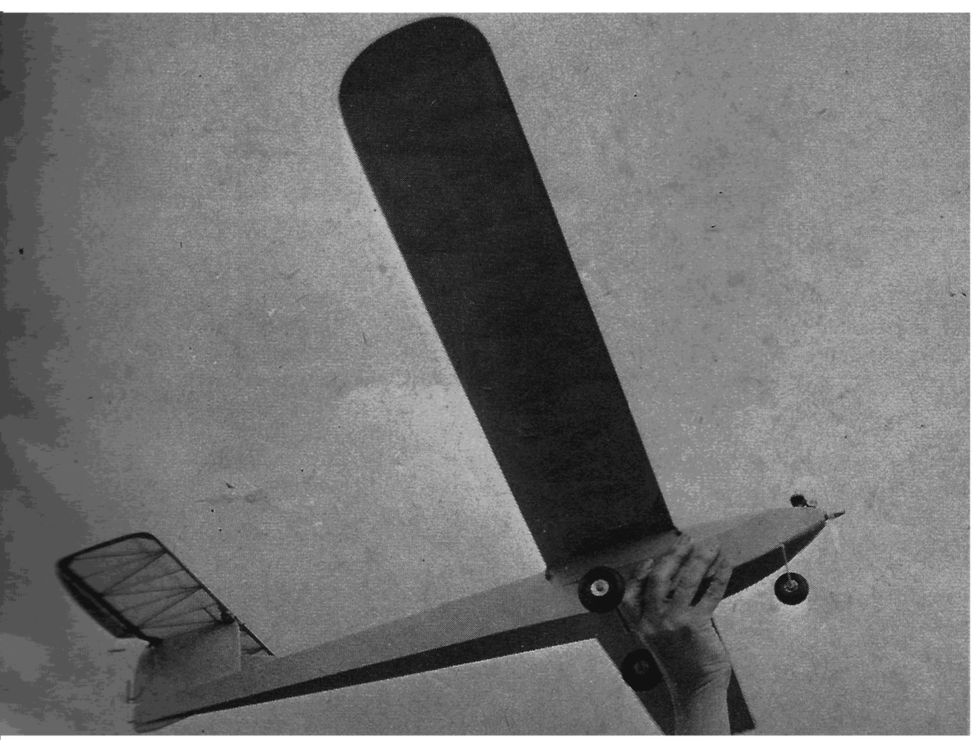
Woody's inspiration and best cheer leader proudly holds the U-ALL-2 aloft for the world to see.

U-ALL-2

By WOODY BLANCHARD

OUR PERENNIAL NATIONAL CHAMP HAS COME UP WITH A LITTLE "GIDGET" WITH ALL THE GADGETS! SMALLEST YET WITH FULL HOUSE GALLOPING GHOST FOR EXTRA CONTROLS.

Another view from down under. Here we see the rudder and elevator linkage in excellent details.



►*Introduction and Control System*

Recently, following a three-year absence from model aviation (caused by the lure of extreme proximity to some excellent blue water fishing), the author was accidentally led back into the RC fold by the arrival on the scene of a new R/C'er who asked for aid in getting his first r/c ship trimmed and flying. First trip to the flying site with the above-mentioned culprit, and yours truly was thoroughly "hooked" again. We envisioned dragging out our old faithful Struck-designed Seacat from a number of years ago, installing some of this new and exotic tone equipment, and flying "Galloping Ghost" all over the place, as we had done with this ship and several others, using the old CW equipment, circa 1954-1959. But we were in for some rude awakening.

Our first surprise came in finding out that, while this area was a veritable hot-bed of successful Galloping Ghost flying back in the late '50's all the single-channel fliers were now flying strictly escapement, with the exception of a few hardy souls who fly rudder-only pulse. And we soon found out why: Relay-type Tone equipment, especially Superhet, is not very tolerant of servo noise—and this seems to be particularily true of the Mighty Midget servo, which used to be our standby. While the noise problems are not insurmountable, they nevertheless seem to make the otherwise trouble-free single-channel gear somewhat troublesome. So we started looking for a scheme with which to overcome the difficulties. Meanwhile, we were flying several old converted .02-powered free-flight ships (including an old Paamite, and an 18″ Guillow's Bristol Bullet) with spring-loaded magnetic actuators made from Bonner SN escapement coils, coupled to a single-ended Otarion 0-21, which yielded adequate rudder-only pulse. Then came the breakthrough: we procured a Frank Adams Magnetic actuator, and built it into a rather large .02-powered ship, coupled to a double-ended Relayless receiver (C&S Finch). This actuator, which weighs slightly over one ounce, delivers excellent torque through a range of ± 45° torque rod rotation, with only 3V. (rcvr power) to the actuator.

Our first attempt at getting Galloping Ghost out of the Adams actuator consisted of using pulse rates no lower than those re-

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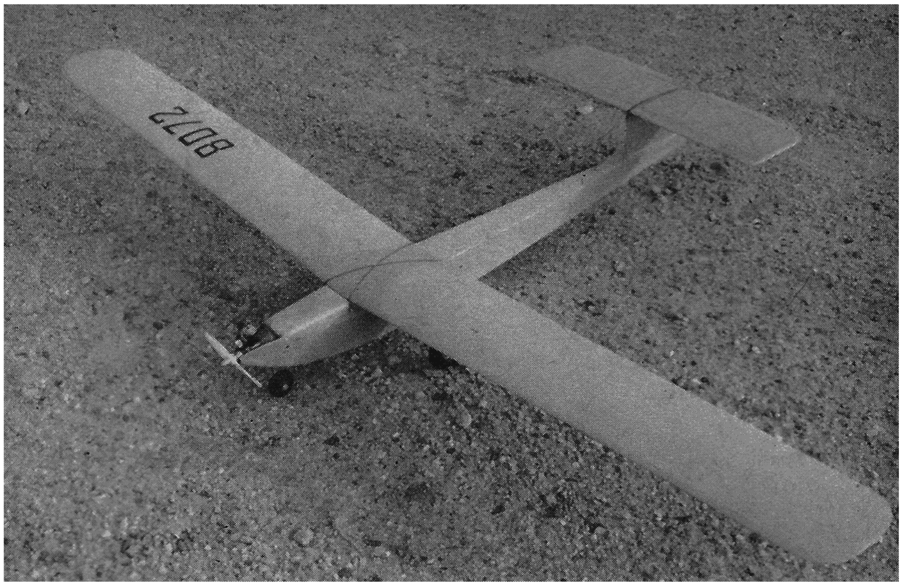
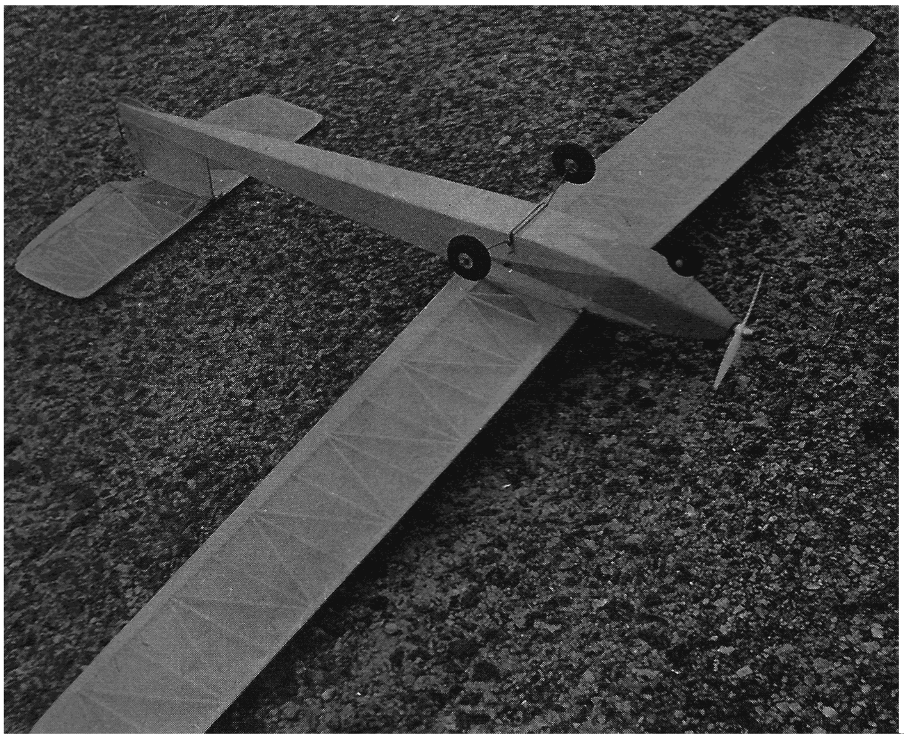
quired to make the rudder hit both stops, since the magnetic actuator is inherently unstable at zero deflection; our "up elevator" was obtained by going to even lower pulse rates, thereby allowing the rudder to spend larger percentage of its time at the stops (our linkage was shaped to give *down* elevator with neutral rudder, *up* elevator with left *or* right rudder.) This system worked fine, but available effective elevator deflection was limited, unless we went to extremely low pulse rates for up elevator, which resulted in objectionable airplane "galloping." Further experimentation showed that, by properly shaping the elevator follower, and applying the proper amount of elevator down-load spring, a very effective increment of "centering stability" was forced on the rudder, overpowering the previously-mentioned instability of the magnetic actuator at zero deflection! We have now adjusted our Phelps Pulser (rotated the rate-pot) so that, at the maximum nose-down condition, (stick forward, elevator trim knob at down-trim limit) we're sending out rates of about 30 cycles per second, and the rudder still centers beautifully! And at 30 cycles per second, the rudder is only moving about ± 3°. Since only about 15° effective rudder deflection is required to get adequate turns left or right, we are able to get very effective down elevator for turns, as well as for straight flight. Neutral elevator is obtained, of course, at lower rates, which allow the rudder to travel through a larger part of its ± 35° available travel. Up elevator is obtained at lower pulse rates still, with the maximum effective "up elevator" naturally resulting when the rudder travels through its full ± 35°, and spends part of each cycle at either or both of its stops, depending on whether any left or right rudder is desired along with the "up elevator."

The system as it now stands has several very nice features going for it: First, with more than a hundred flights, it has shown extreme reliability. Considerable experimentation with the control linkage has shown that there is nothing critical in the linkage department (you can change the shape of the follower, pin and yoke without having the whole system go "ape"). The superregen, double-ended Finch receiver, which performs beautifully if you don't have excessive citizen's band interference in your area, has been replaced in the author's ship by a Citizen-Ship 3-volt, relayless RSH Super Het, with an Ace add-on switcher to make it double-ended, in order to operate the magnetic actuator in both directions; this receiver *also* performs flawlessly in this installation, including following the highest (30 cps) pulse rates, and has the added advantage of being unaffected by outside citizen's band traffic, to say nothing of the fact it allows you to fly while 5 other superhet (on the other five authorized 27 mc frequencies) are also in the air.



It does have the look of the U-2 with its high aspect ratio wings and long sleek fuselage.



Upside down for a look at typical Blanchard construction for warp-free wing and stabilizer.

Construction:

U-ALL-2 evolved around the system described in the foregoing section.

While the ship will handle OK as a rudder-only pulse project (the author's ship has been flown that way, prior to the addition of the elevators), and should fly nicely even with escapement rather than pulse, its *full* potential can only be achieved with elevator as well as rudder control. The airplane is designed to be an East Coast (flatlands) substitute for the RC soaring that is done so successfully on the West Coast, and other places that are geographically suited to that sort of activity. U-ALL-2 is designed to *climb*-up to thermal territory, and then trim for minimum sinking speed in the glide. And if your flying area is as windy as ours, you will quite often need considerable down-trim to penetrate the high winds at the higher altitudes. Also, there are times when you'll want to fly an entire flight at low altitude, using down-trim, and then be able to "plane" the ship for a nice, slow landing. This would be a bit difficult with out elevator. The author does not intend to insinuate that escapements are a poor way to fly; he does, however, have a strong personal preference for proportional control, and the ability to direct the aircraft with a control stick, rather than by pushing buttons. U-ALL-2 and its control system are presented here *primarily* for those who prefer the proportional rudder and elevator set-up.

Fuselage construction is straightforward, and is as follows: Add 1/16 sheet doublers to 1/16 sheet sides, cement the sides to the vertical fin, add the single ⅛ sheet former and the ⅛ plywood firewall. Add ⅛ x ¼ stiffeners as shown on the drawing, install the bottom 1/16 sheet doublers, install the Adams actuator and torque rod, then cover the top and bottom with 1/16 sheet (grain spanwise). Add the soft ⅜ sheet nose fairing, and the fuselage is complete, execept for sanding and the addition of the required dowels and hooks (see drawings).

The wing is built in the same manner as a number of the author's old free-flights ships where light weight was *not* a prerequisite, and a good airfoil was required. By following the steps outlined on the drawing, a good wing can be built rapidly. Note that the bottoms of the ribs (both parallel and diagonal) will require some sanding, particularly out toward the tips, a sanding block is recommended for this operation; rib bottoms can be sanded either flat, or with some undercamber, depending on the builder's choice; build according to the steps outlined on the drawings, the trailing edge will have sufficient "Droop" to yield low sinking speeds, with or without undercambered ribs. Also because of the tapered trailing edge, the wing will automatically have the desired amount of "wash-out" in both panels.

The horizontal tail structure is self-explanatory, and will not be discussed here. The required wire parts for the control system (torque rod, rudder "yoke," rudder "pin" and elevator follower are shown on the drawing. Note that the yoke, pin and follower are sewn to the respective surfaces, and that rudder and elevator hinges are the "sewn" type. Be sure that a figure "8" pattern is used when sewing the hinges. All sewn joints should be done carefully, and then cemented. Be sure that rudder and elevators move freely, with a minimum of friction. Also, note that metal-to-metal moving contact is avoided by the use of plastic tubing; while this may not be necessary if you use a super-regen receiver, it's a good idea anyways, as added assurance against spurious signals; superhet receivers generally demand this sort of precaution.

Silk is not recommended for this little ship; while it may be OK on the wing, it would certainly warp the light weight horizontal tail. It is advised that the complete ship be sanded, pre-doped with one coat of Aeroglossdope (Aerogloss because of its non-warping tendencies), then covered (fuselage, entire wing, etc.,) with a good grade of Japanese tissue or superfine tissue; if desired, a coat or two of sanding sealer can be applied and sanded prior to covering. Finish all parts with a minimum of three coats of Aerogloss clear, using colored dope sparingly (trim).

We have found that the Tee Dee .02 puts out adequate power with the 4½x2 Cox "High Thrust" prop, using Cox 'blue can' fuel; avoid red can fuel if possible, as it will attack Aerogloss, as well as most other suitable model finishes. One further tip: strain your Cox fuel through a piece of silk or Silkspan prior to using it; we've found a multitude of white "flecks" in the Cox fuel we get locally; this may also be true in your area; these "flecks" can definitely cause erratic engine runs.

Flight Testing:

Some of you old hands at RC flying will probably laugh at our "chicken" procedure for test flying, but bear with us. Remember, there may be some beginners reading this article and building the ship, so let's have 'em start out doing it the way we "say" rather than the brave manner in which we sometimes "do"; this way we increase the chances of having them stay with us.

Inspect the wing and stab for warps; if you find any (other than the deliberate "wash-out" in both wing panels), remove them by holding the guilty surfaces over the spout of a steam kettle, while gently twisting in the opposite direction.

Locate the receiver and batteries in such a way as to yield a center of gravity location for the complete airplane as shown on the drawing; follow manufacturer's advice on receiver mounting; above all, do *not* mount the batteries *behind* the receiver, as they make an excellent "battering ram" in the event you fly the ship into a wall (or the ground.)

With transmitter, pulser and receiver tuned on, note whether the rudder appears to be moving symmetrically about neutral; if not, bend either the rudder yoke, or the torque rod (assuming, of course, that the rudder trim knob on your pulser is adjusted so that you're getting a symmetrical signal, i.e., on-and-off signal each occupying half the time). Now try right and left rudder, using the control stick on the pulser, if left is right, and vice versa, reverse the two outside leads at the actuator in the airplane; now you're in business. Next, check elevator travel at all pulse rates; if necessary, bend the rudder pin or the elevator follower to get approximately equal movement of the elevator in the up and down directions when the control stick is in neutral with the elevator trim knob at the nose-up limit. Now, with the above conditions existing, test glide the ship. Glide should be relatively slow (about 15 mph) and flat, but with no tendency to stall. Make an adequate range check, to be sure your receiver is properly tuned, see equipment manufacturer's instructions for details. Now you're ready for that first flight.

Install the prop on the engine *backwards*, and peak the engine out; check to be sure the controls are not affected by the engine; stick in neutral, set the ship on the runway, and steer upwing. If the ship does not become airborne in about 100 feet, ease back on the stick. When you're airborne, try some gentle turns, but keep working *upwind* (it's inadvisable to let a new ship get downwind, until you're sure of the trim). When you reach about 100 feet altitude, try up and down elevator, mentally note whether you will want to adjust the range of trim before the next flight. Retain about 100 feet altitude (or more) until the engine quits; now try left and right turns and up and down elevator in the glide. Avoid excessively tight turns near the ground.

Results of the first flight will tell you whether you need trim changes prior to further flights. Possible problems and their cures, are as follows: nose too high under power, but OK in glide, add more down thrust, and vice versa; nose too high under power and also in the glide, add shim under the stab leading edge, or bend middle pin to give more down elevator. Nose too low under power and in glide, add shim under wing leading edge or bend rudder pin to give more up elevator; bears to left under power, Ok in glide, add more right thrust; bears to left under power and in glide, bend the rudder yoke or the torque rod to give more right rudder.

After you're satisfied with the trim, put the prop on forward. Watch this flight carefully, for you may want to make further thrust line adjustments. Once you have the ship well trimmed, you'll be able to fly in windy weather with no sweat, because of the ability to get excellent penetration merely by pressing the stick forward, getting a resultant big increase in airspeed.

Assuming you have trimmed your ship to fly at relatively high pulse rates (between 6 cps and 30 cps for the full range of elevator effective position needed), you won't see any sign of a "gallop" in the flight pattern. Pulse rates much lower than 6 cps, however, will yield a "gallop" since the moments of inertia of the ship are such that she will respond to these lower frequencies.

The author plans to add a two-or three-position throttle, using a pulse omission detector, if he can find a scheme to handle the mechanical end of throttling an 02, without resorting to expensive machine shop operations. Also, we're now experimenting with "galloping ghost" on an 18″ World War I ship weighing 5 ounces all up; total weight of the airborne equipment (using single-ended Otarion 021 receiver and spring-loaded coil from a Bonner SN escapement) is *less than 2 ounces*, including batteries and switch! Performance with rudder-only is fine, but the elevator is not yet in the circuit; possibilities still look good.

In closing further comments regarding the Adams actuator are believed appropriate. The manufacturer states that voltages as high as 7.2 can be applied without danger of damage. This information, coupled with knowledge of the torque available at only 3 volts, means that, in all probability, adequate "galloping ghost" can be achieved on ships as large as .29-powered jobs, using this actuator coupled to aerodynamically balanced rudder and elevators.

Comments regarding U-ALL-2 will be gratefully acknowledged by the author.