imminent UBI

CEO ELLEN CHRISTOPHERSON
combined aviation, surveying, and
engineering to found Canada-based data
collection business Elevated Robotics.

L as Vegas bursts with hyperbole. Along with untold miles of neon and gallons of champagne, the city is home to the FleurBurger 5000, a $5,000 burger made with Kobe beef, foie gras, and black truffle; the Golden Opulence Sundae, a $1,000 ice cream dessert adorned with caviar and gold leaf; and Slotzilla, an 11-story zip line attraction shaped like a slot machine. Its exaggerated trappings are so abundant and outrageous they can easily overwhelm and distract the senses. The chaos is so much so that when something notable happens in Las Vegas, it often flies under the radar— sometimes literally.

QUITY

BY MATT ALDERTON

THE PROLIFERATION OF UNMANNED SYSTEMS PROMISES TO INFUSE COMMERCIAL ENTERPRISES WITH THE POWER OF GEOINT.

Such was the case Jan. 6 during opening day at the 2015 International Consumer Electronics Show (CES), the annual tech-toy spectacular. Amid the buzz of smart TVs and superphones, wearables and wireless, attendees were so busy looking around that some of them forgot to look up. If they had, they would have witnessed the show's most prescient products: unmanned aerial systems (UAS)—otherwise known as unmanned aerial vehicles (UAVs) or drones—surveying the crowd from their home base in the first International CES Unmanned Systems Marketplace.

One of 20 category-specific marketplaces at the International CES, the inaugural Unmanned Systems Marketplace comprised 6,500 square feet of exhibit space occupied by 16 commercial UAS companies. This was proof, according to one exhibitor, that UAS is finally ready for prime time.

"The drone industry has really boomed in the past two years," said Jessie Lu, director of communications at EHang Inc., a Chinese UAS company that displayed its signature Ghost drone, a UAS controlled via a smartphone app. "Two years ago [UAS] didn't even fill up a single conference room at CES. This year we had a whole section in the exhibit hall."

The reason isn't just that unmanned systems are cool—it's that they're disruptive.

"Unmanned vehicles have the potential to create new businesses and new jobs and give consumers unprecedented remote access to our skies. They also will improve and protect lives," Consumer Electronics Association (CEA) President and CEO Gary Shapiro said at the 2015 International CES. "Drones already are helping emergency and disaster management programs, national weather service tracking, and traffic management programs among others … [and] are revolutionizing how we capture and monitor our world."

CEA research estimates the global market for consumer UAS will approach $130 million in 2015, up 55 percent from 2014, with unit sales expected to reach 400,000 worldwide. Within just five years, CEA predicts, revenue from consumer UAS sales will easily exceed $1 billion.

As more consumers adopt unmanned systems, so too will more companies, according to Gretchen West, former executive vice president of the Association for Unmanned Vehicle Systems International (AUVSI) and now vice president of business development and regulatory affairs for DroneDeploy, a San Francisco-based maker of geospatial software for commercial UAS. "There's been tremendous interest in grassroots, organic development of technologies for the commercial market," West said. "Lots of people have seen the value in that market because there are literally hundreds of potential applications."

Because imagery and location services are among unmanned systems' innate features, those applications are poised to unlock in ways heretofore unimagined the transformational power of GEOINT.

"It's not just about a small vehicle flying through the sky," West continued. "It's about collecting information that just isn't readily available right now. It's the real-time data this technology can provide that's going to be revolutionary."

REDEFINING 'DRONE'

Like so many technologies before them such as microwaves, computers, and GPS, unmanned systems were born in the military. The world's first UAS were balloons launched by the Austrian army, which in 1849 assaulted the city of Venice with a battery of explosive-laden balloons. Approximately 70 years later, during World War I, the U.S. military used the same concept to turn unmanned airplanes into flying bombs.

"This technology was really founded back in World War I—even prior to that—and it's developed since then over several decades of use," explained West, who said the commercial application of unmanned systems has been in the works almost as long as the military application. "Look at the Academy of Model Aeronautics, which was formed in the 1930s to represent the hobbyist community flying model airplanes. Clearly, the technology has been around outside the military for quite some time."

That public discourse on UAS has evolved to include not only military Reapers and Predators but also recreational quadcopters suggests a tipping point.

"The conversation has changed from a debate strictly about targeted military killings to a much broader discussion about what this technology will mean for our society, including its implications for business," said Dan Gettinger, co-director of the Center for the Study of the Drone at Bard College.

Echoed Lu, "Just a few years ago we were still in the Iraq war and people had an instinctive, defensive response to the word 'drone.' They still have concerns, but we are definitely starting to see public perception change."

As it does, UAS will become synonymous not with war, but rather with efficiency, ushering in a new era that embraces drones instead of fears them.

JONO MILLIN, co-founder of DroneDeploy, demonstrates the ease of flight planning for drone use in commercial markets.
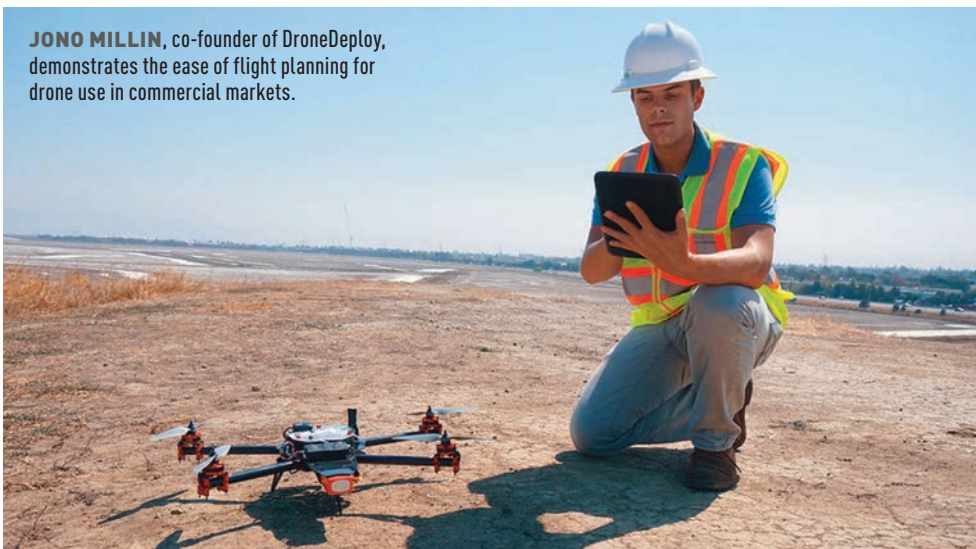
PHOTO COURTESY OF DRONEDEPLOY

The proof is in the profits.

"Right now the global UAS market is at $11.3 billion; over the next 10 years, that market will grow to over $140 billion," said AUVSI Government Relations Manager Mario Mairena, who cited AUVSI data encompassing not only consumer drones—the subject of CEA's data—but all manner of UAS. "The economic impact of UAS airspace integration [in the United States alone] will be over $13.6 billion in the first three years and will grow substantially, accumulating over $82 billion between 2015 and 2025."

In the commercial market, two principal motivations are driving growth, according to West. "The two key words are probably 'money' and 'efficiency,'" she said. "The commercial end user needs to make smart decisions about their business in a very timely manner. They need good data to make those decisions, and that data needs to be captured in an efficient way that's quick, affordable, and actionable. That's where drones are very, very valuable because they can capture and process information quickly and cost-effectively in a way that enables the end user to make data-based decisions right away."

DULL, DIRTY, OR DANGEROUS?

In the United States, tight regulation by the Federal Aviation Administration (FAA) has kept commercial UAS mostly grounded. Slowly, however, the skies are clearing for takeoff. In February, the FAA proposed new rules for commercial UAS suggesting private companies should be allowed to operate the systems as long as they do so below 500 feet, at speeds less than 100 miles per hour, and only during daylight. Current rules forbid commercial UAS entirely, except in instances where the FAA issues a special "Section 333" exemption; at press time the FAA so far had granted only 99 such exemptions. However, that doesn't mean the FAA isn't forging ahead, albeit with caution. In May, the administration announced a new program called Pathfinder, in which three companies—CNN, PrecisionHawk, and BNSF Railway—will test the use of UAS for commercial purposes.

Restrictions haven't stopped dreamers in the U.S., who continue to imagine new commercial applications for UAS every day.

"So far, there have been more than 300 different uses identified for the UAV in our economy," said Michael Drobac, executive director of the Small UAV Coalition, a consortium of UAS companies that promotes the adoption of small UAS for civil and commercial use. "The possibilities are limitless."

The "three Ds" are a good starting point for determining the commercial applications of UAS, according to USGIF Vice President of Professional Development Dr. Darryl Murdock. "If you want to know when and where companies are going to use UAS," he said, "ask yourself: 'Is it dull, dirty, or dangerous?' If it's any of those, chances are it's a good fit for UAS."

Among the earliest adopters, according to Lu, are filmmakers, videographers, travel companies, and extreme sports producers, all of whom want to use UAS to capture new and awesome perspectives with GoPro cameras, whether it's Spiderman swinging through the city, the bride and groom at a destination wedding, sunset in the Grand Canyon, or a pro surfer riding waves.

"Human beings have always wanted to fly. Many companies want to latch onto that human instinct and magnify it by filming things from the air," said Lu, whose company plans to launch a UAS

regulating the future

Drones. Unmanned aerial systems. Unmanned aerial vehicles. Whatever you call them, their commercial versions won't just deliver packages and pizzas. They'll also deliver a host of regulatory questions and challenges, according to Kevin Pomfret, executive director of the Centre for Spatial Law and Policy.

"The driving issue right now with respect to drones is the FAA and how they're going to develop a regulatory framework that allows for drones to be integrated into the national airspace," Pomfret said. "That's a significant task, and it's going to take some time, but I think it's going to work itself out."

When it does, UAVs will face yet another layer of legal and policy issues.

"Privacy will be huge," Pomfret continued. "You're also going to have intellectual property rights and licensing issues associated with data as well as liability and insurance issues. There's a whole host of things that are going to evolve over time."

Although UAS companies are keen to address the issues at hand—the industry, for example, recently launched NoFlyZone.org, which allows consumers to register their address in a shared database that UAS companies will use in concert with geofencing to create no-fly zones—doing so without legal guidance is like throwing darts in the dark.

"Most companies recognize there are issues and to the extent possible are trying to design around them," Pomfret observed. "But it's really hard to do without some understanding of what your obligations are from a legal standpoint."

In the end, Pomfret believes, drones will be as widely accepted as makers and users hope. Along the way, however, turbulence is likely.

"In general, we'll move forward," he said. "But I do think in the short term that there will be a period when companies are unable to collect the geospatial data they can collect today because of laws and court rulings that develop with unintended consequences. It won't be permanent—those laws will be overturned or replaced eventually—but we should be prepared for some setbacks."

PRECISION AGRICULTURE accounts for approximately 80 percent of potential commercial UAS markets. Germany-based Skysense has developed a waterproof charging pad to solve the problem of UAS battery life for industries such as agriculture, inspection, security, mining and energy, and more.

designed especially for the commercial market later this year.

Applications aren't just visual, however. In addition to full-motion video, sensor-equipped UAS have the potential to capture thermal, hyperspectral, and infrared data, providing utility across a range of industries.

Perhaps the biggest of these industries is precision agriculture, which according to AUVSI totals approximately 80 percent of the known potential commercial UAS markets. "Farming is going to be the biggest sector for UAS domestically," Mairena said. "Deployed on farms, UAS can determine whether crops need to be watered, if soil is healthy, and whether herbicides or pesticides are needed. And because of the low lift in altitude, when they're used for application of herbicides and pesticides they practically eliminate environmental runoff."

In May, the FAA granted approval for a remotely-piloted helicopter called the RMAX, produced by Yamaha, to spray crops in the U.S.—an important step toward helping more industries realize the benefits of UAS, according to supporters.

> "So far, there have been more than 300 different uses identified for the UAV in our economy."
>
> — Michael Drobac, executive director of the Small UAV Coalition

Construction is another significant area of opportunity. "If an engineering company wants to do an assessment on a bridge, they can't do it with a plane, and doing it with a helicopter is extremely dangerous," Mairena continued. "But with a micro platform that weighs only 10 to 12 pounds, you can collect live video and very easily determine what portions of the bridge may be damaged and in need of repair."

UAS could contribute to project management as well, with builders and developers deploying UAS on job sites at timed intervals to collect data on deliveries and construction progress.

Canada-based Elevated Robotic Services regularly serves sand and gravel companies and pulp mills, both of which commission UAS to monitor the volume of their raw materials.

"We also provide a lot of data to surveying companies, which use aerial imagery for planning, and … utilities, which use UAVs to inspect pipelines and power lines," said Ellen Christopherson, founder and CEO of Elevated Robotic Services.

Whether they use UAS to inspect utilities or monitor crops, the availability of fast, accurate, and affordable data from unmanned systems will help companies act early to solve problems and seize opportunities, the results of which could benefit the public at large. Enhanced land surveying, for example, could mean better redevelopment in blighted communities or shorter pipelines for projects

of public benefit such as renewable energy and mass transit.

"Access to more data is going to shift companies from catching things after the fact—being reactive—to catching things before they happen, being proactive," Christopherson predicted.

GEOINT'S OPPORTUNITY

Companies hoping to extract value from commercial UAS must focus not only on acquiring the systems, but also on developing the resources needed to support them—in particular, the human resources capable of analyzing data streams.

"GIS specialists and remote sensing specialists are going to be much more in demand because those are the skills companies are going to need to have in-house to be able to properly analyze data from unmanned systems," Christopherson said.

Although several universities have established programs to train and educate future UAS pilots, data scientists likely will have—at least initially—military and intelligence backgrounds, since defense heretofore has been the fountainhead of GEOINT tradecraft.

"The commercial side of UAVs is a fledgling industry, so my assumption would be that the military will be providing the basis of experience in terms of data analysis, because that's really where the experience so far has been," Gettinger said.

Retired Air Force Maj. Gen. James Poss, former assistant deputy chief of staff

on land and at sea

UAS potential isn't limited to the air. In fact, unmanned systems promise as many commercial benefits on the ground and at sea as they do in the sky.

"Ground robots are extremely important," said Mario Mairena, government relations manager at the Association for Unmanned Vehicle Systems International (AUVSI), who touted as an example the impending rise of autonomous cars, which eventually will offer safety, liability, environmental, and cost advantages not only to individual motorists, but also for industries that rely on ground transportation, such as shipping and logistics, emergency services, and mobile asset management.

Startup company Transcend Robotics, which designed a ground robot capable of climbing stairs and curbs, emphasizes the benefits of ground technology, including superior battery life, payload capacity, maneuverability, and durability.

"Ground robots have applications in all sorts of different situations," said Phillip Walker, CEO of Transcend Robotics. "The most common we've seen so far is HAZMAT and structural inspection; we've already attracted nuclear plant inspectors and bridge data mappers to our product."

Another dangerous sector where ground robots could likely flourish is mining.

"You could send robots down into mines to assess whether there are gaseous fumes in the area that may pose a risk to human life," Mairena said. "And if there's an accident, you can send ground robots down to search for missing miners. That's huge."

At sea, companies such as Fugro and Leidos have introduced unmanned systems that deliver similar benefits to the offshore oil and gas industry, which uses autonomous underwater vehicles (AUVs) for deep-water surveying.

"Fugro has six autonomous underwater vehicles, and three of them are based in the Americas," said Edward Saade, Fugro's

FUGRO'S STATE-OF-THE-ART Echo Surveyor AUV is designed to operate at depths up to nearly 10,000 feet.

RENDERING COURTESY OF FUGRO

regional survey director for the Americas. "Obviously, when you have an autonomous underwater vehicle you're not putting people at risk, which is a major benefit in the oil and gas world because you're operating in a tough environment."

AUVs also could assist with environmental risk mitigation by providing continuous monitoring of deep-water oil wells.

"All of us remember the BP disaster a few years ago. As a result of that, there's been a lot of pressure for the oil and gas industry to develop more vehicles and technology to be able to monitor the general well-being and health status of their systems," said Gunnar Galsgaard, division manager of maritime vessels at Leidos, which on behalf of the Defense Advanced Research Project Agency is currently developing an autonomous continuous trail unmanned vessel (ACTUV) capable of surveilling the ocean for months at a time.

Although ACTUV is being designed for anti-submarine warfare, its technology could be translated for commercial applications.

"It's a fully autonomous surface vessel, but the foundation is applicable to the undersea environment in addition to the surface-ship environment," Galsgaard said.

Unfortunately, there still won't be enough GEOINT talent to go around. Poss predicts an unavoidable analyst shortage in the commercial sector based on his Air Force experience.

"The Air Force is now awash in digital video and imagery, and we've barely kept up with it … We're barely surviving with a fairly large contracting force in some of our areas, which are almost 90 percent retired military imagery analysts," Poss said. "The Air Force, in that way, is an example of what is going to happen to the rest of the aviation industry once we're allowed to fly UAS [more freely] in the national airspace."

Provided the programs are created proactively, junior colleges and technical schools might be a solution to the talent shortage.

"It's possible to scale-up quickly," Poss said. "We can train a really solid imagery analyst in the Air Force in about four to five months, and that's about what a junior college would be able to do in a year or 18 months."

An open-minded GEOINT Community could also contribute to this emerging demand, according to USGIF CEO Keith Masback.

"The commercial UAS community is going to create a need for a new genre of analytic workforce," Masback said. "More platforms with more sensors are going to create more data. In many cases it's going to take qualified imagery and video analysts to turn that data into actionable insight to apply to problem sets and support decision-making in a

for intelligence, surveillance, and reconnaissance at U.S. Air Force headquarters, confirmed Gettinger's assumption.

"We already lose a lot of our young airmen to contracting after their first enlistment because when they come back they can get paid two to three times what they were paid [in the military] to do

basically the same job in the civilian sector," said Poss, now executive director of the FAA UAS Center of Excellence Team at the Alliance for System Safety of UAS through Research Excellence at Mississippi State University. "We lose our cyber guys to Microsoft all the time. It will be the same thing with GIS and UAS."

wide range of industries, from realty to precision agriculture. For many in the GEOINT Community, this will transcend what they traditionally envision when they think about an imagery analyst. This is GEOINT in its broadest sense, being leveraged across multiple business areas."

FLYING HIGH

In addition to labor challenges, commercial UAS enterprises also must overcome technological and regulatory hurdles.

On the technological side, companies must contend with limited endurance and payload capacity, both of which could hamper near-term efforts. Companies such as EHang, however, are hard at work on research and development that in the long term would likely render such issues moot.

"Currently, flight time on [most commercial] drones is less than 15 minutes," Lu said. "Our next-generation Ghost drone is going to improve that to an hour."

Data storage likewise could be an issue—but probably won't be,

> "Currently, flight time on [most commercial] drones is less than 15 minutes. Our next-generation Ghost drone is going to improve that to an hour."
>
> — Jessie Lu, director of communications at EHang Inc.

according to Murdock. "Because the cost of storage is cheap, we're rapidly reaching a point where we have the ability to collect and store an unlimited amount of data," Murdock said. "The military is grappling with storage because they want persistence. Their mode of operation is to collect everything you can and figure out later how to deal with it. The commercial sector will be much more surgical about data capture, storage, and retention. They can't afford to collect everything and figure it out downstream, so they're going to be very specific about the information they want."

If technology isn't ultimately a roadblock, regulation could be.

"There's no question that businesses want to adopt this technology," Drobac said. "Unfortunately, it hasn't been easy for them to do so in the United States."

Not knowing what regulations will allow makes it hard to plan for the challenges and opportunities ahead.

"Until we know what the FAA is going to let us do, we can't know how to prepare," Poss said.

Even so, commercial enterprises and the larger GEOINT Community have reason to be sanguine.

"I'm generally a pessimistic person, but I am extremely optimistic about this because technology always wins," Drobac continued. "When something is as life-changing as this is, it will prevail." ▪