

Defining a Future that Runs on Drones

Over the past decade, drones have become a hot topic within the science and technology community. These devices, formally known as unmanned aerial vehicles (UAVs), are essentially flying robots that can be controlled remotely, often embedded with a camera or other sensors.

The U.S. military developed early drones in 1918 for combat purposes — first referred to as cruise missiles, these crude UAVs were airborne bombs equipped with 12-ft wings made of cardboard and paper mâché. Over time, military scientists refined the technology, adding weapons and sophisticated precision controls to deliver accurate air strikes while removing soldiers from immediate danger.

“The military has continued to be a catalyst for the development of UAV hardware, which has allowed commercial drones to become cheaper, lighter, and more advanced,” says Barry Alexander, the founder and CEO of Aquiline Drones. “Today, drones

aren’t just for delivering military payloads across a variety of terrains or for swarm attacks in foreign lands. In fact, drones are now also used in a wide range of civilian and business roles, including search and rescue, surveillance, traffic and weather monitoring, videography, agriculture, and even delivery services.”

According to Alexander, drones can easily perform many activities, including routine inspections of construction sites, tunnels, bridges, power lines, and energy plants — they are unrivaled in assessing and mitigating potential disasters. Indeed, this quality makes them ideal for use within the chemical process industries (CPI) as well as a plethora of other essential applications.

Drones in the CPI

Flyability, a drone technology company based in Switzerland, designs drones to inspect closed, confined spaces. Flyability’s drones are built to check out what is happen-

ing inside a nuclear reactor, boiler, or storage tank — without physically sending in workers to conduct an inspection. The company works with organizations in the oil and gas, chemical manufacturing, power generation, and mining industries.

“There are all kinds of assets that, without maintenance, can develop serious problems that could become catastrophic over time,” says Zacc Dukowitz, the content marketing manager at Flyability. “Some examples are fermenter tanks, pressure vessel storage tanks, or anything that contains volatile chemicals. Any system that requires regular inspections as part of the maintenance process, that’s where our technology comes in. Some of these vessels are huge — inspectors need scaffolding that they must climb to visually inspect every square inch of the vessel. Instead of building scaffolding and sending a person into a potentially dangerous space, our technology allows inspectors to stand safely outside while the drone collects visual data inside.”

Flyability’s first drone, ELIOS 1, helped keep workers safe and performed inspections at a basic level. It was set in a cage to prevent collisions within the vessel, but analyzing the collected video was difficult, as ELIOS 1 continually bounced around within the cage. While it was a nifty gadget and useful in some ways, that first-generation drone could not take the place of an inspector.

Flyability created ELIOS 2 after dozens of interviews with inspection professionals and built it to address their needs. One major modification was the addition of oblique lighting, which is a light source positioned at a



▲ ELIOS 2, a drone developed by Swiss company Flyability, is built for inspecting industrial systems. This includes oil tankers or pressure vessels. Image courtesy of Flyability.

low angle to provide an understanding of the depth of a space.

Typically, inspectors would shine a flashlight into a vessel to observe its internal structure — oblique lighting mimics this action, providing a three-dimensional understanding of a vessel. Flyability engineers also added a feature known as distance lock to ELIOS 2.

With this revision, inspectors can ascertain exactly how far the drone was from the target object, thereby tracking the ELIOS 2's exact position. Finally, Flyability updated camera quality and stability in ELIOS 2, allowing inspectors to lock the drone in place and get solid visual data from any coordinate.

In one application, Flyability employees flew ELIOS 2 at a fertilizer plant located in France, where the timing of inspections is crucial. Delays in the inspection process can be costly because the plant must be offline for the inspection. During the inspection, ELIOS 2 carefully reviewed all assets in the plant, looking for corrosion degradation and any damage or defects.

Using a drone in that case sped up the inspection process significantly, according to Dukowitz. The plant saved time because it did not need to build scaffolding. In addition, it takes much longer to walk the facility by foot than it does to fly a drone through the area and collect video.

ELIOS 2 also created a digital record of what the plant looks like at a given time, so if an issue arises later, the workers could refer to the previous images from the specific date of the inspection.

Contending with resistance to drone technology

Despite the benefits drones offer, according to Dukowitz, there are a few roadblocks in getting companies to

adopt the technology.

“What you usually see is a big company that is slow to implement change, regardless of how many benefits it may bring,” he says. Despite the safety benefits and cost savings, companies are often entrenched in existing inspection practices. “So, internal culture can often be the biggest stumbling block when it comes to drone technology.”

Dukowitz acknowledges that the stigma around drones might stem from their close association with artificial intelligence (AI) and the gut reaction some people have to robots — it could be that people do not want, say, the Terminator starting employment at their company, he says.

Dukowitz spends much time advocating for drone technology, often emphasizing the potentially significant financial benefits of using drones for inspections. In one case, Flyability worked with a client that rented out oil tankers. At the beginning of the COVID-19 pandemic, oil prices were so low that companies were buying inexpensive oil and stor-

ing it until they could sell it at a profit.

The client was renting out oil tankers for over \$1 million per day — so if an oil tanker were offline during inspection for even one day, the company could lose a significant amount of money. When one of the oil tankers developed a crack in a weld, Flyability used ELIOS 2 to inspect the crack, which allowed the client to fix it in a timely manner and save \$2 million.

Outside of financial benefits, Flyability pushes the significant safety advantages of drones. In fact, the company was founded in 2014 after the 2011 Tōhoku earthquake and tsunami in Japan.

One of the company's cofounders was on the scene as workers attempted to get into the severely damaged Fukushima nuclear plant but struggled due to high water and radiation levels. He wondered why they didn't have a drone to perform the task, which could save lives and crucial time.

The cofounder helped found Flyability soon after, and the company



◀ Drones mitigate the need for enclosed-space entries by maintenance personnel, which is helping to improve safety in industrial facilities. They can help personnel inspect damaged or malfunctioning structures without putting humans at risk, and can help companies save millions of dollars. Image courtesy of Flyability.

■ UPDATE

has continued to work to improve its software and hardware to make things even easier for inspectors. Currently, they are working on a powerful localization tool to visualize exactly where defects are positioned.

“Every company could benefit from adopting drone technology at scale,” says Dukowitz. “We will see significant reductions in annual fatalities and accidents that take place in confined spaces. Once we see widescale adoption, I think we’re going to dramatically improve safety and save companies millions of dollars every year.”

Drones in the age of COVID-19

Aquiline Drones, a drone technology company based in the U.S., also uses its drones for a wide variety of applications. In addition to aerial inspection of major industrial plants and facilities, the company’s drones can deliver small packages using autonomous flight and precision terrain data. This is particularly exciting after the Federal Aviation Administra-

tion (FAA) granted companies such as Amazon approval to operate drone fleets to deliver packages.

Aquiline’s drones also offer next-generation video production for entertainment and marketing purposes and have multiple agricultural applications. They can track farmlands in need of irrigation or fertilization, and can even carry more than 25 lb of liquid to distribute fertilizer and insecticides over 12,000 ft².

The drones are also used by various branches of the military for intelligence, surveillance, and reconnaissance purposes — they can patrol borders and inspect heavy military assets, making them effective in warfare.

Perhaps most importantly, Aquiline Drones is working within the public safety sector, providing effective disaster and medical responses, including the delivery of emergency supplies and equipment to areas that are not safe to access. This is particularly important in the age of COVID-19.

“Around the world, authorities are turning to drones in the battle against

the coronavirus pandemic, using them to remove the risk of infection for humans,” Alexander says. Drones can be used to deliver medical supplies to frontline workers and transport test results from remote locations to labs, he says.

Drones can also help deliver medicine and urgent supplies to individuals in quarantine and can conduct disinfectant spraying in public areas. According to Alexander, they can help maintain critical business processes, minimize disruption to company operations, and reduce the loss of revenue and financial impact by helping society treat this pandemic in an orderly, efficient manner.

“Drones are not as smart as their programmers, so while they may not be able to prevent another pandemic from happening, they can certainly mitigate conditions sooner by potentially containing the disease and stopping its rapid spread before it reaches pandemic status,” Alexander says.

In addition, drones can help prevent serious damage from a future pandemic by temperature-scanning individuals, providing surveillance to help enforce lockdowns, curfews, and social distancing, as well as helping to map infections in specific populations.

Aquiline Drones sees a future for drones in healthcare that is massive. In the distant future, drones could even be equipped to draw blood in a home healthcare setting and immediately transport samples to a testing lab. But that is far from the only benefit drones can provide to the medical community.

“One of the greatest potential benefits of drone use in healthcare is delivering life-saving blood and organs across greater distances at faster speeds,” Alexander says. “According to the American Transplant Founda-



▲ Drones have applications in nearly every industry, from agriculture to entertainment. Most recently, the drone technology company Aquiline Drones has been exploring how to solve global public health issues, such as COVID-19, using drones. Image courtesy of Aquiline Drones.

tion, there are 114,000 people in need of organ transplants in the U.S., and only 30% will receive their life-saving surgery. This is partially attributable to cumbersome and complex transportation systems.”

Recently, Aquiline partnered with a logistics technology firm to create an innovative, rapid delivery service for human organs and tissues using drones. The company also envisions using its drones to move patients, as a replacement for both ambulances and stretchers. Its overarching aspiration is to operate a fleet of drones and manned aircraft for healthcare purposes.

The company is growing rapidly,

and it plans to launch an app that will give the public the ability to order drone services through a mobile device, whether that is for aerial photography services or for utility inspections. In addition, Aquiline’s Flight to the Future (F2F) program is training a new breed of highly skilled commercial drone pilots. According to Alexander, this will create high-paying jobs that could help reduce the unemployment rate.

The company has pledged to add more than 1 million drone-based jobs to the U.S. economy. They foresee a bright future that runs on drones operated by citizens across the nation.

– *Nidhi Sharma*

Artificial Mini Lungs to Study COVID-19

Researchers at Duke Univ. have developed a miniature lung model grown in their laboratory that mimics the lungs’ air sacs, where COVID-19 infection typically takes place. This organoid (*i.e.*, a simplified version of an organ) could allow engineers and scientists around the world to more closely understand the effects of coronavirus on lung cells and the respiratory system.

SARS-CoV-2, the virus that causes COVID-19, gains entry



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