

FLYING WITH COPILOT – A MAGICAL EXPERIENCE

As of March 2002, Copilot has been shipping for four months and a body of field data and feedback exists. Some magazine reviews have appeared and several are pending. Those interested in Copilot will find most questions and information addressed in this paper.

A. WHAT COPILOT DOES - Copilot is the most revolutionary new "happening" to appear in the field of R/C in many years. Nothing as significant has occurred since Jerry Pullen and Howard Bonner introduced the concept of "Digital Radio" in 1962 or perhaps the event of acquisition of the 80 frequencies for models by the AMA Frequency Committee under the guidance of Walt Good, Fred Marks, Bob Aberle, Jack Albrecht, et al in 1982. There is no longer a need for a flight simulator and a club no longer has to impose the requirement for a buddy box; therefore, concern for compatibility between transmitters goes away. The instructor's job becomes greatly simplified and consists mainly of being sure the beginner's model is safe and flyable and then reminding the student, gently, to "let go of the stick" when necessary so the airplane can recover itself from any undesired attitude. The student always knows who is flying the airplane and this speeds training tremendously. When the student is ready to land, he is instructed to turn the plane until it is lined up with the runway (or grass field); then to stay off the right stick and throttle back. Power is added or reduced as needed to reach the landing spot and Copilot keeps the nose and wings level, even in gusty wind, all the way to touchdown. The best testimonial seen personally is the 12-year-old youngster who flew the first prototype on a RAZOR at the DCRC field. The transmitter was handed to Sean with the airplane a couple hundred feet up and he flew the rest of the flight, landing exactly in the middle of the runway. During the flight, he was instructed to "push the stick forward" to dive the model, then to let go of the stick to see the reaction. This was repeated a few times for elevator and for roll, even including inverted flight, so that he understood the reaction completely. Confidence that Copilot will prevent a crash builds immediately. The pilot realizes that Copilot will fly the airplane for him if he gets in trouble. People who have never flown are learning to fly and are making their own landings within three to four flights. No more crashes!

As experience is gained, the beginner learns to flare just before touchdown for a smooth landing. You can land without flaring, but it puts wear and tear on the nose gear. The primary function of the club instructor becomes that of making certain that the student has an airplane that is properly assembled and with linkages, etc. as they should be. The airplane has to be flyable, of course. Copilot can actually make an airplane flyable that has the cg, etc. out of bounds. However, if Copilot is turned off, that airplane is not flyable, so ensure that the model is flyable without Copilot turned on. This is common sense.

B. INSTALLATION IS QUICK AND THERE ARE FEW LIMITATIONS ON INSTALLATION- Installation takes longer to tell about than to do. It takes 15 minutes or so to install Copilot. Two limitations on Copilot are that the sensor must not be installed in the engine exhaust stream where oil can coat the sensor window and the sensor cannot be mounted next to a fuselage where IR is blocked. The latter also means that Copilot cannot be mounted internal to the fuselage or under a canopy, which does not transmit IR. In due time, we will offer a "heat pipe" assembly that will permit the sensor to be mounted internally with a heat pipe extending from each lens to the outside. A 1/4" ID pipe is sufficient. At this time, Copilot does not have the cables and connections needed to operate dual ailerons (for use as flaperons) or CCPM heli controls that require three servos with mixing in the transmitter. A version of Copilot will be available in the next few months that has that capability. So, **don't order Copilot now if that is your application.** Rather, watch this web site for announcements.

If, during calibration, Copilot signals that the IR strength is one on a scale of ten, there may not be sufficient IR differential between earth and space for Copilot to respond. No harm will result; it's just that Copilot won't help you any under those circumstances and it is best to turn it off using the gain control on the on-board computer. This is a rare occurrence that happens when there is snow, low cloud cover, and fog at the same time.

C. COPILOT IS MUCH MORE THAN ON-OFF - Copilot has variable gain if you have an extra channel available. It can be turned on or off with the retract gear switch or other switch or the gain can be set remotely if the radio has a lever or knob available. The beginner likes to have the airplane "stiff as a poker". The experienced flyer backs off on the gain to the point that maneuvers can be done with Copilot providing just the right stability. Copilot tames the scale airplanes and makes pattern flying more precise. During a loop, Copilot holds the wings level. Axial rolls are best done with Copilot gain fully reduced since it will resist attempts to roll the model. Application of Copilot to control elevator and rudder during hovering is now being explored by several users.

D. COPILOT: PATENTED TECHNOLOGY USED TO STABILIZE SPACECRAFT - Copilot is very much better than competing stabilizers that depend on optical measurement in that Copilot derives the stabilizing signal by measuring the difference in Infrared signature of the earth and deep space, notably the carbon dioxide in the upper atmosphere. Thus, the variations in cloud cover and light conditions are avoided. It is easiest to visualize if you think of the model being suspended on a taut string from the center of the earth to deep space. If the nose or a wing tip starts to dip toward the earth, the sensor on that side sees the average IR signature of the terrain and the opposite sensor begins to see the cold of deep space. Effectively, the sensor "flies toward the cold"; that is, it raises the hotter sensor to fly the model away from the ground. This is a powerful restoring signal. Copilot is not affected by clouds or variations in terrain as the sensors see the "average" IR signature of the composite terrain including buildings, trees, lakes, pavement, etc. Copilot can even be flown at night; hence, the quip that optical stabilizers and Copilot are "as different as night and day"!

E. AS PRECISE AS YOU WANT- The second huge advantage of Copilot over optical stabilizers is that Copilot is very precise, as precise as the user cares to make it. Reaction time is determined by the servos and is much faster than one can move sticks. Recovery from any situation occurs in about one second. In one defense application, the sensor is hard mounted to a heavy steel body and mechanically aligned to produce zero error. Of course, the manual just suggests mounting the sensor to the model with Velcro and that permits about 2 degrees error depending on how one positions the sensor. Copilot takes care of any misalignment through its unique calibration procedure that requires perhaps 30 seconds before the first flight of the day. The more accurately the model is leveled during calibration, the more nearly it will fly level. Heli fliers who want more precision sometimes mount the sensor on a platform with fine-thread screws to adjust it to precise alignment using a bubble level. Hal DeBolt made such a rig to use on his autogyro. One user had Copilot on a big heli to be used for surveillance and he had permanently mounted a bubble level on the heli. Shims are added under the landing gear until the heli is precisely level before hitting the calibration button.

F. INCREDIBLY, COPILOT MAKES IT EASIER TO FLY A HELI THAN AN AIRPLANE - Copilot has an even greater impact on helis. When a heli is outfitted with a Copilot on roll and pitch cyclic and a heading lock gyro on tail rotor, it is easier to fly than an airplane. The reason is that the airplane is still flying when Copilot brings it back to level flight and the pilot has to figure out what to do. However, the heli stops, hovers, and waits for the pilot to figure out what to do. Landings are made by reducing power and letting Copilot land the heli.

G. IF SOME THINK COPILOT IS LIKE CHEATING, THAT IS O.K. - It is probably true that some will never progress beyond flying with Copilot, but that's OK. They will still keep building and advancing to scale, etc. even if every model they build has a Copilot on it.

H. FINALLY; TRUE FAIL-SAFE INSTEAD OF A PROGRAMMED CRASH - Copilot offers a tremendous safety feature. If the radio has fail-safe, Copilot will hold the nose level and the wings at a preset bank angle while the rudder can be programmed for a circling turn. Throttle can be programmed for gradual descent, hold-altitude, or cut off. Now true fail-safe becomes a practicality.

Should you wish, you may call 301 668 7615 and our staff will provide additional info. **COPILOT-ITS WHAT'S FOR FLYING!!!**

I. A FEW REPORTS FROM SATISFIED USERS: (See Customer Talk for others)

From:"CharlesKimbrough"
To: Tim Marks Tim
Sent: Tuesday, March 19, 2002 7:31 PM
Subject: Copilot

Tim,

I purchased a FMA Direct Copilot, several weeks ago. A friend of mine installed it in a six foot slope glider foam flying wing he built. We both flew it last week end. It's magic!

The wonderful thing about it is, I haven't flown an R/C glider for more than a year and a half, because I have Macular Degeneration, and have become legally blind. I can't drive a car, or read newsprint, but I can now fly slope gliders again, with the help of a Copilot. Now when I temporarily lose sight of my glider, I just release the stick, and wait for it to come back into view, it just flies perfectly by itself through the dead spots in my vision.

This glider is so easy to control, I could hand the transmitter to any one even if they had no R/C experience, and would not fear they might crash my model. As I stated before the Copilot is magic! The person that developed it should be given a medal, or at the very least some kind of award of merit by the R/C manufacturers association.

I just ordered another Copilot from you, I am back in the glider flying hobby again.

Chuck Kimbrough

And a message from Gordy Stahl:

Hi Guys,

I am planning an article about the new FMA Co-Pilot Flight Stabilizer. It seems to be as good as we hope these things should be. Very tiny, two components that total about 1oz. One mounts outside and one in. This could be the answer to that club trainer we have been relying on 2m foamies to take care of.... with warped result. Now you can put up a woody and maybe even a glass ship and turn it over to a newbie to wiggle.

Gordy

Gordy,

Here's what I know about the new FMA CO-PILOT!!!

I've already sold 5 of 'em. We checked it out about 2 months ago...Put 1 in a Windstar EP Sailplane and 1 in my Raptor 30 Heli. We've (literally) took a passer-by, explained what we were trying to do, and they were able to fly circuits with the Co-Pilot on the Windstar. Ray (my buddy) has his 6-year old son flying absolutely beautiful circuits with the Windstar.

On the Raptor...a friend (who's an excellent 3D pilot) got it into all kinds of obscene situations and the Co-Pilot always was able to recover it. However, the Co-Pilot WILL NOT hold your chopper in 1 place, that's a mis-conception because...How many days is there absolutely NO wind???