**Package Delivery**

In an interview with CBS’s “60 Minutes,” Amazon CEO Jeff Bezos said about 86 percent of the orders the online retailer ships weigh less than 5 pounds. That’s lightweight enough to be delivered by drone. Amazon is now testing autonomous aircraft that can drop a book or a pair of shoes at your home within 30 minutes of receiving an order.

So it’s not difficult to imagine a day when you no longer have to rush out to the store in your pajamas for a quart of milk. In fact, Dominos has already begun to test drones for pizza deliveries in New Zealand. And Walmart is examining ways to deploy drones inside its warehouses to photograph and catalog inventory. The retail giant has offered few ­details on its plans, but if it used drones for transporting goods, too, it would be a game-changer: 70 percent of the U.S. population reportedly lives within 5 miles of a Walmart store.

Google’s research facility, known as Google X, launched a test program of its own in 2012. In one trial, the company has been delivering Chipotle meals to students and faculty at Virginia Tech. But rather than receiving a burrito in front of, say, a dorm, customers must place their ­orders at a local kiosk, then wait a few minutes while a drone approaches and lowers their food into a field with a rope.

So much for convenience. The point, says Blanks of Virginia Tech, is safely mastering the logistics. “Package delivery is one of the harder challenges to overcome,” he explains. “It involves operating over people, controlling multiple aircraft at once, and handling spikes in demand at certain times of day.” But if Blank’s researchers can create an effective air-­traffic-­control system, we could be looking at much more than a cure for the late-night munchies. Cutting down on the number of delivery vehicles on the ground could reduce the strain on the nation’s streets, highways, and bridges, too.

**Bottom line.** Don’t expect Amazon to roll out mass drone deliveries for at least three years.

**Agriculture**

In recent years, farmers have discovered that drones are very useful for monitoring the health of their fields. “It would cost me a couple hundred dollars an hour for a plane or helicopter,” says fourth-generation grain and apple farmer Jeff VanderWerff. “With my [DJI] Phantom 3 drone, a ­device I paid $1,200 for, I can fly it every day.”

When he gets a commercial license, he plans to put the craft to use on the family’s 1,800-acre Michigan grain farm. Aerial imagery from a drone equipped with an NDVI (normalized difference vegetation index) camera could help him accurately estimate the yield of a crop in July, rather than waiting until harvest in October. With special software he could analyze that imagery, spotting crops beset by diseases, weeds, and flooding while there’s still time to save them. And he could then use the drone to efficiently apply fertilizers and pesticides.

At the moment, he has to use a giant crop sprayer to treat the entire field. “With drone technology,” he says, “I’m going to determine exactly where the problem exists and apply pesticide to that area alone. Rather than 80 acres, I might treat just 15.” That means fewer pesticides on the food, lower fuel use and emissions, and more healthy plants at harvest time.

**Bottom line.** Drone use on farms will become more significant when FAA rules permit certain flights beyond the pilot’s field of vision.

**Photos and Videos**

 “If you want a moment to look epic,” Parker Gyokeres says, “hire a drone.” As a photographer in the Air Force, he once built a drone from scratch, outfitting it with a GoPro camera, because he could not persuade anyone to take him up in a helicopter. Today he owns a fleet of autonomous aircraft in New York that he uses to shoot projects as ­varied as BMW commercials, corporate events, and weddings (including the nuptials of U.S. Rep. Sean Patrick Maloney, D-N.Y.).

The soaring panoramas captured by drones are compelling enough to have made their way into movies such as “Captain America: Civil War,” “Spectre,” and “The Wolf of Wall Street,” as well as CNN’s coverage of the earthquakes in Italy and Ecuador a year ago. Real ­estate agents and travel hot spots are embracing the technology, too, to promote their scenic offerings. And now that drones can be programmed to follow their owners, they’re even more likely to turn up in the air above cyclists, skiers, surfers, hikers, and kayakers.

**Bottom line.** Images from drones are appearing right now on TV, movie screens, YouTube, and Instagram feeds.

**Humanitarian Aid**

Some 1.3 billion to 2.1 billion people on the planet don’t have access to essential medicines, the World Health Orga­ni­za­tion says, often because they live in hard-to-reach places. To address that concern, California drone maker Zipline signed a deal with the government of Rwanda last February to shuttle supplies to remote areas on demand.

With “Zip” drones, which cover a roughly 50-mile radius, a health center in Rwanda can send a text message to order blood for a patient with severe malaria-related anemia and it shows up via parachute within 40 minutes.

“We are already delivering more than 40 percent of the transfusions for the entire country,” says Zipline founder Keller Rinaudo. “These are cases where, if bad roads or lack of supply prevents deliveries, people die.”

Similar efforts involving organizations such as UNICEF and Doctors Without Borders and the companies Matternet and Vayu are already underway in Malawi, Madagascar, and Papua New Guinea. Even certain remote locales in the U.S. will soon benefit from such services. Last August, the Obama administration announced that it would partner with private-sector firms to begin testing the idea on Maryland’s Smith Island, Washington’s San Juan Islands, and Nevada’s Pyramid Lake Tribal Health Clinic.

**Bottom line.** Drones are now delivering medical supplies in countries beset by malaria, tuberculosis, and AIDS.

**First Responders**

In February 2015, the Michigan State Police received FAA approval to fly a SkyRanger quadcopter made by Canada’s Aeryon Labs for public safety efforts. A week later, troopers used it to investigate a suspicious fire in Jenison. According to Aeryon CEO David Kroetsch, the craft can also be used to conduct search-and-rescue operations, gather aerial intelligence for SWAT teams, and even map accident scenes. That last task usually involves an officer on foot measuring the crash site and sketching the details on graph paper—a system ripe for inaccuracy, given the time constraints. With a drone and a laptop, he can instead stitch together a series of geotagged photos and even film fly-throughs to determine what drivers might have seen in the moments before impact. “That’s evidence-grade data,” Kroetsch says, “and it can be done in 15 minutes.” By completing the mapping quickly, officers can reduce the length of lane closures on busy highways, potentially sparing hundreds of thousands of dollars in tolls for a state, he says.

Better yet, aerial footage provided by drones keeps early responders out of harm’s way. In a SWAT scenario, for exam­ple, a camera-equipped craft with a powerful 30x zoom lens can give officers a close-up look at a compound where hostages are being held—while they remain 1,000 feet away. And, likewise, a fireman can fly a drone with thermal-­imaging and video-streaming capability over a four-alarm blaze and determine, in real time, where to ­direct his colleagues and where to help them avoid trouble.

Of course, drones with zoom lenses also raise the specter of unwanted surveillance. In a 2012 Monmouth University telephone poll, fewer than one in four Americans endorsed the idea of having the aircraft patrol the nation’s highways, doling out speeding tickets. That’s why the Michigan State Police have taken a cautious approach, even meeting with the American Civil Liberties Union to review policies, says Sgt. Matt Rogers, a member of the force’s aviation unit. “The last thing I want to do is create case law,” he says. “If using a drone furthers an investigation, we require a search warrant.”

**Bottom line.** Drones will become a vital tool for police ­officers and firefighters in the next five to 10 years.

**Safety Inspections**

Drones are exceedingly effective at finding structural flaws, not only because they can quickly and efficiently take high-resolution images and laser scans but also because they can get up close in treacherous spaces, such as the underside of an offshore drilling rig or the top of a cell tower.

Boeing’s drone-making subsidiary Insitu is working with BNSF Railway to test rail-inspection possibilities in New Mexico. “If there was a lot of rain overnight,” says Jon ­Damush, the company’s vice president and general manager, “we could send an unmanned sentry out before the first train of the day and see if there was a washout.”

With a waiver to the flight rules that prevent drones from flying beyond the pilot’s view, the technology could one day be deployed to spot-check roads, bridges, pipelines, dams, and other public works. That could allow for better use of limited tax dollars. “Even with the same amount of funding, with better information workers can be deployed to the places where they’re most needed,” says Thomas Haun of PrecisionHawk, which offers drones and data services to energy companies, utilities, and construction firms. In the U.S., a country with a D+ infrastructure rating (according to the American Society of Civil Engineers), that’s no small thing.

**Bottom line.** Inspection crews are already putting drones to use, and the scope of those efforts will increase as regulations get sorted out.

**Insurance**

“Let’s say a hailstorm rolls through Texas and damages 2,000 roofs in its wake,” says Dan Burton, founder of DroneBase, an Uber-like service that connects businesses with independent drone pilots. “We could go take some pictures and then say, ‘Based on the damage to this roof, there’s a 98 percent chance you will pay a claim. On this other one, it’s 80 percent.’ ”

With that in mind, most of the major insurance companies are now experimenting with drones, some by hiring outside contractors, others by sending out aircraft of their own. If you’re a claims adjuster, it saves you time and money, and reduces the risks of climbing ladders and walking on damaged roofs. But if you’re the customer, that might not translate to lower insurance premiums.

“I doubt the savings will be passed on to consumers,” says Skylogic Research’s Snow. But those reductions in inspection time could lead to quicker settlements, and the detailed documentation in the aerial photos feasibly could aid with disputed claims.

**Bottom line.** This application could be widespread very soon.

**Internet Access**

Well over half the planet’s population—some 4 billion people—currently has no internet access. A full 1.6 billion live in areas too remote for mobile broadband. That means no Facebook, of course, but also no email, no world news, no information and instruction from YouTube, and no access to online commerce. And without a huge investment in satellites and cell towers, that’s mighty difficult to change.

Google has floated a plan to fix the problem by relaying internet signals via a network of giant, high-altitude balloons, but the company is also reportedly looking into drones as a solution. Facebook is headed that way, too.

In the latter company’s vision, a series of lightweight drones with the wingspan of a Boeing 737 will cruise high above normal airspace delivering connectivity to people within a 60-mile radius. Powered by batteries and solar ­energy, they will remain aloft for three months at a time. The company can’t say when the project will be operational—“significant advancements in science and technology will be needed,” a spokesperson says—but last June a full-scale prototype (shown at the top of this article) made a successful test flight of more than 90 minutes over southern Arizona.

**Bottom line.** It could be five to 10 more years before the program takes flight.

**Hurricane and Tornado Forecasting**

In the future, when a severe tropical storm approaches Florida, as Hurricane Matthew did last October, auto­nomous aircraft developed by defense contractor Raytheon Missile Systems could fly right up to the maelstrom to take measurements for the National Oceanic and Atmospheric Administration (NOAA).

Originally created for anti-submarine warfare, the small, fixed-wing crafts known as Coyotes launch from the bottom of hurricane hunter planes, which often fly in the upper reaches of a storm, often more than 10,000 feet in the air. The Coyotes can, by contrast, maneuver around at 500 feet—right at the dangerous boundaries of the storm, where the most dramatic atmospheric changes occur.

“Instead of a camera to find bad guys,” says John Hobday, head of business development for unmanned air systems at Raytheon, “the Coyotes carry atmospheric sensors to measure things like air pressure, temperature, wind direction, and humidity.” The changes they detect govern how a storm moves and what kind of damage it might do.

“For NOAA, that is the info they have to deliver accurately to authorities in Miami, New Orleans, or Charleston,” Hobday says. “They need to be able to say with a high degree of accuracy, ‘This is the big one. You need to worry about it now.’ ”

For tornadoes, the margin for error is even narrower, ­explains Brian Argrow. A professor of aerospace engineering at the University of Colorado Boulder, he has been conducting research with drones for more than 15 years. “Right now, the average warning time for a tornado is 14 minutes,” he says. “Drones enable us to get data that’s going to protect property and save lives.” But because tornadoes travel on land, beneath airspace governed by the FAA, it will take some time to iron out the necessary safety guidelines.

**Bottom line.** This is happening in limited scope now.

**Wildlife Conservation**

In recent years, scientists at the Woods Hole Oceanographic Institution in Massachusetts have used drones to monitor the health of humpback whales off the coast of Cape Cod, even capturing from their blowholes breath samples flush with DNA that can be analyzed for wildlife studies. The U.S. Geological Survey has also dispatched them to observe sandhill cranes in Colorado. But to date, the tech’s most profound contribution to wildlife protection might be unfolding in Africa, where drones are policing vast tracts of land to catch poachers hunting rhinos and elephants. The horns and tusks of those animals can fetch hundreds of thousands of dollars from Asian crime syndicates.

Instead of having park rangers go out after dark to try to catch the heavily armed bandits, drone pilots patrol the targeted areas with their aircraft, collecting data used to predict the poachers’ movements. “We look at the patterns of how the animals move because that dictates how poachers move,” says Bowling Green State University professor Thomas Snitch, who is working to refine the approach. “We keep track of water sources because the animals have to get water every day.”

That information is then cross-referenced with factors such as the weather and time of the month—because, for instance, well-lit full-moon nights are particularly dangerous.

**Bottom line.** Wildlife protection programs involving drones have been evolving since 2011.

**Editor's Note:** This article also appeared in the [January 2017 issue of Consumer Reports magazine](http://www.consumerreports.org/cro/magazine/2017/01/index.htm).

**Clarification:** In an earlier version of this story, we referred to Virginia Polytechnic Institute and State University as Virginia Tech University. We have revised the name to Virginia Tech, which is the more common shorthand for the school.