The Drone Revolution is Hovering — But is it Ready to Land?

JABIL

Regulatory standards and proven performance are key to mass adoption.

No longer just for hobbyists, today's drones or unmanned aerial vehicles (UAVs) are sophisticated devices packed with highly technical electromechanical components, advanced structural mechanicals, and complex integrated electronics like sensors, communications, and power management systems. Industries as varied as retail, defense, agriculture, utilities, and construction are deploying fleets of drones for delivery, inspections, data collection, and environmental monitoring. E-commerce deliveries are on the rise, with more than **400 billion packages estimated to ship in 2025**. Still, retailers, UAV manufacturers, and third-party logistics service providers are working to determine how drones can solve the complications of last-mile delivery, like speed and sustainability.

The market is at a tipping point. Advisors at **McKinsey** report, "Regulations, customer acceptance, and cost will all determine whether the industry reaches its potential to disrupt global logistics or remains limited to isolated applications." UAVs and their supporting ecosystems require complex capabilities involving sensor integration, electronics miniaturization, power management, precision molding, and manufacturing to regulatory standards. Growth of UAVs in the air will also grow the market for ground control station equipment requiring complimentary technologies, such as power management, communications, ruggedized enclosures, miniaturization, light-weighting, and software security.

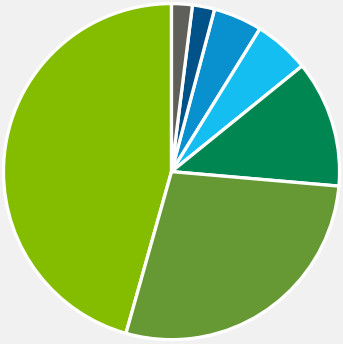
Global Commercial Drone Market

$43.4B

Global Market Size

2026 (projected)

Source: Drone Industry Insights



The global commercial drone market size is projected to grow to **USD $57.8 billion by 2030** at a 7.3% CAGR. This growth must be supported by the development of a ground infrastructure that manages the storage, charging, and maintenance of growing UAV fleets. While government agencies and defense contractors have been the largest buyers to date, commercial UAVs are also expected to see major adoption in the near-term, led by the **agriculture, construction, and energy sectors.** Several countries are exploring UAVs for postal deliveries, and large retailers like Walmart and Amazon have deployed UAV delivery fleets across metro areas of the southern and southwestern U.S.

UAVs address many of the costly, negative drawbacks of delivery today. They remove the weight and carbon emissions of gas-powered vehicles, reduce traffic on roads, and increase speed of delivery by flying over obstacles and traffic. A white paper from the World Economic Forum and Accenture found the use of autonomous vehicles like UAVs for last-mile delivery could potentially **reduce traffic congestion by up to 13%.** And they do it with increasingly quiet devices capable of improved delivery accuracy. The company **Zipline**, for example, claims its delivery area is as small as the front steps of a home.

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The Anatomy of an Unmanned Aerial Vehicle

The complex workings of the UAV require a unique fusion of cross-discipline engineering and specific manufacturing capabilities. From optics and sensors to electromechanical assembly and power management, the technology and expertise required to build, integrate, and operate a UAV is complex and intricate. To address the challenges and opportunities in manufacturing a modern UAV, let's take a look at a sample vehicle:

- **Airframe** – airframe, fairings, landing gear, aerodynamic devices, payload mounts
- **Flight Systems** – flight controls, motors, wings/propellors, camera gimbal, navigation LEDs, payload deployment mechanisms, safety systems
- **Power Management** – battery, chargers, weighting/balance, energy management, battery swaps, battery status, communication
- **Autonomous Operating Systems & Sensing** – collision avoidance, communications, cameras, LiDAR, radar, and infrared sensors, antennas, gyro stabilization, GPS, GNSS, compass
- **Infrastructure** – ground support equipment, charging hardware, communication terminals, payload loading stations

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Power Management

Go Farther, Do More

From smartphones to electric vehicles, modern technologies are constantly challenged by battery power and energy management. UAVs are also subject to this pressure — especially as their role in tasks that require operating Beyond Visual Line of Sight (BVLoS) increases. While battery improvements — like greater density — will be key to longer flights, other power management factors like weight, payload, and distance play into the energy consumption models. To optimize these systems, UAVs may employ a hybrid power supply system architecture, defined as a product having two or more power supplies available for the propulsion and auxiliary system, to boost endurance and performance. Fuel cells, batteries, solar cells, and supercapacitors are examples of power sources that could be combined in a hybrid power architecture. To enable today's drones (and those of the future) to work efficiently, the appropriate energy management system must be selected based on optimal and accurate modeling techniques. These techniques could consider route planning, real-time environment factors, battery health, payload prediction, and other factors.

Jabil is a manufacturing partner to companies across several industries that require intensive power management. In particular, Jabil works with several electric vehicle and robotics companies to optimize their systems for power management and autonomous features. "UAVs and autonomous applications are accelerating demand for advanced battery systems with higher energy density, improved power efficiency, and robust power redundancy and management," said Jonathan Lee, Senior Director of Engineering Services at Jabil.

> **"These are demanding applications, and manufacturers need a higher level of performance and full system integration with deep electromechanical expertise and know how."**
>
> **JONATHAN LEE**
> Senior Director of Engineering Services, Jabil

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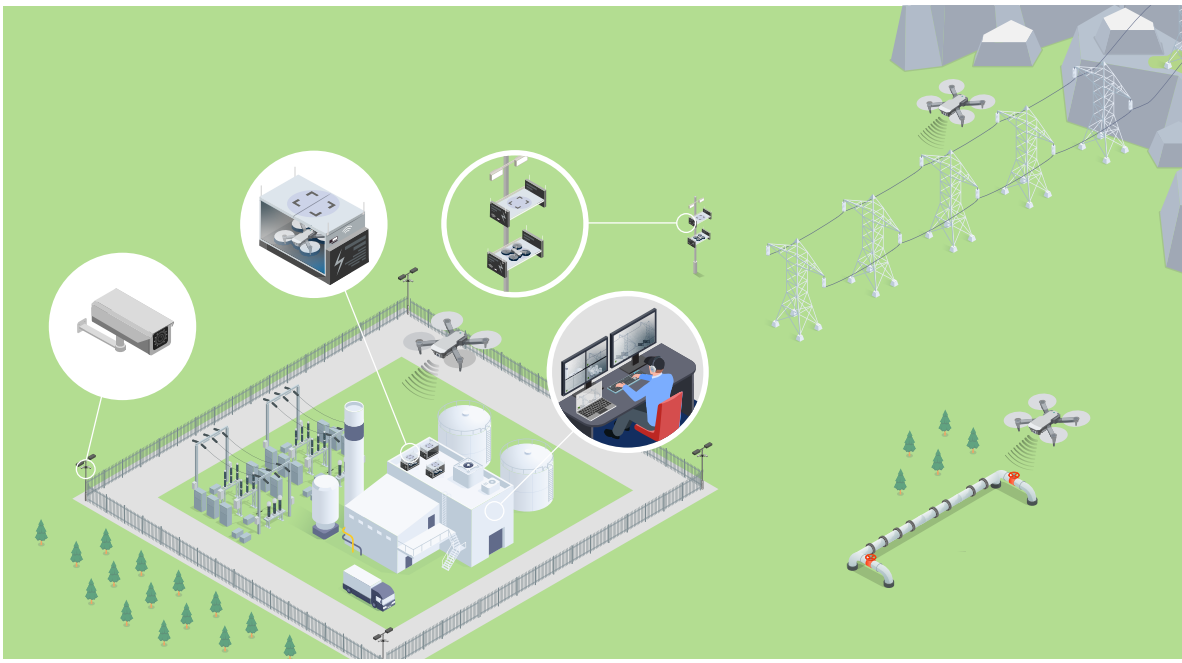
As UAVs are expected to carry more and travel farther, static onboard power will not be sufficient. To support critical UAV missions, an infrastructure of charging and storing stations will be required. Positioned atop power or lighting poles, UAV charging stations can fill in the gaps for long-range BVLoS flights like that illustrated below. The UAV startup Nomadic Drones has developed another alternative — self-charging drones that live on and are powered by high-voltage electricity lines. These drones require little human oversight and enable essentially round-the-clock monitoring of utility lines.



UAV Ecosystem Supporting BVLoS Inspection Flights

Utility companies spend a significant amount of time and money to inspect their far-ranging power lines and pipelines. For power lines that run through mountain ranges and across other difficult terrain, inspections of the pylons are difficult, expensive, and risky for workers. It is much more efficient to send UAVs that can fly over traffic; examine and document the state of pylons from top to bottom; and send the images or video to headquarters for examination. UAV utility inspections are beginning to happen at scale. With FAA approval to operate BVLoS, Dominion Energy — a utility company with operations across Virginia, North Carolina, and South Carolina — have deployed autonomous drones to inspect their solar panels with thermal imaging, conduct storm damage assessment in real time, and perform high-risk inspections of nuclear plants instead of humans. Other pilots programs using UAVs for utility monitoring are underway throughout the U.S. (such as New York and California), Germany, and the Nordics, with government regulations remaining the primary limitation to adoption on a larger scale.

Structural Efficiency

The Growing Role of Materials Innovation

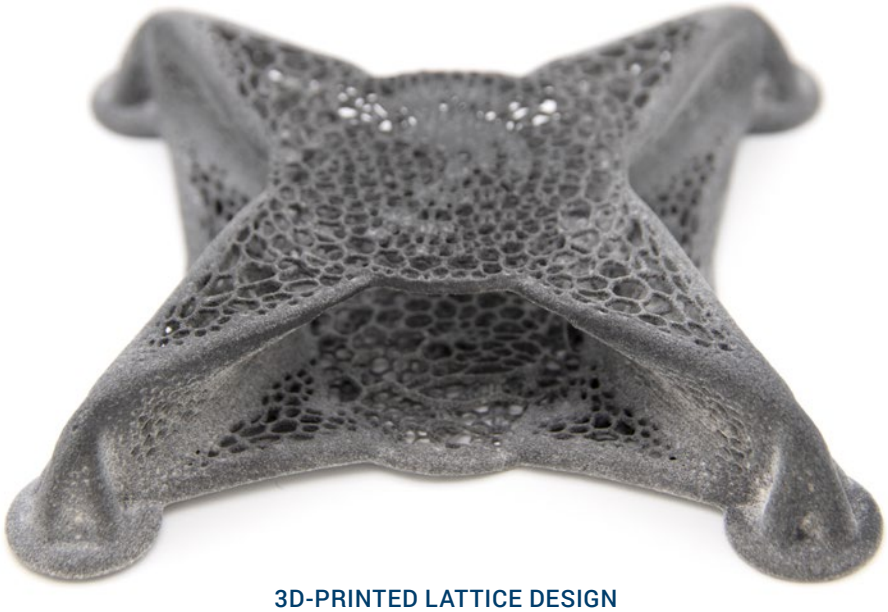
Optimizing a UAV system for energy efficiency goes beyond the battery. In fact, there's an acronym to address it: "SWaP" for size, weight, and power. Materials engineering and additive manufacturing, or 3D printing, can help reduce weight and create the most aerodynamic forms for a drone's body, battery, cameras, and payload. The effect of each of these weight inputs can be minimized by unitizing multiple components into single multi-functional components, reducing the part count and eliminating additional fasteners and bond lines. This all serves to streamline the UAV's shape to reduce aerodynamic drag as it moves through the airspace.

Achieving an aerodynamic, minimum operational weight with a ruggedized design is a priority in UAV development and production. "UAVs require a delicate balance between weight and power, which kicks off a problematic cycle," explains Chris Huskamp, sales director for Jabil's Defense and Aerospace division. "Namely, they operate by battery, and while carrying payloads, they require greater reserves of power. To generate more power, they require bigger batteries. But bigger batteries add weight, which must be then counterbalanced with more power... It's an unforgiving spiral."

Additive manufacturing helps address the weight issue with its ability to print complex geometries, like the lattice design shown here. Lattices can dramatically reduce the weight of a component while retaining its structural integrity. Additive manufacturing also enables parts consolidation and tight packaging of subcomponents.

Today, almost all UAVs incorporate carbon fiber composite material. Although carbon fiber is a structurally efficient material option for general use, manufacturers need to consider a wide range of criteria during material selection. For one, the vehicle's structure must possess high structural stiffness to maintain its aerodynamic shape. Second, rotating blades such as rotors, propellers or engine fan blades, and structures undergoing pressurization cycles require high stiffness. Otherwise, the thrust distorts the blade profile, reducing propulsion efficiency.

As UAV use cases increase, manufacturers will need to explore additional material options. Specialized use cases for UAVs usage may require certain specifications or characteristics that can be addressed by material engineers. For example, firefighters can use UAVs to monitor and help control the spread of wildfires without putting crews on the ground at greater risk. In this situation, it's necessary to use heat-resistant materials to avoid damaging the drone or creating an environmental hazard.



3D-PRINTED LATTICE DESIGN

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Optics & Sensor Breakthroughs Drive Increased Autonomy

When people talk about "autonomous vehicles," they usually think of self-driving cars. As car manufacturers begin testing autonomous features like automatic steering and lane-keeping, they (and the rest of us) are realizing just how complex, nuanced, and reliable this technology must be to ensure safety. For cars and UAVs alike, it's not just a matter of improving individual optics and sensors; these components must seamlessly integrate with the device software to respond, take evasive action, or perform its designated tasks. State-of-the-art perception systems capture scene information from a combination of multiple sensor sources, typically cameras, radar, thermal imaging, and LiDAR. Artificial intelligence fuses these sensor inputs to identify objects, precisely localize the UAV in space, and plan the optimal path to reach the destination. Importantly, these sensors must be ruggedized to perform in even the most challenging conditions.

A process called sensor fusion combines data from these various sensors to provide higher quality information so an autonomous system can make better, safer decisions. Typically, one type of sensor cannot safely monitor the conditions around a device in all situations. For example, cameras may not be able to accurately recognize other objects in low-visibility conditions, such as darkness, fog, or even blinding light. The types of sensors that benefit autonomous vehicles include:

- **Cameras for video and still images are common types of optical sensors.** Multiple cameras can provide a 360° view of the environment, which is vital for identifying obstacles. Beyond drones, camera sensors are equally valuable for autonomous vehicles in other environments, such as warehouse and retail robotics.
- **Light Detection and Ranging (LiDAR) combines unique software and hardware to transmit and interpret light waves that generate a precise 3D map of the UAV's surroundings.** Light is sent out to survey and measure the distance to surrounding objects and features.
- **Ultrasonic sensors send out short ultrasonic impulses that are reflected by obstacles.** Unlike LiDAR, ultrasonic sensors "see" through objects; unlike cameras, they are unaffected by low-light situations.
- **Radar sensors use Frequency Modulated Continuous Wave (FMCW) radar to recognize both moving and stationary targets.** These sensors are ideal for long-range detection and are not affected by extreme weather conditions.
- **Infrared sensors provide images under low-lighting conditions, such as those in night-vision systems.** With infrared sensors, UAVs can fly at night which is optimal with less ground and air traffic of other types.
- **Thermal imaging sensors also enable nighttime and low-light flights, as well as operation in poor conditions due to smoke or fog.** This technology can help first responders quickly assess on-the-ground conditions during a fire, and it can let utilities effectively monitor power lines or solar panels.

In recent years, there have been several ground-breaking innovations in sensors and optics. Below are two that Jabil has recently developed to support work on autonomous devices like cars, robots, and UAVs:

- **Omnidirectional Sensor** – This showcases an industry-first solid-state 3D camera combining a 3D time-of-flight (ToF) depth sensor with a custom 360° x 60° field of view optical assembly. The sensor earned the 2025 Photonics Frontiers Award in the Imaging Technologies category from Electro Optics.
- **SWIR 3D Camera** – This first-of-its-kind 3D camera operates in the short-wavelength infrared (SWIR), at 1130 nanometers, solving a problem of capturing 3D images when moving between differentiated light levels, e.g., inside to outside. The 3D sensor data from these innovative depth cameras will improve obstacle identification, collision avoidance, localization, and route planning — key applications necessary for autonomous platforms.

> **"By combining SWIR 2D imaging and 3D laser triangulation, Jabil's line profile sensor can deliver precise, high-contrast images and measurements, even in the most challenging lighting conditions. The ground-breaking sensor is facilitating new opportunities for fast, non-contact imaging for inspection, monitoring and measurement in agricultural fields, forests, greenhouses, and on roads and rails."**
>
> *Electro Optics*

"The new SWIR camera provides a glimpse of the unbounded future of 3D sensing where sunlight no longer impinges on the utility of UAV platforms," explains Ian Blasch, senior director of business development for optics at Jabil. "As an example, integrating SWIR cameras with UAVs will improve performance in several precision agriculture applications such as crop management, targeted resource allocation, and topographic map development."

As these technologies and their integration continue to improve and prove themselves safe and effective in testing, the regulatory aspects of UAV development should also evolve and clear the way for wider adoption.

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Regulation is Key to Mass Adoption

With no set global standards for drone operation, determining and establishing regulations for the UAV market is an active process for civil aviation bodies around the world. This is perhaps now the industry's greatest limiting factor. As of October 2025, UAV companies await updated Part 108 regulation from the U.S. Federal Aviation Administration (FAA) and, potentially, the Transportation Security Administration (TSA) on BVLoS drone operations. Proposed new rules could restrict existing and planned drone deployments for commercial use and public safety.

Instead of simplifying the current system, which requires operators to secure waivers for BVLoS flights, the regulation could limit BVLoS operations even further and remove many of the permissions granted under the waiver system. Additionally, the proposed regulation would require drones to have a backup power source onboard — adding weight that can't be accommodated to keep drones small and light. If implemented, these changes would prevent some drone applications and flights, thus hampering innovation and negatively impacting the UAV industry's progress toward mass adoption.

However, certain other regions are expanding their drone regulations, with some changes making BVLoS operations — especially lower-risk flights — more accessible. These include Canada, the European Union, the United Arab Emirates, and Brazil. UAVs will likely continue to be regulated by the civil aviation authority for a given country, with most countries currently evaluating the best move forward to keep people's safety at the forefront.

The benefits of UAVs are acknowledged by most governments, and they want to regulate in a way that encourages the safe deployment of UAV fleets. One advantage of UAVs is that they can avoid obstacles and traffic jams on city streets, preventing additional accidents. Moreover, increasingly urgent environmental goals regarding emission reductions and energy savings are strengthening the value proposition of battery-powered vehicles over traditional cars or trucks for last-mile logistics.

"Jabil has a wealth of experience in regulated industries such as automotive, healthcare, and defense and aerospace," explained Huskamp. "In the current conversation around UAV regulation, Jabil supports decisive action so companies can continue to advance technology in a safe manner. The adoption of UAVs has the potential to address environmental issues, improve rural deliveries and services, strengthen infrastructure through inspections, support rescue missions by aiding first responders, and ultimately, improve lives."

Still, the regulatory situation — particularly in the U.S. — is in flux and under pressure for movement. A 2025 industry survey by Drone Industry Insights shows that regulation remains the biggest challenge to the drone industry's growth. In most of the world, a waiver is required to operate a UAV BVLoS, which usually involves a long bureaucratic process. While the abilities of optics, sensors, and software to safely pilot UAVs through space continues to improve, the main obstacle to adoption is less about technology and more about regulatory clarity.

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Be Ready for the Tipping Point

In multiple market forecasts, the UAV market is consistently seen as a growth market with most predicting a double-digit increase in revenue this decade. Grandview Research forecasts that, while North America region held the most significant market share in 2024, the Asia-Pacific drone industry is expected to grow the fastest over the next five years due to developments in drone technology, the expansion of AI, and growing demand from enterprises across numerous industries. Fleets and swarms of UAVs are coming. The benefits are too environmentally and cost-effective to postpone when we could have integrated large-scale deployments of flying devices that do not require roads, gasoline, or pilots.

UAV functionality continues to evolve despite regulatory delays — and most of these advances support safety and consistent performance. Commercial UAV companies need to make sure they are ready to meet regulatory standards, operate with proven safety guidelines, and deliver on the promise of UAVs to reduce their reliance on riskier, time-consuming, and fossil-fuel-dependent methods. From optics and sensors to motors and batteries, today's UAVs are highly advanced technological vehicles. A solid approach to creating powerful UAVs for mass adoption will be collaborating with manufacturing partners that support your vision, deliver on the technology, maintain quality and regulatory standards, and incorporate all of this complex functionality into a unified whole.

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