



Leopard FPV Drone



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[VIEW IN BROWSER](#)

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Summary

Completely modular, designed for durability and sexiness. The ultimate printed 5" frame

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Let me be clear about one thing. I like drones. And I like printing them. It drives down costs, it makes parts easily replaceable, and it enables all a whole new kind of design philosophy. So I've certainly made a good few of them myself. But this thing here? It's my best yet.

The first thing you'll notice is the complete lack of sharp corners on any load bearing part. Nowhere for stresses to concentrate. Even the vent holes in the plates are circular, the strongest shape of perforation. The arms are shaped like ellipses, aligned in the likely direction of a crash. If you imagine the force of an incoming impact acting on the frame, it offers no place for a fracture to form easily. In other words you get the most out of your plastic, no Achille's heel.

The rest of the improvements are quality of life. TPU bumpers for arms improve durability, while the semi open motor housing gives you something to grip when installing props. A more spacious interior (finally) fits even the wider 30x30 stacks, and you can select from a variety of parts to match the hardware you've got. In the back, a single block neatly holds the receiver antenna, GPS, and either a 3mm or 4mm video antenna, and a camera guard in the front that can be braced by 20mm aluminum standoffs.

And now, without any further adieu, here lie the details of the build. Read them carefully.

The Electronics:

- **1x flight controller / ESC stack**
 - No taller than 20mm if using 20x20 or 25.5x25.5
 - No taller than 18mm if using 30.5x30.5
 - what I used: SKYSTARS F722 HD MINI 55A STACK
- **4x 22xx size brushless motor**
 - what I used: RCINPOWER GTSV2 2207 2500KV
- **1x ELRS receiver**
 - what I used: HAPPYMODEL EP1 2.4GHZ
- **1x HGLRC M100 GPS**
 - I made the mount specifically for this affordable module, but since it's TPU you might be able to stuff in a similar GPS unit if you're lucky
 - what I used: HGLRC M100
- **1x Digital or Analog FPV system**
 - A digital FPV system comes with everything you need; the camera, transmitter, and antenna
 - An analog FPV setup usually requires camera, transmitter, and antenna be obtained separately
 - what I used: RUNCAM VISTA WASP PHOENIX HD
- **1x LiPo Battery**
 - Depending on the KV value of your motors, you choose a battery
 - For example, motors with KV around 2400 want a 4S ~1600 mAh battery
 - While motors closer to 1900 KV can handle a 6S ~1300mAh battery
 - What I used: OVONIC 5S 1550MAH (more power at my own risk)
- **1x ELRS radio controller**
 - what I used: RADIOMASTER POCKET

The Hardware:

- **4x 5" drone propeller**
 - I suggest getting more as replacements though
- **1x 250x20mm velcro battery strap**
 - Simply holds the drone battery
- **4x male-female pair MR30 connector**
 - These are for the motor / ESC connections
- **1x XT60 female connector**
 - Usually the flight controller / ESC stack comes with one of these
- **4x M3x22-20 screw**
 - These are for mounting the FC / ESC stack. Depending on stack height, you can get away with 20mm screws, otherwise you need 22mm screws.
- **16x M3x10 screw**
 - These are for mounting the motors
- **16x M3x8 screw**
 - These are for connecting the arms
- **2x M2x25 screw**
 - These are for attaching the camera guards
- **4x M2x20 screw**
 - These are for affixing the VTX, but may change depending on your VTX
- **4x M2x14 screw**
 - These are for attaching the rear block
- **4x M2x10 screw**
 - Two of these are for attaching the camera
 - The other two are for mounting the GPS *
- **1x M2x8 screw**
 - This lone screw is for securing the VTX antenna **
- **3x M2 Locknut**
 - Two are for the GPS *
 - One is for the VTX antenna **
- **16x M3x4xOD4.5 insert nut**
 - Four of these go in each arm
- **10x M2x4xOD3.2 insert nut**
 - Four in the back for the antenna block
 - Four for mounting the VTX
 - Two in the front for the camera
- **2x M2x20 aluminum standoff + 4x M2x14 screw**
 - These are optional, if you want to reinforce your camera guards

Cost Estimate:

- Drone ~ \$150 - \$400 depending on how fancy you get with the parts
- Controller ~ \$60

And lastly, the Instructions

So, I had an idea. Instead of writing a dissertation or a guide manual. I'll let a bunch of photos do the heavy lifting for me. You know what what they say, about pictures being worth a thousand words and all, but I'd already call it a win to shave off a hundred. In the photo reel of this project, you'll find a series of pictures that illustrate the build process in chronological order. And here, I'll fill in any details that aren't obvious.

1. Step one. Make sure you have a functional 3D printer. And a soldering iron. And make sure you have something to turn all those screws with. Tweezers can be helpful.
2. Step 2, print out all your parts.
 1. The drone is made of one top and bottom plate, one left and right camera guard, one antenna block, four TPU bumpers, two each of arm A and B, and lastly one GPS mount if you plan on it. You'll notice that for a lot of the parts, there's more than one version. They have descriptive file names, match them to the dimensions of your hardware.
 2. Let's talk materials. You can't use PLA and expect decent results... I'm not sure if it would melt or shatter first but either way, we can do better. Likewise with PETG, it's marginally better than PLA, but if you can afford it, why not treat yourself? Go for some ABS or ASA, perhaps Nylon or Polycarbonate, the good stuff in any case. Personally, I used PPA-CF for the plates and PA6-GF for the arms. And of course, it is essential that the camera guards, bumpers, antenna block, and GPS mount be printed in TPU.
 3. Mind your settings. I've noticed strong filaments like being printed slowly. Don't skimp on material either. For the arms and plates, use at least 5 walls and 7 top/bottom layers @0.2mm layer height.
3. Step three, take care of inserts. Each arm gets four M3x4 inserts, two on the top side, and two on the bottom. The front of the bottom plate gets two M2x4 inserts, and the backs of both the top and bottom plates get two more each. The last four go in the bottom plate, where the VTX will be.
4. Prepare the male MR30 connectors with some wire, which you can trim from the excess length on your motors. You don't need much, each motor can donate about 4cm. To make life a little easier, you can cut them at an angle, (like in the photo) before soldering to the ESC.
5. Next, to finish off the ESC you will solder on the battery leads and XT60 connector. Cut the leads to about 8 or 9 centimeters. And be patient soldering to the battery pads of the ESC, since they have a lot of thermal mass. The last thing to take care of is the capacitor,

which I connected through some 18AWG wire so that it can sit in front of the ESC.

6. Once that's done, you may solder the female connectors onto your motors. Extra wire doesn't matter all that much, with some finesse it can be stuffed into the arms.
7. When steps 5 and 6 are done, have some tea or hit the vape, because now the drone can start taking shape. Thread the leads of each motor through one arm, then **minding the symmetry of the arms**, plug one motor into each slot in the ESC. Now you can screw the arms down using 8x M3x8 screws, and the motors (don't forget the bumpers) with 16x M3x10 screws as well. Once that's done, push those M3x20-22 screws through the bottom plate and ESC.
8. Seat the flight controller onto the ESC and connect it with the provided ribbon cable, mind the orientation.
9. Alright, so this marks the end of a big milestone in the build. What's left is essentially the front and rear parts, plus the VTX. Each of these components, you can first prepare separately, then simply drop them into the build.
10. A good place to start is the VTX. Whether it is digital or analog you end up using, now's the time to solder on all the required wires, and install the VTX using the four M2x20 screws. If your VTX is digital, chances are the camera is already connected to it, so if this is the case you should use two M2x10 screws to sandwich the camera between its two TPU guard pieces, and then lightly screw that assembly into place at the front of the drone, for now ignoring the top plate. If your camera is separate from the VTX, you do the same thing, but solder the camera wires to the flight controller as well.
11. All that remains is the antenna block. If you haven't already, solder on wires to your ELRS receiver and snap on its antenna. Don't forget to heat shrink the receiver afterward. The receiver antenna then goes into the two side holes in the antenna block, and can be locked from the inside with two zip ties. The VTX antenna slides in from the outside and is secured with one M2x8 screw and a nut. At the very rear goes the the GPS unit in its mount, secured by two M2x10 screws and two more nuts. There is an opening in the antenna block that allows for the GPS wires to pass through easily.
12. Very good. It's all but easy from here. Mount the antenna block using only the bottom two M2x14 screws. Make sure everything is laying nice and neat, find a spot to tuck that receiver into. Once you're satisfied with how it looks, you can free the camera assembly, line up the top plate, and drive in every last screw that remains.
13. Profit???

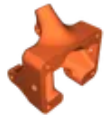
I sincerely hope that ya'll have a good time cobbling this thing together

Model files



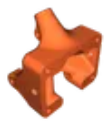
Antenna blocks & GPS mount

7 files



3mm-antenna-block.stl

☐ print either this or the 4mm version



35mm-antenna-block.stl



4mm-antenna-block.stl

☐ print either this or the 3mm version



3mm-dual-antenna-block.stl



35mm-dual-antenna-block.stl



4mm-dual-antenna-block.stl



hglrc-m100-gps-tpu-mount.stl

☐ print one of these



Arms & TPU bumper

3 files



arm-a.stl

☐ print two of these



arm-b.stl

☐ print two of these



tpu-bumper.stl

☐ print four of these



Plates

6 files



top-plate-305x305.stl



top-plate-20x20-and-255x255.stl



bottom-plate-20x20-m2.stl



bottom-plate-20x20-m3.stl



bottom-plate-255x255-m3.stl



bottom-plate-305x305-m3.stl



Camera guards

10 files



tough-cam-gaurd-l.stl



tough-cam-gaurd-r.stl



basic-cam-gaurd-l.stl



basic-cam-gaurd-r.stl



large-cam-gaurd-l.stl



large-cam-gaurd-r.stl



o4-cam-gaurd-l.stl



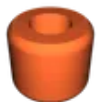
o4-cam-gaurd-r.stl



o3-cam-gaurd-l.stl



o3-cam-gaurd-r.stl



4mm-vtx-spacer.stl

☐ print four of these



gopro-adapter.stl



leopard-fpv-drone.step



leopard-fpv-drone-7-inch-version.step

☐ longer arms for 28XX motors and 7" propellers

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