

## Industrial Use of Drones: What's in the Works?<sup>1</sup>

Drones are projected to soon become a multi-billion dollar industry. Predictably, industry is not immune to the allure of the precision, safety and efficiency that autonomous aerial systems are capable of delivering. Industry has adapted to the limited drone use that is currently authorized by the FAA, deploying drones in nearly every industry imaginable. Industry's options for working with drones will only expand and will do so quickly.

Currently, special permission from the FAA is required for beyond visual line of sight drone operations (BVLOS), operations at night, and urban operations, which operational types are necessary for drones to reach their full potential. These limitations are a significant constraint on the drone industry's ability to fully mature. However, those constraints are quickly being resolved by the dizzying progress of drone technology. Once FAA is convinced that BVLOS and night operations can be safely conducted and that it is safe for drones to operate over populated areas, drones will quickly emerge as a leading tool for industry to become more efficient, safe and innovative.

Some industrial uses of drones in the works follow. However, please keep in mind that by next year, this list is likely to be obsolete, and in two years, quaint.

### **Autonomous Air Passenger Travel/Autonomous Air Operations**

Currently, there is little for a human commercial pilot to do in passenger air operations. Pilots now are useful in take-off operations, monitoring weather conditions, tracking fuel consumption and are available to take control of an aircraft if necessary. But impressive autonomous systems are already in place in today's commercial air operations to fly a commercial airliner once it is aloft and can even land it.

With NextGen coming on line in 2020, commercial aircraft will be expected to utilize the National Airspace System even more efficiently and commercial aircraft will be required to fly in closer proximity to one another than ever before. For this to work as envisioned, robots must largely control air operations in the NAS. There is no room for human error. Enter the testing of fully autonomous commercial aircraft.

Boeing is developing a fully automated passenger aircraft. <https://www.wired.com/story/boeing-autonomous-plane-autopilot/>

Airbus is also developing an autonomous passenger aircraft. Specifically, the "Vahana", an electric, self-piloted aircraft is being developed by a subsidiary of Airbus and is being tested at the Pendleton UAS Range in Oregon.

Dubai was to have launched a taxi drone manufactured by Chinese Ehang 184 this July that carries a single person who directs his or her flight using an onboard navigation pad. <http://www.cnn.com/2017/03/17/tech/ehang-passenger-drone-dubai/index.html>. However, the service itself did not begin in July, but a well-publicized test of the taxi occurred in July instead.

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<https://www.thenational.ae/uae/transport/all-eyes-to-the-sky-as-dubai-s-flying-taxi-takes-off-for-the-first-time-1.484382>

The Chinese company Ehang 184 is also testing its drone taxi in China.

<http://www.popularmechanics.com/flight/drones/a24584/ehangs-autonomous-passenger-drone/>

Lockheed Martin's K-Max is a fully autonomous firefighting helicopter. It is capable of not only getting into tough places with water and fire retardant that are dangerous for manned aircraft, but also can restock personnel on the ground or even extract firefighters in trouble.

<https://www.youtube.com/watch?v=g9vIk0qY0sY>

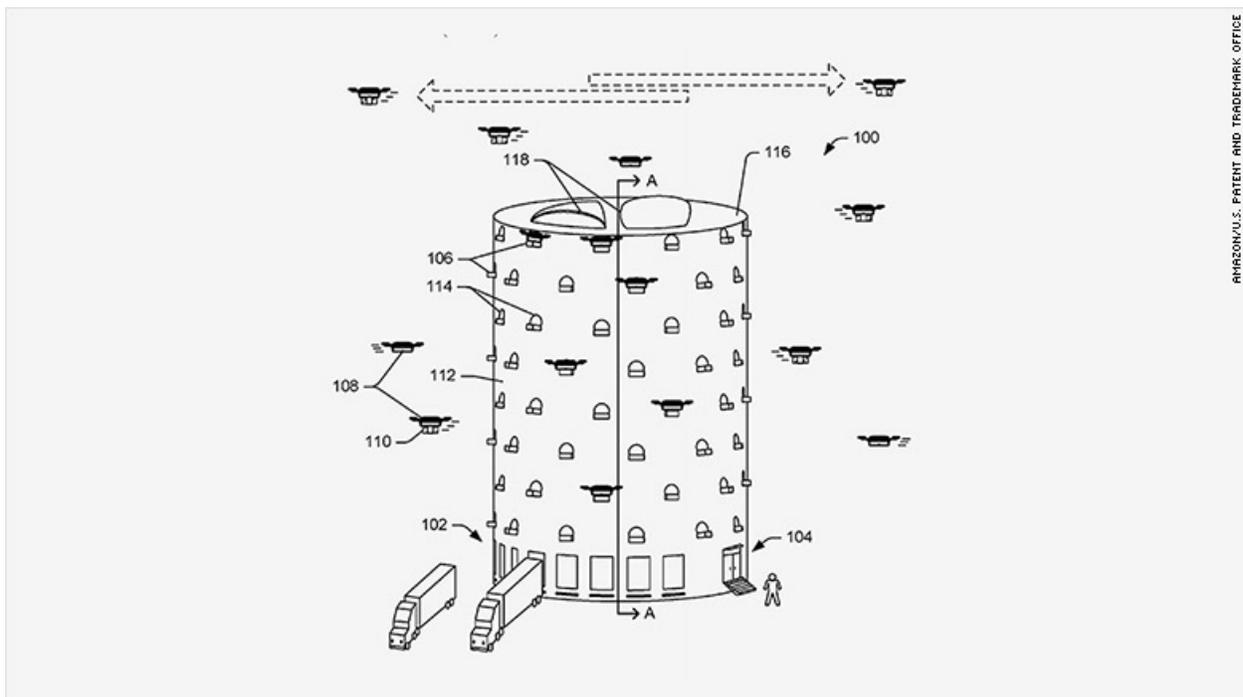
### Package / Food / Medicine Delivery

Drones are used to deliver medicine and blood in remote regions of Africa. Those deliveries are likely to start in the US as well. According to The Verge, August 2, 2016: "California-based Zipline will bring its drone delivery program to rural and remote communities in Maryland, Nevada, and Washington, including some Native American reservations. Zipline will announce its expansion at a White House workshop on unpiloted aerial vehicles (UAVs) Tuesday morning." See <http://flyzipline.com/>

European and Chinese postal agencies and the United States Postal Service

<https://www.usps.gov/blog/do-americans-want-drone-delivery> are looking into using drones for mail and package delivery.

Amazon has famously pressed forward with package delivery plans, using drones. Amazon has filed a variety of patents for package delivery services a reality, including for drone bee hive like fulfillment center towers (<http://money.cnn.com/2017/06/23/technology/amazon-drone-beehives/index.html>):



United Parcel Service began testing package deliveries, launched from electric UPS trucks, to make deliveries in rural areas, while a driver delivers another package. Dominos is experimenting with pizza delivery, dropping off a pizza in Whangaparaoa, New Zealand in November 2016. Google delivered Chipotle burritos via drone to Virginia Tech in November 2016. New Jersey's Cape May Brewing Company announced that it would begin drone beer deliveries in May 2017, but so far it does not appear to have yet done so. Point being, drone deliveries are sure to be a part of our near future, although as a practical matter, FAA must allow BVLOS, night time and operations over people for such deliveries to become ubiquitous. Most people agree that this is unlikely to occur on a generalized basis before 2020.

### **Agriculture**

Drones are deployed with optical and multisensory in agriculture to perform a number of tasks in agriculture. Drones collect crop data – like determining crop yield or to determine whether crops are getting enough water, whether insect or fungal infestations are starting and where and so forth. Drones can be used for the spraying of pesticides. Drones will be used in roundups and animal monitoring in remote regions.

### **Managing Building Sites**

Technology exists and is being perfected to enable industry to use a drone to survey a job site and build maps and assemble complex data sets for things like comparing an engineering design file with as built progress, or determine whether construction or grading elevations are correct or any number of other applications. Previously, obtaining such information was the province of heavy machinery & expensive surveying tools and man hours, that took a great deal of time, was expensive and not always accurate. For example, determining elevations could take an experienced field engineer hundreds or more survey shots and would not supply the end user as much information as a few hours of drone time can provide. Further, drones can improve worker safety and a companies' OSHA compliance – things like distances between a spoil pile and trench can be accurately determined and maintained. Drones make property inspections reasonably fast, efficiently and accurately.

### **Mining, Oil and Gas Industries**

The mining, oil and gas industry have embraced drones in large measure due to the fact that such operations occur in notoriously remote regions and are expensive and tie consuming. Here, drone technology truly shines. Drones provide inspections, and data collection, including calculating the location of resources, the volume of available resource, the size of stock piles and remaining capacity. Regarding the latter, a drone can calculate the volume of stock-piles many times faster, and with greater accuracy and reliability, than a human. Drones are useful in monitoring erosion, gathering and interpreting pre- and post-blast data, identification of misfires and wall damage, thermal detection of ground water inflows, etc.

## **Real Estate & Construction Industry**

Drones are useful in structure inspections and property marketing. Almost no real estate agent worth his or her salt markets property without the use of drone captured imagery.

Drones can check gas tanks and lines for leaks. Drones can monitor site security, in the future staying aloft for hours and covering vast distances, alerting police or other security forces of intrusions and identifying perpetrators.

Drones can be the “eyes” of fully automated bulldozers. These drones can map an area in three dimensions and can also track the progress of dirt movement activity.

## **Insurance Industry**

The insurance industry was an early adopter of drone technology. Drones have been helpful to insurance adjusters to evaluate property damage. Drones can capture imagery of places that are difficult or dangerous for humans to reach. Drones are small and easy to maneuver. State Farm began inspections for roof damage mid-2016. Drone data collection can also evaluate the extent of property damage and in this way are useful in the avoidance of fraudulent claims.

Drones are being used to evaluate risk and tailor pricing to customers.

### **Other Non-Industry Specific But Important Uses For Drones Include:**

1. Search and rescue operations
2. Emergency response including in remote areas or where people cannot safely go

An ambulance drone has been developed that could quickly deliver life-saving aid to workers in remote areas. <https://www.youtube.com/watch?v=y-rEI4bezWc>

3. Monitoring public events / spaces for terrorist activity before it happens
4. Animal science and research
5. Preventing poaching and wildlife crime

## **Overcoming Technical Obstacles**

### *Battery Life*

Regulatory impediments to fully autonomous flights are not the only obstacle to drones reaching their full potential. One of the most vexing issues for small commercial drones is battery life and the need to switch out or recharge batteries after a relatively short period of time.

On the horizon are innovative ways to either change drone batteries or recharge them and exchange drones. Successful drone deployment requires an energy infrastructure system to power them.

Companies are developing autonomous battery swap stations which can be “daisy chained” over long distances. <http://dronelife.com/2016/11/02/group-friends-mit-might-just-solved-battery-problem/>.

Autonomous battery charge areas are begin developed which can include quick charge drone charging pads. <http://www.skysense.co/>

One company has developed an autonomous battery swapping station to be maintained at construction sites. <http://newatlas.com/airobotics-system-drones/43985/>

Another strategy is wirelessly charging drone batteries. This will be done using cell towers and other technologies. <https://www.engadget.com/2017/02/27/huawei-drone-charging-cell-towers/>.

A fairly dense technical paper explains the technology behind wirelessly charging drones. [https://www.google.com/search?q=self+charging+quadcopter&sa=X&ved=0ahUKEwjF-duRjNrVAhUO2GMKHfP\\_BLMQ1QIIggEoBQ&biw=1774&bih=983](https://www.google.com/search?q=self+charging+quadcopter&sa=X&ved=0ahUKEwjF-duRjNrVAhUO2GMKHfP_BLMQ1QIIggEoBQ&biw=1774&bih=983)

### *Improving or Creating Internet Signal in Remote Areas*

Google, among others, is developing a system to use drones to transmit signal, a system tht is briefly described below <https://www.theguardian.com/technology/2016/jan/29/project-skybender-google-drone-tests-internet-spaceport-virgin-galactic> :

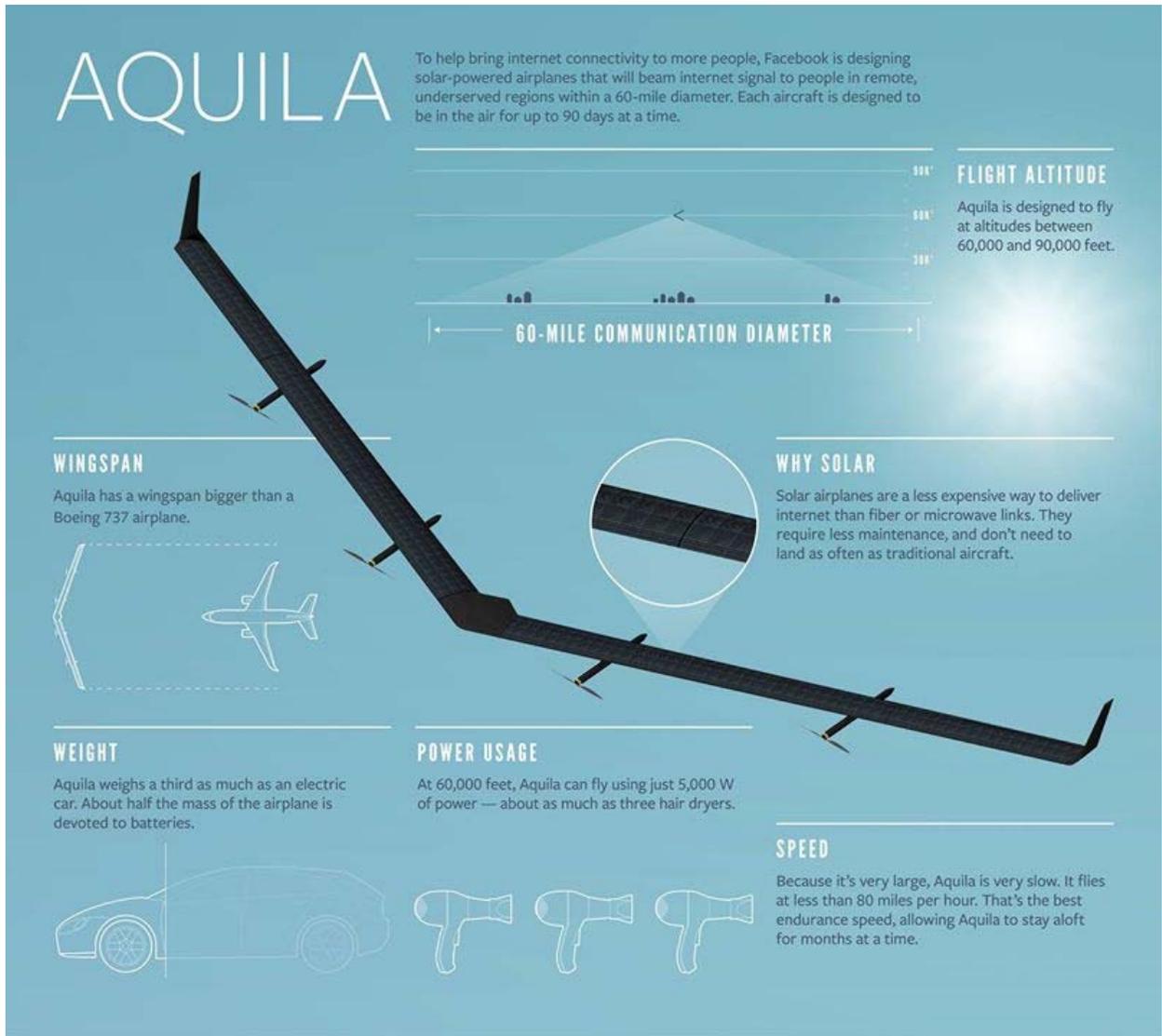
“Based out of the site near the town called Truth or Consequences, Project SkyBender is using drones to experiment with millimetre-wave radio transmissions, one of the technologies that could underpin [next generation 5G](#) wireless internet access. High frequency millimetre waves can theoretically transmit gigabits of data every second, up to 40 times more than today’s 4G LTE systems. Google ultimately envisages thousands of high altitude “self-flying aircraft” delivering internet access around the world.

“The huge advantage of millimetre wave is access to new spectrum because the existing cellphone spectrum is overcrowded. It’s packed and there’s nowhere else to go,” says Jacques Rudell, a professor of electrical engineering at the University of Washington in Seattle and specialist in this technology. \* \* \*”

Similarly, Facebook in 2016 announced its first test of a plan to transmit internet signal to places that are currently unserved or underserved, using drones as the conveyance of “millimeter wave radio signal” (MMW radio technology).

<https://www.cnet.com/news/facebook-f8-acquila-drone-internet-wi-fi-getting-better/> . That first flight crashed after about 90 minutes, substantially damaging the aircraft. A second test was conducted by Facebook in May 2017, which lasted 1 hour 46 minutes and landed safely on the ground. Using a solar powered drone about the size of a 737 but weighing in at just 1000 lbs called “Aquila”, the idea is that the aircraft can hover at high altitudes for months or potentially years, and transmit signal anywhere which signal can be received on the ground within a 60 mile radius.

Facebook provided the below graphic accessible online  
<https://www.facebook.com/notes/mark-zuckerberg/the-technology-behind-aquila/10153916136506634/> :



### *Overcoming Policy/Acceptance Obstacles*

Issues of privacy and private property have yet to be resolved. Until these issues are resolved, drones can expect an icy welcome in consumer quarters.

The question of the displacement of jobs humans formerly provided is one we wrestle with across the technology spectrum and drones present issues that are no different. Than ones we've wrestled with since automation first became a viable manufacturing tool. Technology is here and retraining displaced workers is a policy priority that is and has been important as the employment landscape matures, with or without drones.

## **Summary**

Drones have nearly limitless applications to improve the lives of people and to help industry function more efficiently, more accurately and less expensively. The obstacles to full drone implementation are sure to be overcome in a few years, making drone technology one of the most exciting technologies to watch and be a part of, ever.