One of the most thrilling experiences in flying RC aircraft may be the ability to see the world from a bird's-eye view. First Person View (FPV) is a method used to operate a remote-control aircraft using an on-board camera and a video-downlink system, with the video signal transmitted through goggles or a video monitor. Goggles offer a more immersive experience, especially with sophisticated setups that control pan-and-tilt camera gimbals with gyroscopic sensors. In this article we'll take a closer look at the basic equipment you'll need for FPV, and I'll offer some advice for getting started in this exciting aspect of multirotor flight.

A VIEW FROM ABOVE

YOUR GUIDE TO FIRST-PERSON-VIEW FLIGHT

BY **GUS CALDERON** PHOTOS BY **TONY DONALDSON**

TRANSMITTER

A VIEW FROM ABOVE

CONTROLLING YOUR DRONE AND GETTING TO SEE THE WORLD FROM THE PILOT'S VIEW IS NOTHING SHORT OF AWESOME

ANTENNAS

Antennas are a critical part of the video system. Most FPV transmitters are equipped with a di-pole antenna that may suffice for beginners and short-range operations. A Cloverleaf Circular Polarized antenna is now the preferred standard for multirotor FPV on 5.8GHz. Using circular polarization on both ends results in cleaner video and better range of transmission. Other benefits include a better video signal when banking the aircraft.

Video Receivers and Diversity

The video receiver processes the video signal and sends it to the operator's visual display. The frequency of a good-quality receiver is matched to that of the video transmitter. Since this component is ground-based, its weight is not critical. Some operators use receivers that are integrated into either the video monitor or goggles to reduce the number of cables and connections. "Diversity" is a term for receivers with two antennas and sometimes two receivers that automatically choose the best signal.

VIDEO DISPLAY MONITORS

Although video monitors do not offer the same feeling of immersion as video goggles, they are great, affordable tools for learning FPV. Monitors with integrated video receivers and internal batteries can be attached to the operator's transmitter. Another advantage of a monitor is that others can view the FPV image while the aircraft is flying.

Selecting a Frequency

The most common frequencies used for FPV video transmission are: 910MHz and 1.2, 2.4, and 5.8GHz. Because most radio-control transmitters operate on 2.4GHz, multirotor operators generally use 5.8GHz for video downlink. Although 5.8GHz is the weakest frequency band as far as range and penetration are concerned, it uses the smallest antennas and has the greatest number of available channels, thereby causing less interference with other equipment. Make sure that all of your FPV equipment is compatible and on the same frequency!

TRANSMITTER

It is critically important that the frequency for the FPV system is different from that of the transmitter. When learning to fly FPV, it is recommended to use a transmitter with a buddy-box system or "training cable" which links to the observer's transmitter.

GOGGLES

Video Goggles

Video goggles give a "fully immersive" feeling of being on board the aircraft. Some goggles now offer the option of diopters, thereby allowing operators who wear prescription glasses to go without their specs. Various configurations are built specifically for FPV and many have the receiver built into the unit. Some goggles include "Head Tracking," a feature that pans and tilts the camera on the aircraft. "Head Tracking" allows the FPV operator to control the camera with head movements.

These goggles have a built-in video receiver as well as video output for an external monitor or recorder. They have been upgraded with a circular polarizing antenna. Power is supplied with an external battery such as a 3S LiPo.

DRONE

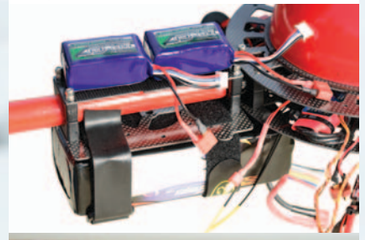
High-definition video cameras have an output that can be connected to the video downlink transmitter. If the HD camera is mounted on a gimbal, a separate camera is needed for flying FPV. It is possible to switch between cameras for flying and filming.

VIDEO TRANSMITTERS

Video transmitters with mid-range power output (400 to 600mW) are used for multirotors that are being flown within visual line of sight. Video transmitters can get hot and require cooling from airflow, heatsink or a fan. A wireless video transmitter should never be powered without its antenna, as doing so may cause damage and reduce the operational range.

Cameras and power supply

The most important part of an FPV system is the camera. High quality, small and lightweight cameras have interchangeable lenses. Cameras designed for FPV flying need a power supply of 5 volts or 12 volts. Using the same voltage for all wireless video equipment is highly recommended. Many operators use a separate 3S LiPo battery to power their 12 volt systems.



THE ABILITY TO SEE THE WORLD FROM A BIRD'S-EYE VIEW IS ONE OF THE MOST THRILLING EXPERIENCES IN FLYING MULTIROTOR AIRCRAFT.

While wearing video goggles, the operation of a multirotor by FPV is a fully immersive experience. Flying FPV is the next best thing to actually being on board an aircraft and maneuvering around the sky.

Additional safety

The ability of FPV aircraft to fly beyond the visual range of the operator and at high altitudes has raised some safety concerns regarding the risks of collisions with manned aircraft and danger to persons and property on the ground. FPV operators should take additional safety measures such as avoiding flying above populated areas or at high altitudes where manned aircraft are likely to be present. FPV flights should only be conducted with the assistance of an observer or spotter who is trained to assume control of the aircraft if the operator becomes disoriented or loses the video signal. For added safety, the use of flight controllers with "return to home" capability in the event of a signal loss is highly recommended. Such precautions ensure that FPV flights can be undertaken safely and minimize the risk of losing the aircraft or damaging property.

7 Safety Flight Rules

1 All FPV pilots must fly with a spotter who will watch the aircraft throughout its flight as well as let the FPV pilot know of any incoming aircraft or other issues.

2 If an FPV pilot experiences a safety issue that's more than a brief glitch, they must abandon FPV and fly visual line of sight.

3 Before flying any aircraft for the first time with FPV or after any changes or repairs, it must perform a safety flight via visual line of sight.

4 FPV model aircraft must use frequencies approved by the FCC for both the radio-control system and the wireless video system.

5 FPV pilots must be capable of flying their model aircraft via visual line of sight before they try FPV flight.

6 To be excluded from FAA regulations, model aircraft must be flown within visual line of sight of the operator at all times and at or below a 400-foot altitude.

7 FPV model aircraft are limited to a total ready-to-fly weight of 15 pounds and a speed of 70mph.

This list of FPV rules is based on a document from the Academy of Model Aeronautics (AMA), the world's largest model aviation organization and the official national body for model aviation in the U.S. AMA leaders work with the Federal Aviation Administration as well as state and local governments to promote the interests of RC pilots. To view the entire AMA Document #550 on "Utilizing "First Person View" Systems," go to modelaircraft.org/files/550.pdf.