

THE RISE OF THE DRONES

"The machine yes the machine/never wastes anybody's time/never watches the foreman/never talks back." Carl Sandburg (1936)

Sensationalized in popular culture by the *Star Wars* movies and made sinister by their use in the war on terror, automated drones will fly above the public and investors soon, performing tasks that raise their standards of living and their investment returns. We are destined to have this experience because Congress ordered it in 2012. The introduction of unmanned aerial vehicles (UAVs), the formal name for drones, into American life may begin as soon as October 2015, just 14 months from now.

They will give many of us the willies until we become comfortable that drones are safe, will not invade our privacy, and will not undermine civil liberty. Their first uses will transform agribusiness, boosting yields and lowering crop prices. It will help agribusiness and ethanol manufacturers, while slashing fertilizer and pesticide use, and undermining fertilizer and pesticide companies. Soon thereafter, drones will revolutionize package delivery, to the delight of Amazon, UPS, and FedEx shareholders, and taxpayers who are tired of large, never-ending, postal service losses. UAVs already are operating in Alaska, helping [British Petroleum](#) look for oil. Governments will use them to put out forest fires, to catch criminals, and to guard borders. This is just the beginning.

If You Dislike the UAV Future, Blame Congress; If You Dislike Its Delay, Blame the FAA

It has been apparent for some time that UAV deployments would become cost-effective quickly if the authorities permitted them. However, the Federal Aviation Administration (FAA), which controls America's airspace, forbids UAVs for commercial use unless they first grant a Certificate of Authorization (COA), which they rarely do. In 2012 Congress stepped in by passing the [FAA Modernization and Reform Act](#). Fed up with slow progress on integrating UAVs into the national economy, Congress gave the FAA 17 specific UAV deadlines and tasks. Most importantly, section 332 gave the FAA marching orders to integrate safely UAVs into the national air space by September 2015.

Few executive branch agencies are known for efficiency, and the FAA is not an exception. It is apparent that the FAA will not make its August 2014 deadline to issue a final rule covering UAVs that weigh 55 pounds or less, nor the broader September 2015 objective. However, they are moving forward, and the safe integration of UAVs into the national airspace will happen. For a realistic assessment on where matters stand, investors should examine the report issued by the Department of Transportation's [Assistant Inspector General](#) on June 26, 2014. Key Congressional officials, the Chairmen and Ranking Members of the Senate Commerce Committee and the House Committee on Transportation, requested this audit. Congress is watching, and it is annoyed that the Obama Administration is not using its discretionary authority more aggressively to move forward.

After compelling the FAA to answer numerous detailed questions, DOT's Office of the Inspector General reported to Congress that the FAA expects to approve the "small UAV rule" in 2015. This is a key announcement for attentive investors. Agribusiness uses of UAVs should grow rapidly once the agency issues its final small UAV rule because crop-mapping drones are light and easily controlled by line-of-sight operators. Package delivery drones also are light and will meet the 55 pound standard. However, if they go more than a few thousand feet away, they cannot be controlled using line-of-sight vision. Their full roll-out will take more time.

The Big Three Drone Problems: Runaways, Collision Avoidance, and Unethical Snooping

Over the long haul, the FAA will wrestle with three large problems in writing UAV rules:

- *Preventing "runaways" when links between drones and their base stations are disrupted:* There is a simple and easy solution to "runaways." UAVs will be programmed to "return to base" whenever signals between them and their base stations are lost.
- *Preventing UAVs from hitting each other, large aircraft, or birds:* In the next decade, it is likely that few commercial UAVs will fly higher than 400 feet or fly within 3 miles of an airport for safety reasons. These rules will make collisions with larger aircraft unlikely. But UAVs still will confront dangers at lower altitudes, making effective "sense and avoid" technology mandatory. Several ideas have proven to work, with "automatic dependent surveillance broadcast" (ADS-B) designs the leading one. ADS-B systems send out continuous low-powered lasers to perform spherical sweeps of the relevant airspaces and trigger evasive maneuvers as needed. One system now weighs only 3.5 ounces. Safety experts consider ADS-B an improvement over currently-used radar, and most U.S. aircraft of any size will rely on them by 2020, per FAA order.
- *Preventing UAV users from illegally invading the privacy of others:* Few corporate UAV "pilots" will use drones to invade privacy. Tort law and criminal law already provide damages and jail times for invasions of privacy caused by peering into homes, and such laws also cover invasive UAV use. In addition to strong legal penalties, companies can limit flight plans and times of operation to limit possibilities of employee misbehavior. It can also audit pilot behavior and, of course, fire violators.

But what should the government do about companies that decide to hover 380 feet above someone's house for twenty seconds, for marketing research purposes, to see if he owns a dog or whether he has an outdoor grill in the backyard? Is that a privacy invasion? President Obama soon will task the National Telecommunications and Information Administration to coordinate preparation of an Executive Order he will sign on drone privacy. NTIA will consult with other federal agencies and work closely with private stakeholders in developing this Order. After that, America will have a formal drone privacy policy. Initial privacy rules will be updated by actual experience. None of these rules should interfere with clearly legitimate UAV uses, to boost agriculture yields or to deliver packages, however.

UAVs-- Disruptive Technology That Will Boost Farm Yields and Cut Costs

Archeologists inform us that men ceased being hunter-gatherers 10,000 years ago when homo sapiens invented agriculture and animal husbandry. His efficiency at doing so continues to improve, with large gains occurring in the last two hundred years. Widespread adoption of UAVs on the farm in the next decade means this trend is intact.

Currently, American farmers typically "walk the fields" and sample one out of every 1,000 plants to determine where their fields need more or less moisture, fertilizer, and pesticide. They then use crop dusters or ground equipment to treat the soil as needed. UAV use will make this process far more efficient. UAVs soon will be taking pictures and video of farm fields with cameras that can detect the health of individual plants or stands of plants, a level of accuracy far beyond what sampling provides. It will become routine to program the entire back-and-forth flight path of a UAV to film a farm. The images will be seamed together by specialized software to reveal areas on a 1,000 acres farm that need water or fertilizer, for example. The technology is maturing, and a common method is to use Normalized Difference Vegetable Indexing (NDVI) imaging.

At first, it will be ground-based equipment that will act on the information from UAV aerial maps, because drones that disburse fertilizer efficiently weigh more than 55 pounds.

The market leader is

Yamaha whose RMax drone weighs 200 pounds. Farmers in Japan use the RMax and similar systems as crop dusters on more than 90 percent of the country's [rice fields](#) . It is easy to visualize how precise farm maps will boost crop yields while cutting the amount of fertilizer and pesticide use. The Association for Unmanned Vehicle Systems International (AUVSI) predicts in their [study](#) that grain yields will grow by 15 percent while fertilizer use will fall by 50 percent. An expert they cite also predicts a decline of 40 percent in pesticide use. This is wondrous news for farmers but grim news for the following companies. Demand for their products is headed for a sharp decline.

Six existing UAVs that could be mapping America's farms:

[Precision PaceSetter Drone](#) [The CropCam](#)

[Honeycomb AgDrone System](#) [The Precisionhawk Lancaster Platform](#)

[DJI Phantom FC40](#)

[DJI Spreading Wings S1000](#)

Company	Ticker	Market Cap (\$ bn)	Fertilizer Sales % of Revenues	Pesticides/Herbicides % of Revenues	U.S. Sales
Potash	POT	30.34	88%		56%
Mosaic	MOS	18.15	89%		39%
Terra Nitrogen	TNH	2.64	100%		100%
CF Industries	CF	13.3	100%		82%
Rentech Nitrogen Partners	RNF	0.656	100%		100%
CVR Partners	UAN	1.4	100%		100%
Intrepid Potash	PIP	1.12	88%		96%
Monsanto	MON	61.57		30.40%	54%
Agrium	AGU	13.29	79%	21%*	77%

*Includes seeds

Drone Advances Will Help Many

Clearly, farmers' profits grow if they use UAVs to economize on the use of fertilizer and pesticides. The average corn farmer generates \$750 per acre in revenue, while a wheat farmer generates \$300 per acre. However, the corn grower pays \$185 per acre in fertilizer and other chemical costs to do so, while the wheat farmer lays out \$60 per acre, according to the [Department of Agriculture](#). When UAV use cuts fertilizer and pesticide use, the cost of producing corn will fall by approximately 12 percent, and wheat production costs will fall by 10 percent. This will boost per acre profitability, based on existing yields, by 25 percent or more. Now assume that AUVSI is correct, and that due to precision agriculture, yields grow by 15 percent. It is not hard to predict that future corn and wheat supplies will be plentiful and highly profitable.

With bumper corn crops likely for many years, ethanol producers will be loving life. Corn represents 80 percent of their costs of production, and corn prices will decline. Their all-important oil-corn price spread will widen, helping Great Plains Resources (**GP**RE), Pacific Ethanol (**PE**IX), and Rex Resources (**RE**X). Naturally, Deere (**DE**) and Caterpillar (**CAT**) also will benefit. With both farm income and yields getting a boost from precision agriculture, demand for their machines will grow. With the exception of fertilizer and pesticide producers, this green revolution is good for everyone.

Amazon: When Allowed, Drone Delivery Will Send Profitability Flying

Two weeks ago, Amazon (**AMZN**) reported its second quarter results. Once again, the company disappointed and reported a loss of 27 cents per share, despite a 23 percent increase in year-over-year quarterly revenues of \$19.3 billion. Is Amazon doomed to profitless prosperity despite its \$144 billion market cap? When the FAA lets them use drones to deliver packages, the answer is "no." The future is closer than it appears as this link demonstrating its Prime Air [drone delivery system](#) makes clear. Not only are drone deliveries technologically feasible, they already are taking place in Australia where Zookal is using drones to deliver textbooks. Elsewhere, Shunfeng Express is using them to deliver packages in Dongguan, China.

Investors should care -- drone delivery is cheap

It costs Amazon a pretty penny to deliver a hardcover copy of "Fifty Shades of Gray."

- One "back of the envelope" [savings calculation](#) finds that *it costs 9 cents to deliver a package by drone and \$1.20, thirteen times as much, to deliver a package using a truck and driver.*
- Another analyst, a skeptic who believes that drone delivery will never routinely happen, nevertheless finds *it costs 50 cents to deliver a package using drones, compared to \$1.00 per package using trucks and [drivers](#).*
- The skeptic believes that if Amazon uses drones on some items, this will drive up the unit cost of delivering other items, negating the savings; this assumption is flawed if drone use becomes widespread.

Just how important is this issue to Amazon? Amazon's global revenues are \$74 billion and its global shipping costs are \$6.6 billion. North American revenues are \$44 billion, implying proportionate shipping costs of \$4 billion. Netting out estimated Canadian costs leaves estimated U.S. shipping costs of \$3.5 billion. Initially, the FAA is unlikely to allow delivery of heavier objects. If the FAA will only allow drones to deliver 86 percent of Amazon' packages, those

weighing less than 5 pounds, it will sanction the use of drones in areas where Amazon now spends \$3 billion dollars to ship. FAA requirements are one limiting factor. Geography and engineering restraints pose two other limits.

Drone delivery challenges

- It may not be practical to deliver items by drone in congested urban areas, at least until Amazon has established secure locations for roof top pick-up, or at nearby staging areas.
- A drone's battery life limits its range. Amazon's current delivery octocopter would have to make a pit stop and a hand off to another drone if the distance from its warehouse to the customer exceeds five miles.
- Given the skepticism over whether Amazon's octocopters will fly, little of this is reflected in its stock price.

Assume these constraints mean that one-third of U.S. addresses are off-limits to drones. This leaves U.S. shipping costs of \$2 billion dollars to deliver packages weighing 5 pounds or less to two-thirds of the locations Amazon now ships to. Finally, assume savings of 50 percent to 80 percent in drone-eligible delivery costs. This produces savings of \$1 billion to \$1.6 billion, equaling \$2.17 to \$3.48 per share, pre-tax. Trailing 12 months reported earnings are only \$0.38 per share.

UPS, FedEx, and the Post Office Also Will Use Delivery Drones -- Sooner Than You Think

Amazon's drone plans attract most attention, but the huge cost savings potential for using drones to deliver packages is not lost on UPS, FedEx, and even the Post Office. They are likely behind Amazon in testing and thinking, but probably not by much. Failure to innovate while competitors leap ahead could lead to dire consequences for any of those involved in package delivery. When your competitors announce permanent 40 percent price cuts because their costs are plummeting, you had better have a way to match them.

We estimate that the FAA will allow Amazon to deliver its first package to a customer by drone in 18 months. Integrating Unmanned Aerial Vehicles into the national air space will be phased in over several years, and it is likely that most packages weighing under five pounds will be delivered by drone by 2020.

In These Political Battles, the Empire and the Rebellion Can Find Agreement

Not every broad issue that Washington adjudicates is partisan. There is wide agreement that UAVs should fly safely, with rigorous privacy safeguards, as soon as possible. Right now, the idea of privately-owned and operated UAVs is flying under the radar, but commercial UAV use is destined to become routine. The speed of implementation will be determined primarily by how fast the FAA moves. As a technology, drones users are ready to revolutionize agriculture, and soon they will revolutionize package delivery -- but not all Americans are prepared.

For further analysis or information, contact Capitol Analysts Network, Inc. at:

2230 Decatur Place, N.W.
Washington, D.C. 20008
Email: capnet@xecu.net

Phone: 202-223-4014
Fax: 202-223-3380
website: www.capitolanalysts.com

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