

TO: Daniel Jacobs

FROM: Mickey Horn

DATE: August 15, 2017

SUBJECT: ECHO Drone V3

You asked that I research potential new drone options for ECHO. I have narrowed down my candidates to four drones: the DJI Spreading Wings S1000+, the SteadiDrone Vader X8, the xFold Travel, and the Freefly Alta 8. I will also be using the 3DR X8-M, our current drone, to serve as a basis for comparison. I will be examining key characteristics of each drone to determine which will be the best for our case. These characteristics include reliability, payload capacity, flight time, accessibility of the bottom plate, ease of storage/transport, and cost.

3DR X8-M

The 3DR X8-M is our current drone, otherwise known as ECHO v2 or Pancake. With eight propellers and a fully ready-to-fly system, including a Pixhawk autopilot system, this drone provides great reliability and easy setup. It weighs in at 7.7 lbs and has a payload capacity of only 0.5 lbs, which is much less than the other drones we will be looking at. Its flight time lingers around 15 minutes, which we would ideally like to increase to 30 minutes to allow the drone to fully cover its path in only two passes. The bottom plate is almost entirely open and accessible for mounting, and even includes some holes and slots that are easily usable for attaching a mount directly to the drone. Unfortunately, it is not easy to fold down and store the X8-M, as folding the legs and arms requires removing screws and basically detaching those parts. At only about \$1300 though, it's a relatively cheap option.

DJI Spreading Wings S1000+

The DJI Spreading Wings S1000+ is a true octocopter that has eight arms with a single propeller each, instead of four arms that each have two propellers. Advertised as a professional drone for film or photography, this drone does appear to be the most consumer friendly of our four options. DJI is also one of the best in the business when it comes to reliable, long-lasting drones, and customer reviews confirm this. It weighs slightly more than the X8-M at 9.7 lbs, and can carry a maximum payload of up to 14.6 lbs, which is a huge improvement over the X8-M. However, that is likely overkill in our case. It also only has a 15-minute flight time with a 11 lb payload, which again, is lower than what we would like. There appears to be a mounting plate below the bottom plate of the drone, which would allow us to very easily attach our own mount. The arms and the legs can both fold down to allow for easy storage and transport, which is a huge improvement over the X8-M. It comes with DJI's own autopilot system, called A2, but this is easily replaceable with our own Pixhawk, as the top plate of the S1000+ is designed to be removable to access the inside of the drone. DJI prices it at about \$1500, which is only slightly more expensive than the X8-M.

SteadyDrone Vader X8

The SteadyDrone Vader X8's claim to fame is its heavy payload capacity while still reaching long flight times. It goes back to the same configuration as the X8-M; four arms with two propellers on each. However, like the S1000+, the arms fold in for easy storage and the legs fold up during flight. It seems like the legs detach for storage, but they appear to be much easier to work with than the X8-M. It weighs 26.5 lbs including batteries, which I *believe* the previous weights included as well, but I could be mistaken. This is much heavier than our previous two drones, but that shouldn't pose an issue. It can carry a 13.2 lb payload, which is about on par with the S1000+ and is more than enough for our needs. With no payload, it boasts an impressive flight time of approximately 40 minutes. I imagine that with our small payload, we will easily reach a 30-minute flight time. It is designed to allow for payloads to be mounted below it, however, due to a lack of pictures, I am unable to tell if it would be easy to design a custom mount to attach to the base. I would guess that it is possible, but I can't guarantee it like I can for the X8-M or S1000+. The Vader's main issue is that it's manufacturer has been undergoing some changes recently, and it is hard to find info directly from them. Most everything I've found has been through third party websites. I only found one mention of the Vader's autopilot, which apparently is a Pixhawk, but I cannot confirm that from SteadyDrone themselves. This does hinder its reliability, and if we do decide that this is the drone we want, I believe it would be a good idea to contact SteadyDrone and confirm some of our assumptions. This also creates a wide variance in price. The cheapest I found is approximately \$15,000, which is obviously a big increase from the S1000+.

xFold Travel

Unfortunately for xFold drones in general, there is a large lack of information on their website. It is also a four-armed drone with dual propellers on each arm. It weighs 8.6 lbs and can carry a maximum payload of 21.8 lbs, while its optimal capacity is only 6.6 lb. This weight is more in line with a standard drone than the Vader, but boasts the largest carrying capacity yet. Unfortunately, its flight time also rests at about 15 minutes. It appears these smaller drones just don't pack the power needed for a 30-minute flight time like the Vader does. Adding a custom mount to the bottom of this drone should pose no problem, as the plate design looks like a combination of the X8-M and S1000+ and has built in attachment points that we can work with. The legs do fold up during flight like the other drones, but there is no mention of the arms folding in for storage. It does support something called "Multiple Autopilot Control Mode", but there is no mention of an autopilot being included with the RTF version. We could always add it ourselves, but this would be easier with the S1000+ and has no drawbacks compared to the xFold Travel. Through multiple third-party vendors, this drone will cost about \$12,000, which is probably overpriced for what it offers. I sent a message to xFold with some questions about this drone, but I have not heard back yet.

Freefly Alta 8

The Freefly Alta 8 looks like a suped-up S1000+; it's also a true octocopter. It is another smaller drone, weighing in at 13.6 lbs with a payload capacity of 20 lbs. If we keep the payload below 2 lbs, this drone will reach a 30-minute flight time. Custom mounting to the bottom of the drone may prove to be problematic. The Alta 8 has its own unique mounting system that works as is, with little room for custom attachment points. There likely is a way to design a custom mount for this drone, but with the images I could find, it is hard to tell exactly what is on the bottom. The entire drone folds into an incredibly compact configuration for storage, as both the arms and the legs fold up and inwards. The Alta 8 has its own autopilot called Synapse, and according to a forum post, it doesn't integrate with other systems. If we are determined to stick with a Pixhawk, then this is likely not the drone we are looking for. This is the most expensive drone of the bunch, priced at about \$17,500.

Conclusion

Based on the facts detailed above and other snippets I picked up through research, I believe that the SteadiDrone Vader is the best drone for ECHO. Provided we can find a reliable retailer, despite the manufacturer undergoing changes, the drone itself is the most promising. It has the longest-lasting flight time, has folding legs and arms, and *should* come with a Pixhawk autopilot already installed. However, the haziness of the manufacturer, the lack of a good view of the bottom of the drone, and its \$15,000 price are considerable drawbacks. Therefore, if we want a cheaper, more reliable drone, the DJI Spreading Wings S1000+ is my next choice. The only flaw with the S1000+ is that it doesn't reach that coveted 30-minute flight time. Besides that, it fits our needs perfectly.