SPEED FREAKS!

A LOOK INSIDE THE FPV RACING SCENE

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In the sport of First-Person-View (FPV) racing, three things are key: lightning-fast reflexes, a passion for speed and the ability to dust your drone off after a crash and get back in the air. One of the fastest-growing segments in the multirotor world, across the country racing quads are literally flying off the shelves and pilots are gathering at makeshift courses in remote spots to compete. Who can fit their quad through the smallest opening in the quickest amount of time? We met up with some top FPV racers at an abandoned prison in the middle of nowhere to capture racing action. Want to be a part of this growing sport? Read on to see what it takes to race these fast little quads!

Just some of the equipment that these guys bring to a typical race day.

WHAT IS FPV RACING?

For the purposes of this article, FPV racing means flying a multirotor by viewing the flight from the multirotor itself. Full-size aircraft do this all the time because the pilot is actually sitting in the cockpit of the aircraft. We use a camera and transmitter on the drone that instantaneously sends video to a monitor or FPV goggles that the pilot uses to fly the aircraft.

Pilots like 250mm size quads for racing because they are fast, durable and inexpensive. These small quads can also take a hit, even cartwheeling along the ground, and after you replace a few props are ready for the next heat. Believe me when I say that having a durable quad is a requirement. When you first try FPV racing, three things will happen: you'll crash a lot, you'll go through a lot of props, and from the first flight you will become totally addicted. Now let's look at some of the equipment you'll need.

FPV Racing Gear

THE QUAD

The first requirement is a race machine, and a 250mm size bird is just the ticket. They cost as little as $15 and can go all the way up to $300. Get the best one you can afford; quality counts, and $100–$200 quads usually have a nice thick carbon-fiber frame that can stand up to FPV racing. In addition, the frame will protect all of the internal parts, which could easily add up to more than the cost of the frame. Plastic or thin carbon-fiber frames will shatter when they hit something (trees do always seem to get in the way) and once that frame goes, all of the internal parts tend to follow in the destruction.

Thick booms/arms are another thing to look for as they offer some protection to the motors hanging out on their ends. One common thing that tends to happen when you're first learning to fly FPV is getting the quad too low to the ground at full speed; this causes some spectacular cartwheeling as the bird rapidly slows down, and quads with thick arms tend to fare very well when the rotation stops.

RADIO

Use whichever brand you prefer, but you'll need at least 4 channels; ideally 6 channels are better: a 6-channel radio lets you program in flight modes. Many pilots will fly without any assistance from GPS or automatic stabilization, which allows the quad to be very maneuverable and hold the heading it is put into. Once pushed into forward flight, the quad maintains that angle so the pilot only has to concentrate on guiding it through racecourse and navigating through small openings.

An S-bus system works well here because it only requires a one-wire connection between the receiver and flight controller. Get a high-quality servo extension for this task. Weight is always a consideration so be sure to use the smallest receiver possible to save on weight and maximize your speed.

EYES

FPV equipment consists of a small video camera mounted to the front of the aircraft. It's key is to get one with as wide a view as possible without distortion. Many racing quads are designed so the camera is protected, so it's wise to invest in your FPV system.

TRANSMISSION

The camera is plugged into a transmitter that relays video in real time to a ground station, which the pilot monitors.

MANY PILOTS FLY WITHOUT ANY ASSISTANCE FROM GPS OR AUTOMATIC STABILIZATION, WHICH ALLOWS THE QUAD TO BE VERY MANEUVERABLE AND HOLD ITS HEADING.

The truck tailgate serves as command station and racing pit area.

The top camera is for FPV viewing while the GoPro documents the flight.

Tony Mendoza shows off his stylish flight goggles.

Rowell "Ro" Royola replaces a set of props before the next race. Having backup props and quads is a good winning strategy.

FLIGHTLINE EQUIPMENT

Here are some items you may want to have on the sidelines:

- **Chair:** Why not be comfortable while you're racing?
- **Cold drinks in an ice chest:** Racing is hard work!
- **Shade:** Keep yourself (and the drinks) out of the hot sun.
- **Tools:** Bring all of the tools you need to completely take apart your quad. You never know when you or another pilot will need them for repairs!
- **Extra props:** Not all landings are pretty: if you fly, you will need to replace propellers.
- **Extra parts:** Just in case you decide to race hard.
- **Extra quad:** Just in case you decide to race really hard.
- **Sunglasses:** Protect your eyes from all the camera flashes and champagne while standing in the winner's circle.

ImmersionRC 600MW 5.8GHz transmitters are a popular choice, and many races add some type of circular or mushroom antenna to make sure that the signal is continuous and strong to create a good visual link between the camera and pilot on the ground. A semi-flexible antenna is a good addition; it will flex instead of breaking off.

GROUND CONTROL

Most pilots use FPV goggles (FatShark units are a popular choice) to receive the video signal and convert it to a video that plays on two small screens in front of your eyes. Here again, a high-quality pair of goggles will improve your vision and make it easier for you to guide your multirotor through the course. Goggles block out light and make it easier for you to direct all of your attention to flying the multirotor.

Another option is a small to mid-size monitor that allows you to see what the camera is transmitting. It's a great alternative for pilots who get dizzy flying with goggles. A sunshade for the screen is a good investment; it prevents any extraneous light from interfering with the image quality. The disadvantage is that you don't get that feeling of total immersion like you do when using goggles. The advantage is that you can look up at the multirotor and guide it in for a landing.

"THOSE DAMN TREES ALWAYS GET IN MY WAY."

Pilot Profiles

1 Tuan Phan
AKA Diamondback

Drone of choice: Black Out Mini H
Favorite controller: Naze32 Acro FC
Guidance: FrSky Taranis X9D Plus
Power Pack: Nanotech 1300mah 45-90c
FPV specs: Goggles – Fatshark Dominator V2, Transmitter - Immersion RC 600 mW Antenna – Home Made
Race strategy: Tuan's racing strategy maybe considered a bit diabolical by some, this is because he employs a two-prong attack strategy. First he begins by loosening up a couple of the pilot's prop nuts and then spiking the drinks of the other ones with some laxative. Then as he says, I just sit back and watch the hotshots crash into each other as the race starts. As the race progresses the others have to land their aircraft to go to the bathroom, this allows me to cruise to a nice easy victory.
What is your pre-race ritual? I leave a nice little Bologna sandwich with a bag of carrots, for the officials incase of any close calls.
What is your fuel of choice for your body? Beef jerky before and after along with some Gatorade.
Favorite quote: "What! I was never near your quad."

2 Christian Quezada
aka "Bob"

Drone of choice: Xhover MXP230
Favorite controller: FTP Naze32
Guidance: Turnigy 9X with JR module
Power Pack: Glacier 4S 1300mAh 30C
FPV specs: FatShark V2 goggle; Immersion 600mW 5.8GHz transmitter; Immersion SpiroNet antennae; Fatshark 700tvl camera
Race Documentation: GoPro Hero 4
Race strategy: Fly crazy and smart at the same time. "I fly so crazy that people think I'm outrageously smart. I can make these wild moves because I fly on manual mode all the time, which gives me full control over the quad."
He says: "I practice with no limits; since I am sponsored by XHover I have no worries about breaking up the frame. (My sponsor won't see this, right?)"
Pre-race routine: "Subway sandwiches, I like my Subway."

3 Daniel Sandoval
aka "Viper"

Drone of choice: Xhover MXP230
Favorite controller: FTP Naze32
Guidance: Taranis
Power Pack: Glacier 4S 1300mAh 30C
FPV specs: FatShark HD goggles; Immersion 600MW 5.8GHZ transmitter and SpiroNet antennae; Fatshark 700TVL camera
Race Documentation: GoPro Hero 4
Daniel's racing strategy: Go fast and pass everyone as quickly as possible, and his best move is to barrel using maneuver possible to get ahead. He practices in an open field racing with some of his friends at least once a week.
He hates: "Seeing another quad pass me by; I always want to be in the lead!"
Pre-race routine: "I try to avoid energy drinks and go for something more natural! The worst thing is your fingers and body to be hyped up with caffeine."

4 Tony Mendoza
aka "Dr. Drone"

Drone of choice: Shredder 330mm Quadcopter w/PDB
Favorite controller: FTP Naze32
Guidance: JR 9503 Boosted to 2 watts for better range
Power Pack: Jet Pack 4S 2200mAh 45C
FPV specs: Fatshark Dominator HD goggles with ground station 5800 Duo; Immersion RC 600 mW video transmitter; FatShark 700 TVL camera.
Race Documentation: GoPro Hero 3 black
Race strategy: Tony believes that a slow and steady pace will always win the race. He said that he usually likes to fly his best and keep it aggressive with style rather than an all-out speed.
He says: "I like flying proximity high-speed courses, especially locations with many trees. My favorite race move is the same as many other pilots, a full forward motion left barrel roll. Perhaps the worst thing to see through my goggles is the end of my flight interrupted by a wall or a tree, but hey it happens, more times than I like to admit."
Pre-race routine: "I usually drink some Red Bull 30 minutes before sitting in the cockpit of my Shredder 330mm; it gives it plenty of time to jet through my veins, then I let it rip!"
Favorite quote: "Those damn trees always get in my way."

5 Rowell "Ro" Royola
aka "Black Mamba"

Drone of choice: XHover MXP230 with T-motors
Favorite controller: FTP Naze32
Guidance: Taranis
Power Pack: Glacier 4S 1300mAh 30C
FPV specs: Skyzone diversity goggles; Immersion 600MW 5.8GHz transmitter; ImmersionRC Omni antenna; 650tvl Sony Super HAD CCD camera
Race Documentation: Mobius ActionCam
Race strategy: Ro's strategy is to fly hard and pass other pilots so closely that they end up crashing. He says, "Sometimes I fly a wee bit too close and our props manage to connect. On my best day my favorite move is a simple barrel roll as I pass you on the racecourse."
He hates: "Seeing another pilot's camera view when I wear my goggles, because that means I will crash seconds later (thanks, Bob!). Folks, turn on your goggles first to see if anybody is on your channel before you turn on your quad!"
Pre-race routine: "I eat my Wheaties before I race. Some day I'll be on that box!"

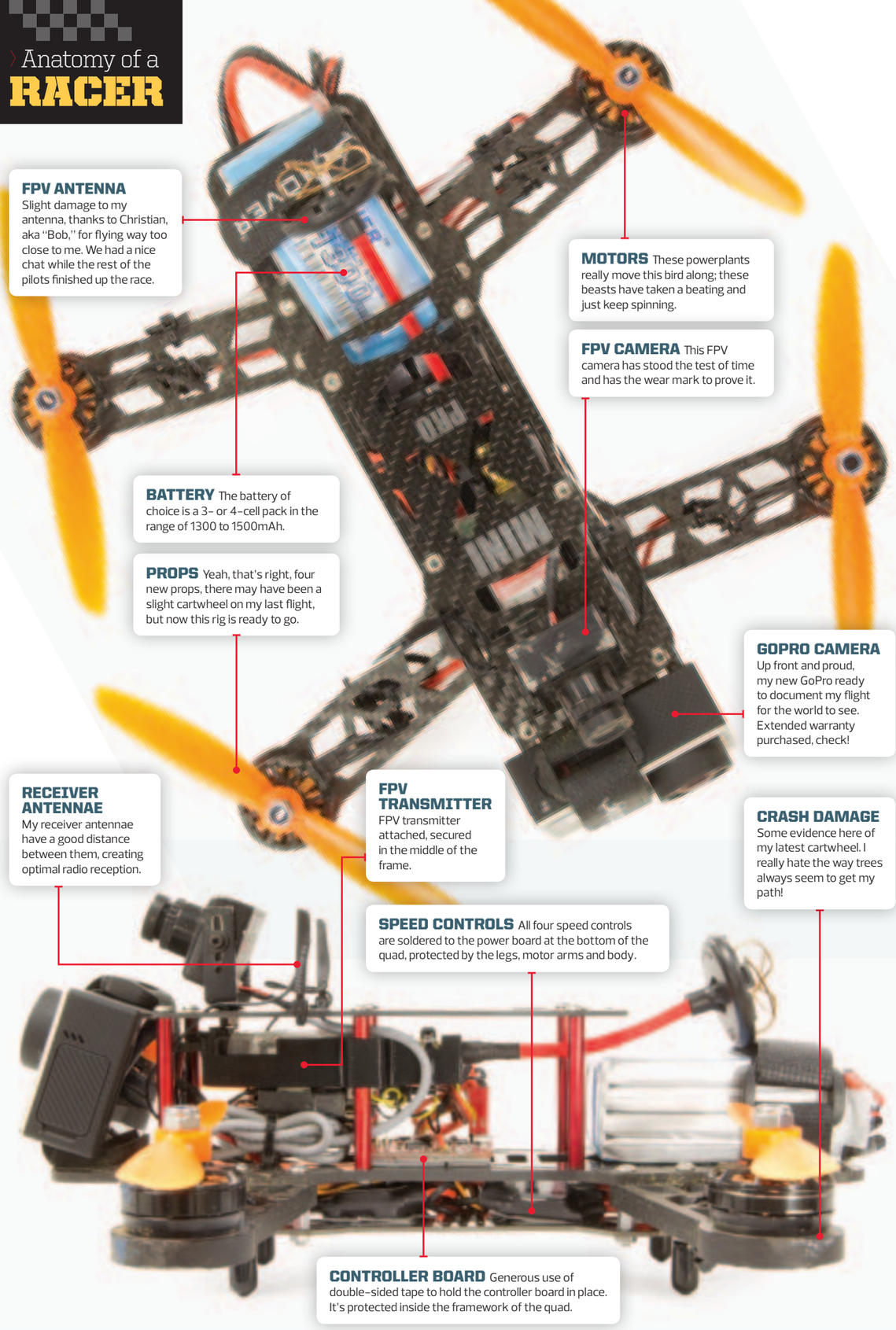
6 Ben Saraceno
aka "Sidewinder"

Drone of choice: Blackout Mini H Quad
Favorite controller: Mini H Quad
Favorite controller: Dragonfly32/Naze32
Guidance: Turnigy 9X
Power Pack: Turnigy Nanotech 4S 1300mAh 30C
FPV specs: FatShark Attitude; Immersion 600mW 5.8GHz transmitter; Immersion LHCP Skew Planar antenna; PZ0420 camera
Race Documentation: GoPro Hero 2
Race strategy: Ben's racing strategy is to go as fast as he can without crashing. Ben feels that he is fortunate because his local flying field has a small course laid out through the trees, where he can practice as much as he wants.
Best move: "Landing in one piece."
He hates: "Tree branches, smoke and fire. This answer should need no explanation."

7 James Velez
aka "Cobra"

Drone of choice: XHover MXP 230
Favorite controller: FTP Naze32
Guidance: Trananis
Power Pack: Glacier 4S 1300mAh 30C
FPV specs: Goggles; Fat Shark Attitude goggles; Immersion 600mw 5.8GHz transmitter; 650tvl Sony Super HAD CCD camera
Race Documentation: Mobius ActionCam
Race strategy: James' racing strategy is to stay out of the mix and wait for somebody to make a mistake: "Then like a cobra, I strike. Most of the time I will fly through the debris of their mistake by performing some type of flip or roll just to show off."
He says: "I am at the park flying almost every day."
Pre-race routine: "A dozen raw eggs in a glass." (Editor's note: we have not documented this ritual but have no reason to doubt its validity).

Anatomy of a RACER



FPV ANTENNA Slight damage to my antenna, thanks to Christian, aka "Bob," for flying way too close to me. We had a nice chat while the rest of the pilots finished up the race.

MOTORS These powerplants really move this bird along; these beasts have taken a beating and just keep spinning.

FPV CAMERA This FPV camera has stood the test of time and has the wear mark to prove it.

BATTERY The battery of choice is a 3- or 4-cell pack in the range of 1300 to 1500mAh.

PROPS Yeah, that's right, four new props, there may have been a slight cartwheel on my last flight, but now this rig is ready to go.

GOPRO CAMERA Up front and proud, my new GoPro ready to document my flight for the world to see. Extended warranty purchased, check!

RECEIVER ANTENNAE My receiver antennae have a good distance between them, creating optimal radio reception.

FPV TRANSMITTER FPV transmitter attached, secured in the middle of the frame.

CRASH DAMAGE Some evidence here of my latest cartwheel. I really hate the way trees always seem to get my path!

SPEED CONTROLS All four speed controls are soldered to the power board at the bottom of the quad, protected by the legs, motor arms and body.

CONTROLLER BOARD Generous use of double-sided tape to hold the controller board in place. It's protected inside the framework of the quad.

Some of the fly-through openings were rather small, as Daniel Sandoval shows us in this example.

FLIGHT TIPS You have to crawl before you can walk, and you have to walk before you can run. FPV racing is definitely running at full speed, so if you've never flown a quad before, start out by flying a smaller unit around the house. This way you can learn how to control it and even try flying under and through obstacles.

When you're ready to move on to your racing quad, any 250mm size model will work. Try flying it around in an open field and get used to the controls, hovering and moving around imaginary obstacles. When you feel comfortable, open it up and fly forward at the fastest speed possible. This will be your normal racing speed, so get used to the angle of the quad and see what it's like to make quick turns and other maneuvers. Now you are ready for FPV flying.

Eddie Fiola looks on as James readies his quad for the next round of flying.

Flying with Goggles

When you first start flying with FPV goggles, be prepared to be really frustrated because it will feel like you're learning to fly all over again. Daniel Sandova, expert FPV pilot and owner of XHover, said that when he first started flying FPV two years ago in his backyard, he was ready to sell everything after his first flight. Now he is one of the premier racing pilots. He recommends learning how to hover with and without FPV goggles to learn how high the actual quad is compared to what you see in the goggles. Your perspective will be off at first, but after a few flights you will get the hang of it.

One of the best learning tools is to have a calm person (emphasis on calm!) stand next to you as your spotter and tell you just how high you are flying. This really worked for me and allowed me to understand that what I was seeing through the goggles was very different than reality. After about 10 flights, I started to feel comfortable and was able to navigate around the field and fly figure-8s without any assistance from my spotter. The key is to keep at it and you will eventually learn how to handle your quad through FPV like an expert. See you at the races!

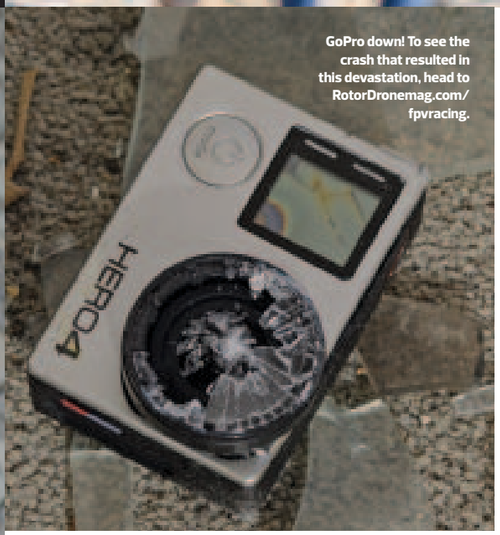
"KEEP AT IT AND YOU'LL EVENTUALLY LEARN HOW TO HANDLE YOUR FPV QUAD LIKE AN EXPERT."

"I like Skyzone Diversity Goggles because two antennae are better than one," says Rowell "Ro" Royola.

Racers competing head-to-head see who can fly through the smallest opening.

CRASH REEL It's hard to believe, but crashes happen. A good racing quad that is durable and solid will survive the hit. In many cases, only the props need to be replaced to get the bird back in the air.

In some crashes, it's easy to find the quad!



GoPro down! To see the crash that resulted in this devastation, head to RotorDronemag.com/fpvracing.

GET INVOLVED

FPV racing is mainly grassroots, so to find a group near you, check Meetup.com, call local RC hobby shops, or just get your friends together. I've started a list of FPV racing "club" links at RotorDroneMag.com/fpvracing, and feel free to add other links in the comments and I'll keep this updated. See you at the racecourse!