

I am learning about FPV and a few things associated with it, so I would like to ramble on a bit about some of what I have learned and done. There just may be something in here that someone else could find useful, whether for FPV or just general use.

After over five years of DX9 ownership, I am still figuring out some new things that can be done with this system. AirWare is the operating environment that is common to all of the later DX series of Spektrum radio systems.

This particular plane has one or more cameras. One is coupled to the video transmitter (VTX), and the other, a Mobius, can be snapped into place, if high quality video recording is desired. Either or both can be set up on a simple homemade Pan+Tilt mount which is controlled via certain switch(es) or a stick on the DX9, or by moving one's head via a device attached to the FPV hood.

I also have installed the Vector, by Eagle Tree Systems. They also make the well-known Guardian stabilizer, which I have used for several years and is top notch equipment. This GPS-equipped autopilot system that can stabilize and aircraft in various modes, follow pre-programmed waypoints, loiter around any point during its flight or return-to-home (RTH) upon command. You can set up to 5 of the Vector's Modes, selected from a longer list, which you will map to one or more switches, perhaps in conjunction with different Flight Modes you have set in the transmitter

RTH can be set up to take over upon command or in the event of a loss of signal from the RC transmitter, whereby it will control power and the primary flight controls in order to seek a predetermined altitude, or follow a straight descent and return-to-home, even attempting to land all in association with its GPS module. (Note: It has no way of knowing about trees, terrain or other objects on its intended flight path!). This is one of the two main reasons that I bought a Vector. I want to fly FPV and feel confident that, if I or my observer should lose sight of the aircraft, or I want to put a headset on or take it off in order to transition from or to normal line-of-sight flying, or if I lose the video link, I can have the aircraft remain in a known location or be heading back home. I can put the aircraft into a suitable Mode while I look around a bit via the moveable camera. Losing the radio control signal is rather unlikely, as I do not plan to do long range flying, but it is nice to have.

The other, more important, reason for to have the Vextor is its on-screen display (OSD) functionality. This will overlay a complete head up display onto the realtime video feed. This includes such things as artificial horizon, altitude, compass orientation, reference to Home, power system information, etc. The overall impression is that of being in a modern high end aircraft with full glass cockpit and head up display.

That is a lot of stuff!

Some programming notes follow:

I have (currently) three Flight Modes, which I call Normal, Cruise and TO/GA. In addition, there are switchable options available in any of these Flight Modes, such as camera manipulation, different flight controller modes (RTH, 2D and 3D stabilization with or without Heading Hold, etc.)

In Normal and Cruise Modes, everything is simple, no mixing of any kind (although some individual mixing can still be selected via dedicated switches, most useful during testing new things). The TO/GA (Takeoff / Go Around) sort of emulates that standard feature on most modern jet and other sophisticated aircraft, where one may want to be quickly and efficiently reconfigure the aircraft or change several

things concurrently. I have that on my Fun Cub, Turbo Beaver, and sailplanes.

In Normal and Cruise Modes, two 3-position switches have been set, each with a different subset of Vector Modes. Which switch and therefore Vector Modes have been chosen for the kind of flying that would be compatible with the Flight Mode in effect.

In Cruise Mode, if the Vector is enabled, it will be set either to RTH or 2D Heading Hold, thus ensuring that the aircraft is flying level and restricting the flight to enable worry-free “sightseeing” or if the pilot panics! The Normal Mode will allow the Vector, if enabled, to Loiter the aircraft or provide full gyro stabilization along the flightpath.

So, what happens in TO/GA mode? A bit of mixing, nothing too fancy but quite significant and in common use on full house sailplane models, as well as some sport planes – like several of mine. When selected, the Throttle stick now has additional function. As the Throttle is reduced into its lower half of travel, the ailerons function as Spoilerons, i.e., they progressively raise as the Throttle stick is pulled back. Although my Penguin does not have Flaps, these exist on my sailplanes, Fun Cub and Turbo Beaver (slats), so this function does one more thing - the Flaps would drop progressively as the Spoilerons are rising. This is referred to as Crow. Concurrently, some Down Elevator is fed in to push the nose down a suitable amount to make this very draggy/ low lift configuration work. In fact, if you use Crow and get it right, a plane which is normally a real floater can dive down at an incredibly steep angle without building up airspeed, especially if the motor rpm is held at an idle so that the prop disk acts as an additional dive brake. As you approach flare time, easing the Throttle stick forward will reduce Crow, arresting the descent somewhat and possibly adding some power. You do the normal flare via Elevator control. It's a lot simpler than it sounds – the mixing takes care of the hard part, equivalent to having an extra pair of hands and you only need to apply some judgment.

That is part of what TO/GA does. The other part can be useful during any takeoff and is also nice to have should you misjudge the final approach or something appears on the runway. You need to quickly reject the landing and climb out. The upper part of the Throttle movement controls only the power. The mixing of Elevator to Ailerons (creating Spoilerons) which was part of the landing phase now reverses. As you apply Up Elevator, the Flaps (if equipped) would likely be lowering, but the Ailerons now function as Flaperons, moving downward in conjunction with the Up Elevator and creating high lift. Away we go!

The Vector has no Modes available during the TO/GA flight Mode. Why? Because of the mixing to primary control surfaces. As with many other stabilization systems, such as the Guardian, the stabilizer would detect any mixed input to, say, the Spoilerons, as the command to release it from controlling the flight. I am still a bit uncertain of some of this, but that is my current understanding and much more experience and experimentation is required. There is already a bucket full of possibilities with just the simple setup I now have. And that is not even my first crack at it, as I had some very different configurations and control possibilities set up originally. For instance, I had the left (Throttle/Rudder) stick change over to only controlling the camera Pan and Tilt during one of my Flight modes but have abandoned that approach. Sometimes, it sounds good while sitting at the bench but perhaps a bit less exciting in the air, especially with a whole lot of new gear and low experience.

That is pretty much the setup at present. Things usually change on a daily or more frequently basis, as the Airware system is very comprehensive yet easy to work with, once you get the hand of it.

Now, there is at least one more trick:

There is a neat little device called a HeadTracker. These are built into some FPV goggles; mine is a little separate circuit that you can stick onto the goggles or helmet, such as the Headplay or even onto your flying hat if you are using a separate flatscreen attached to the transmitter.

HeadTracker contains 3-axis accelerometers and gyroscopes. It senses its movement and orientation and outputs its Roll, Yaw and Pitch commands as a PPM stream that can be injected into the Trainer port of the transmitter, as whatever channels one chooses.

Mine targets the 2 AUX channels which control the camera Pan and Tilt servos. I don't bother with Roll, as it makes no sense to me and would be very complicated to build a decent, simple 3-axis camera gimbal.

When selecting the Student function, the camera responds to my head movement, as if I were in a real aircraft. The Trainer button, which is a momentary switch, seems like a good idea for this function, as the camera will immediately return to its standard position as soon as the switch is released. Or, you can set up another switch to select Student mode. Of course, this does not preclude using another knob or a Trim tab at any time. If you were to select the Student mode, as soon as you touch whichever knob, lever or switch normally operates either the Pitch or Roll servo, control immediately reverts back to them and remains so until you would recycle your HeadTracker selection switch back to Master and again over to Student.

There are now many ways to control the camera orientation: directly via specified switched, knobs, levers, etc.; directly from one or both control sticks, either in conjunction with their normal functions or superceding those functions; and, viaa HeadPlay arrangement. In fact, all three can exist simultaneously and you can choose (or confuse) at will. Just don't forget to fly the aircraft!

My head is aching and by now yours probably is, too. Perhaps this had given you something to think about, either in the FPV world or just some of what can be done with some of those neat buttons and things on a modern rc transmitter. We can talk more about this at the field and you can try out some of the stuff yourself.