

**PRODUCT TEST REPORT by Dick Pettit**

**Item Tested**..... Co-Pilot

**Type**..... Infrared Flight  
Stabilization System

**Purpose**..... In-flight stabilization

**Manufacturer**.....

FMA Direct  
5716A Industry lane  
Frederick, MD 21704  
1-800-343-2934

**Distributor**..... Dealers/Direct

**Suggested Retail Price**..... \$119.95

**Applicability**.....

Most any radio system, fixed wing, helicopter, glider

**Dimensions**.....

Sensor: 1 3/8" by 1 3/8" by 5/8"  
Computer: 1 3/4" by 7/8" by 1/2"

**Weight**..... 1.0 oz.

**Instructions**..... 24 illustrated pages

**Plans**..... n/a

**Hardware Included**.....

Sensor, Computer, ribbon cable, calibration button with cord, installation hook and loop material

**Items Needed To Complete**.....

Optional elevon mixer, various lengths of ribbon cables, optional digital servo buffer

**Tested On**.....

Several fixed wing aircraft

**Special Test Conditions**.....

None

**CHEERS** - very easy to install and calibrate, easily moved between planes, it works exactly as described in the instructions

**JEERS** - none, but read my "Conclusions"

R/C flight instructors are constantly looking for better and more efficient methods of passing along vital information to their students in order to get them to a point where they can take off, maneuver and land with little or no assistance. The process of using a "buddy box", where two transmitters are electrically connected and used by both student and instructor, has been one of the best methods for training new pilots. The advent of computer based flight simulators also has made a large impression in many new pilots, since they can "fly" an R/C airplane with no fear of crashing. There are also a large number of potential R/C pilots that simply head to their local hobby dealer, buy one of the many ARF (Almost Ready to Fly) trainers and attempt to learn to fly on their own, usually with disastrous results.

The FMA Direct Co-Pilot is an electronic system that is connected into the receiver outputs for elevator and ailerons (or rudder). The sensor unit mounts on the top or bottom of the airplane, either on the wing or fuselage, and the computer unit mounts inside the fuselage to connect to the receiver. A small hole must be provided for the tiny calibration push button. After a simple calibration procedure is completed before each flying session, the plane is ready to fly.

Here's how it works: "The Co-Pilot looks at the horizon with infrared heat sensors (the same technology is used in thermal imaging cameras). The earth is warm (even when covered with snow) below the horizon, while the sky is cold above the horizon. The Co-Pilot 'sees' this temperature difference. When Co-Pilot senses changes in aircraft attitude relative to the infrared horizon, it sends corrective signals to keep the aircraft level." The sensors can see all the way to the Earth's infrared horizon. The infrared temperature seen for the Earth is an average of infrared generated from all terrain features. The Co-Pilot's computer takes the signals from the infrared sensors and uses them to modify the signals sent by the receiver to the servos that control pitch and roll.

"Flying with Co-Pilot is easy. When you center the control stick, Co-Pilot automatically returns the aircraft to level flight." It works over a wide range of weather conditions. It is calibrated to the local flying environment and it's sensitivity control can vary the Co-Pilot's response to transmitter inputs.

I read the entire instruction manual several times to familiarize myself with what is used, how it is all connected and how to adapt the Co-Pilot to several types of aircraft. FMA Direct takes a full page to describe the safety precautions that must be followed, such as reading the manual, getting help if you don't have the experience, and other general R/C related safety practices. They also list many Co-Pilot related precautions, such as mounting on the aircraft, calibration prior to first flights, protection from fuel or other contamination, and the Co-Pilot checklist.

The Co-Pilot can be connected and controlled three ways, manually, on/off and proportionally. If your transmitter is the basic 3 or 4 channel type with no unused channels, The Co-Pilot is always engaged during flight. The flight characteristics are set up by the sensitivity adjustment (throw) on the computer module. To change the sensitivity, you must land and adjust the control. If your transmitter has an on/off channel (typically found on 5 channel radio systems with a 5th channel switch), the Co-Pilot can be turned on and off during flight. You must set the sensitivity manually on the computer, but you can use the Co-Pilot for taking off and landing, switching it off for aerobatics and normal flight. If your transmitter has an unused proportional channel, you can connect the

Co-Pilot so that you can adjust the sensitivity in flight and turn it on or off. The sensitivity can be matched to the student's skill during the course of flight instruction. If a strong cross wind develops, the sensitivity can be set for more stabilization for better control during landing.

According to FMA Direct, the Co-Pilot is "...an excellent teaching aid...maintains stable flight while student develops flying skills...". Advanced pilots can use the Co-Pilot on new models during first flights or on unstable airplanes. It will not, however, be able to teach you how to fly. You will need an instructor for several reasons, one, to make sure your airplane is indeed capable of flight and two, to quietly remind the trainee to "center the sticks" to bring the plane back to straight and level flight.

The instruction manual is written using 3 basic types of R/C models as examples, an engine powered fixed wing airplane, an electric powered flying wing and a helicopter. Some digital servos may require the use of the optional Digital Servo Buffer available from FMA, along with an elevator mixer, used for some delta wing installations.

Let's take a closer look at installation and use of the Co-Pilot. The first thing to do is pick a suitable place for the installation of the sensor unit. On a typical high wing trainer, the sensor is located half way between the root and the tip of the wing that is opposite the engine exhaust. This gives the sensor a full view of the infrared horizon and will keep it clean of exhaust residue. In a low wing plane, the sensor is mounted on the bottom of the wing away from the exhaust. On a helicopter, the sensor is mounted on the tail boom.

The calibration button is mounted on the side of the aircraft fuselage, preferably close to the radio power switch, since the power switch and calibration button need to be turned on and off during some of the calibration procedures. FMA Direct states that you should not merely let the calibration button hang loose.

Finally, the computer unit is connected between the receiver and the pitch and roll servos. The servos are unplugged from the receiver, the computer input leads are connected to the receiver outputs and the servos are plugged into the computer. There are 4 small DIP switches that must be set up depending on the type of model you are flying. All this is covered in detail in the instruction manual. Be sure to provide some sort of vibration isolation, just as you would for a receiver or battery.

Next comes the calibration of the Co-Pilot system. The computer and infrared sensor must be calibrated to detect where the sky and ground are located, both side to side and front to back. The plane is then held vertically with its nose on the ground and the calibration button is pressed. The Co-Pilot responds by moving the flight surfaces from one to ten times, one being marginal and ten being perfect. It is determining how well it can differentiate between the sky and the ground. The plane must then be placed on the ground and leveled, easy for a tricycle gear model but you have to raise the tail on a taildragger with a support of some sort, not merely your hand. The aileron stick on the transmitter is then moved to either full right or left, and the Co-Pilot responds by moving the flight surfaces again, indicating the calibration is complete. After the unit is calibrated, the elevator will move up when the plane's nose is pointed down and the low aileron will rise when the plane is rocked side to side. All this confirms exactly to what the instructions say, and I was very anxious to get the Co-Pilot equipped plane into the air.

For the first flight tests, I installed the FMA Co-Pilot on my trusty Night Flyer, a Telemaster 40 with a new Saito 56 engine. The infrared sensor unit was fastened to the top of the wing using hook and loop fasteners. The 4 wire cable was then routed to the front of the wing center section and also secured with several more pieces of hook and loop. The computer unit was installed at a location convenient to the receiver, the aileron and elevator servo leads were taken from the receiver and plugged into the computer and the computer leads plugged back into the receiver. The 4 wire cable and the calibration button lead is then plugged into the computer and the remote control lead was plugged into a radio channel that was controlled by a rotary knob. I wanted to have as much control of sensitivity as I could. The system was tested following the very complete instruction manual and after several adjustments to switch positions, the Co-Pilot was ready to calibrate. This procedure has to be done at the place you will be flying and also must be done every time you fly, since the temperature and other conditions will probably have changed.

I took the plane with the Co-Pilot to our local flying field and first flew it without using the Co-Pilot at all. I wanted to see how the plane flew under the conditions of that particular day. There was a moderate cross wind which required a little correction during take offs and landings. Hopefully, the Co-Pilot would help in those maneuvers. I followed the calibration procedure, which takes no more than 5 minutes at most to complete. The Co-Pilot need not be re-calibrated unless the weather conditions change during the flying session by an extreme amount. The controls responded with a "9", meaning I had almost perfect differentiation between earth and sky.

I then fired up the engine, set the sensitivity control at about half and took off with the Co-Pilot helping. I began to notice that I could make turns in either direction and change the pitch of the plane, but the Co-Pilot always seemed to want to keep the plane straight and level. But, that's exactly what it was supposed to do. After trimming the plane for hands off flight, I just sat back and watched as the Co-Pilot made small adjustments to keep the plane in a straight line.

I then got brave and turned the sensitivity to about 3/4 and put the Telemaster into a diving turn. I immediately let go of the sticks and the Co-Pilot returned the plane to straight and level flight in a few seconds. Of course, the plane was now flying in a different direction, but it was under control and flying straight and level. I was beginning to see where the Co-Pilot would be an invaluable accessory for preliminary flight training.

I then tried a landing using the Co-Pilot to keep the wings level. I took my hands off the right stick and used throttle to control the rate of descent and rudder to steer the plane to the runway. The Co-Pilot simply kept everything in the correct direction and I landed quite nicely. Next, I used the Co-Pilot to help me perform a hands-off takeoff. I dialed in a little up trim, pushed the throttle forward and the Telemaster simply took off and gained altitude just like as if a real pilot was flying.

During one of the many flights that day, I heard my cell phone ringing in my car. The plane, under complete control of the Co-Pilot, was at one end of the flying area at a slow and steady pace, heading towards the other end of the field. I put the transmitter on the ground, walked to my car, answered the phone while walking back to the transmitter and told my wife, the one who called, that I was watching my plane fly itself using the Co-Pilot. She asked if it was flying OK and I replied that I needed to turn the plane around,

heading it back in the opposite direction using rudder input only. After that, I just sat down in a chair, reduced power to cruise and just poked the rudder from time to time to turn the plane. The Co-Pilot was indeed doing exactly what it was supposed to do.

I then took the Co-Pilot from the Telemaster and proceeded to install and calibrate it using the closest thing I could get to a trainer, a Hangar 9 Cessna. While not exactly a beginner's airplane, this plane has been used to provide basic flight instruction for several of our newer club members. The Co-Pilot sensor was again installed on the top of the left wing, the computer was installed inside the fuselage and the calibration button was put in place. Calibration took little more than 5 minutes and the Cessna was ready to fly. Despite the balky engine, the plane soared into the morning sky, first without the aid of the Co-Pilot, then when it was turned on, it performed flawlessly. I did notice that it seemed to take a few seconds longer to resume straight and level flight after the sticks were centered, but that may be due to the flight characteristics of the plane itself.

I had several occasions to test the Co-Pilot during a dead stick landing (remember the balky engine?). The Cessna, without the aid of a spinning propeller, merely remained level and almost landed vertically using the Co-Pilot. It was quite hard to keep the plane's nose down to keep the airspeed up. I would recommend using no more than 1/2 the sensitivity during take offs and landings. Otherwise, set the control for whatever the pilot (and student) is comfortable with during the actual flight time.

I have several conclusions about the FMA Co-Pilot, one of them being the fact that it performs exactly as it is advertised. It stabilizes the aircraft and allows the plane to be flown with complete confidence, a big plus needed during introductory flight training. It is easily installed in almost any airplane and weighs next to nothing. With a price of only \$119.95, it is a great value, especially for a flying club to be used on their trainers or other pilot's planes. It can be switched from plane to plane in minutes and is ready to calibrate soon after that.

Even though FMA says that the Co-Pilot can be used on a 4 channel radio with the sensitivity control on the computer used to set the operating range, it seems to me that I would like to have at least a little control of the unit from the ground. If you have a 5 channel transmitter and receiver, use that 5th channel to turn the Co-Pilot on and off. If you only have 4 channels, go easy on the sensitivity at first and get used to the characteristics as you progress.

The other conclusions are not meant to be "Jeers" but they have to be taken under consideration in any case. First, the Co-Pilot cannot be installed in an aircraft that uses 2 aileron servos that are electronically mixed in the transmitter. This includes many of the high performance aerobatic planes and some of the others that use "flapperons" or individually controlled ailerons. Needless to say, if you're flying a plane as described, you probably don't need a Co-Pilot. I have heard that a newer version of the Co-Pilot will be available soon, and may handle more than just 2 control channels.

Most importantly, I have found that the Co-Pilot, during the course of each flight, moved the ailerons and elevator quite a bit more than a normal human pilot would do. The minor corrections needed to keep the plane straight and level move each servo much more than I would have to do as a pilot. This means that the radio system and servos are using more battery power than normal and the charge state of the battery should be checked after

every flight. I found that I got just about half the total flight time I normally do while using the Co-Pilot. The unit itself only uses 10 milliamps, but the servos and their constant corrections eat up the battery power. Get an ESV and use it after every flight, and charge the battery when necessary.

I am highly recommending the FMA Direct Co-Pilot for use by both flight instructors and beginning pilots. Once the complete review of my Co-Pilot is complete, I will be giving the unit to my local flying club to be used on their trainer. I'm sure that they will be putting it to good use in the future.

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