reduction in cases of bovine respiratory disease

Inputs		Sources & Assumptions
# of cases of bovine respiratory illness per year	# of cattle in the U.S.	Tyne Morgan, Drovers, <i>U.S. Beef Cattle Inventory Falls to the Lowest Level in 64 Years (2025)</i>
	Incidence of bovine respiratory illness (w/o) drone surveillance	22% infection rate among all cattle, according to S.A. Dubrovsky, A.L. Van Eenennaam, B.M. Karle, P.V. Rossitto, T.W. Lehenbauer, S.S. Aly, <i>Journal of Dairy Science, Epidemiology of bovine respiratory disease (BRD) in preweaned coalbeds on California dairies: The BRD 10K study (2019)</i>
Reduction in cases of bovine respiratory illness with drone surveillance		45%, according to 3Laws, <i>Drones and the Future of Beef Cattle Ranching and Farming, including Feedlots (2025)</i>

We then calculated the reduction in mortalities based on the reduction of bovine respiratory disease. It is estimated that 4% of cattle treated die, and that 87.5% of cattle with the disease are treated.^{cxxiii} We then multiplied this number by \$1,000, which is the expected value per cattle head^{cxxiv}, to calculate the total increase in sales due to reduction in herd mortality.

Calculating time savings on pasture inspection

In order to calculate the time savings that a drone could create on pasture inspection versus physical inspections, we determined that a cattle ranch with 1,000 head of cattle typically spends 6-12 hours a week on pasture inspection.^{cxxv} There are 86.7 million cows in the U.S.,^{cxxvi} therefore we multiplied 86,700 (86.7 million / 1,000) by 6-12 hours, to get to 52.02-104.04 million hours spent on pasture inspection. For the purposes of this study, we decided to use the more conservative number (52.02 hours). Drones can reduce the time spent by 70%,^{cxxvii} meaning that drones can save 36.41 million hours annually on pasture inspection. We then converted this to value of time saved, leveraging the assumption that the average ranch worker's average salary is \$17.68.^{cxxviii} We multiplied \$17.68 by 36.41 million to get to \$643.8 billion.

End Notes

- ⁱ Cost savings to businesses based on reduction in operational and resource costs. Increased sales based on expected uptake of consumer buying due to lower prices (assuming price is proportional to productivity)
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- ^v Michael Leedom, *Think Global Health*, *Drones Deliver Humanitarian Aid in Africa* (2024)
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- ^{vii} Scotland 5G Centre, *Pop-Up 5G Drones to Transform Mountain Search and Rescue* (2025)
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- ^{xxi} A full outline of Accenture's modeling approach is available in the appendix
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