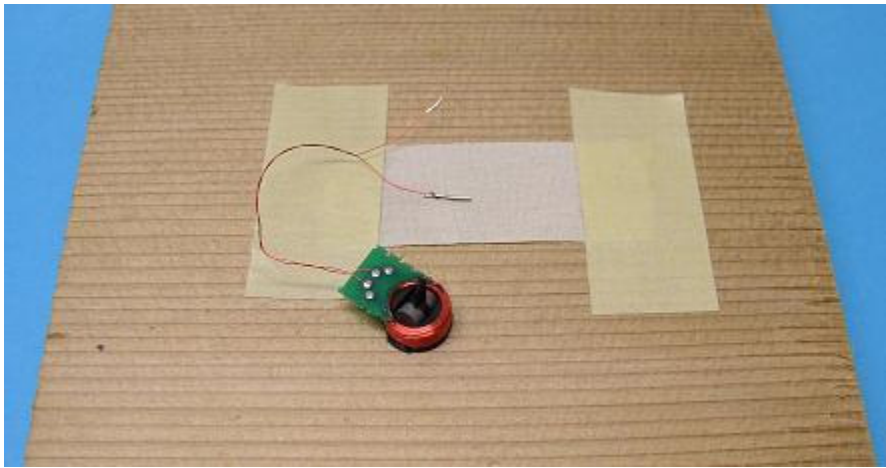


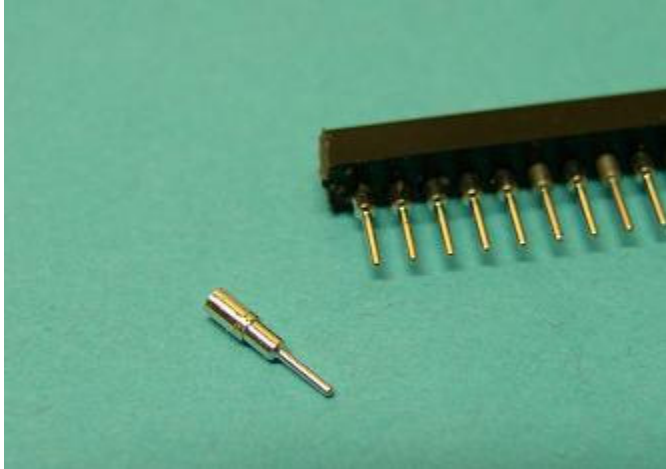
7 Remote Actuator Secrets Revealed

By Gordon Johnson

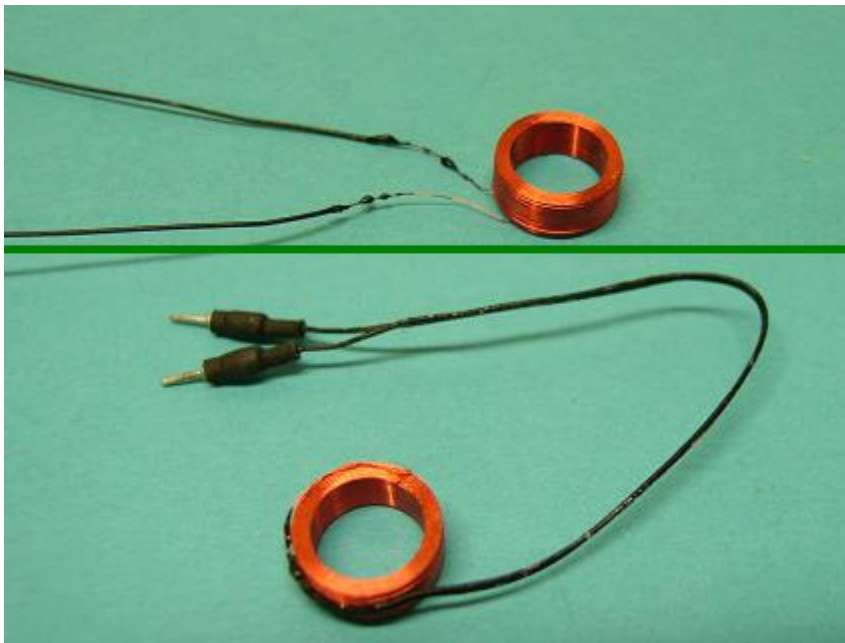
Since the introduction of Dynamics Unlimited's RFFS 100 receiver there has been a huge amount of interest in actuator controlled micro planes. Then came LiPoly cells which were much lighter than their NiCd and NiMH counterparts. This created problems obtaining the desired CG. The easiest way to solve the problem is to move what seems like a trivial two grams of actuator weight from the extreme tail of the plane to near the CG of the plane. This in turn caused problems with mastering how to hook up the actuators to the tail surfaces, but also opened up other possibilities as well. This article is a cookbook of what I have learned the hard way, and from others, about remote actuators. Not all techniques are covered here, just the ones I use the most. For example I don't cover pull-pull controls since I use push rods.



Soldering Magnet Wire: The very fine magnet wire that actuator coils are wound from can be very difficult to solder. Take a piece of masking tape and place it sticky side up on a piece of wood, and then tape it down with two more pieces of tape. Some magnet wire coatings will burn off with the heat from a soldering iron, but others won't. Scrape the last half inch of the wire with a hobby knife held at a 45-degree angle to remove the coating. It's best to do this by holding the end of the wire and scraping away from the end. The knife will make a small dent in the wire where you start scraping, and this is prone to breakage. By scraping more of the length than you need, and then cutting off the portion where you started the scrape you will minimize the chance of breakage. Wrap the magnet wire a couple of times around a length of stripped wire you are going to use for a plug. Place them both down on the masking tape, which will hold them in place, and brush a small amount of soldering flux on. Now just touch it with a hot soldering iron that you have loaded some solder onto and it's soldered very nicely. The smallest heat shrink applied to this joint will help prevent it from breaking.

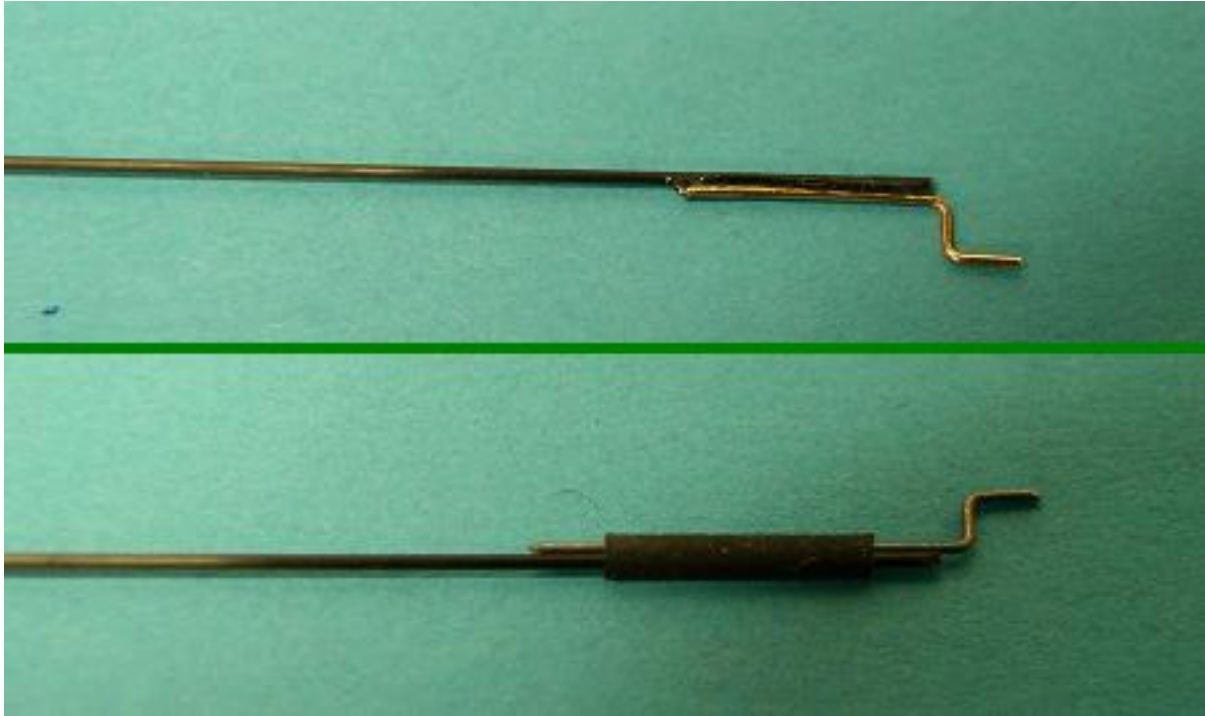


Making Pins From Computer Plugs: I often like to use very fine insulated 38 or 32 gauge wire for actuator hookup (available from Indoor Flyer in the UK or BSD in the US). This works well with the same type of hollow pins that the RFFS-100 uses. I got mine in a kit from Didel, but they can also be obtained from BSD and from various surplus sources. Remove the pin from the plastic block. Strip about 1/8 inch of insulation from the wire, tin with your soldering iron, brush some soldering flux on the wire, insert into the back side of the pin and touch with a iron loaded with some solder. Very small diameter heat shrink can now be applied over the top of the pin and wire to make a sturdy pin that you can plug in and out of your receiver many times.



Insulated Wire Hookup of Coils: The 38 gauge insulated wire needs to be soldered to the magnet wire of the coil. Use the method above for soldering magnet wire. Generally I just overlap the magnet wire with the tinned end of the insulated wire. To keep the wires from shorting out I paint them with enamel model paint, which you can see in the upper picture. To keep stresses from crashes etc. from pulling on the fragile magnet wire I wrap the wire around the coil so the insulated wire goes about half way around, and then glue it to the coil with CA (or

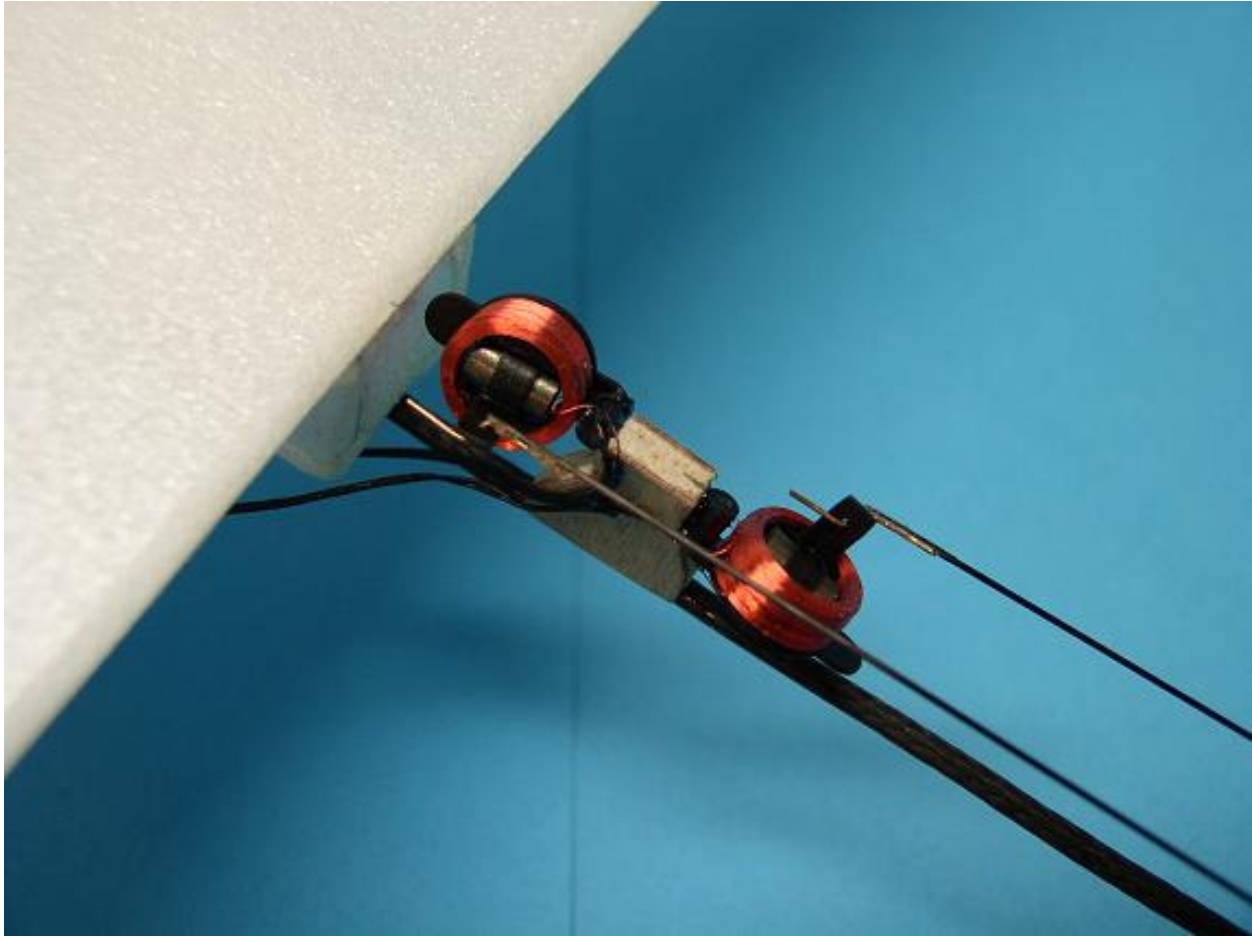
other glue like Ambroid) on a toothpick. This is shown in the lower picture, along with the computer plug pins ready for plugging into the RFFS. I leave the other half of the coil without any wire on it in case I need to use magnets on it for centering the actuators. Note, some people prefer to glue the hookup wire to the actuator housing, or wire to a plug glued to the actuator housing. Those are good methods also.



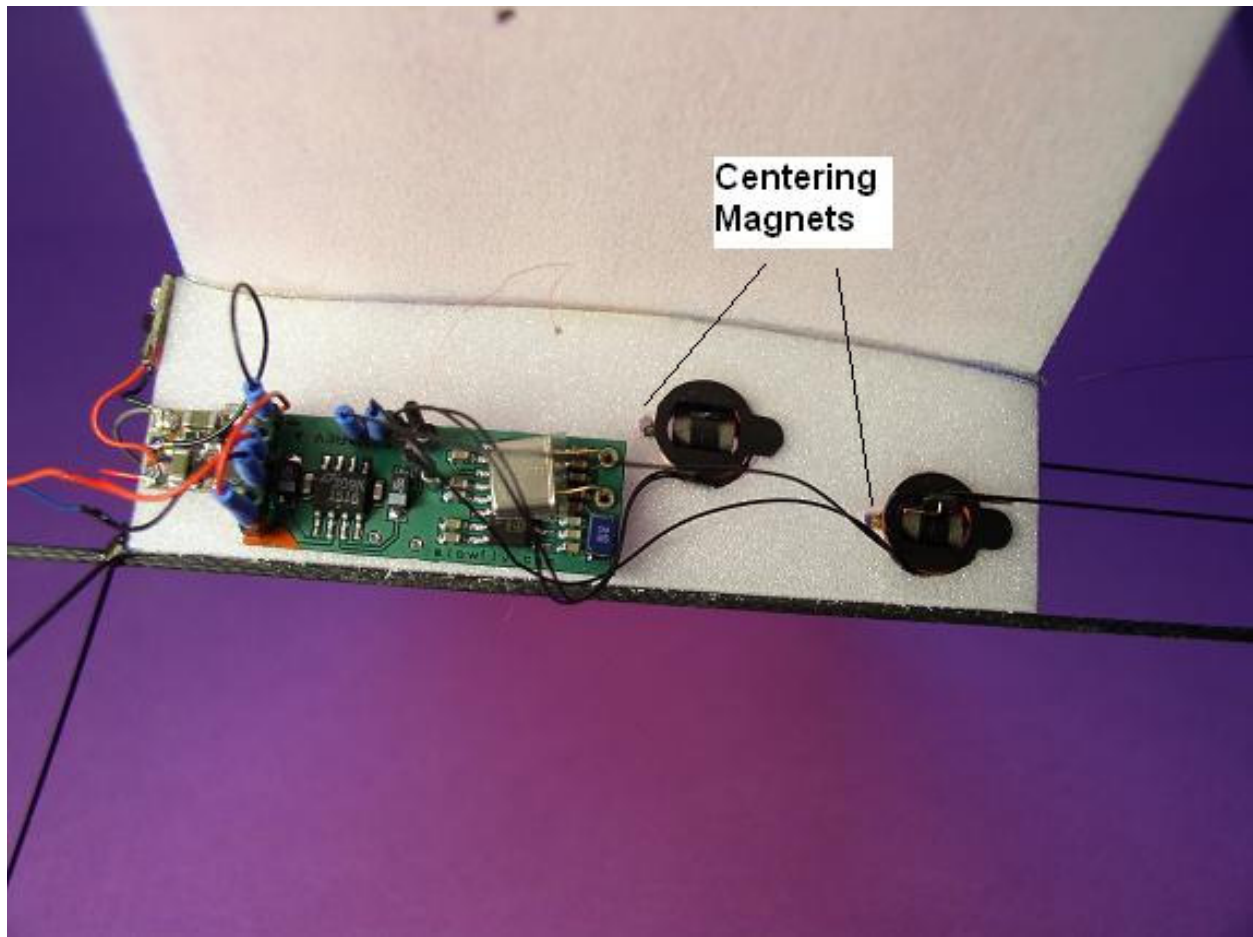
Push Rods: For most applications I use 0.5mm carbon fiber rod for the push rods with a Z-bend on each end. Make the Z-bend on the actuator end from fine brass wire. Lay the rod and Z-bend down on a piece of wax paper and use a pin to apply a small amount of thick CA to the area where the wire and the rod touch. Some people want to wrap this joint with thread and then dowse with CA. But, with the forces we are talking about from actuators this is simply not necessary. For the Z-bend back at the control surface I use fine piano wire. I sharpen the end on the long part of the Z-bend to make it easier to insert into the heat shrink tubing. I place the CF rod and Z-bend in a short length of heat shrink tubing and shrink it. It does not have to be super tight as you want to be able to adjust it. Work the Z-bend in and out a few times to loosen it up a bit. It will still have more friction than is required.



Push Rod Installation: It's a good idea to leave the CF rod longer than necessary until installing the push rod. Insert the actuator end Z-bend into the actuator arm, lay the rod in place and estimate where the CF rod needs to be cut. When in doubt cut it a bit long. Put the pieces in place and see if you got the length correct. In the picture above you can see that the piano wire Z-bend is just long enough to overlap the CF rod. And, the CF rod ends about $\frac{1}{4}$ inch from the control arm when the surface is neutral. It helps to sand the CF rod to a slight point to help inserting it into the shrunk heat shrink tubing. Now comes the tough part. I put the model in a model vice to hold it securely. With everything in place and the heat shrink on the CF rod, I use two needle nose pliers to hold the CF rod and the piano wire Z-bend and insert the z-bend into the heat shrink tubing. I use the pliers on the CF rod to keep force on the heat shrink. Once it is on keep adjusting the length by pushing the CF rod and Z-bend together or apart until the control surface is adjusted.



Centering Using 90-degree Orientation: To provide centering force on the control surfaces the standard BIRD style actuator that the RFFS originally came with rubber band hinges were used. A problem with this is the least amount of centering force occurs when the control surface has no deflection. As it is deflected more the rubber band provides more centering force. An advantage of remote actuators is it is easier to use magnet centering. One method is to orient the actuators 90-degrees to each other as shown in the picture above. If oriented on the same plane when one actuator is moved the other will want to move. When oriented 90-degrees to each other when one is moved the other does not move, and when you let go of the one you moved it will spring back to a neutral position. In this application I made a pylon to mount the actuators to that has a CF rod for the housings to slip over. I glued the actuator hookup wires to the pylon to keep stress off the magnet wire.



Centering With External Magnets: Mounting actuators in a profile fuselage or in this case in a wing pylon is a very clean way to place actuators. The problem is that the actuator magnets are oriented in the same plane. A way around this is to use a centering magnet. First, the actuators must be assembled and oriented so the poles on both actuators are pointing in the same direction (i.e., N pointing to the left on both actuators in the above picture). Some people make a slit in the fuselage and place a larger magnet half way between the two actuators. I prefer to use much smaller magnets on the outside of the coil of each magnet. For the elevator this means I can slide the magnet to one side or the other of the coil to provide more centering force in the up direction for the elevator. All or most of the elevator droop can be eliminated this way. On the plane above I have the control rods for the actuators on opposite sides of the wing pylon. Cut the holes for the actuator using sharpened brass tubing I purchased at the local hobby shop in the same diameter as the coils. Next I cut out a small square on one side where the 1/16x1/32 magnets I get from Forcefield.com will go. I place the small external magnets in place before I hook up the control rods. Once I have the length on the elevator control rod adjusted where I want it, I use a toothpick to push the centering magnet to one side and provide up centering force. After I find the correct position for the magnet, I apply a spot of thick CA to the magnet to glue it in place. The rudder is simpler as all that needs to be done is find the position that centers the rudder. I also do this final placement of the centering magnets with the receiver hooked up and powered. I adjust the trim on my radio so the actuators are in the center and not humming. Then, I try and find the centering position for the magnets that will also result in no humming. This means neutral on the transmitter is also neutral on the actuator. You might

wonder how much torque is lost with this magnet centering technique. I've measured it and when using a Forcefield 1/16x1/32 magnet on a Dynamics Unlimited coil with the Bob Selman actuator kit the loss of torque is about 10%. I consider this acceptable as the centering I get is so much more precise and consistent. For more on magnetic centering see Matt Keennon's article in the September 2003 RC Microflight.



Creative Installation: The plane pictured above is my profile P40 covered with printed tissue. The actuators are both on one side with the actuator arms on the other side cut off so they don't poke through the tissue. This makes one side of the plane have perfect graphics. And, on this side of the plane the actuators were positioned to let the gold color of the actuator coils blend in with the brown of color scheme. The green circuit boards that come on some of the Dynamics Unlimited actuator coils blends in with the green portions. So, even on this side of the plane the actuators really don't stand out.

Conclusion: There are a number of very good reasons to switch to remote actuators. The techniques take a bit of practice, and a few specialized bits are needed like very thin CF rod and brass wire. But, once you have the materials needed and have done a couple of remote actuator installations you won't want to go back to the type built into the control surfaces. Give remote actuators a try on your next plane.

