drone facts

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Build Your Own Low-Cost Drone to Map Large Areas for Fun and Research

Figure 1. Parrot Disco drone with controller, first-person view goggles and case.

Many drones are available for taking images and mapping fields. Some of the better systems we have tested are the DJI Phantom 3 and 4, Mavic Pro and Inspire 1 and 2, which are available at many electronics retailers. These drones may not cover the large areas found in farming, and, for that reason, many drone companies use airplane-type drones that can cover much larger areas — more than 200 acres — per battery. They are sometimes considered safer because they are basically standard remote-control airplanes composed of plastic foam and have very low crash energies. They can also glide safely down if you lose power. If you have tried to buy an airplane-type drone for mapping, you will find they are much more expensive than standard multi-rotors, costing anywhere from $4,500 to $15,000 dollars each. For many consultants and farmers, this expense is too high for a device that may be only occasionally used and is probably more of a learning tool. For this reason, we have been looking at low-cost airplane-type drones that are inexpensive, easy to fly and can do some amount of camera work.

We have found that a Parrot Disco combined with a small action sports camera, such as the GoPro Hero5 or Hero6, can perform mapping work with equipment costs under $1,000. The Parrot Disco drone has an easy-to-fly automatic altitude hold, loitering capabilities and return-to-launch functions if the radio loses contact. Takeoff is performed by hand-releasing the unit. Landings are somewhat automatic — you set up the landing approach and then push a button. Be careful. You can easily overshoot or undershoot your landing area and plenty of clearance is needed. These drones can be found at most online retail stores (Amazon, EBay, etc.) for prices ranging from $399 to $699.

When this airplane is paired with a GoPro Hero5 or Hero6 camera ($299 to $399), the system becomes an excellent visual (RGB) mapping drone. The newer GoPro cameras have many functions that aid in drone use. They can take continuous intervals of photos, and they feature a built-in GPS that adds coordinates to the photos for ortho-rectification and a special linear function that automatically reduces the fisheye lens effect in the images.

All that is needed is to mount the GoPro or similar camera inside the fuselage with slight modifications to the body (see Figure 2). The Parrot Disco does come with a forward-facing camera, but most current software does not transform this image into a 2-D orthogonal image needed for mosaics.

To mount the camera:

- Using a hot knife or Dremel tool, cut a 1.5-inch by 1.25-inch square hole in the fuselage just behind the battery compartment (Figure 2-A and 2-B). A hot knife can be created by heating a regular metal kitchen knife with a hot plate. Do not get the knife too hot (i.e., bright red), or the foam will melt instead of cutting it.
- Make sure the hole is oriented correctly with the longer dimensions in line with the wingspan, so the camera will fit correctly. The tray that the camera sits in may also need to be lowered slightly to allow the GoPro to fit snugly between the fuselage and cover.
- Next, flip the fuselage over and taper the underside of the body (Figure 2-C) to allow the camera to have a full field of view. This tapering will also help prevent the hole from digging into the ground when the drone lands. A piece of soft foam can be added to the top to help hold the camera, but ours fit very well. For flying, we used the following flight parameters to get the correct overlap for mosaics:
  - Flight altitude (default): 150 feet
  - Speed (default): 20 to 25 mph
  - Camera settings: One image every 2 seconds / 12 megapixels / linear mode (lin)

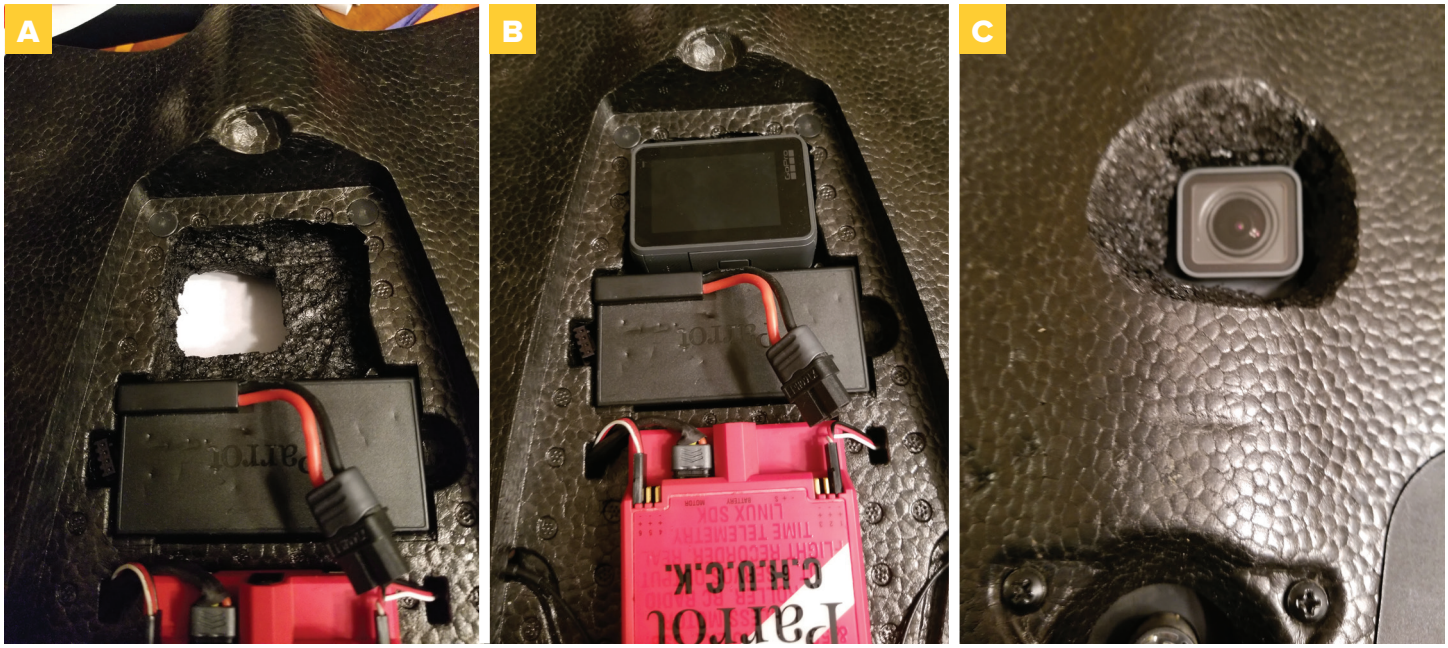

Figure 2. (A) Hole cut in fuselage to hold camera (B) and underside of drone with tapered edges (C) to allow full field of view from camera.

Although an automated flight program is available, we used the following manual flight procedure to map a field:

1. Turn on the camera and set to it to take still pictures at a timed interval.
2. Launch the aircraft into the air against the wind and allow it to climb to its flying altitude.
3. When at flying height, guide the airplane to the field entrance and fly straight down the field into the wind.
4. At the end of the field (easily determined by the camera view), perform a smooth U-turn and allowed the airplane to fly back to your location.
5. Repeat procedure as you move it down the field.

Using this approach, the whole field can be scanned in. Larger areas can be covered by standing in the middle of the field and flying from one side to other. It is important to note that FAA rules state that you must maintain visual line of sight of the aircraft at all times.

An automated flight program does exist for this airplane. However, Free Flight Pro, a smartphone application with a $19.99 cost, will allow flight paths to be created for longer flights with automatic takeoff and landing. Leave plenty of room for landing as these drones are known for undershooting or overshooting landing positions. The program does not contain higher-end mapping functions like "box the field," "select altitude" and "fly.

A mosaic created with the images from this drone is shown in Figure 3. This mosaic was created with Agisoft PhotoScan, which you can try for free. Other similar programs are Pix4Dmapper and Pix4Dag.

Figure 3. Mosaic created using 156 individual photos from a GoPro Hero5.

Many online services are also available, such as DroneDeploy, Drone Data Management System from Event38.com and PrecisionHawk's PrecisionMapper. All allow some amount of free use, and DroneDeploy allows up to five free maps per month.

Consultants and farmers may be able to use the first-person view (FPV) of the drone for real-time crop scouting. The FPV goggles are great for being able to see where you are flying. Note: To use this approach, you will have a tandem pilot flying the drone while you are viewing through the goggles to meet all regulations covering drone use.

Using this drone you can perform large area evaluations at a fraction of the cost. This drone is fun to fly recreationally as well as professionally. Parrot also markets another version of this drone as the Disco-Pro Ag with a high-end multispectral camera for $4,500.

As always, follow the designated flight rules for drones. For recreational and fun use only, an FAA registration is required, but for commercial use a drone pilot license is required.

Questions

If you have any questions, you can contact Dr. Randy Price at the LSU AgCenter Dean Lee Research and Extension Center in Alexandria, Louisiana. Or you can search the LSU AgCenter website at www.lsuagcenter.com.

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