

# Opportunities in Aerial Robotics 2014+

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## Overview

The author believes that aerial robotics is a burgeoning new field with numerous opportunities. However, overestimating the market may cause a classic “bubble” in these companies as the buzz around the industry grows. As with other budding technologies, the vast majority of companies entering this field will fail. This is especially true with aerial robotics as much of hardware is produced by large commodity manufacturers (intel, etc.). Also, much of the software is open source - which means there is unlikely to be a “Microsoft of the drone biz”.

On the positive end, it appears that the use of aerial robots is only limited by our imagination - technology has already produced most of the parts and will move forward much quicker than the total integration of any particular package(s). To the uninitiated, I like to explain it as follows. The real nerds among us have been pining for the “robotic revolution” for 30-40 years, but vast barriers have always stood in their way. As an example, look at the products from the robotic leader - Boston Dynamics:

<http://www.bostondynamics.com/>

Many tens of millions of dollars were expended in just making the robots walk. More was invested in obstacle avoidance.

**BUT, take a robot to the air and 90% of the development problems disappear!**

This is in addition to all the possible functions in higher aerial uses. Just the fact that a multicopter has freedom of motion makes it ideal for many application. **Therefore, it is possible that this is the robotic revolution we were all waiting for.**

A primary concern for investors or startups in this field is a simple one - how is the company going to make a profit! It may be that there are some rare examples of companies being purchased by bigger fish to take over their technologies, but in general those going into the drone business need to have a plan to continue to build the company. In addition, they must be extremely flexible and able to change their strategies and goals if and when it appears that their direction needs to be shifted.

It may be that smaller is better in aerial robotics - that is, the selection of known niche markets or the creation of same may provide opportunity without having to compete against the likes of google (they now own Boston Dynamics) and others already in the field.

Although smaller companies do not provide as much excitement to the investor looking for massive scale and returns, it may be the safer bet in this industry.

### **State of the Market in 2014**

UAV (unmanned aerial vehicles) are already in use worldwide. As an example, Yamaha makes unmanned helicopters used extensively in crop dusting, ag mapping, etc:

<http://global.yamaha-motor.com/about/business/sky/>

It may help to break the drone hardware market down to sectors. As the market matures, many of these divisions will melt away. Future “swarming” small multirotors may consist of 2 dozen units each selling for as little as \$100-\$200 - units which alone might be toys or hobby grade, but when in communication with each other and a ground station can perform complex tasks (search and rescue, etc.)

1. The Toy Market - this covers aerial robots which cost from \$30 to \$400+. The upper end of this market encroaches on the “hobby” market and there is some other crossover as hobbyists enjoy modifying some of the toys. In terms of number of units, this area is currently - by far - the largest. Millions of units are selling yearly. The smaller units are somewhat disposable, making for lots of repeat sales. Also, many consumer enjoy owning a variety of sizes and types, so it's very typical for the owners of toy-grade machines to spend \$200 to \$800 per year on their fun. Also, many will make the leap into hobby grade machines.

2. The Hobby and Hacking Market - now includes some prosumer video and photographers in addition to those who just enjoy flying, technology, customizing and building, etc.

The leader in this space, by far, is DJI Global:

<http://www.scmp.com/news/hong-kong/article/1370451/apple-pearl-river-delta-dji-innovations-taking-flight>

Given their growth rate, it's probably that they will surpass \$500 million in yearly revenue by 2015/2016.

Parrot is probably the next in line in this space - their new BeBop drones combined with their other small drones could move them towards a decent sales volume - a complete guess would be 200K units per year (looking forward to 2015) and perhaps 100-200+ million yearly in drone-related revenue.

3rd place in the mid-market.....hardly exists! Companies like 3D Robotics and many others are slowly building up their chops, but very few are executing perfectly. We could speculate that 3rd place companies such as 3DR may do \$10-\$30 million dollars in 2015+.

In 4th place, there are dozens of small shops putting together quadcopters on a semi-custom basis...many of them seem to have too much business to handle. These quadcopters range in price from \$350 to \$2,000+, and the upper end can encroach on the “professional grade” category. Yearly revenue for these small integrators is probably in the realm of \$100K to 2 million. Many are 1-2 man operations which use existing parts, perhaps with some touches of their own (they may manufacture open source hardware boards with slight differences to the reference version)

3. The prosumer, semi-pro, light commercial, light ag market - like the other two above relies on most purchasers being individuals or very small businesses. These entities, from pro photographers and videographers to site management (construction supervision, etc.) would be willing to spend 2K to 10K+ on the right equipment - often they will purchase multiple units for a crew or to serve as backup. As a reference point, the top of the hobby market - such as a DJI Phantom 2+ with additional batteries and accessories (\$1700+) would represent the bottom end of this sector. Large multirotors such as the DJI “Spreading Wings” series come into play, as these can lift DLSR Cameras or professional video cams such as the Red One and others from Sony, Canon, etc. (\$8K to 40K for cameras and lenses!).

4. Agencies, larger corporations, etc - may be good customers for drones in the \$10K to 50K price range. As priced increase, unit volumes decrease and customer service needs increase. It’s also possible (as with personal computers) that the high end will be disrupted by the capabilities of lower priced units.

#### *Brief Comparison to other Appliances and Technologies - life cycle*

It’s worth noting the relatively short life cycle and high maintenance cost of flying machines. This means consumers will continue to repair, replace and upgrade regularly - as the older machines tend to break, get lost or become obsolete quickly. Therefore, the market will likely be larger than some projections. As a suggestion, I would offer up the following as average replacement cycles.

Smartphones - 2 years

Laptop Computers - 3 years

Desktop Computers - 4 years

Unmanned Aerial Vehicles - 1 years (can be lengthened with service and replacement)

The above speaks to potential revenue, especially in the case of actual hard goods and per unit software licensing fees. The entire ecosystem which will be built around these

machines will also benefit - just as the large players which make accessories for smart phones have.

In summary, sales projections for drones should keep their short lifespan in mind - while also understanding that cumulative numbers will not rise as quickly due to the destruction (loss, crashing, etc.) of many units in the field.

## **Potential Functions - Present and Future**

### **Present**

Many screeds have already been written about the consumer uses for aerial robots. In terms of the individual consumer, these are currently:

1. Photography and Video
  2. Enjoyment, racing, technology demonstrations, pastime, hobby
- Stepping up one notch to small agencies, etc.:
3. Mapping, ag use, search and rescue (many options there), deliveries (especially emergency medicines and supplies over rough terrain, etc.).
  4. Inspection - House and building inspection (roof, construction, etc.)

### **Future**

As has been noted, uses are only limited by our imagination.

Examples:

1. Trim bushes, hedges and trees.
2. Clean gutters
3. Maintain and clean the glass and lenses on the millions of solar collectors being installed.
4. Help with pollination of certain crops or trees.
5. Actually perform small construction details - with these efforts getting larger as the tech improves. As it stands, for example, helicopters set a lot of the A/C and heat pumps on buildings over a couple stories high.
6. Clean glass on houses and tall building
7. More detailed inspections - such as rivets on airframes, etc (already proposed by Easyjet).
8. Pick fruits and vegetables

The above us just off the top of my head - this topic could be brainstormed and other examples suggested.

## Example of potential revenues and valuation

### *DJI - the "Apple" of Quadcopters in 2014*

DJI could surpass \$500 million in yearly sales in a year or two - but it's worth noting that they currently employ well over 1,000 people - not exactly a light head count. However, it's possible the automation combined with higher priced models will allow their top line to grow without vastly enlarging the number of employees. Then again, this industry may need brute force in order to shorten the development cycle.

It's fair to say that DJI is already a company which would have a multi-billion dollar market cap if it was to have an IPO or open itself to private investment.

#2, #3, #4, #10, etc.

As of mid-2014, the other multirotor companies which have carved out smaller pieces of the market:

Parrot

(consumer)

3DR

(hobbyist, hacker, research, prosumer)

<http://www.draganfly.com/>

(prosumer)

Horizon Hobby - Blade - <http://www.bladehelis.com/CameraPlatforms/>

(hobbyist, photographers)

<http://www.mikrokopter.de/en/applications/filmtven>

(photos, videos, inspection)

<http://www.asctec.de/>

(research, photography, inspection)

<http://www.aeryon.com/>

(public safety, inspection, etc.)

There are a couple other established small companies working niches in the market - as well as dozens of small firms and individuals putting together multirotors from parts. Revenues of the companies above can only be guessed at, but most are probably relatively small firms doing 2-10 million in revenue per year. In some ways this reflects the apple/samsung/everyone-else smartphone market where one or two companies are

making the lion's share of profits and sales and all of the rest need to find niche markets to sell more specialized machines (price, quality, customer service, features, etc. differential).

### **So Where is the new Money going to come from?**

Tough call. In 2014 it would be very easy to create various small businesses built around the various aspects of multirotors...but building something which is truly unique and of great value would be much more difficult. Some brainstorming below:

1. Multirotors themselves - companies such as the new Airdog sports multirotor could carve out nice businesses - especially since many of these types of applications do not rely as much on the FAA ( fewer problems having a quad following your mountain bike or sailboat than flying high). There are also some small companies such as RClogger which could fill spaces in the market if they had more capital and better advisors. Unit sales in the millions is not out of the question for lower priced (under \$300) multirotors. A company like Airdog ,with a unit selling at \$1500-\$2000 (with cam) might sell 10,000 units a year without some intense marketing and growth.

Sales of such hardware requires a plan and staying power, as well as marketing and customer service chops.

Purpose-made multirotors, such a fleets designed specifically to clean the front of solar panels, could have a market. Same goes for swarms designed to seek living things (search and rescue) and many other such uses.

2. Distribution, Insurance, Repair Depots, Extended Warranties, etc - the service sector may end up being a large part of this industry.

This requires further thinking - I can't help but remember a friend of our who partnered with another guy in his insurance firm and started one of the first insurance plans for cell phones. They were the company behind the policies your provider would sell you. They did very well.

Millions of aerial robots will be sold. Who will be fixing them - both under warranty and after warranty?

3. Aftermarket Accessories - there is certainly a lot of room for the "logitechs" and "Griffin Technologies" of the aerial robotic revolution. Quality is the key word here because the margins are too slim in the "low price" part of the market. Using the smart phone, computer speakers and other such examples, one could determine where the potential profits lie.

4. Software, Programming, Sensors, etc.

There are unlimited opportunities in this field, however there is somewhat of an Elephant in the room - which is open source, government financed and other projects which are available free or at very low cost. Unlike some previous technology revolutions, all the hardware and most of the operating systems already exist - it's integration and execution that matters. No matter how exciting a new programming feature seems, the real question becomes "who is lining up to buy this and for what price?".

I have a friend who has worked at MIT for years...on the physics and mathematics behind swarming intelligence and other similar topics. From what he told me, most of the research is published and available to all. The sum total of all the software used in quadcopters (Linux, sensors, IMU's, GPS, etc.) already represents many millions of man-hours and is available at low (or no) cost. It would seem a risky bet that a couple programmers at a startup could come up with something saleable which could not easily be replicated. In short, this author believes that software and interfaces will vastly improve over the next decade, but that most will occur to support the other business models, as opposed to as an end in itself (saleable technologies).

### **The People matter, as always**

*Companies need a specific vision and/or founders who have passion for a particular part of the industry - note that the founder of DJI and many other smaller R/C companies are hobbyists themselves - who went looking for a better way, ala Jobs and Woz. Without this passion and staying power, it's doubtful that startup aerial robotics firms will achieve success - because in whichever space you can name, there are many similar firms or individuals working on solutions. The winners will be the ones with the drive to succeed.*

### **For the Small Entrepreneur wanting to enter the Business**

While there is no such thing as a "sure thing", the field of aerial robotics has great potential for the hard working individual and small companies. These opportunities fall outside of the "investor" class of operations, but could be very rewarding to those who desire the freedom of working for themselves. The possibilities are almost endless and included smaller versions of many mentioned above, but here is a short list:

1. Entering the retail, importing or wholesale business - due to pressure on pricing, this is only relevant to the small company when you "add value" to the chain. This means that perhaps you test, modify and otherwise add to the stock units.

2. Photography, Video, etc - this could be a great part time way to add to an existing photography, marketing or video business.

3. From the ground up customization - more risky, but you could build a multirotor designed for building or chimney inspection, etc - these could be built from stock components as well as other systems (obstacle avoidance) being introduced into the market presently.

4. Education - Drone schools are becoming popular. These could run the gamut from informal education to possible licensing as the FAA gets their act together.

5. Repair Depots - although the business has not yet fully formed, it would seem that large companies like DJI are going to need to subcontract repair and testing services. This may also be true of others entering the market. Independent of business directly from the companies, multirotor owners are going to need repairs.....lot of them, and many will be extensive (and expensive).