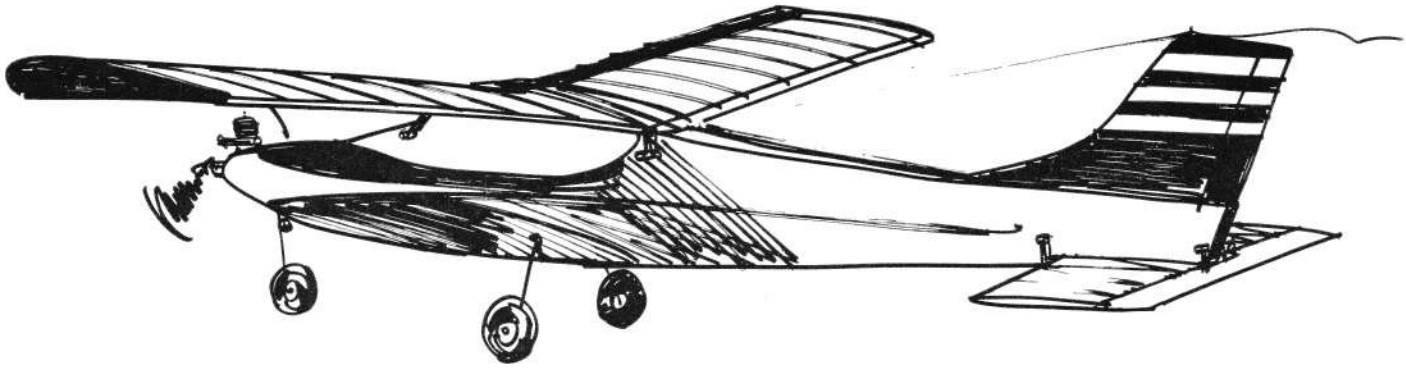


Return of the Ghost

SIMPLE proportional control has been with us for a long time. But it has never reached the heights of popularity that it will attain in the months to come. In its various forms, simple proportional has been called pulse rudder, Galloping Ghost, Kicking Ghost, Kicking Duck, Simpul-Simul, etc. To the newcomer to R/C, these terms simply add to the collective mass of confusion that confronts him when he attempts to decide which type of radio system will give him the most for the money he has to spend on his hobby. For this reason, let's discard the various names – they are just that, names given to various ways, both electronic and mechanical, of deriving proportional control from a single channel radio system. Let's look at the overall picture and see what **you** can expect . . . what **you** can do with simple proportional control.

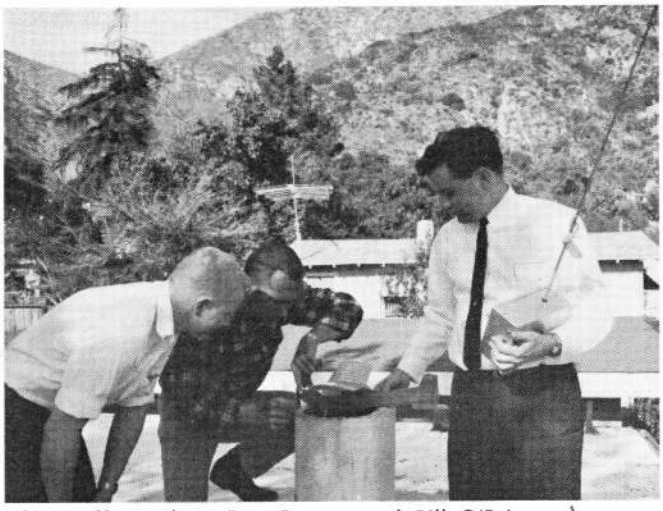
This is the age of proportional control. The pages of this magazine contain advertisements for "full-house" proportional systems ranging in price from $300 to nearly $700. There is no doubt in any RC'ers mind that proportional control is far more precise, smooth, and exacting than "bang-bang" type of control, such as single channel escapements, servos, or multi-channel reed systems. But what if you cannot, or do not wish to, afford one of the more expensive systems? What can you do for a lesser sum? Let's say, $150 maximum?

Very simply stated, proportional control means moving a control surface in degrees proportionate to the movement of the stick at the transmitter. Contrast this to a single channel escapement or servo, or a multi channel reed system, where full movement of the control surface results from signaling a control from the transmitter. In the full-house proportional system, an individual servo is normally used for each control surface, such as rudder, elevator, aileron, motor, etc. The terms "digital" or "analog" simply refer to the type of electronics used to convey and decode the transmitted information. For our purposes, we will not delve into the complexities of the various types of feedback proportional systems, since our goal here is to see what we can obtain by simpler methods and what results we can hope to achieve with these efforts.

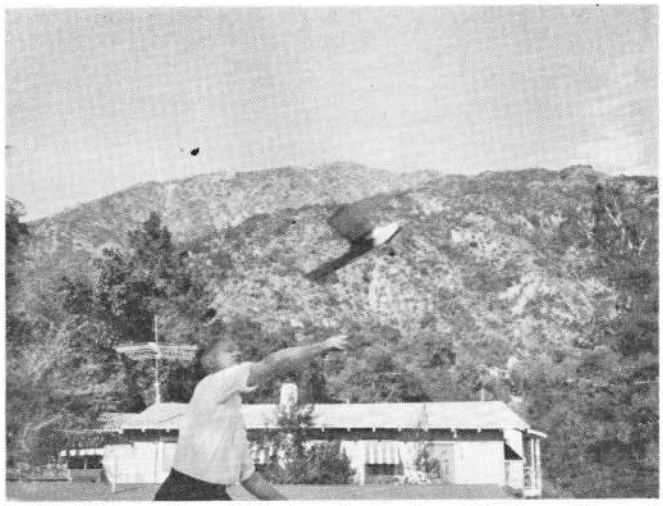
In a simple proportional system we are using a single channel transmitter to transmit a single tone to the receiver. By "breaking up" this tone in various ways, we can achieve more than a single result, or function. In past years, many methods have been contrived to obtain the maximum results from a single channel system. Unfortunately, most of these "systems" depended upon every individual component working to complete perfection in order to attain the desired results. And, although some excellent flying was accomplished by those individuals who had the time and patience to see the whole thing through, it became known as a "tinkerer's art." One spring on a fragile motor, a slightly mis-bent "birdcage" out at the tail, a pulser that wasn't too happy with a given transmitter, a variety of relays that had to be continually adjusted, were all part of the game if you wanted to participate. Happily, the story today is different. Manufacturers, realizing the impact of the "big rigs" on the market, also realized that there were many, many individuals who would like to go the proportional route but simply couldn't justify a $500 expenditure out of the grocery money!

In looking at the simple proportional picture, let's set a goal of the utmost reliability and control with an absolute minimum of "tinkering." If you're an experimenter and want to add this or that gimmick, go ahead. This article is strictly for the RC'er who wants reliable proportional control that will be as close to an "out-of-the-box" system as possible, utilizing commercially available equipment.

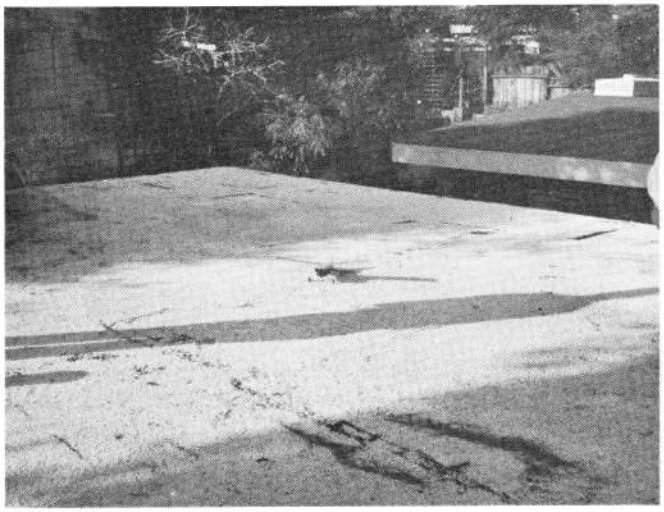
Before going any further, let's set down a few requirements. First, we want control of rudder, elevator and motor. The transmitter will be a single channel unit of good design with a built-in electronic pulser. No add-on pulsers and no pulsers with relays to adjust. The single channel receiver will be of proven design, preferably superhet for maximum immunity to interference, and one that is virtually immune to interference from motor driven ser-



RCM staff members Don Dewey and Bill O'Brien take turns cranking the Cox .010. Bill Welker of CitizenShip holds the Pipsqueak on the chimney.



RCM's Editor with a high launch to clear telephone lines at outside right of photo. Ed Thompson takes the photos.



The landing . . . with room to spare on the gravel rooftop.

The victorious four — Ed, Bill, Don, and Bill Welker. Photo by Sally Dewey on lower sundeck.

vos. It will also be as light and compact as possible to allow it to be used in the smaller .020 sized aircraft as well as the larger ships. The servomechanism must be capable of providing proportional control to the rudder and elevator, and ideally, positionable throttle. Complicated wire linkages out at the tail are absolutely verboten. The servo must transmit its mechanical energy to the surfaces via the standard pushrods used in the full-house systems. The servo must also be a unit that can withstand a lot of flying without continual adjustment. It must also have adequate power to adequately move the surfaces on a ship from .020 size to .35, giving the individual RC'er his choice of aircraft size. The overall result of the simple proportional system must allow the RC'er to have the precise control necessary to fly from restricted areas, such as schoolyards, hillsides, parking lots, etc., where permitted. And, keep in mind, that we said less than $150!

Our own experiments in the field of simple proportional are not those of a "Johnny-come-lately." Long before this magazine was started, we experimented with virtually all of the techniques for achieving single channel proportional — the original Worth Simpul-Simul system, simple relay actuators, magnetic actuators, go-around Mighty Midgets, and the like. Since the establishment of RCM, manufacturers of simple proportional equipment have been sending many actuators, pulsers, and a variety of components for testing and evaluation, attempting to develop just what we are talking about in this article. We have been testing, reporting, and consulting with John Maloney at World Engines, Bob Schmidt at Min-X, Herb Tomoser at Tomoser, and Herb Abrams at Rand Manufacturing. In addition, we have had the assistance of many individual modelers who have worked and experimented in this field for many years. One of the most notable contributions was from Dave Robelen who developed the Pipsqueak design and actuator in this issue. And, although this home-made actuator and linkage system does not fill the requirements of this particular article, it did give a very startling demonstration of the capabilities of simple single channel proportional. As you will see from the pictures, the Pipsqueak was flown from a small confined rooftop area of my own house, negotiating such obstacles as trees, TV antennas, power lines, and the like — being launched and landing in this small area. The flying was accomplished by individuals who had never attempted this feat before, nor were particularly experienced in the field of simple proportional control. This was not intended to be a bit of exhibitionism, but rather, to find out what we could expect from even the smallest plane and system. The precise control proved the feasibility and potential of simple proportional. Now, let's simplify it even further.

Two transmitter-pulser combinations stand out above all others in our own tests. These are the Controlaire Galloping Ghost and the Min-X Pulsemite units. Both are completely electronic in design and no add-on units are neces-

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the time to install the actuator and torque rod. The actuator should be glued in place on a pad of ⅛" foam. (Dr. Scholl's brand, available in all drug stores.) Bend the torque rod to shape from 1/32" music wire – be careful to get the correct shape from the side view. Use a small eyelet in the tail post for a bearing and solder into the 1/16" O.D. tubing shaft on the actuator. Be careful to get a good alignment between the crank on the torque rod and the centering pin on the large gear of the actuator. When satisfied that all is free and working well, the top may be planked with 1/32" balsa. Plank the area from the firewall to the cabin bulkhead also (don't forget those blind mounting nuts!). The front and rear cabin fairing blocks should be carved and hollowed from soft balsa and cemented in place.

At this time the entire fuselage should be sanded smooth and the corners rounded slightly. Make the fin and rudder from 1/16" balsa, noting the grain direction on the fin and dorsal. Hinge the rudder and make certain that it is quite free, then sand this assembly smooth. The fin should be glued on with some cement that does not shrink. I feel that HobbyPoxy is superior here.

Install the strip of 1/32" plywood that serves as a stop for the landing gear and temporarily mount engine in place. An extension for the needle valve will have to be made and the fuselage side notched to clear it. Take the engine off and put it back in its dust free box.

The fuselage and tail should be given three coats of thin butyrate sanding sealer (I use Aero-Gloss), sanding well after each coat with 400 paper. The stab may be covered with Japanese tissue to match the wing, using the same technique of doping it down around the edges, then lightly water

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sary. For receivers, we used the Controlaire SH-100 superhet single and the matching Min-X 800 or 1200, depending upon which system you choose. For actuators, we eliminated all but the Rand LR-3 Galloping Ghost unit and the Tomoser GG unit. At this point, we have the three basic items involved in the system – transmitter-pulser, superhet receiver, and actuator. Where are we cost-wise? With the Min-X system and either actuator, the total cost is $120. With the Controlaire system, $130.

We'll take this simplification a bit further and add a Controlaire NND switcher for $2.98. Both of these actuators require a 2.4 to 3.75 volt power supply on either side of the motor. By utilizing this simple little switcher, only one supply is needed – such as two nicads (180 Mah to 600 Mah), two alkaline energizers or three nicads, depending upon the size of your airplane and the power required by the servo. With the Controlaire receiver, we used all combinations of batteries and found them to work quite well, using the same actuator supply for the receiver. One of the photos with this article shows an .020 size airplane designed by the author which included the SH-100 receiver, Tomoser actuator and switcher, plus there nicads. Total system weight was 5 ounces!

A word or three about the actuators, themselves, is in order. The Rand LR-3 is a very powerful unit that provides proportional rudder and elevator, plus positionable motor. Power transfer to the surfaces is by two standard pushrods. Throttle linkage is the standard pushrod or Teflon tube and cable. Power is adequate for any size within the range stated in our requirements. Upon loss of signal, the Rand unit will provide neutral rudder and elevator and low motor. The Tomoser actuator is designed for smaller aircraft, approxi-

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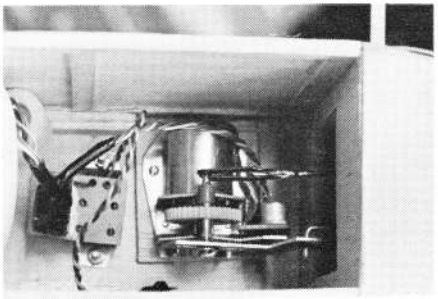
RCM Editor with original design, Gigi, and Tomoser actuator.



Tomoser GG actuator inside Gigi.

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mately .020 to .09, and does not have a throttle arm. There is no fail-safe feature. If you should lose signal you will receive a full up and full left control. By the same token, the full "on" and full "off" buttons on the Min-X transmitter, or the throttle lever on the Controlaire transmitter, can be used to provide an automatic left or right spin with this actuator.

Now that we have the system, what can we expect from it? First of all, unlike a "full-house" system, the control surfaces are "flapping" all the time. In the neutral position, they are "flapping" equally left and right and up and down, giving a smooth forward flight. As the control stick is moved toward the down position, the rate is increased and the elevator gives a "down" proportionate to the amount of stick movement at the transmitter. You will note that the "flapping" movement was stepped up to such a degree that in full down it is almost motionless, due to the increased pulse rate. In the "up" position, the rate decreases, and the flapping is much slower and more pronounced. In flight, however, this thrashing about is not noticeable, and control response is quite smooth. By varying the width of the pulses, that is, moving the stick left or right, the rudder responds with a proportionate amount of left or right rudder. Throttle is accomplished by either buttons (Min-X) or a reed lever (Controlaire) which signals a full "on" or full "off" signal. The throttle will move toward the high (full on) or low (full off) position as long as you hold the button or lever depressed, giving trimmable throttle control. During this period of time, the servomechanism is "going around," that is, the surfaces are rotating through their complete cycle, giving in effect, neutral control at the rudder and elevator.

Very simply, this is proportional control via a single channel system. At first glance, it may appear to be a giant threshing machine at work, but in flight, it is excellent and precise. It is not a full-house proportional system with independent control of each flight surface, but it **is** proportional control, and will give the average flyer many hundreds of hours of proportional flying with a minimum of expenditure. And it is, now, reliable – thanks to the efforts of these manufacturers. And, for the average flyer, the system will provide more potential than he can reach for quite some time. As an example, we have seen almost the entire Class II pattern performed with a Galloping Ghost system in a C.G. Junior Falcon – complete with consecutive touch and go's!

Just a hint or two – keep your pitch axis (elevator) surfaces small, chordwise, and keep the control surface throw down until you are familiar with the flight characteristics of your system and individual model. Use DuBro adjustable Kwik Links at the surfaces so that you can adjust the throw as desired.

You'll like simple proportional. We predict that in the coming months the sale of this type of equipment will reach an all-time high and outsell all other forms of R/C equipment, insofar as new equipment sales are concerned. New actuators will make their debut. We also expect to see a full feedback proportional rudder and elevator, plus trimmable motor system in the miniature – somewhere around 5 or 6 ounces all up weight.

You can also expect to see a new class of Sunday flier competition develop – Goodyear type pylon racing limited to single channel control systems with a maximum engine displacement of .10. These racers will not necessarily be scale, but will be identifiable as Goodyear racers. There will be no weight restrictions, but the minimum wing area will be 320 square inches. This will be a whole new field for the sport flier with the new, reliable Galloping Ghost equipment.

Has it been tried? Yep. As a matter of fact, Frank Garcher (Midwest Products) has challenged us to a race, after trying this new event. He bet a bottle of Tequila (imported, complete with worm) against a bowl of anchovy olives floating in Beefeater's Gin that he could whip us two out of three.

Not a chance. He's overlooked the power of the press. RCM is hereby offering a $50 prize, in addition to the regular publication rates, for the first design for this new category, accepted for publication. Read the specs listed above, build it up, draw out the plans, write a short article, send some pics . . . and above all . . .

. . . go out and fly simple proportional. You'll love every minute of it!