



PERCEPTO

THE ULTIMATE GUIDE TO **AUTONOMOUS DRONES** FOR INDUSTRIAL SITES

Business leaders at large-scale critical infrastructure and heavy industrial sites strive to maximize productivity and minimize safety and operational risks. Yet the maintenance and security of sensitive and complex equipment at these sites poses unique challenges. Lowering operational expenses while preventing safety incidents and maintaining strict regulatory compliance have become top priorities for nearly all organizations.

To meet these goals, more and more large-scale industrial and critical infrastructure players are turning to autonomous industrial drones deployed on site, also known as a “drone-in-a-box” systems. This groundbreaking technology is literally transforming industrial operations - automating time-consuming and labor-intensive processes, and driving a whole new world of data-driven analytics.



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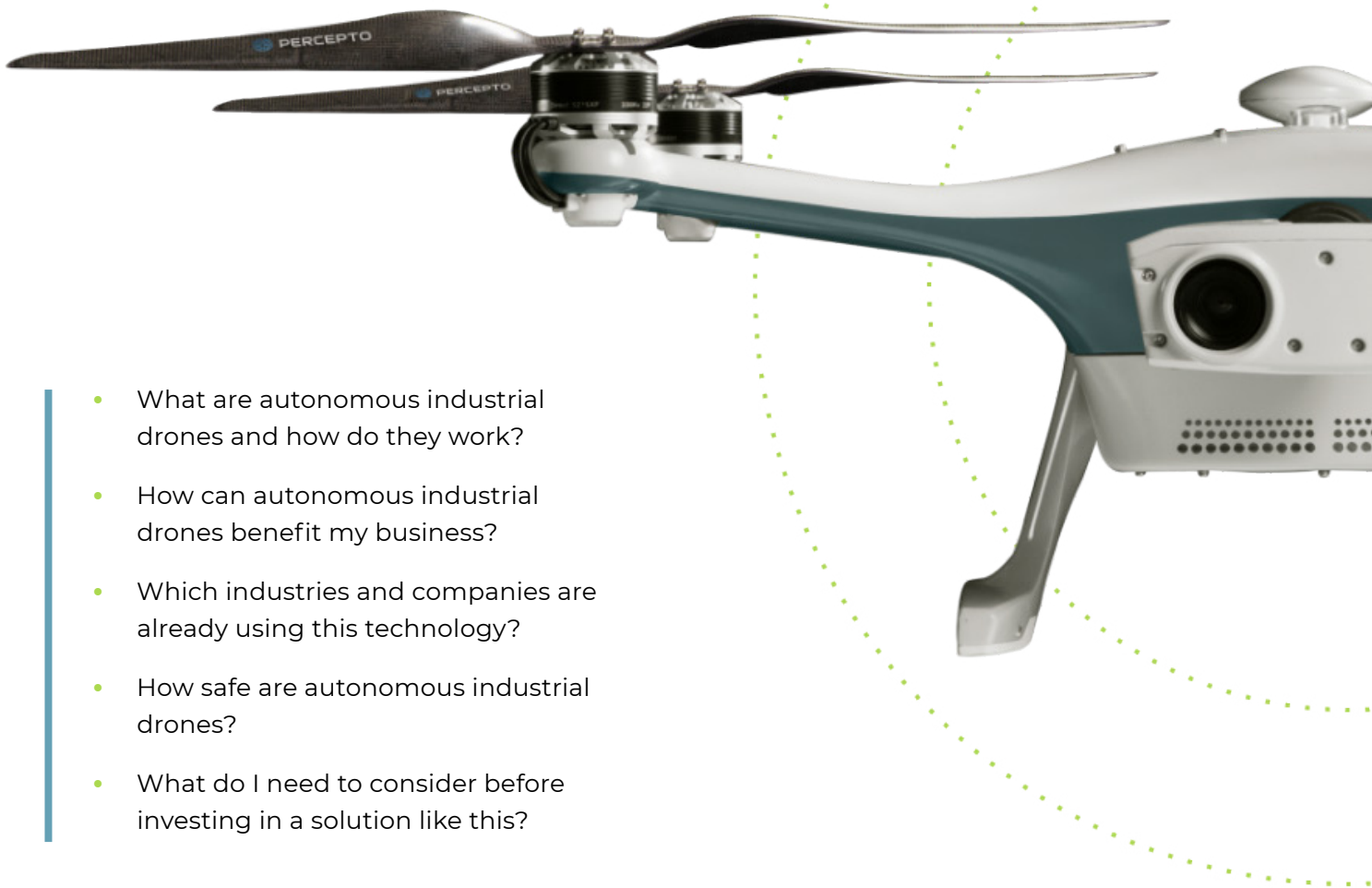
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Across industries and across the globe, organizations are turning to drone-based solutions. According to PwC, commercial drone use is a growing global market valued at more than \$127 billion.

Once considered a consumer trend alone, it's become clear that autonomous drone technology is here to stay in the industrial sector, and will play a key role in shaping the future of industrial operations.

This guide will delve into how organizations can best leverage on-site autonomous drone solutions and will answer questions like:

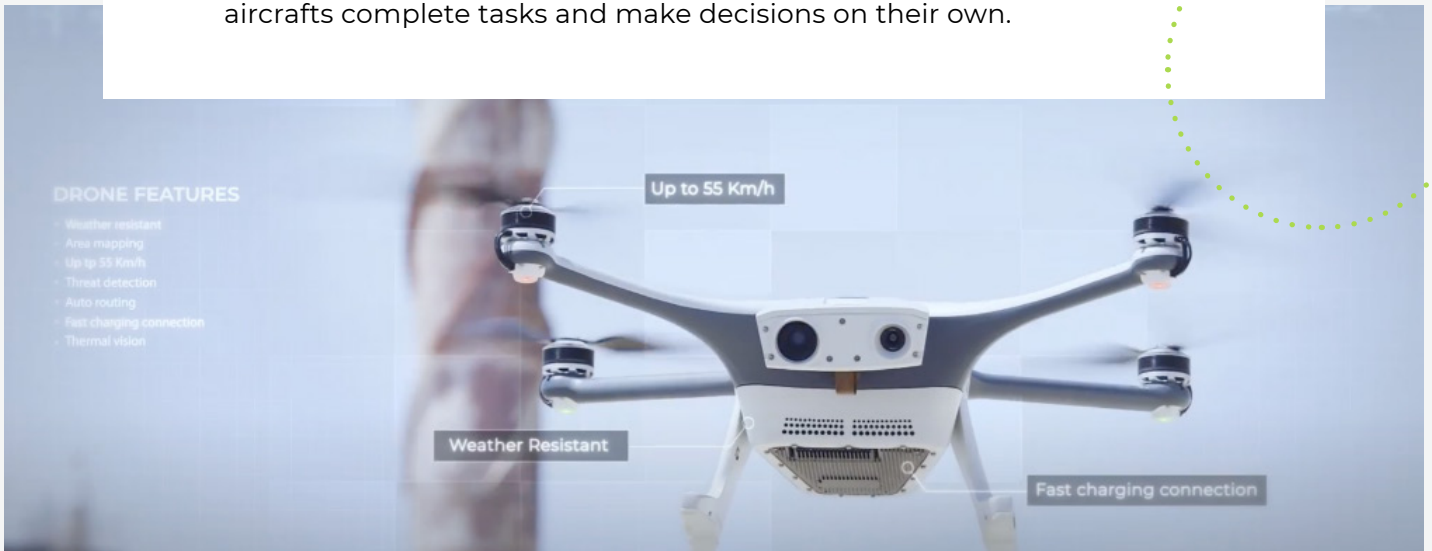
- What are autonomous industrial drones and how do they work?
- How can autonomous industrial drones benefit my business?
- Which industries and companies are already using this technology?
- How safe are autonomous industrial drones?
- What do I need to consider before investing in a solution like this?



Introduction to On-Site Autonomous Industrial Drones

ARE ALL AUTONOMOUS DRONES THE SAME?

Autonomous drones are unmanned aerial vehicles (UAVs) that operate using Artificial Intelligence (AI)-powered navigation and operational software, and do not require a human pilot. From taking off and landing to carrying out aerial site inspections and surveying, these aircrafts complete tasks and make decisions on their own.



ARE ALL AUTONOMOUS DRONES THE SAME?

Not all drones with autonomous capabilities are the same. It is one thing to automate a flight. Yet much greater value is realized from automating the entire flight and data collection cycle – preparation for flight, autonomous flight, data gathering, data upload and analysis, generation of insights, and preparation for the next flight.





WHAT IS AN ON-SITE AUTONOMOUS INDUSTRIAL DRONE (DRONE-IN-A-BOX)?

An on-site autonomous industrial drone system (drone-in-a-box) is an all-in-one autonomous drone solution with two main components:

- **The platform** - An autonomous drone and base station ("the box") that has been specially adapted to the unique needs to large-scale industrial sites
- **AI-powered software** that manages the drone and analyzes visual data gathered

These solutions are growing in popularity because of their immediate on-site availability, convenience, and data collection capabilities. Deployed on-site, a drone-in-a-box is available 24/7/365 to enable more efficient and frequent site and equipment inspections - collecting data in a consistent and persistent way, eliminating human error, and gaining actionable AI-driven insights. These systems also enable site stakeholders to react quickly to incidents – gaining immediate situational awareness.

With a drone-in-a-box solution, all you need to do to gather high-quality visual data is program a flight path or set of tasks on any computer at any location. Without a ground-based controller or a human pilot on site, once activated, the drone gets to work – it deploys from the box autonomously, performs on-demand or pre-scheduled missions, and returns home when it's finished. The box acts as a landing pad, recharging station, shelter, and data hub.

Industrial drone-in-a-box solutions are highly-adaptable to business needs. For example, you can launch one drone-in-a-box or combine multiple systems depending on the coverage requirements of each industrial site. During the drone mission, even if you're off-site, you can view site conditions in real-time and also receive alerts and operational insights. If you're not available during the mission, the system automatically generates reports based on mission findings for review at a later time.

What Are Autonomous Industrial Drones Used For?

By removing the human error factor and the overhead of piloted drone systems, autonomous industrial drones are changing the way industrial and critical infrastructure sites conduct routine maintenance, oversee safe and secure operations, ensure business continuity after severe weather and other incidents, and maintain compliance. What are some of the most common applications of on-site autonomous industrial drones?

SAFER AND MORE FREQUENT EQUIPMENT AND SITE INSPECTION

On-site autonomous industrial drone systems enable closer, more frequent and more accurate monitoring of large-scale sites or dangerous equipment. For both incident response and ongoing maintenance, autonomous drones allow close-up visual and thermal observations – easily accessing what human teams can't. And the data generated by autonomous drone mission serves as a baseline for more effective anomaly detection for predictive maintenance. Manual inspections pose risks to employees can take a long time and may require shutting down equipment, while infrequent inspections can result in even costlier downtime.



PERSISTENT AND CONSISTENT MONITORING

Autonomous drones collect visual data on critical site assets on a persistent and consistent basis. This data is analyzed, actionable insights are generated, then the data is archived to serve as a comparative baseline for future analysis.

INFRASTRUCTURE INSPECTION

Minimize human risk with autonomous drone inspection of inaccessible areas like rooftops, pipelines, tanks, thermal structures and even high-altitude assets like antenna towers.





ANOMALY DETECTION

Machine vision automatically detects anomalies, leaks, fires and more on site so you can take action right away, preventing potentially disastrous failures.

INSURANCE

Leverage aerial data from site inspections to get insurance claims validated faster.



FASTER EMERGENCY RESPONSE

Delivering live aerial footage day and night, autonomous industrial drones enhance safety protocols and optimize emergency response and security, offering:

RAPID RESPONSE

Immediate dispatch to emergency sites with no dependence on ground transportation allows for rapid situational awareness while keeping employees out of harm's way.

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MORE EFFICIENT AND ACCURATE SURVEYING AND MAPPING

On-site autonomous drone systems can conduct site surveys and map terrain. Leveraging integrated elevated map detection, these drone systems can map harsh environments and hazardous sites without putting employees at risk, and perform area, volume, and high accuracy linear calculations. For a mining company, moving to daily drone pile inspections allows for precise materials transport, cutting costs and supporting logistics teams.

TIGHTER SECURITY

Cost-effectively augment facility perimeter security patrols, gate inspections, parking lot monitoring, and inventory inspections – all without adding personnel. During shutdowns, easily ramp-up security operations with a fully-autonomous solution that requires minimal on-site human presence.

STRICTER COMPLIANCE

On-site autonomous drones facilitate industrial site compliance by automating data collection, supporting:



ENVIRONMENTAL RESPONSIBILITY

Preventing equipment failures that could lead to ecological disasters protects people, wildlife and site equipment.

ENVIRONMENTAL COMPLIANCE

Avoid environmental fines by preventing leaks and other failures as well as ongoing drone-based monitoring of key site conditions such as temperature and air pollution.



AUDITING

Site activity data collected over time streamlines regulatory compliance.

What is a Beyond Vision Line of Sight (BVLOS) Waiver?

Beyond Vision Line of Sight (BVLOS) waivers are granted by regulatory authorities to allow advanced on-site autonomous industrial drone systems to effectively cover large-scale infrastructure and other facilities – without the need for pilots and observers on the ground.

While BVLOS flights are highly regulated, the rapid adoption of remote operations is driving demand for streamlined regulatory approvals. Countries such as the United States, United Kingdom, Canada, and Australia have recently introduced regulations that provide a clear path to BVLOS approvals. And in other countries, industry leaders are working with governments to develop policies that make BVLOS flights more accessible.

Top 5 Industries Using Autonomous Drone Technology

Autonomous drones are changing the way industrial sites operate. They're pushing industries forward by maximizing production, improving safety measures, and encouraging data-driven decision making. As a result, innovation is happening at rapid speeds, especially in the thermal power, solar energy, mining, port, and oil and gas industries.

THERMOELECTRIC POWER

Thermoelectric power plants have unique safety challenges and complex operational protocols, making them some of the most hazardous industrial environments. Many thermal energy facilities have turned to autonomous industrial drones to eliminate the need for in-person inspections by completing pre-scheduled surveillance and remote monitoring missions. By leveraging on-site autonomous industrial drones to avoid unplanned downtime, these utilities have saved millions.

Through the use of radiometric, thermal, and high definition visual imaging, autonomous industrial drones inspect, analyze, and alert operational staff of performance, maintenance requirements, and safety and security concerns. Located permanently on-site, drone-in-a-box systems increase the frequency of inspections while improving the quality of data collected. This reduces employee risk and provide consistent inspection data to ensure the facility runs smoothly and adheres to regulations.

Florida Power and Light (FPL), one of America's largest energy companies, has already had great success with autonomous drones. The company relies on Percepto's solution to quickly identify power outage sources when storms cause service disruptions. Percepto autonomous drones also monitor numerous FPL facilities around the clock and conduct thorough inspections of hard-to-reach areas like power lines and solar panels.

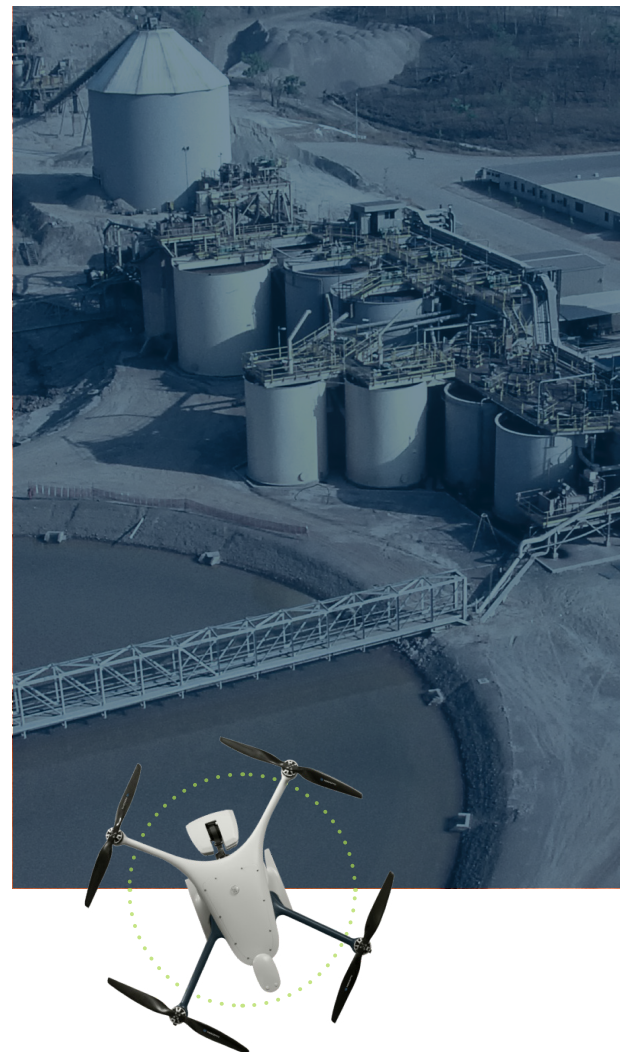


SOLAR ENERGY

Solar power is a fast-growing renewable energy industry, and solar farms are being built all over the world. Yet operations and maintenance of these large, remote and geographically dispersed facilities is complex and costly. By deploying an autonomous industrial drone with thermographic imaging technology, an entire farm can be monitored 24/7 and rapidly inspected. Malfunctioning panels can be spotted in minutes through temperature analysis, and high-frequency inspections ensure that malfunctions don't go unnoticed and degrade production. During construction, a drone survey can help with terrain mapping and positioning of solar panels while alerting staff of construction bottlenecks to minimize delays.

MINING

Autonomous industrial drones have been integrated into worldwide mining operations and fulfill numerous mission-critical functions. Mining companies worldwide are leveraging these systems to regularly inspect critical equipment over vast operational sites – enhancing safety and avoiding downtime. Moreover, with fast and reliable data retrieval capabilities and advanced on-board sensors and cameras, drone-in-a-box systems are producing 3D models and volumetric data to accurately and consistently assess inventory for companies like Israel Chemical Industries (ICL) Dead Sea. Elsewhere, mining operators are using autonomous drones to conduct surveillance perimeter security patrols, as well as to monitor noise and dust levels to prevent regulatory penalties, and confirm safety zone clearance before planned explosions. Finally, mining firms that use driverless vehicles are realizing great value from autonomous industrial drones, which are used to assess large sections of roadways and alert personnel of obstacles that may damage vehicles or halt operations.



OIL AND GAS

Safety and environmental risks at oil and gas facilities can be more effectively managed with on-site autonomous industrial drone systems. At facilities like Delek Israel's XYZ, drones are used to inspect and monitor hard-to-access places like oil rigs, bridges, boilers, and fuel storage tanks – keeping workers out of harm's way and automatically detecting anomalies like leaks and temperature surges right away. In the event of an emergency, autonomous drones provide immediate situational awareness and help direct response efforts without an on-site pilot.



PORTS AND TERMINALS

Port and terminal operators across the globe leverage on-site autonomous industrial drone systems to overcome a wide variety of security and inspection challenges. Scheduled aerial monitoring extends security perimeters by keeping an eye on crane and freight operations, port entrances and exits, and surrounding coastlines. AI-powered applications automatically detect, track and alert about suspicious objects or people. Percepto has partnered with companies like CERTUS Port Automation - a major port security firm servicing over 30 ports and 50 container terminals around the world – to roll out autonomous drone-in-a-box solutions to clients like the Port of Rotterdam.



Seven Benefits of Autonomous Drones for Industrial Sites

From enhancing workflows to preventing workplace accidents, here are seven ways autonomous industrial drones can drive your business forward:



VALUABLE DATA-DRIVEN INSIGHTS

Operational data is the key to operational success. Yet manually gathering and interpreting operational data from equipment and other sources across a large industrial site is challenging and expensive. Employee data gathering is inherently subjective and subject to oversights and errors - workers can spend hours jotting down observations and metrics, yet easily overlook or omit essential data points. And much equipment in these types of sites is not fully accessible or safe to monitor up close.

Leveraging pre-scheduled data-gathering missions, advanced on-board cameras and sensors, and machine learning, autonomous industrial drones automate the data gathering process for key production KPIs including:

- Reduced downtime
- Overall labor effectiveness
- Capacity utilization rate
- Manufacturing process cycle time
- Material rejection and scrap
- Emission rates
- Inventory management
- Safety near-misses

STREAMLINED OPERATIONS AND MAINTENANCE

Autonomous drones save time and money by automating routine inspections, increasing both the quantity and quality of data collected. From drone roof inspections to pipeline checks, on-site autonomous drone systems carry out a wide range of ongoing and preventative maintenance procedures. The drones can also gather accurate volume measurements and generate inspection reports – leaving human teams free to focus on critical observations instead of data collection.





COMPANY AND EMPLOYEE SAFETY

Autonomous industrial drones can prevent mishaps by responding to emergencies and inspecting inaccessible areas without exposing teams to risk. They also detect fires and leaks early to minimize the chance of on-the-job injuries. Incident reports show 80% to 90% of injuries and organizational accidents are attributed to human error. Stress, carelessness, and other factors cause humans to make mistakes – whereas autonomous drones follow protocol and carry out missions with precision every single time.

CREATION OF NEW JOBS

According to the Association of Unmanned Vehicle Systems International (AUVSI), drones and related technologies are projected to actually create 100,000 new jobs in the United States alone by 2025. Although autonomous industrial drones will automate some manual tasks, and make other tasks more efficient, employees are still crucial – among multiple other reasons to operate drone management systems and coordinate the activities of multiple drone-in-a-box solutions.



LOWER OPERATIONAL OVERHEAD

Autonomous industrial drones can accomplish many tasks more cost-effectively than manual operations, and can slash manufacturing overhead with:

ON-SITE SURVEILLANCE

Autonomous drones can replace expensive security cameras with pre-scheduled surveillance missions

DATA COLLECTION

Autonomous drones regularly collect, process, and analyze data more cost-effectively than having a team do it manually

EQUIPMENT MAINTENANCE

Drone inspections offer preventative maintenance and operational insights that extend equipment life

SAFETY EQUIPMENT

Drones lower demand for personal protective equipment, reduce risk of injury, and eliminate some workers' compensation claims since employees are not exposed to hazardous materials or environments

ENHANCING COMPLIANCE

Insights from data gathered by routine drone flights can alert of risky operational practices that may violate regulations – lowering regulatory exposure and the need to hire legal and regulatory consultants.



INSURANCE BENEFITS

Insurance companies are utilizing drone-based technologies to fight fraud, mitigate risk, and process claims faster. Some have even started offering discounted insurance and expanded coverage to commercial clients who use drones to collect aerial data. Drones with sensors and thermal imaging help lower insurance premiums by detecting maintenance issues early. Moreover, insurance claims supplemented by a recorded archive of aerial data can be validated and processed faster.

ENHANCED SECURITY

Industrial site security teams have large physical areas to cover – stretching resources thin even during routine operations. Companies are turning to on-site autonomous industrial drones to cost-effectively augment facility perimeter security patrols, gate inspections, parking lot monitoring, inventory inspections and more – all without adding personnel. During plant shutdowns (from pandemic or other natural causes, for example), drones help security rapidly ramp-up operations with only minimal on-site human presence.



Debunking Autonomous Industrial Drone Misconceptions

Autonomous drones are a powerful tool for industrial sites. Yet common misconceptions may prevent some from considering a drone-in-a-box solution. Below, we debunk two of the most common misunderstandings surrounding commercial drones:

MYTH 1 | AUTONOMOUS DRONES ENDANGER PRIVACY AND PUBLIC SAFETY

Drones aren't always portrayed positively in the media – we may hear about drones flown too close to airports or used to invade privacy. Yet there's a huge difference between piloted recreational and autonomous industrial drones. Recreational drones cause the majority of drone accidents because they're flown by unlicensed pilots in public spaces with minimal supervision. Autonomous industrial drones fly in remote or rural locations, far from people, and have multiple built-in failsafes and advanced safety features like parachutes to eliminate injuries and mishaps.

MYTH 2 | AUTONOMOUS DRONES ARE EXPENSIVE

Housing cutting edge hardware and software, it's easy to assume autonomous drones are expensive to operate. But this is simply not true. Autonomous drones offer clear economic advantages when it comes to data collection, processing, and analysis. Since they fly without human input, there's no need to pay drone pilot salaries which cost an average of \$100,000 per year. On-site autonomous industrial drones can also save millions of dollars by detecting small issues before they turn into big ones.

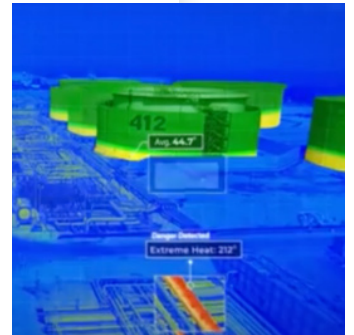
What to Consider Before Investing in an Autonomous Industrial Drone System

Designed to flawlessly integrate into operations, autonomous industrial drones solve many operational challenges from the sky - from strengthening safety and security measures to streamlining maintenance. Yet it's important to remember not all autonomous drone-in-a-box solutions are created equal.

Before investing in a drone-in-a-box solution, consider these five key features before making a purchasing decision:

AUTOMATED DATA COLLECTION AND ANALYSIS

If keeping data assets current is a top priority, choose an autonomous drone that automates the entire process. Certain models like the Percepto Sparrow can repeat missions at set intervals to generate high-resolution maps, 2D/3D models, and other valuable aerial data assets.



COMPUTER VISION AND AI-POWERED APPLICATIONS

Autonomous industrial drone solutions with on-board computer vision and AI-powered tools give you a better understanding of what's going on at your site. These smart features can immediately alert you of security and safety risks and other anomalies, as well as automatically generate and send customized reports with actionable insights to relevant stakeholders.

MULTI-MISSION CAPABILITIES

To increase productivity and lower costs, pick a solution that supports a variety of missions. A drone that conducts aerial inspections, surveying and mapping missions, security patrols, and more will provide greater value by fulfilling different objectives and supporting multiple on-site teams.



USER FRIENDLY AND EASY TO CONFIGURE

Usability is important when it comes to adopting and implementing new technology. Your drone solution should have an intuitive interface that's accessible from any web browser. When setting up missions, make sure they can be easily edited so different groups can make changes when necessary. And after missions, ensure that data is readily accessible via the cloud for faster insights.



REMOTE OPERATIONS

An effective on-site autonomous drone system should be able to operate from any location with no on-site personnel. You'll want a solution that safely performs pre-scheduled or on-demand missions so it can act as your "eyes on site" even when you're not physically there.

