DESIGNING FOR PULSE PROPORTIONAL

The Properly Designed GALLOPING GHOST Ship Will Give You Maximum Performance. HERE'S HOW . . . AND WHY.

BY CHUCK CUNNINGHAM

WITH the advent of the small single channel proportional rigs, galloping ghost and pulse rudder, a re-awakening of interest in ships of this type has been sweeping the country for the past year. Several months ago I set out the rules covering a competition for this class, the Midwest RCM Air racers, and many new designs have been offered for these systems. The new Testor's pulse rudder, all-plastic ready-to-fly is only a forerunner of things to come. This rig, by the way, is really pretty slick, and is an ideal entry into R/C for the beginner, or for a son or daughter, or a wife. The point is, there are lots of slick ships that are perfect for this type control system and many fine small engines to provide the power. But, with all of these new gadgets, ready-to-fly models, and so on, a refresher course is needed for the old rudder-only flier, and a new lesson might be of some use to those of you new to this hobby. Last month we dug into trimming out a full house ship (should we call them "multis" anymore?) so for this month, let us go into the design of a small rudder-only ship and then see how it is modified for galloping ghost. Now, if only my badly damaged right index finger will stand up to the rigors of typing! (Damaged by a backfire from my slightly, loaded, and cold .61. Naw, Fearless, the **engine** was loaded!)

A small ship, unlike some of her larger relatives, flies on the wing, not on the engine power alone. (Dirty dig, I'll admit.) Since we must depend upon the wing for lift, as well as self neutralizing flight, we should be happy to contemplate the good old Clark Y section for an airfoil. Why stick with this old section when the symmetrical and semi-symmetrical airfoils are the thing in "multi"? Simply because this airfoil will fly the ship at a slight nose up attitude; will fly it slowly and safely; will land at a nice slow speed; will not drop out of the sky if slowed up too much in the glide; and will pull out of a spiral dive by itself. This last factor by the way is most important, since with a rudder only ship, ya' simply "ain't got no elevator."

Let's look at the drawing of the basic aircraft. Notice that the nose is blunt, and strong, the wing sits on the fuselage at a positive angle, the engine is mounted with downthrust and sidethrust, and that the wing is rather short and stubby. Why?

First, the nose should be reasonably blunt to slow down the aircraft in a spiral dive, and strong because a rudder only ship often lands on her snoot when coming back to old mother earth (again, no elevator for a flared landing). The wing parks with its leading edge higher than its trailing edge because this positive incidence acts as an elevator (we'll find out how later). The engine is mounted with downthrust so that it will tend to counteract the extra lift generated by the positive setting of the wing, and is cocked off to the side to counteract the torque of the engine, which tends to turn the aircraft to the left. The wing is stubby because this is stronger than a long thin wing, and this type of aircraft has been known to cartwheel once in a while. With a short, strong wing the chance of damage is minimized.

We are talking about using a pulse rudder on this ship, so what kind of monkey shines will be going on at the South End of our ship while it is flying North? The rudder will be flapping away like crazy, that's what will be going on, and in flapping madly from side to side, will act just like an air brake. A very effective air brake, at that! If you want all-out performance, use a larger engine; if you want slow flight, use a ½A engine, but remember, with the nervous rudder a lot of power must be consumed to overcome this braking effect.

Most kit models that have been designed for use with escapements are highly suited to use in pulse rudder, with one modification. The moveable portion of the vertical stabilizer is generally too small. For an escapement operation a small rudder is desirable, since upon command, the rudder moves to one side and stays there. With pulse, though, the rudder is swinging in an arc, and when you give a command for right or left rudder, the center of the arc simply shifts to that side. The total effect is to minimize the rudder control. This is overcome by simply increasing the size of the rudder. Usually, doubling its area is about right.

For the next step, let's assume that you have a completed ship, batteries charged, ready to fly. Let's take a theoretical flight and find out what kind of problems we run into in the first flights and what can be done to solve them.

Since this is a theoretical ship we will extend the theory even farther and assume that there are no warps, nor misaligned components. (Who ever heard of these?) Start the engine, turn on the switches, check the operation of the rudder, and pitch it! If it flies away from you with a gentle upward movement with no tendency to turn to left or the right, forget about reading the rest and just go on and fly! If it dives to the ground about fifty feet in front of you, you probably didn't heave it hard enough to build up flying speed, or it may be too heavy. Let's subscribe to the "harder heave" theory, start the engine again, and pitch it once more. Don't throw it with the nose up — just run along with the model held aloft in a flying attitude, and when it begins to feel light in your hand, push it forward with a gentle shove. Watch the climb out! If it turns either way, trim a little rudder into the transmitter until you have her flying straight away. Now, attempt a gentle turn and let the craft make a sweeping turn. Don't let the nose drop — if it does begin to fall, ease up on the rudder and let the turn widen out. Make the first flight with nothing but large sweeping turns. If the trim settings are correct it will not climb too rapidly. If, though, it does climb out too fast, reaches an attitude of stall, then falls off and roller coasters around the sky, then

(Continued on Page 61)

you probably don't have enough down thrust, or you have too much positive incidence, or a combination of both. The best way to break up a roller coaster is to turn it at the bottom of the dip, let the excess speed be dissipated in the turn. When the engine cuts you can check for many of the trim settings that were impossible to determine with the little mill grinding away. In the glide, the ship should glide straight ahead at a reasonable sink rate. If it continues to porpoise, then you have too much incidence. Raise the trailing edge of the wing with a balsa shim. If the glide seems to be about right, then the roller coaster bit was caused by insufficient down thrust, so add some when the bird is on the ground again.

If, when gliding, the ship turned to the right, and when you had power flight it turned to the left, and you corrected this turn with a trim setting, then you need more right thrust. If, on the other hand, it flew to the left under power, and left in the glide then the rudder setting is at fault, so leave the trim setting alone. It is generally better to have more right thrust than you need than to have too much left thrust.

After you have gotten the feel of the ship you will want to try your hand at aerobatics. As we said earlier, the rudder is to get you into a spiral dive in order to build up speed, while the wing is to pull you out of the dive and let the lift pull you into a maneuver. Get plenty of altitude and then give it a hard right rudder. If your transmitter is equipped with on and off buttons, use these and give the rudder a hard turn to the right. Let the ship spiral down about two turns, then let off and give just a little left stick. The speed of the spiral should bring her up and over in a loop. If you want to roll, at the bottom of the spiral, let up on the hard turn, let the upward zoom begin and then give a hard rudder again. With practice you can roll round and round the field with the initial speed build up. Just let the nose come up, give a hard rudder, then let up and watch the nose again.

Spins are accomplished by letting the ship climb up, then giving a hard rudder when she is just on the edge of a stall. With a good amount of power this is hard to do, but with smaller engines it is easy. The main thing to remember when flying a rudder only ship is to keep flying at a reasonable altitude, do your stunts up high, and always fly upwind. There is nothing worse than to try and bring a rudder only ship back upwind once it has gotten downwind. Keep upwind and keep your ship!

The logical solution to many of the problems encountered in the rudder only ship are solved by the addition of an elevator, a-la galloping ghost. With an elevator many things are possible, and lots more fun is yours for the taking. Wherein the rudder only ship relied upon the wing to provide an elevating means we now have a nifty little elevator to do the work, and in case we wander off downwind on a breezy day, we only have to trim in a little down elevator to penetrate the wind conditions and have our ship come right back to us.

The design of a galloping ghost aircraft differs from the rudder only just slightly, but this difference is of great value. The main point of difference is in the amount of incidence required. For the rudder only ship we needed about three degrees, but in our G.G. ship we can get by with one degree very nicely. Downthrust may be reduced slightly, but chances are, will remain the same.

With our G.G. ship we can do many of the aerobatics that the larger ships can do, and if we realize our limits we can have a complete ball. I've heard it said that it is impossible to make pylon turns with a galloping ghost ship, but those who made these profound statements had not seen a good G.G. ship fly. With the proper ship a beautiful pylon turn can be made and it is hard to tell from a Goodyear racer.

The elevator on the G.G. is most important. The flipper need not be very large to be very effective. A width of ¾ of an inch is usually just about right. The elevator movement should be limited to about ⅛" down and about ¼" up. This will vary on the individual aircraft, but if you keep this movement to a minimum you will keep the brake effect of this surface to a minimum also, and yet retain a good amount of control over the craft. The proper amount of throw can be best determined in flight. If your ship stalls out when given an up elevator, then chances are that you have too much elevator, and/or too much surface movement. A well trimmed ship will fly at neutral with the elevator at neutral (and trim setting in the middle), and will go into a shallow dive with trim all the way to the down position. Up trim should provide a gentle climb out, while full up-stick should give you a nice round loop if your engine is large enough to pull the model through this maneuver. If it will not, then dive a bit to build up speed and then pull up into a loop.

Keep in mind when landing that your elevator is sensitive and must be used in moderation; don't flare too much, but rather, let her come on down and just ease back on the stick slightly to let the wheels touch.

In general, it is easier to trim out a simple ship such as we have been discussing than to trim out a full house craft, primarily since we are not nearly so critical of the little ship as we are of her big sister. If it flies, we are happy, and this is the root of the fun. With a minimum of time and effort we can own a ship that will give us hours of pleasure. For the beginner to the hobby there are many, many lessons we have touched on here, but others are: to fly away from the sun, make sure that your batteries are fresh, or freshly charged, that your trim settings are the same as the last flight (in other words, the kids haven't been messing around with 'em), vibration and electrical noise have been held to a low level, and that your aircraft is stressed for the loads that you are going to induce into it. Most ships will take the additional load of a little larger engine, and more batteries, but if you are in doubt, beef up the center section of the wing; it can't hurt, and sure could help. Our old flying partner, Dan'l Carey, has a complete six channel rig resting at the bottom of Lake Benbrook due to a folded wing! It can happen, and when it does, it hoits!

Pulse rudder and galloping ghost are winning new friends for this sport by the hundreds. I only hope that those new to the game will take words of advice from the old hands around your flying field, and that the main rule to have better and better flying is to remember that there may be more than just yourself on your frequency. Take the time to check around and see just what is going on. Don't turn on unless the air is clear!