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R/C DATA SERVICE ®

& MODEL AIRCRAFT WORLD

Volume 6—Number 3

IN THIS ISSUE

Underway! With Brother Otto's R/C George Washington, Nuclear Powered Submarine.

A Radio Control Publication for Beginner & Advanced Modeler

CONTROLAIRE

GALLOPING GHOST

GALLOPING GHOST TX

SIZE	2½" x 6¾" x 7⅞"
WEIGHT	2⅜ lbs. with battery
POWER INPUT	About 300 milliwatts
R.F. OUTPUT	About 150 milliwatts
TEMP RANGE	0-130 degrees F.
CONTROLS	Stick: Rudder & Elev. Lever: Rud./Elev. Trim. Switch: Motor

Our Galloping Ghost pulse rate, pulse width, signal on and signal off transmitter was the result of combining an all-silicon, unijunction pulser with the basic Mark 11 Mule circuit. The high output is retained along with the clean on/off and rise/fall characteristics of the Mule's audio generator circuit. The pulse rate varies from 3 to 12 cps. Width varies from 20-80% and 80-20%. Power supply—9 volts. Price is $59.95.

CONTROLAIRE 4

SIZE	15/16" x 1½" x 2 1/16"
WEIGHT	2 ounces
POWER SUPPLY	3 volts
TEMP RANGE	0-120 degrees F.
SENSITIVITY	2-4 microvolts
SELECTIVITY	500 kc. with 20 microvolts input
PULSE RESPONSE	Up to 25 CPS

The Controlaire 4 is a tiny, super-regenerative, tone receiver. A low level front end makes this Rx immune to swamping tendencies in the presence of a strong carrier. Also special circuitry has been developed to give linear pulse response; it's ideal for the Galloping Ghost. It is equipped with a SPDT relay. Audio frequency response ranges from 400 to 900 CPS with 600 CPS desired. Assembled price — $19.98 Kit price — $14.98

CONTROLAIRE SH-100

SIZE	15/16" x 1⅝" x 2⅛"
WEIGHT	2⅜ ounces
POWER SUPPLY	3 volts
TEMP RANGE	0-130 degrees F.
SENSITIVITY	2-4 microvolts
SELECTIVITY	3 kc. with microvolts input
PULSE RESPONSE	Up to 25 CPS

Generally single channel, superhet receivers are noise sensitive. The Controlaire SH-100 is not, and so will eliminate 90% of the noise sensitivity problems found with superhets in pulse operation. It uses a 50 ohm relay and requires a 95-100% modulated signal. Audio frequency response ranges from 400 to 1000 CPS with 700 CPS desired. This Rx is highly recommended for pulse applications. Assembled price — $32.98 Kit price — $24.98

World Engines, Inc.

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CONTENTS

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Frank Schwartz—Dale Springsted—John Worth—John Phelps

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GRID LEAKS AT PLAY

■ Judging from response the last issue of GRID LEAKS, must have been one of our better ones. Reaction to "Radio Control—How it Works" was terrific.

Also quite terrific was the Pietenpol Air Camper by Jess Kreiser, and strenuous efforts are being made to catch up with the plans—almost demanded more than our blueprinter can supply. Jess Krieser is to be highly commended. His friends will be glad to know that he has been put on a retainer basis by one of the largest kit manufacturers.

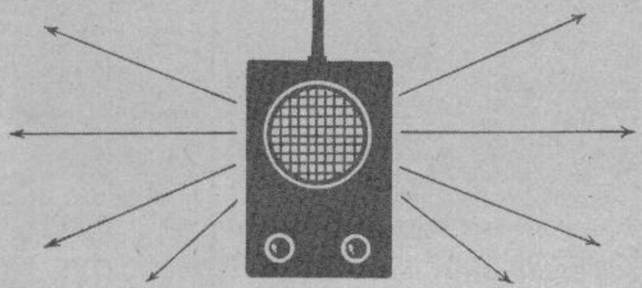
Next in popularity was the sailboat article by John Reynolds of Orlando, Fla. Sailboating is really catching on, and we venture to say 1965 should be a good sailing and yachting year.

Also gratifying to us the past several weeks have been the testimonials from advertisers. Some state they receive a better percentage of return on the number of inquiries that they get from GL than from almost any other source. One stated that two out of three inquiries received from GL ads, resulted in sales! Incidentally, you might let advertisers know that you appreciate their helping you receive this strictly radio control data service.

While the season for sniping at the AMA is open 12 months a year, we prefer to say something constructive, and deserved. The R/C fan owes radio control to the AMA. AMA initiated the advent of license-free examinations (*Continued on page 24*)

THE MONITOR

Regular round-up of new and overlooked aspects of the growing R/C field • Shop talk and just talk • A discussion corner.



■ To cover all the important matters currently of concern to our fraternity would require, in this issue, a 20-channel transmitter. Two of the most urgent items are detrimental developments in RC Scale and the murky inter-magazine differences over the much abused Builder-of-the-Model-Rule which one book clairvoyantly dispatches as a "dying dragon." The evil of these good intentioned and well meaning discussions, sermons and pontifical declarations lies almost more in what is not said, as in what has been said.

In the July-August issue GRID LEAKS, with neither ambitions to serve or advertising to sell or protect, will discuss some curiously missing pieces in the "BOM" puzzle. Rather than add yet another high-dive into a dry pool of inadequate preparation, priority for May-June GL is yielded to the scale problem discussed below by Hale Wallace, of New York State,

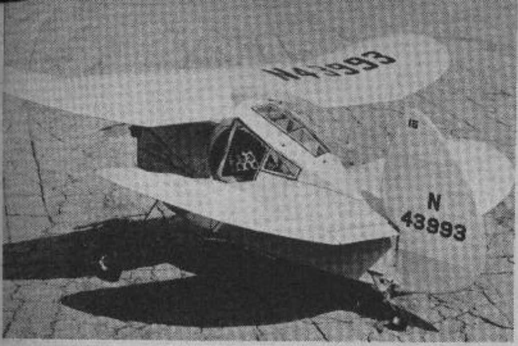
Hale Wallace flies both scale and Class III. In this editorial he discusses the inequities of the scale event, suggests changes.

and Woody Woodward of California.

Woody emphasizes that he speaks only for himself, not any organization, and both, of course, cite individual opinions of rules matters. Hale leads off . . .

RC Scale—That Other Event: Perhaps the most satisfying of the fine RC events flown to AMA rules is Scale. No other event offers the challenge, or matches the feeling of achievement gained from a successful flight with a scale ship—followed from initial choice, locating accurate drawings, drawing your own plan, construction, finishing, detailing and, finally, flight testing.

If all goes well you have a pretty ship that flies well. For many, this is all that is required. For others, however, the competitive urge wins out, and we find the builder scanning contest listings for scale. But Scale, and many times pylon, is missing from many listings. Scale is, (*Continued on next page*)



One-fourth size Flying Flea constructed by Vick Wickline. Six channels, 48 in.

Wallace's Stearman biplane. Famous air-show machine, big job has only one pit.

Kingcobra by Hale Wallace. Except for a cylinder exposed, it is most realistic job.

MONITOR . . . continued

perhaps, the least flown event and therefore often neglected by many clubs running meets.

Our friend finally locates a contest offering scale—at least, that is what the listing says. After a three-hour ride to the meet he is informed that, since not enough entries showed up, the event is cancelled. Besides, the contest sheet noted that, unless there were at least five entries, the event would not be held. After tactfully pointing out to the officials that many contestants never receive these sheets, our undaunted builder heads for home, vowing never to attend that particular meet again.

There is no better method of killing interest in a particular phase of modeling than to penalize those who do participate! (With only one or two contestants, there is little or no competition, but let's promote future entries by offering the event anyway.)

The next contest our scale enthusiast enters is better. Only three entries but the far sighted directors went ahead with hope for greater participation at next year's contest. Our hero now encounters another situation that the scale flyer faces from time to time. He got in his first flight early in the morning in a stiff breeze, and didn't do as well as he could have in calmer weather.

He prepares his ship for scale judging, hoping for a break (*Continued on page* 29)

Readers Write

S.O.S. ANSWERED

I would like to take this opportunity to commend you on a very good RC magazine in GRID LEAKS. I have pretty well brought my file up to date with the purchase of your back issues.

I am fairly new to RC modeling, and it was an article in July-August 1963 G.L. that gave me great help. The article was "Secret of Relayless Operation." Up until that time I was greatly disillusioned, on the operation of RC gear and escapements in general. Like many RC beginners, I assumed that the gear should work right out of the box after purchase. From the information in this article, I have since been able to get fairly reliable operation from most escapements adjusted in accordance with the article.

I think an article giving the desired pull-in and drop-out of today's 3-volt transistorized receivers would be quite helpful to many RC flyers. Also advice on hooking up the Omega Reed Switch in these receivers, would also be of interest.

Again, let me commend you on a truly good magazine.

RICHARD L. MILLER, Kalona, Iowa

FRANKLY SPEAKING

You will never know how right you are in your editorial Monitor in the January issue of GRID LEAKS. Something very definite has to be done for single channel, in the servo end. To put it pretty bluntly, there does not seem to be a decent workable escapement made. All of the present single-channel servos work too slowly, and require too much time to sequence through the cycles to give a given control function. This is a prime function of manufacturers, to bring out suitable rudder and motor-control servos.

The average RC sports flyer, such as myself, wants only a good performing slow flying plane. The half dozen professional RC pilots in each area—and the local group is an excellent example—seem to feel that contest designs are the only thing. As we both know, sport flyers couldn't care less for their opinions in this field, for we are in it for fun, not prizes. The above is the very reason why 75 percent of the RC flyers are not RC club members or even AMA members.

I believe that publications such as GRID LEAKS and *R/C Modeler*, if they could suggest that local sport RC flyers would contact a given individual in each major area, that sport flyer RC groups could be organized. Then with their newsletters, being mailed to the various magazines, a much better picture could be gathered as to just what the majority of RCers really want and need. Many more would become AMA members and a really representative voice of RCers could be heard.

ROBERT L. ROSE, Kansas City, Mo.

(Editor's Note—This is a controversial letter, GL supposes, the sort of thing that may drive some readers to take pen in hand to either put Bob in his place, or to shout acclaim for his having said things that needed to be said. He has stated objectively a sincere and familiar opinion so any rebuttal should shed light, not heat, upon the situation. Being a modeler is the only credential any of us require; the guy with the .010 and the SN is the precise equal of the multi proportional flier. Or vice versa, if you prefer!

Most multi fliers are sports minded. Escapement? Do we mean relayless receiver batteries—a system? It can't compare with $60 in servos, on receiver costing 400% more.)

THANK YOU, SIR!

Either you have modified your writing to suit the majority of us flyers, or I am getting smarter and am not aware of it. Anyway as of this last year, I find your magazine most enjoyable!

CHARLES LARGE, Pacific Palisades, Calif.

STOP THAT NOISE!

I congratulate you on the new format of "Grid Leaks and Model Aircraft World" and for the wealth of modeling information available in the magazine. I have been a keen reader ever since the inception of GRID LEAKS through the courtesy of my friend, Eric Chuter in Sydney, Australia.

Your article on "Noise and Interference" by Ridley, Volume 6 No. 1, is certainly a worthwhile one. Being of a technical background, I am continually surprised by the lack of attention by RC modelers to sources of radio noise in a model aircraft. I want to add a comment on a point which caused me to crash a plane recently and which is not dealt with by Ridley's article, nor have I ever seen it mentioned elsewhere.

It concerns the fitting of exhaust extensions to motors. In my particular case, the fitting became loose and effectively drowned the receiver with radio noise. No doubt in this situation the generation of electricity by the hot gas stream is a very real effect and a loose exhaust extension with the motor running becomes a most effective noise generator.

Hoping that this saves someone a written-off aircraft.

J. C. WHYBOURNE, C/o Telecommunications H.Q., Kuala Lumpur, Malaysia

ON TARGET!

Wish to compliment you on your March-April issue of GRID LEAKS. This is one of your best issues yet! Especially your article "Radio Control, How it Works." Even lowly idiots like myself can understand it. Short, to the point, and simple enough for the common layman to understand. We have quite a group of new RC'ers coming along in this area, and this article is ideal to answer their questions.

A job well done. Keep it up!!!

BURT WINCHESTER, Universal Hobbies, Inc., Fort Lauderdale, Fla.

SCALE IS GREAT

Say, your scale-type flying series plans are really on target. Great! Can't thank you enough for these honest old ghosts from the past. Nothing will ever surpass them for simple beauty and pleasure they gave at a modest cost.

I remember seeing the old Air Camper and there were plans for it in a mechanic magazine of 1930 vintage. Let's have more of the old 1930 planes.

CLYDE WILEY, Athens, Ohio

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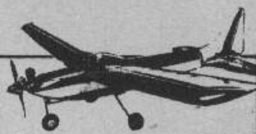

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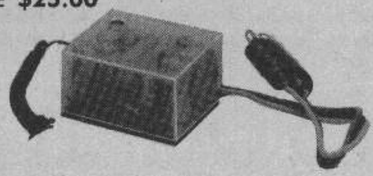

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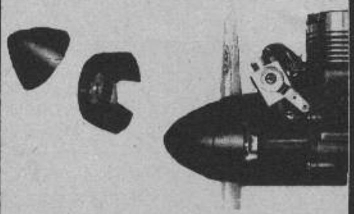

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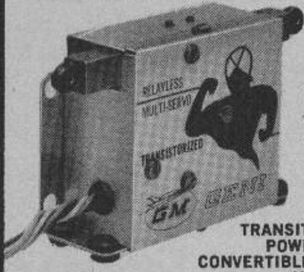

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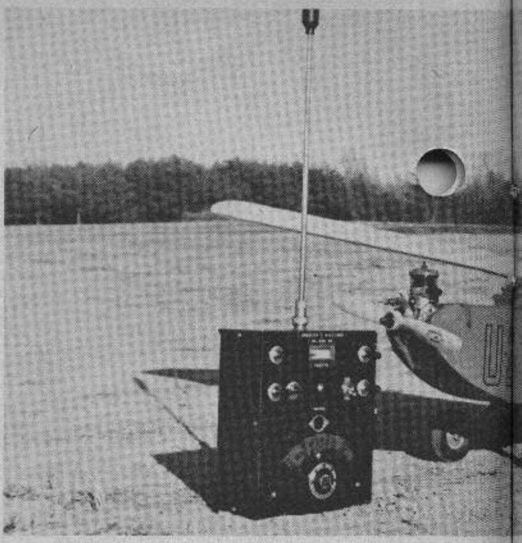
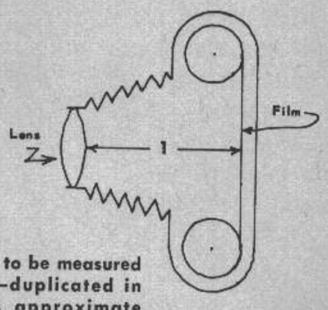
Hole in bottom of fuselage through which the pictures are taken. The camera shutter also can be cocked from outside the fuselage by using this opening. Author snaps 2¼ squares.



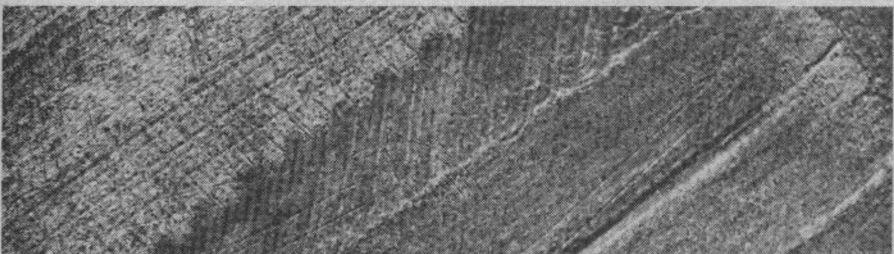
The "U-2 ½," six channels (rudder, elevator, MC)

FIG. 2



Distance "1" to be measured in original—duplicated in new one. Is approximate focal length.

YOU TOO...CAN HAVE A U-2



Aerial shot of the flying field. The author-pilot is the shadow at the extreme left. Taken by the throttle-operated shutter, photo made without a filter. Ground furrows show clearly.

by TORREY WILLIAMS

■ INTERNATIONAL INTEREST in aerial photography runs very high in these times. The Eisenhower "Open Skies" inspection plan of 1955, the 1960 summit conference blow-up over the U-2 flights and the photographs released in the 1962 Cuban missile crisis all showed that the aerial camera is a vital instrument of national policy; that it can be a force for peace, as well as a prime reconnaissance agent in war.

This interest is well deserved, since the modern camera, mounted on an aerial platform is an amazingly exact recorder of the terrain beneath. Accurate lenses, high resolution film and skilled photo interpreters all team together to permit the full potential of this medium to be realized. Military, geologic, agricultural, cartographic and business interests all lean heavily on the data derived from photographs taken from an airborne vantage point.

As with other aspects of modern aviation, aerial photography can be adopted by the modeler as a project for his skill and ingenuity. This two-part article outlines my response to such a project, and is presented in the hope it will inspire others to try their hand.

The key to success in model aerial pho-

MC) Built along lines of Live Wire Trainer and Cruiser.

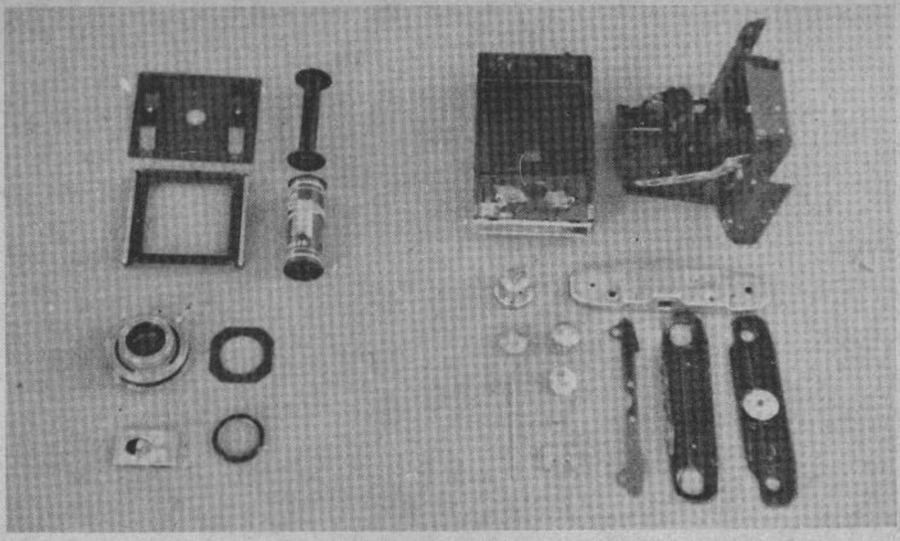
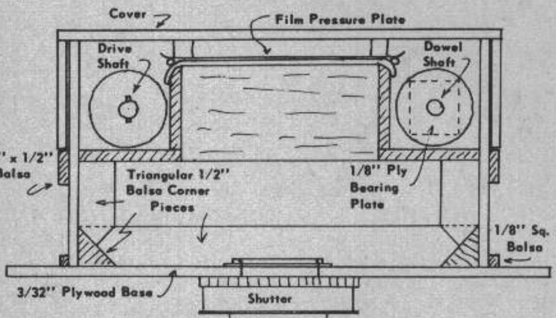


FIG. 1: Original camera disassembled—items on left were retained for use in new camera.

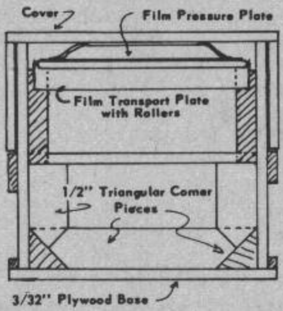


◄ FIG. 3

Left: Lengthwise cross section of camera. Sides and top are laminated from sheet balsa, aluminum foil as a sandwich.

FIG. 4 ►

Lateral cross section. Cover fits tightly, not as shown for clarity.



Camera planes are not new—nor commonplace. Pictures can be taken by anything not too heavy to become airborne. GL author Williams has more specific ideas. First of two parts.

tography lies in "marrying-up" a lightweight camera, a stable airplane and a reliable radio control system. Each of these elements has a role to play and is a subject for further discussion. Let's start with the camera.

Almost any small camera could be used for model aerial photography, but in practice some will do better than others. Good optics and light weight are the essential ingredients, but they must be balanced by the requirement of the average modeler that the cost and complexity of the camera not be too high.

First of all, what is wanted in a camera? After some thought I decided I wanted light weight (not over 10-12 oz.), a physical size which would match a plane of about 60-inch wingspan, and a lens/shutter combination which would give good, clear pictures from an altitude of from several hundred to perhaps a thousand feet.

My first problem was with the weight. All the cameras I looked at were (1) expensive, or (2) older models which were ·rgely made of metal and were both too ·rge and too heavy, or (3) simple little plastic box cameras which didn't have the shutter speeds and lens quality which I wanted. Since none of the cameras inspected were satisfactory, I decided to build the camera from scratch, using an appropriate lens and shutter and relying on balsa wood and plywood for the camera body.

My source of optical parts was the nearest local hockshop which had about a hundred old cameras in varying states of (dis) repair. After much looking and dickering, I was able to buy a Japanese bellows camera of about 1950 vintage for several dollars. I chose it because it had a lens with a focal length of 75 mm, diaphragm openings from f 4.5 to f 22, the film transport hardware for 120 size roll film and a cock-and-trip shutter with speeds to 1/200 of a second. (I would have rather had 1/500 to 1/1000 of a second, but at altitudes above a couple of hundred feet, at slow motor, 1/200 of a second is sufficient to prevent blurred pictures.)

The weight of this camera was about 1½ pounds, the bellows leaked light and the general configuration of the camera did not lend itself to internal mounting in a plane. So I tore it apart. Fig. 1 shows the remains. The items on the left (lens, film transport plate with rollers, film spools, etc.) were saved for use in the new camera. The items on the right were discarded.

Since it is unlikely that a duplicate of this original camera would be available to others, no attempt will be made in the text which follows to set up exact plans which could be duplicated. Instead, the general procedures of building such a camera will be discussed so that other, similar camera parts could be adapted by any modeler with some construction experience.

Before disassembling the original camera, careful measurement must be made of the dimension between the back of the lens and the plane of the film. This distance ("l" in Fig. 2) must be duplicated exactly in the new camera, since it is established by (and is, approximately) the focal length of the lens.

The two cross-sectional drawings (Fig. 3 and 4) and other photographs show the design and constructional details of the camera. The main frame is a 3/32" plywood plate to which the lens is fastened by its original locking nut. This plate also forms the mounting base for installation in the airplane. The body of the camera is built on top of this plate in the form of a box with a sliding cover which together form a light-tight container for the film.

During construction of the camera, every effort must be made to anticipate light leaks and to eliminate them. Balsa wood itself tends to be translucent, so the sides and top of the camera are all made of a sandwich of 1/16" balsa sheet on each side of heavy duty kitchen aluminum foil. This ⅛" laminated material has proven to be opaque and to be strong (*Continued on next page*)

enough for the stresses encountered. I tried various glues in the construction of these sandwiches and found that epoxy glue was far superior to either white glue or ordinary cement. The epoxy glue spread well over the large surfaces (almost like thin butter), didn't immediately start to harden, but did take firm hold after a few hours. Ordinary glues which relied on solvent evaporation were still liquid, even after 24 hours drying time. (As a matter of fact, epoxy glue was used exclusively in the construction of the camera.)

All of the corner joints are potential sources of light leaks. These are blocked by ½" triangular pieces in the lower section of the camera, and are doubly screened by both the box and cover thicknesses in the upper section. A piece of black electrical tape was wrapped around the outside upper edge of the cover to provide additional sealing of the cover top joint. These measures proved to be sufficient in my case, since no evidence of light leakage has been found.

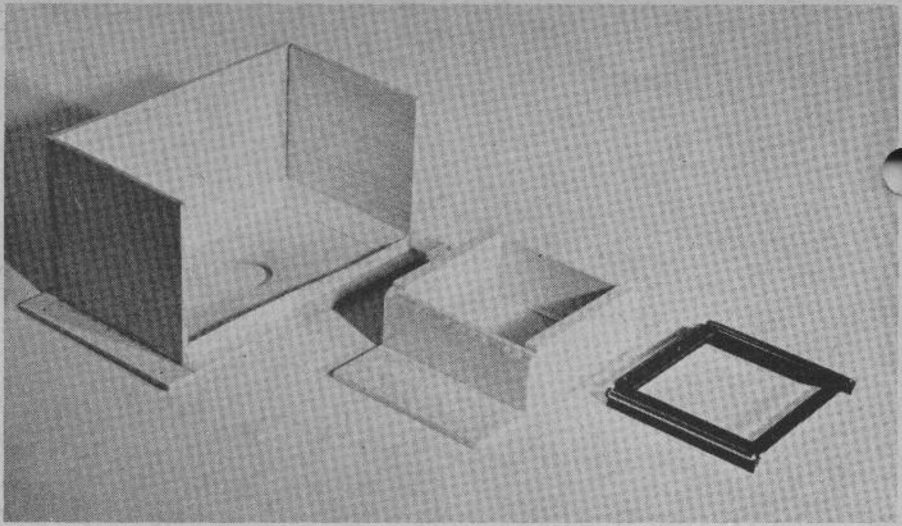


FIG. 5: Three sides of camera are completed in this picture, along with the film bridge and film transport plate (right). The latter two together will comprise a film bridge assembly.

Fig. 5 shows three sides of the main camera box completed, as well as the assembly which I will call the "film bridge assembly" for lack of a better name. This film bridge assembly is constructed separately in order to permit a fine focus adjustment to be made prior to permanent installation. Fig. 6 shows the set-up for this adjustment. The film transport plate with its rollers has been glued to the film bridge and the whole assembly has been pinned in place in the open camera box. The initial position is determined by length "l" in Fig. 2. A piece of ground glass (wax paper will also work) is then pinned across the film exposure area. The camera shutter is set on "time" or "bulb" and held open with the lens opening set on the lowest "f" number available.

The focus can now be checked by examining the image cast on the ground glass when the camera is aimed at distant objects. If the image is not clear, move the film bridge assembly up or down in the camera body until the image is in sharp focus. The distance adjustment on the lens should be set at infinity during this check. When a good, sharp focus is obtained, mark the exact position of the film bridge assembly with respect to the camera body. Remove the assembly, cut and install the triangular corner posts and paint, with black dope, all the interior surfaces of the camera which will become inaccessible when the camera is assembed. Fig. 7 shows this step competed. The back dope cuts down the light scatter inside the camera and prevents possible exposure of the film by any but directly focused light from the lens.

The next step is to glue the film bridge assembly into the camera body and to add the fourth side.

The cover is made next. It should also be constructed from balsa wood and aluminum foil laminate and should be a close fit to the camera body. After the cover has been painted, a spring loaded pressure plate should be installed on the inside top of the cover. (Mine was salvaged from the original camera.) This plate should be checked to see that it forces the film, without binding it, against the film transport plate. This pressure plate insures the film is flat and in the plane of focus of the lens. Fig. 8 and 9 show this plate installed.

The next step is to improvise various aspects of the winding mechanism hardware, depending upon what can be salvaged from the original camera. In my case, the axle for the film spool containing the unexposed film is simply a piece of ⅛" dowel passing through ⅛" drilled holes in the camera body. A piece of spring metal presses on the film to keep it from unwinding by itself.

On the drive spool side, the winding windlass (with its one-way turning direction) came from the original camera and was epoxied to a piece of plywood glued to the inside of the balsa camera body. A small metal gear was fastened to the outside end of the shaft to provide a turning knob. In addition, a pin was placed through the shaft so that an extension crank could be slid onto the shaft and the film advanced from outside the airplane fuselage.

A fitting must be devised on the other end of the film drive spool which will allow the spool to be removed, but which will also lock the spool on the drive shaft during the winding of the film. Fig. 10 is one simple solution for this problem. However, many cameras use a spring device here, and this may be easier to duplicate in some cases.

Fig. 9 shows a roll of 120 film installed in the camera. (Obviously this is a trial roll used during construction; if the film is

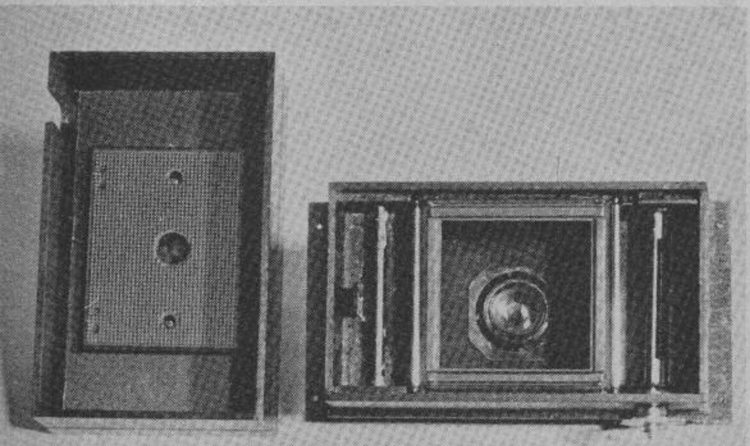


FIG. 8: Finished camera. Note the film pressure plate inside the cover. From original camera, fingers force plate gently against film.

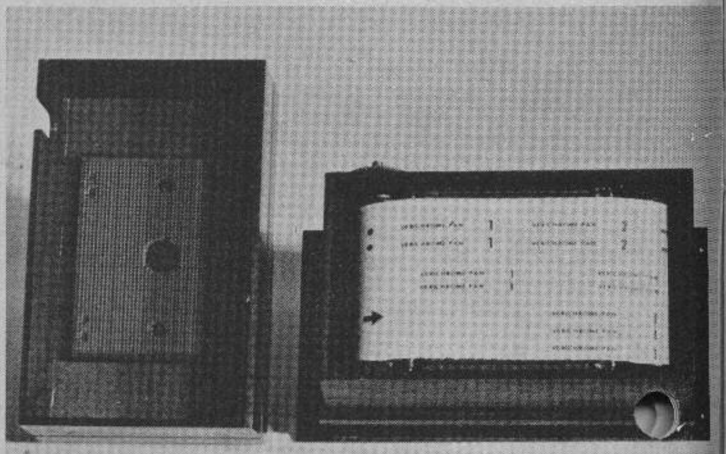


FIG. 9: Finished camera with trial film roll installed. Center set of numbers is used as guide, allowing 12 exposures each roll.

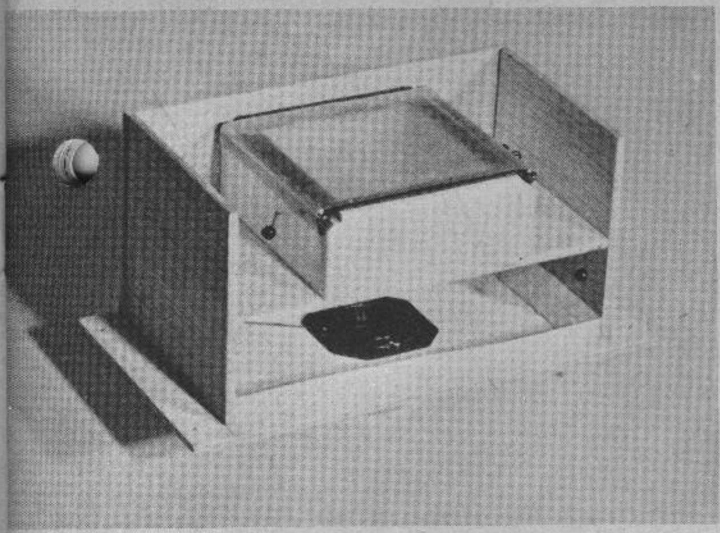


FIG. 6: Film bridge assembly is pinned in place for fine focus adjustment described in text. The lens also has been installed.

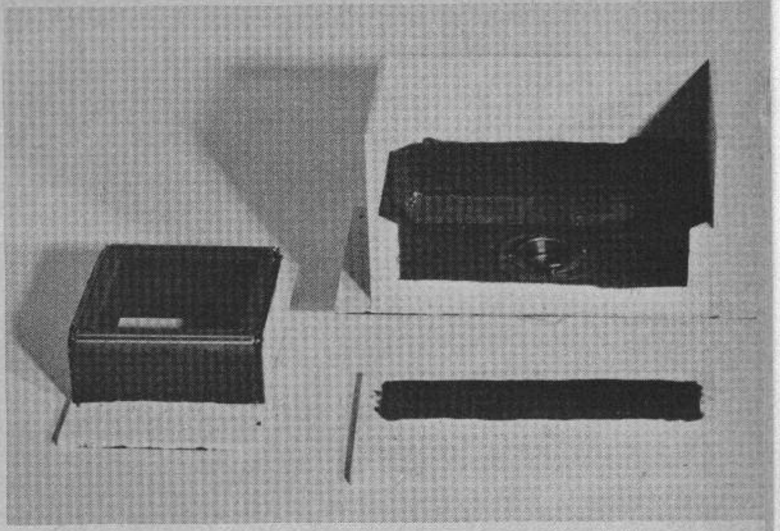


FIG. 7: Triangular corner posts added to the lower portion of the camera body, interior surfaces painted black prior final assembly.

advanced until the numbers show before the cover is closed, it will have been exposed.) Most roll film is set up to permit various negative sizes as can be seen by the three rows of exposure numbers on the back of the film. In my case, the negative area is 2¼" square so that 12 exposures per roll are available and the center row of numbers is the guide. A hole in the camera cover, screened by red tinted acetate, aligned with a similar hole in the pressure plate allows the numbers to be seen.

The last test is to try a roll of film on the ground. I would recommend stepping off about 300 feet from a brick building or other object containing a fine pattern of lines. A series of exposures with different distance settings, shutter speeds and lens openings should be made. The resultant negatives should then be examined with a magnifying glass to see which combinations provided the sharpest images. The higher "f" numbers usually do, and in my case, I found the sharpest detail at lens distance setting of 20 feet (which probably meant that there was a slight inaccuracy in my final installation of the film bridge assembly). If this trial film shows no evidence of light leaks, and the ground pictures are clear, then the next step is installation in an airplane.

Before closing this discussion on camera design and construction, there are a few additional points which may help others in selecting the best available camera as a source of parts.

As mentioned earlier, any small camera can be used and, depending upon the size of the available or projected airplane, camera size and weight considerations will undoubtedly come first. On the other hand, the very smallest cameras, say those that shoot still pictures on 16-mm movie film, are not necessarily the best ones to use. The focal lengths are so short that the images on the film are microscopically small and extensive enlargement of the original negatives is necessary to obtain pictures worth having. Such enlargements are seldom sharp and clear. I think 35-mm film is probably a bit on the small side, although I haven't personally tried it. As indicated earlier, I chose 120 size film which resulted in a camera about 3½ inches wide, 6½ inches long and 4 inches in overall height. Its loaded weight is 10 ounces.

For a given film area (say 2¼" square) the amount of terrain seen by the camera depends on the lens focal length. A long focal length will increase the size of each object on the film, but will cut down the area photographed. A short focal length will see more area, but all objects will be smaller. My camera's focal length is 75 mm which has worked out to be about right for me.

The shutter mechanism of any candidate camera should be studied in detail to see that it will be compatible with your RC system. In my own case, I run the shutter off the engine control. The first time full low engine is signalled, the shutter is tripped. Thus, I wanted a shutter which was cocked with one lever and tripped with another. Such an arrangement prevents double exposures on subsequent low engine signals. Fortunately this type of shutter is quite common. Inexpensive plastic cameras, and some others, use a single button which cocks the shutter early in its travel and then trips it as the button is further depressed. Unless your system can accommodate this, they should be avoided.

With the information presented here, anyone with the inclination to build a camera suitable for model aerial photography can do so, (*Continued on page* 28)

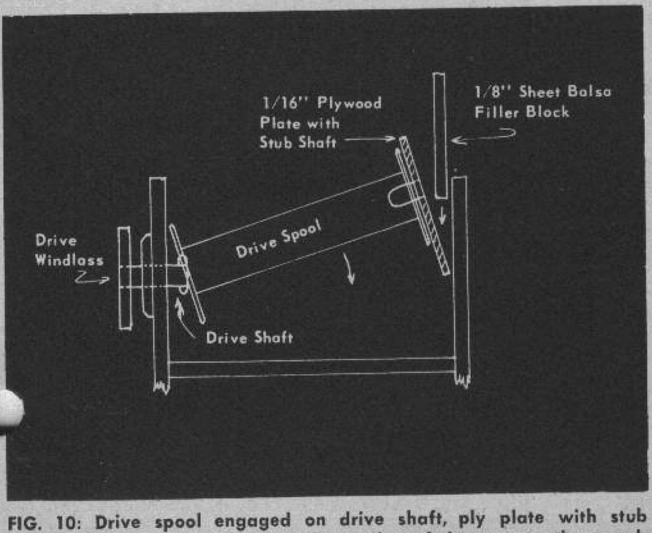
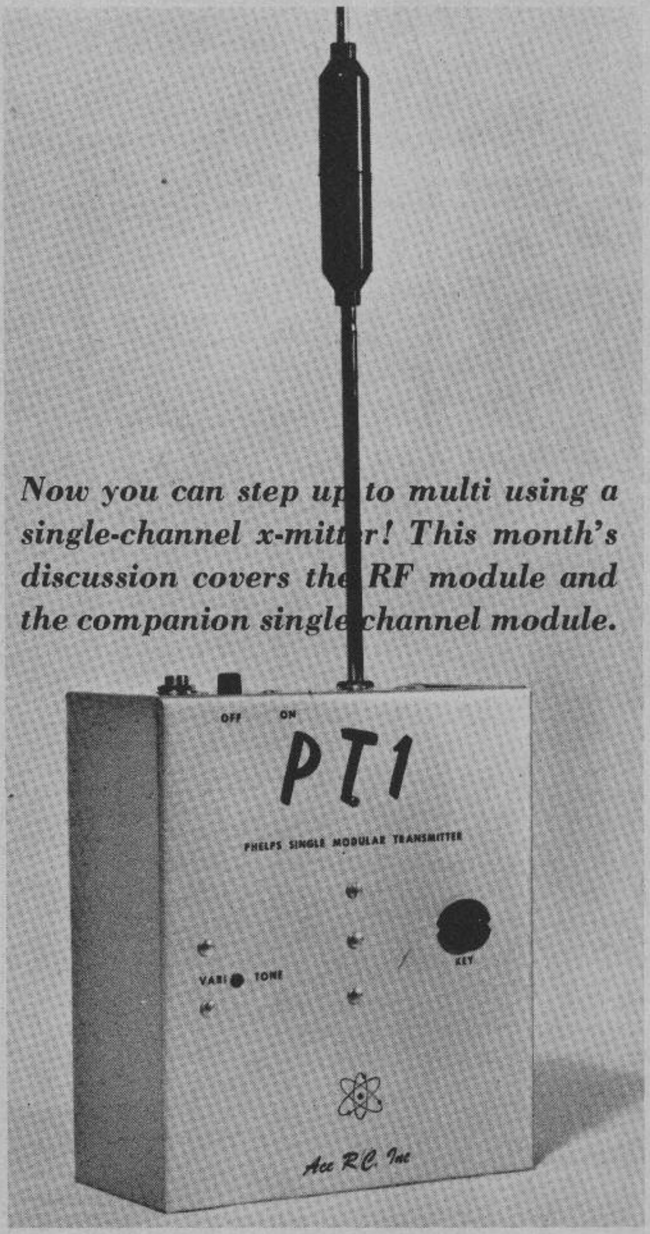


FIG. 10: Drive spool engaged on drive shaft, ply plate with stub shaft, upper end. Spacer block lowered to help engage the spool.

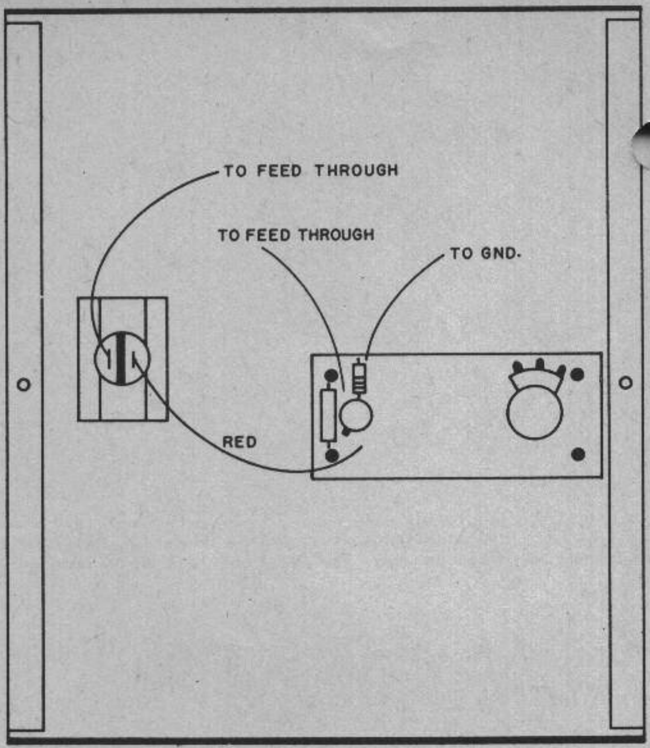
FIG. 11: The finished camera, assembled. Rubber bands are employed to keep the cover in place. Focal length used by author, 75 mm.

A MODULAR ALL-SILICON TRANSMITTER

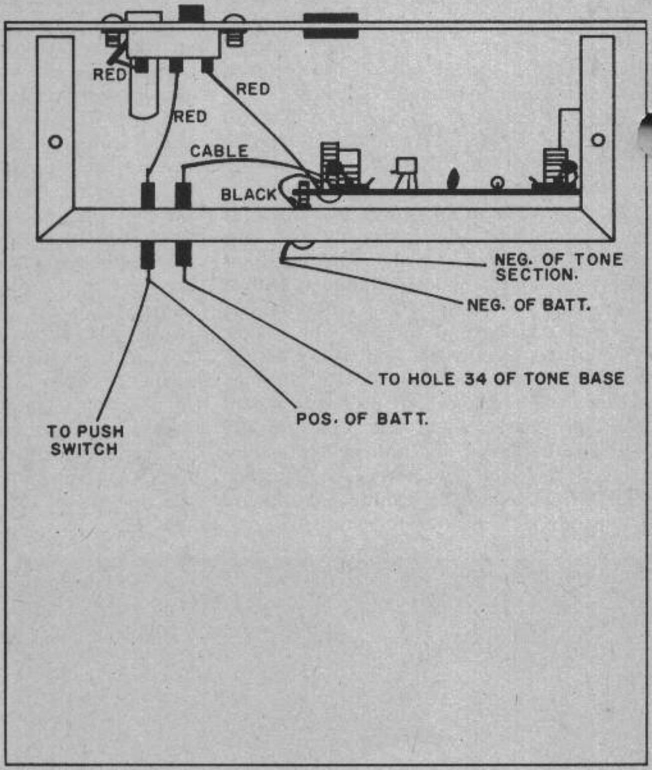
By J. H. PHELPS
APPLICATION ENGINEERING
GENERAL ELECTRIC CO., SYRACUSE, N.Y.



Now you can step up to multi using a single-channel x-mitter! This month's discussion covers the RF module and the companion single-channel module.



FRONT

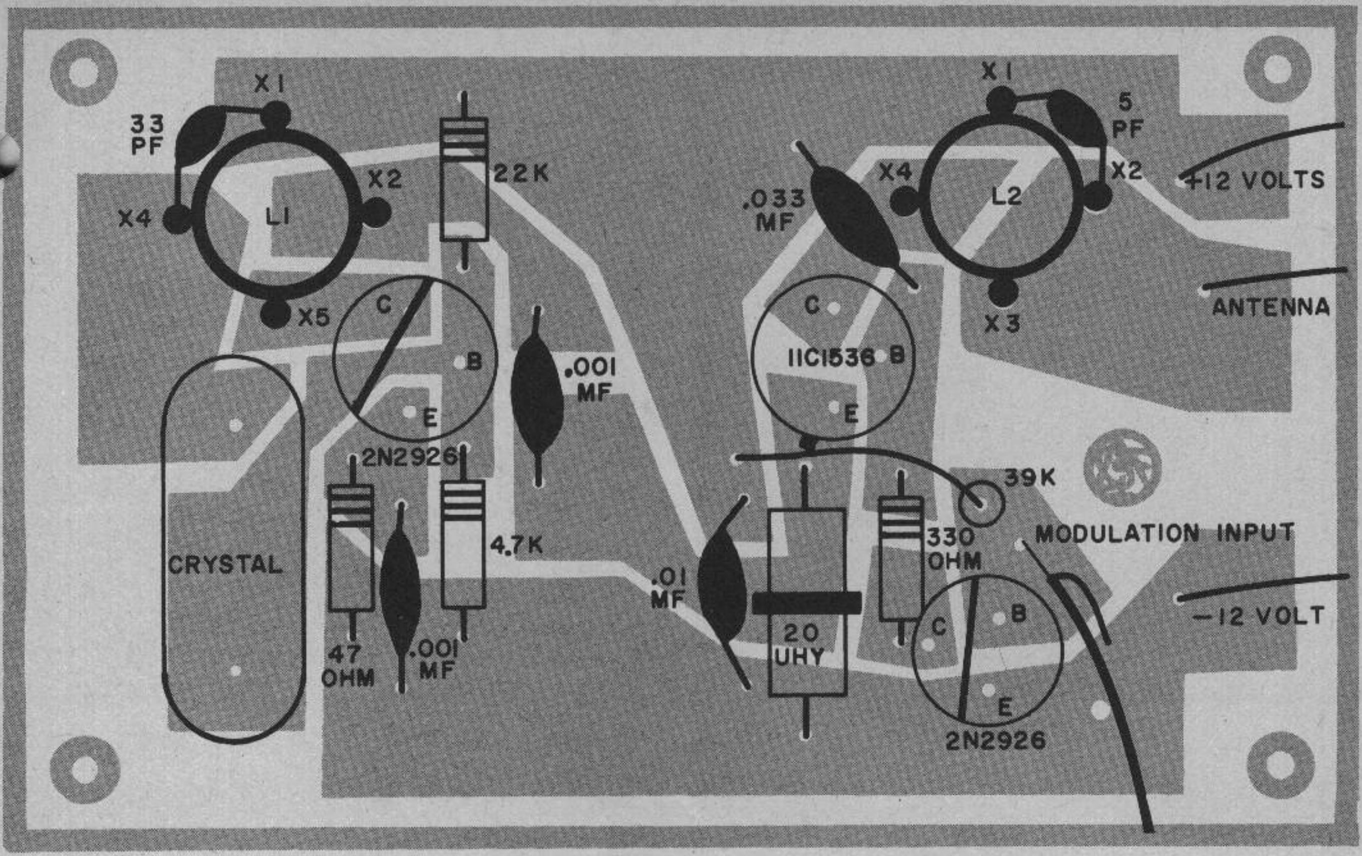


BACK

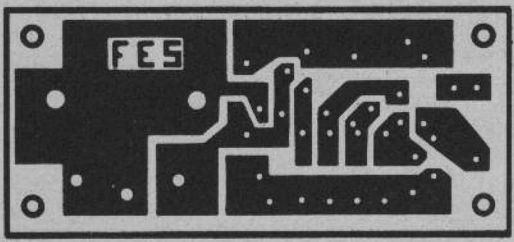
► NEARLY ALL MODELERS begin their radio-control work by buying single-channel equipment and then progress to more complicated control equipment. In the process, it has often occurred to the person juggling the sale of his old equipment (and the purchase of new) that a better scheme should be available.

One approach in the transmitter area is that to be described. Here, we pull out the common functions in all transmitters and group them in such a way that they need not be retired with the system they serve. Specifically, the RF oscillator, RF amplifier, modulator and batteries are gathered together in one module and the encoder in another module. In a single-channel tone transmitter this encoder is no more than an oscillator and pushbutton. For a reed multi-transmitter, the encoder is a pair of oscillators and a number of switches. One can easily see that the number of encoder add-on units is primarily limited only by the imagination of the system designer. Already designed and undergoing flight test is a single-channel transmitter, a 10 12-channel reed transmitter. Each of these encoders is an attempt to provide new performance benefits with reliability through simplicity and circuit design reliability margins. In this first article the RF module and companion single-channel module will be discussed.

RF Module: Although only three silicon transistors are



RF DECK PHELPS TX—ACTUAL SIZE



SINGLE TONE PHELPS MODULATOR
ACTUAL SIZE

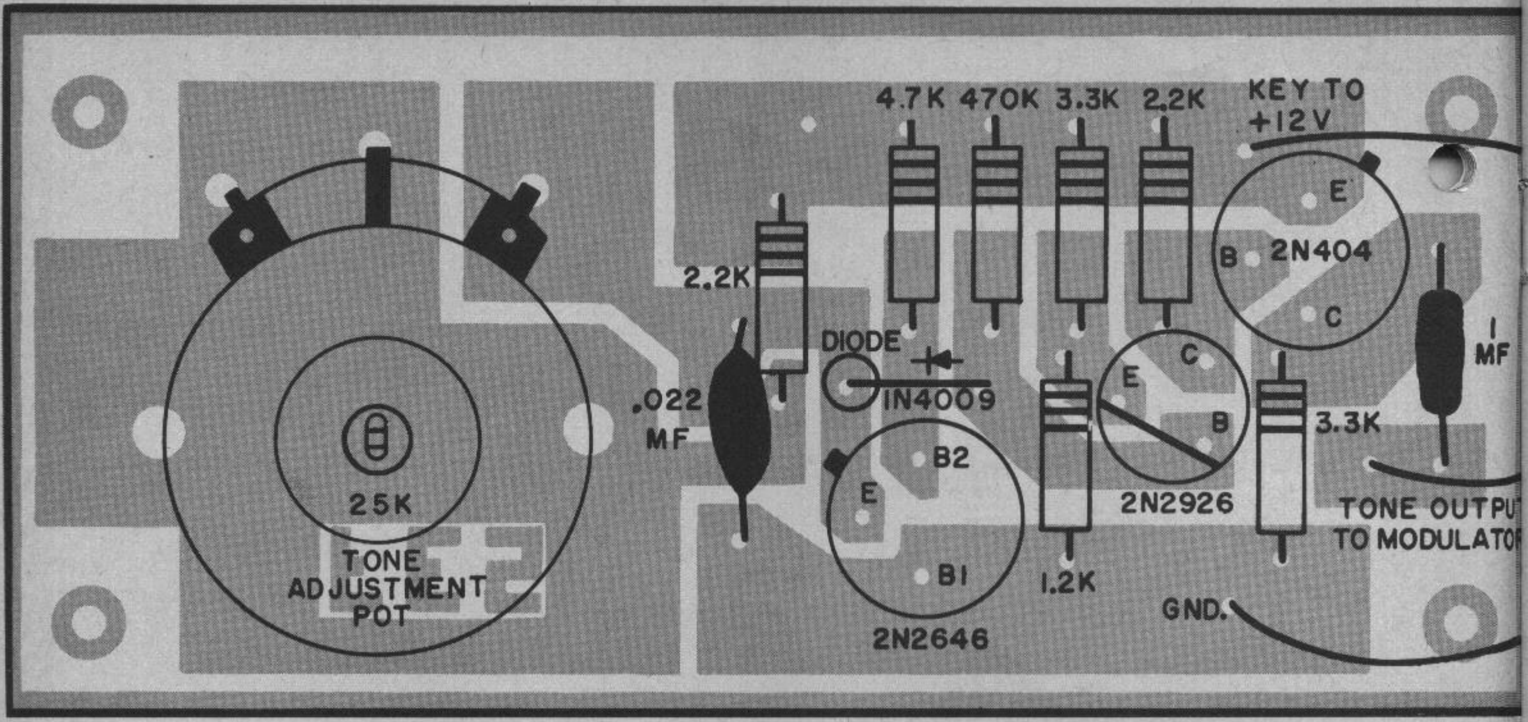
ENLARGED LAYOUT ON NEXT PAGE

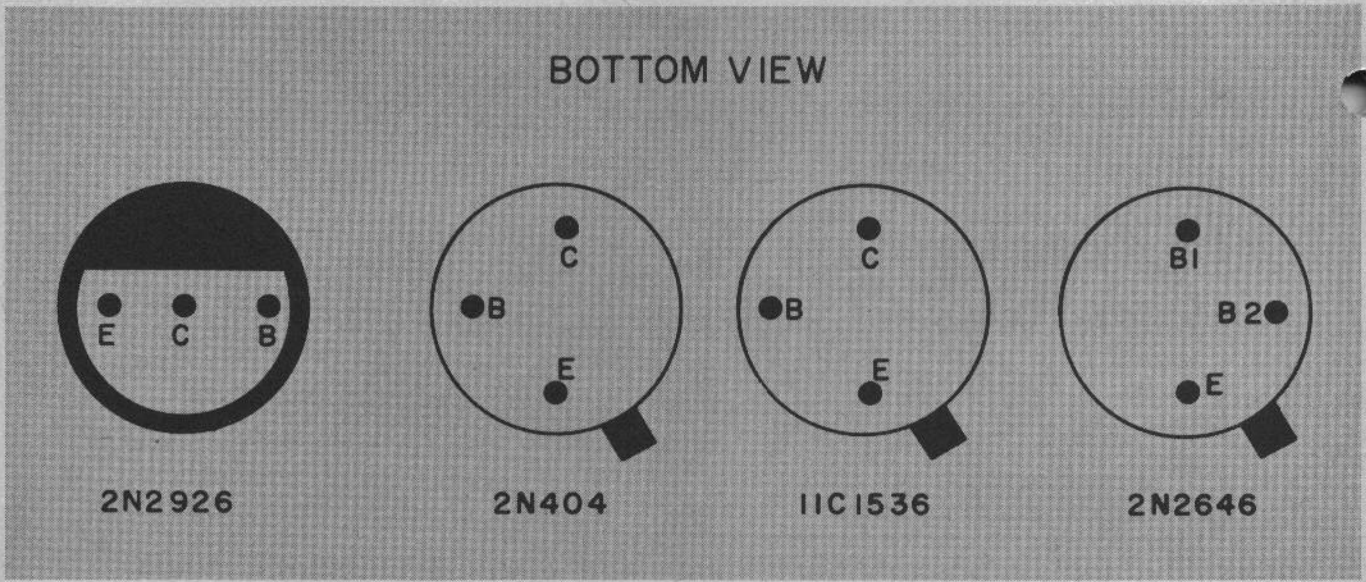
used in this module, it is capable of delivering a 100 percent modulated .5-watt RF output to a 50-ohm load (unmodulated rating). This places it among the most powerful of hand-held units.

The crystal oscillator is usual except for the means of providing feedback. The scheme shown in Fig. 1 allows a greater increase in series resistance during the life of the crystal without oscillator drop-out. Further, the proper shunt capacity is reflected to the crystal to the guaranteed-to-tolerance specified by the crystal manufacturer. This is a simple though sometimes overlooked point of importance. Care to this detail in both transmitter and receiver oscillators removes the most usual objection to solid state I.F. filters in a superheterodyne receiver.

The RF power-amplifier transistor is operated grounded base. This dramatically reduces oscillator feed-through and allows 100 percent modulation without the use of a modulated buffer. The collector of this stage is matched to the whip antenna by means of a tapped collector coil and a center-loading coil. This two-step match efficiently transforms the 50,000-ohm radiation resistance to the required 36 ohms at the transistor collector. Collector efficiency runs approximately 60 percent.

Modulation is accomplished by altering the collector current conduction-angle through base current modulation. This simple series modulation scheme is effective *Continued on next page*



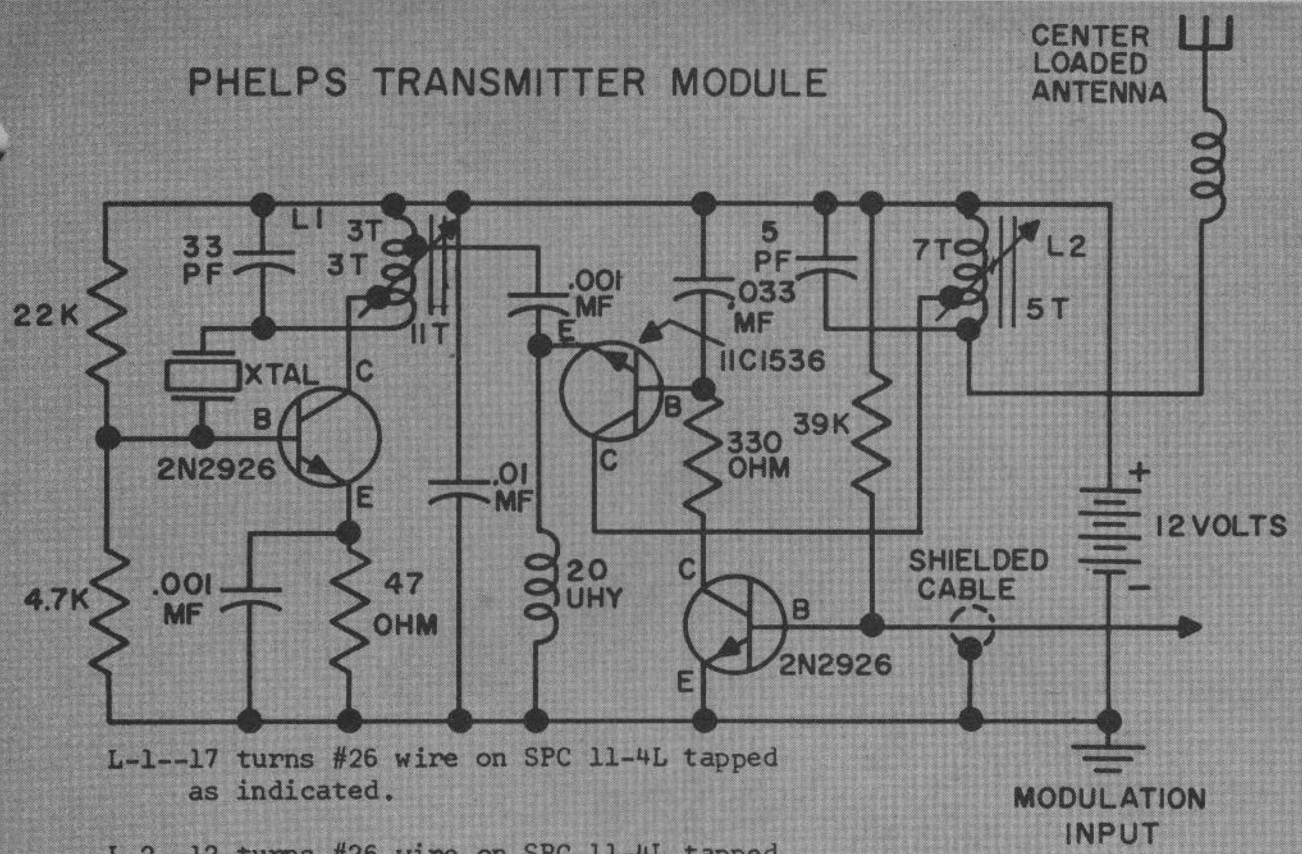


and provides the depth of modulation needed to realize the effectiveness of generous peak carrier-power.

In all transmitter designs the RF module is housed in a separate shielded compartment which keeps radiated energy at home. Connection to the modulating signal and battery power is made through 1000-pf ceramic feed-through capacitors. This feature insures compatability between any RF module and any encoder. Power is connected to the encoded through a pair of miniature body connectors, which provide a convenient reliable interconnection.

Single Channel Tone Encoder: This, the first of the encoders developed, is expressly designed to complement the all silicon selective super-regenerative receiver described in the May-June GL article. It is not limited, however, to use with this receiver. A variable tone frequency provides the flexibility, not only to adapt to other tone operated receivers, but to enable the user to peak system performance by tuning the tone to exactly the right frequency for his own receiver. This features works nicely with receivers such as the Kraft K3VK and the Controlaire 5, to mention two typical tone operated superregenerative receivers.

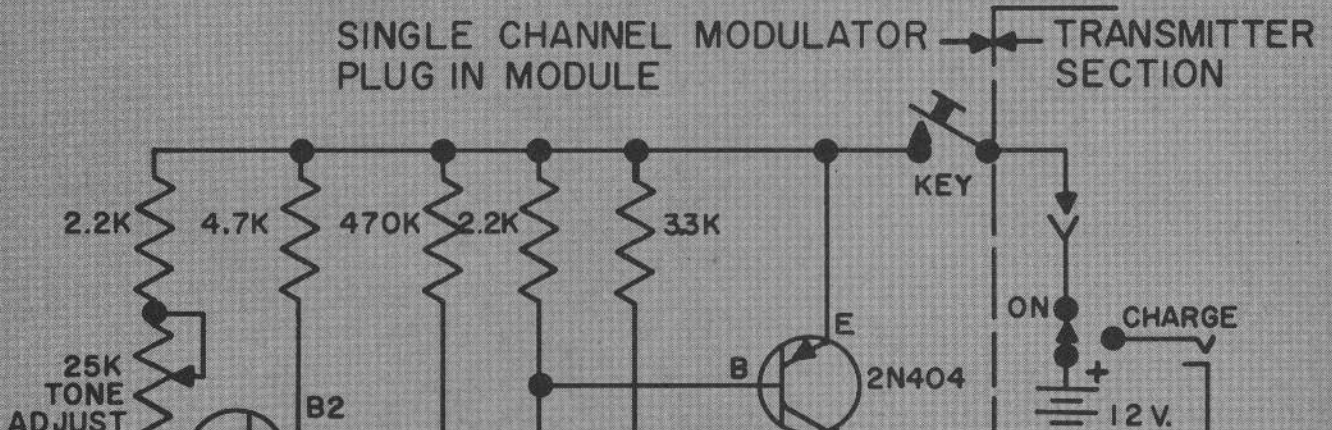
A silicon unijunction transistor generates the temperature and voltage-stable tone demanded by the author's very selective receiver. A screwdriver adjustment is available through the front panel to vary the tone frequency. A squaring buffer follows the oscillator and it delivers the current necessary to drive the transmitter modulator. The result is a 50 percent duty cycle square-wave variable from 300 cps to 3500 cps approximately. The modulator shapes the resulting modulated signal to limit harmonic content and adjacent channel splatter. The front panel pushbutton keys the oscillator on when the button is depressed. If mechanical keyers, or pulsers, are used with the transmitter, the keying button terminals may be used.



L-1--17 turns #26 wire on SPC 11-4L tapped as indicated.

L-2--12 turns #26 wire on SPC 11-4L tapped as indicated.

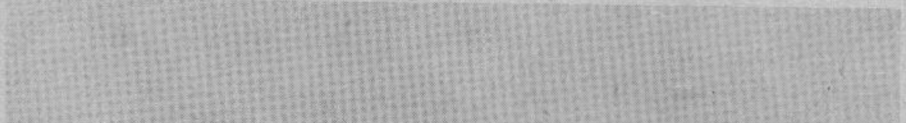
A Modular All-Silicon Transmitter



First powered Rogallo wing ever flown in 1962. John, then with NASA, pushes. It worked quite well but was a bit marginal on both power, directional stability.

...FLYING MORE—ENJOYING IT LESS?

By JOHN WORTH



Semi-scale (pusher) Ryan flex-wing was product of NASA project team headed up by Chuck Libbey. Heavy-duty Globe-motor servos moved the CG for controlling.

Do you have a sense of adventure? Much pleasure will be had from experimentation or merely trying off-beats! All of these designs were flown with notable success.

■ OLDTIMERS WILL PROBABLY get the significance of the title more so than newcomers, but the implication is for all. Who qualifies as an oldtimer? Well, you've got to go back at least ten years, but 15 is more like it. At least, you have to go back to before transistors—back to single-tube receivers.

You either know or heard about those days. That was when one successful RC flight was enough to put you on cloud nine. Compare this with today. There are many days when ten flights do not produce the kick that one of the oldies did.

The difference is in sense of achievement. You *knew* in 1949 what a rare gift of the gods it was to have your transmitter, receiver, relay and actuator all decide to work together at the same time on the field.

So, most oldtimers didn't push their luck on the airplane end of things. The RC bird was usually a tame free-flighter that had been thoroughly glide tested; often extensively test flown without the radio gear—you *knew* it would fly on its own and more likely than not it would have to since the radio might go out at any time.

Today, for most RC ships, the radio has *got* to work. You've had it on most multis if the radio quits—most people realize that fail-safe with today's neutrally stable competition airplane is merely a means of neutralizing control surfaces on the way to a crash.

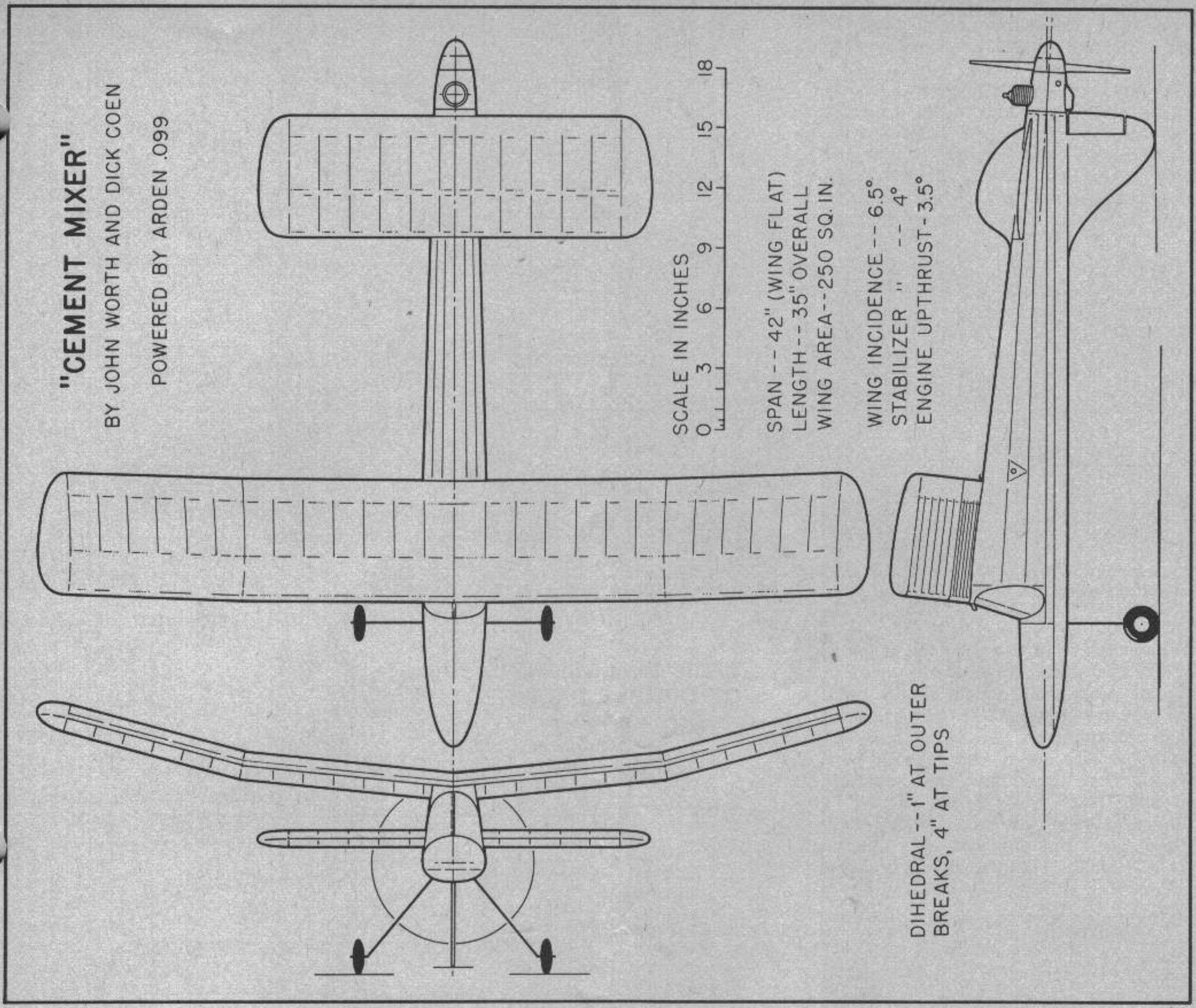
Yet successful flying with today's RC gear is so commonplace that there is little sense of achievement involved—some guys actually come home bored after many flights of full precision pattern maneuvers.

Should we go back then to the old days? Not really—at least not to the old radio troubles. But maybe the airplane itself offers the challenge. A couple of paragraphs ago I said the old time RC bird was usually a tame free-flighter. True, for most people. But not for me.

The radio gear didn't give enough trouble so I had to compound it with tailless original design models, or tail-firsters, or anything except a nice tried and true conventional high-wing cabin job. When one of these jobs flew *that* was a great day—with or without the radio working! And put the two together so that the weird bird and the radio both worked right on the same flight and wowee—*that* was a day to remember!

Three of us, Dick Coen, Bill Poythress and myself, specialized in "different" model designs. Most turned out to be successful. There was no real magic involved, only fundamentals. Frank Zaic's famous yearbooks were an inspiration in that they indicated a wide variety of model designs had been successfully flown. Study of these showed that no matter how weird or unconventional looking a design might be, it usually incorporated sound basic features.

Some rough rules of thumb applied to most all designs: horizontal stabilizer area 25 to 35 percent of wing area, vertical tail area 5 to 10 percent of wing area, center of gravity at 30 to 35 percent of average wing chord position, at least three degrees



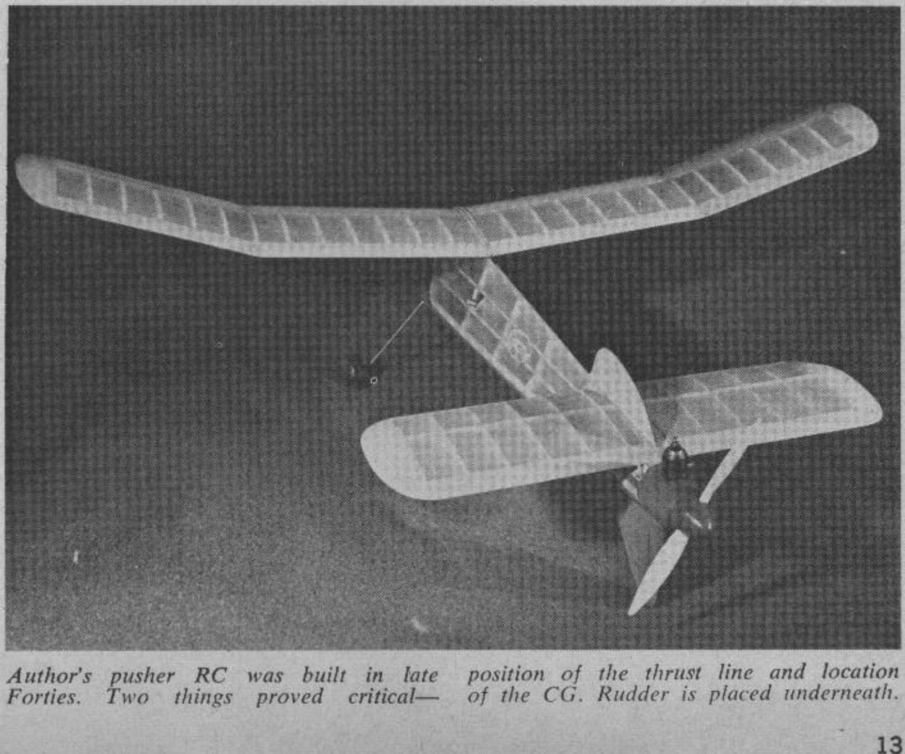
difference in wing and tail incidence angles, etc. Finding the correct center of gravity position was the key factor—usually accomplished by many glide tests.

What has this got to do with today? Well, it just might help get us out of the rut we're in with so many look-alike models on the field. Time was when a low winger was a daring innovation but not so any more. No doubt it would be hard to come up with something better for competition.

But most flying these days is for fun so why not add to that fun by trying something different? And even for competition, the unusual might not be out of place. Look at the deltas in Pylon—they're not so unusual now, but before the Hustler design came along the delta was a real stranger to competition.

Since the delta proved to be so good, why not a double-delta? The double provides some real advantages: Center of gravity position is not so critical, pitch stability is much improved—meaning that more precise flying of the pylon racing course can pick up a few more mph.

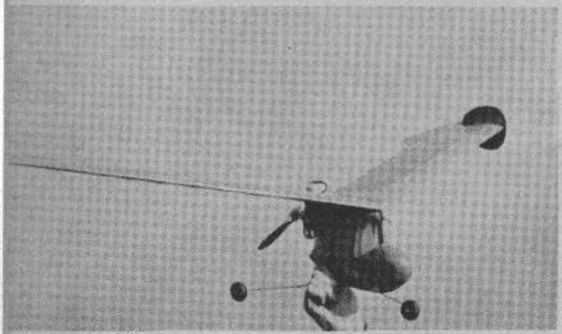
One thing is for sure. You'll get far more bang out of making an original design fly. After (*Continued on next page*)



Author's pusher RC was built in late Forties. Two things proved critical—position of the thrust line and location of the CG. Rudder is placed underneath.

all, you *expect* the kit job to go. But there's nothing like the satisfaction that comes from seeing your own brainstorm come to life.

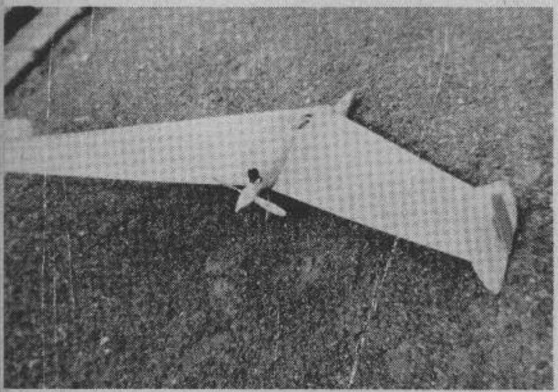
The easy route—and safest—is to modify a kit, in easy stages. Maybe just a change in vertical tail shape at first. Later, maybe, you might get wild enough to put the engine in the tail instead of the nose! Why? Some reasons (or excuses) will come to you later—don't let them get in your way now! Or, swap wing and tail positions —that'll mix things up nicely.



Early wing by Worth was in wartime Air Trails. *Fundamentals useful in radio job.*

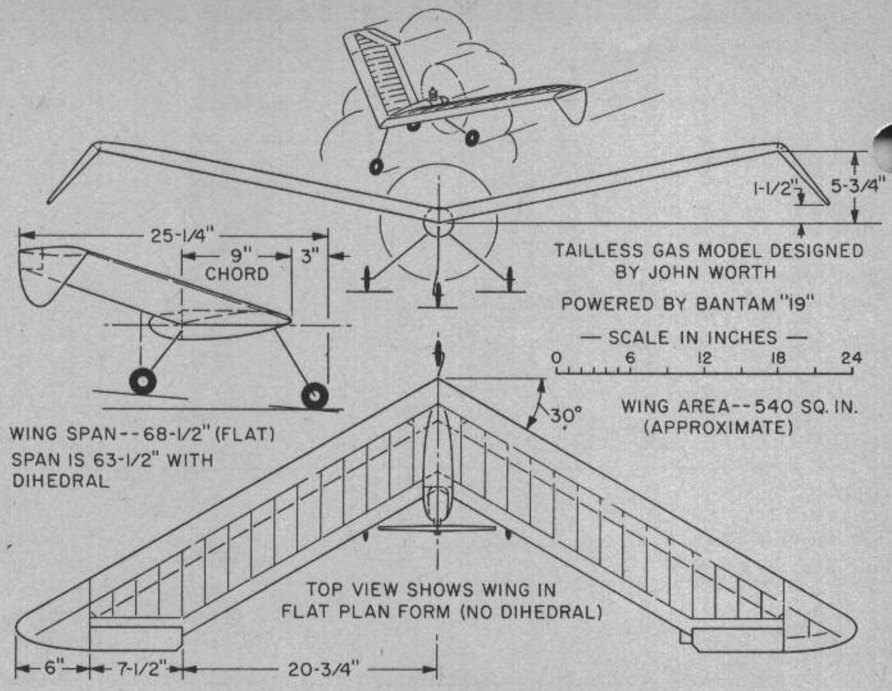
In the process you might find a goldmine of know-how. Like how the wing-tail relationship in terms of area, airfoils and trim angles also are related to C.G. position. Or how thrust line and launching gear angles also get involved.

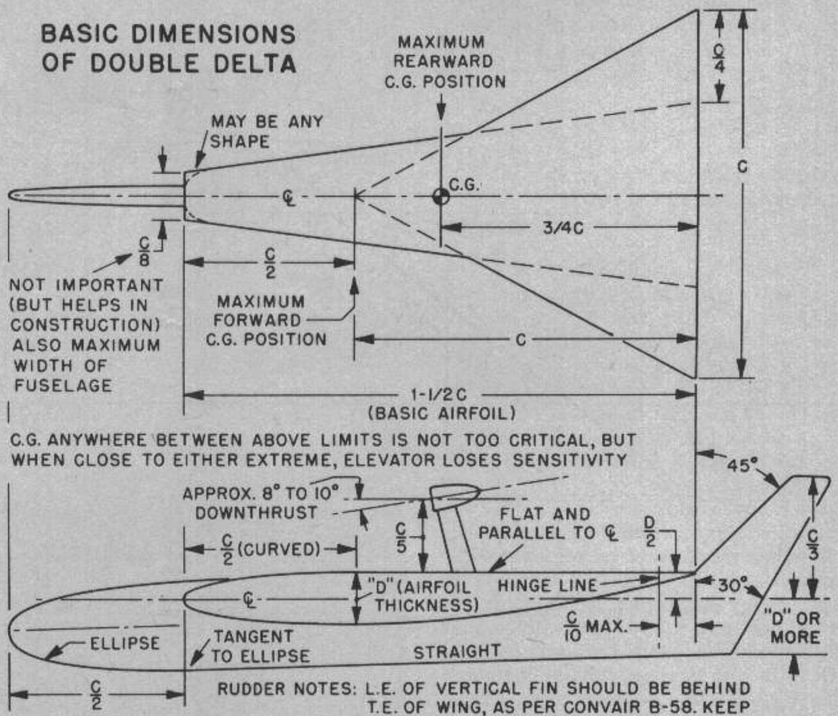
But most of all you might find a goldmine of just plain fun. You may bust up a few airplanes but you probably know by now how to install the radio gear so it is protected. And with all the miracle stuff on the shelf for fast repairs, downtime can be minimized. Mostly, though, it's a matter of sticking to principles: sound construction, careful testing; one adjustment at a time to isolate flight effects of a trim change.



This 1947-48 RC tail-less was built by Bill Poythress, who is still actively modeling.

Illustrating successful off-beat approaches to original designs, are pictures and drawings of a couple of tail-less jobs or flying wings, and an engine-in-tail pusher. The latter was done for *Air Trails* prior to 1950 when the magazine wanted something different for the then-new Aerotrol (what, you don't remember the Aerotrol?). The basic flying wing goes back much farther—too much in fact!





FORWARD SECTION OF BASIC AIRFOIL IS SYMMETRICAL, 10% TO 25% THICK (D). REAR SECTION IS FLAT ON TOP, BOTTOM TANGENT AT C/2 POINT (33%), FAIRING TO T.E.

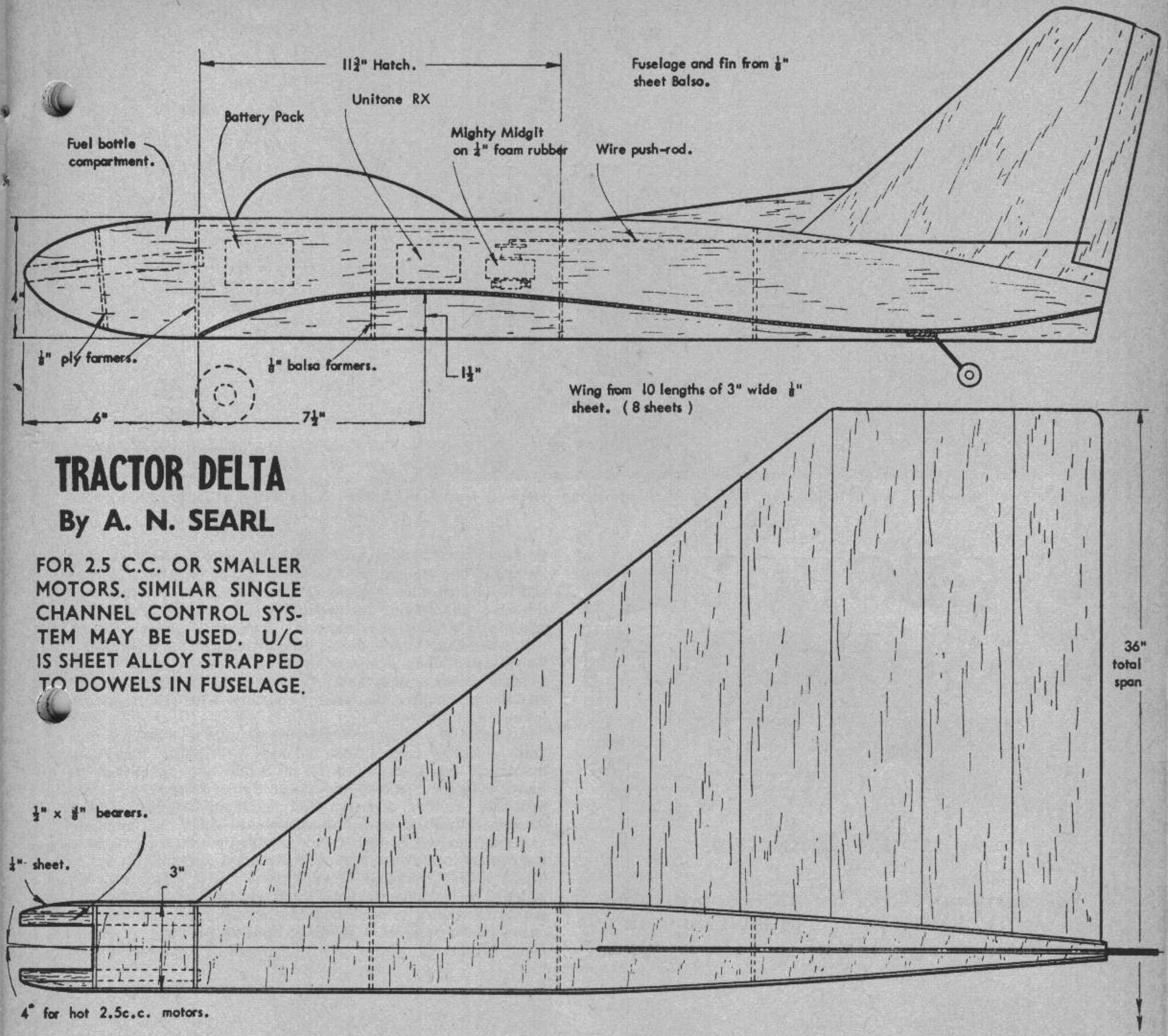
ASSUMING TOP SECTION OF AIRFOIL AS REFERENCE LINE, THRUST LINE SHOULD BE -8° TO -10° (ACTUALLY WING ANGLE OF ATTACK IS ABOUT +8° TO +10°).

LOCATE ENGINE(S) AS FAR FORWARD AS POSSIBLE AND AS LOW AS POSSIBLE WITHOUT HAVING TO COUNTER-BALANCE WITH LONG MOMENTS.

Bill Poythress' double-delta drawn by Paul Plecan (Courtesy of AMA).

The tail-engined job was built during the 1947-48 winter for Arden .09 power. That was a light engine—which helped. Three versions were built, each successively taking weight out of the tail and putting it in the nose. Despite nose ballast bringing the wing loading to a then astronomical 30 ounces on the first version, it was a good flier. (If you are "lucky" enough to know where there is a July 1948 copy of *Air Trails.* you'll be "rewarded" with detailed plans.)

Engine weight so far to rear means *everything* else has to go ahead of the wing. Putting any weight between wing leading and trailing edge area is useless, even more so with today's lightweight RC gear. Whatever is not structure needs to be ahead of the wing leading edge to achieve proper location of the center of gravity.



TRACTOR DELTA

By A. N. SEARL

FOR 2.5 C.C. OR SMALLER MOTORS. SIMILAR SINGLE CHANNEL CONTROL SYSTEM MAY BE USED. U/C IS SHEET ALLOY STRAPPED TO DOWELS IN FUSELAGE.

This interesting two-view appeared in RCM&E. CG is given at approximately 20-25% from leading edge of root chord.

Two ounces of engine weight 10 inches behind the C.G. equals 10 ounces located two inches ahead of it. Biggest gain of all: keep tail structure light—every ounce saved in tail probably saves five or more in nose (more so the further aft you save weight). Yet long nose is undesirable because it causes unfavorable motions in maneuvers.

Interesting thought for an updated approach: rather than one pusher engine behind tail, try one tractor on each tail leading edge!

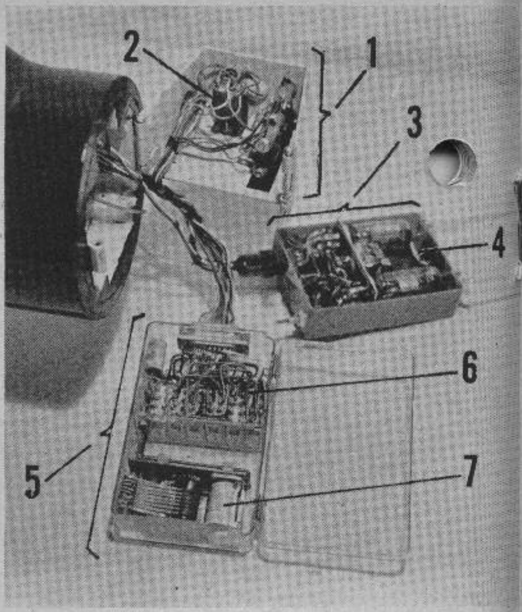
Angle each nose in so that thrust lines converge at the C.G.; little, or no, one-engine-out effect may be noticed. Or, since that is so (and you want to be different), why not just one engine on the tip leading edge of one side of the horizontal tail?! Or, if you're chicken, put the engine up on the vertical tail leading edge—high thrust line produces nose down moment (which can help offset tail heaviness, but only under power unless angled to intersect C.G. position).

That free flight tail-less began life in 1941-42. With an Atom .09 (there's another, remember?) it was consistent and troublefree. It was detailed by the writer and Dick Coen in the July 1942 *Air Trails*—in fact, this pterodactyl is so prehistoric that the then editor of AT (who also arranged for this article!) says he remembers the airplane clearly but not the designers! Naturally, this bout with flying wings showed the possibility of an RC version in 1947-48, this time by Bill Poythress who is still very much with us today. It had a Bantam .19 for power and drag rudders for control. But radio gear problems prevented full exploitation.

A fancy wing is unnecessary. A flat-bottom round-nose airfoil (Clark Y) is good, with elevons rather than either reflex wing section or wing twist. Use a constant-chord wing with 30-degree sweepback and elevons set at about 30 degrees "up"; C.G. at about 30 percent *average* chord position. Positive positioning and fine adjustment of elevons are necessary—trim is affected by very small deflections. Plus and minus five

(*Continued on page* 24)

Where a fast response is not essential, the telephone dial sequencing system is feasible.



1—Hinged bracket; 2—Adjustable resistors, slow-speed drive, filaments; 3—Rcvr.; 4—Rx for stepper switch, time delay; 5—Switcher; 6—Relays; 7—6V relay coil for stepper.

GEORGE WASHINGTON ATOMIC POWERED SUBMARINE

By BROTHER OTTO, S.S.D.

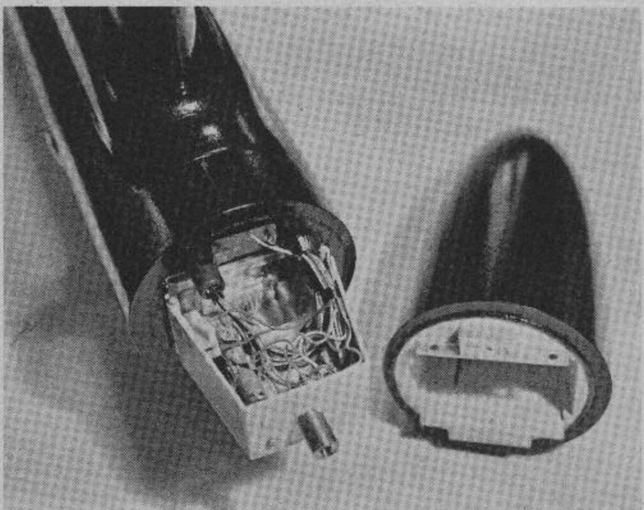
The designer of the Nautilus sub printed in March-April 1964 GL follows up with a ballistic-missile launcher Polaris type.

■ THE NAUTILUS WAS A 56-inch twin-screw vessel with twin Pittmans. The George Washington is driven by a single screw and is 48 inches long. Although the two articles embrace considerable information for would-be submariners, it was not possible in either to present every detail such projects justify.

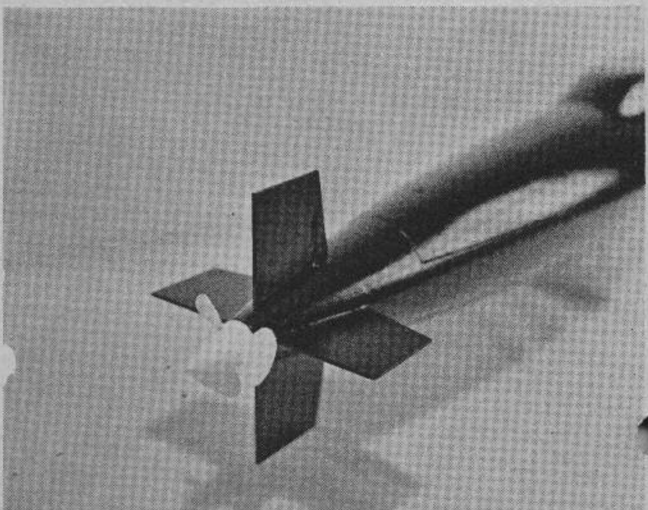
Brother Otto was stationed abroad before this presentation firmed up, leaving a hurried last-minute text, a huge outline working drawing, and many negatives. While he worked on this material he changed addresses frequently, with GL frantically following on Sonar.

Actually, the George Washington feature was tackled as a joint project by GRID LEAKS and by GL's editor, a reprint of the article being scheduled for a hobby book published by Fawcett. In the hectic course of events, the "reprint" appeared first! The finished drawings and additional schematics were completed by Fawcett, and appear now through their courtesy.

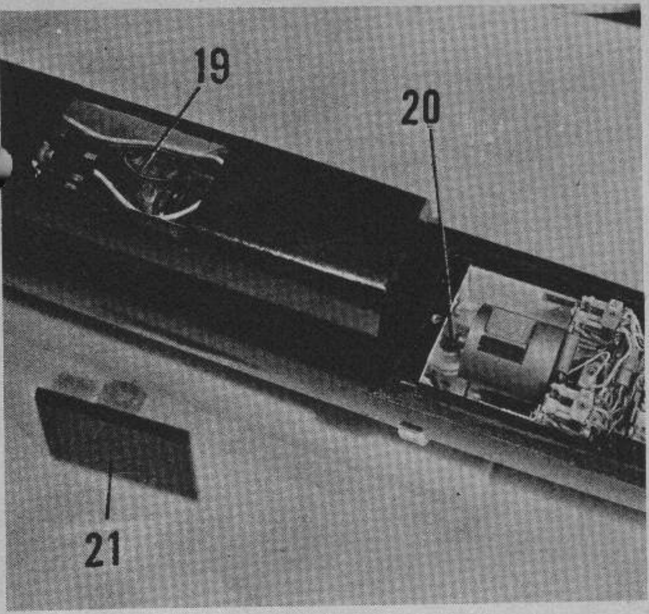
What follows is Brother Otto's necessarily abbreviated article, (as printed in *Handbook of Model Planes, Cars and Boats*) to which notes, extracted from limited correspondence, were added. The phenomenal thing about the designer's radio system is that everything is done with a simple but old Kraft single-channel tube receiver. With limitations on the cost of equipment, Brother Otto, who also is interested in hamming, devised



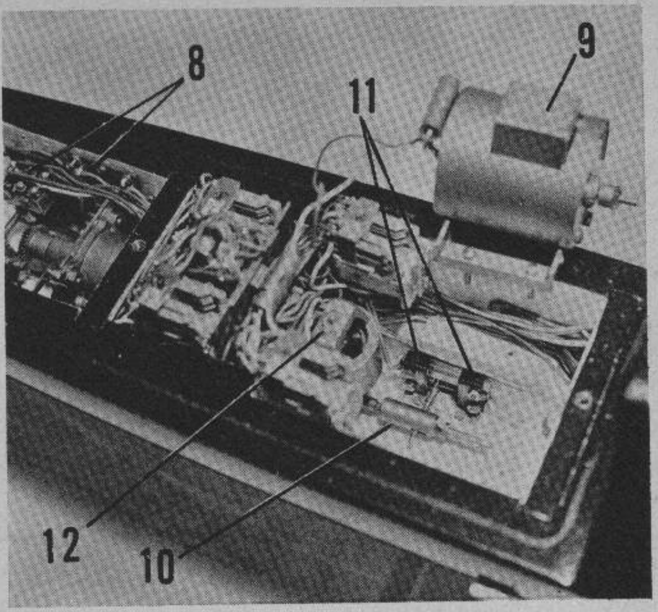
Allen bolt presses bow section tightly in position. The rubber O-ring recessed into a gouged-out groove makes a tight seal.



The three-bladed propeller was home-made. Suitable brass or nylon props can be obtained at many hobby shops (Octura).



19—Lead acid batteries in ballast compartment rubber vented for watertightness; 20—Right-angled pump drive (9 in pic at right); 21—Hatch removed shows the large drive batteries.



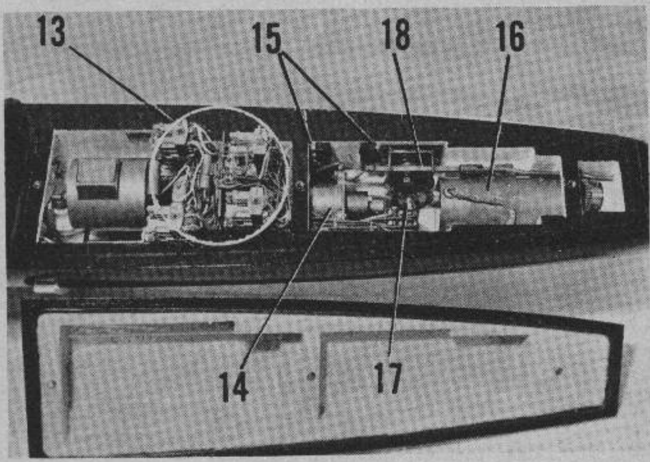
8—Limit switch and a terminal block; 9—Pump motor, right-angle drive gears; 10—Push-pull pump valve, geared-down motor; 12; 11—Micro-switches determine the valve stop positions.

some truly ingenious arrangements for such diverse functions as drive-motor control, ballast pumping system, dive control, and steering. The Nautilus, in fact, even launched a rocket-powered Regulus missile with a range of 75 feet.

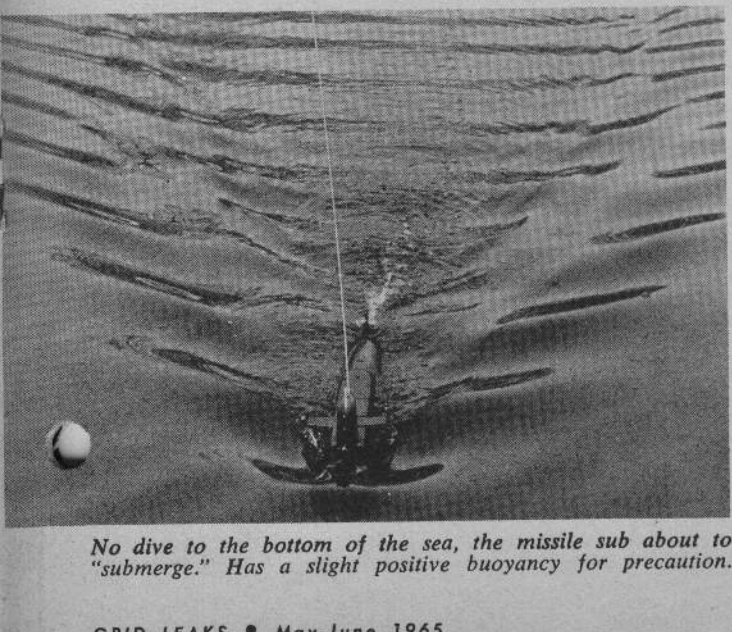
Since multi-channel reed units should provide simplified and improved installations the reader should understand the mechanical and electrical systems, in order to devise his own control and actuation methods. This article is intended as a guide for those who may tackle a sub for the first time. Now the article . . .

Since the pioneer submarine Nautilus entered the fleet service in 1955, events have followed swiftly in the nuclear undersea navy. The records the Nautilus had established for speed and endurance were soon eclipsed by subs of later generations, such as the Skate, Seawolf, Skipjack and Triton. These new records have opened up the Arctic ice packs and set a new pace in underwater mobility.

But perhaps the most awesome development of the nuclear sub has been its marriage with the ballistic missile. This roving arsenal carries 16 missiles that constitute a fearsome weapon of instant retaliation. And paralleling these significant developments, on a miniature scale, has been the hobby, model submarine building.



13—6V relays, all motors; 14—Steering motor; 15—Microswitch steering limits; 16—6V commercial slave drive motor; 17—Limit switch to steering drive motor; 18—Right angle drive gears.



No dive to the bottom of the sea, the missile sub about to "submerge." Has a slight positive buoyancy for precaution.

The design chosen for this project is the fleet ballistic missile type of the first generation. There are five commissioned from the George Washington SSBN 598 to Abraham Lincoln SSBN 602. This class was the first to fire the Polaris intermediate range missile either submerged or surfaced. The decals 594 stand corrected since this number is given to a sub in the attack class, the basic difference between the two being the design of the superstructure to accommodate the ballistic missile tubes.

The Polaris type model is 48" long, with a 4½" beam and weighs 21½ lbs. It displaces 662 cu. in. and was designed to have three independent and sealed compartments. The fore section contains the single-channel tube Kraft receiver and the homemade stepper switch mechanism; the midsection is for flooding—the ER-4-2 lead-acid batteries are located there; and the aft section houses the drive motor, steering and pumping systems.

This type of model is much simpler to construct than the USS Nautilus featured in the March-April issue of Grid Leaks. It cruises at a higher speed; floods and pumps in a matter of seconds, and rudders in a tighter circle. The stepper switch controlled by the receiver provides for: right rudder, left rudder, reverse-on-fast, off, slow, dive, and *(Continued on next page)*

rise. Pulsing of these circuits is done by a telephone dial or a pushbutton microswitch on the Ace Kraft audio single-channel transmitter.

The interior was designed to accommodate the batteries and equipment on hand. After calculations were made to determine how much tank volume was needed for submerging, a problem arose as to the placement of this volume. A surfaced submarine has a different center of gravity than a submerged one. Both had to be considered. The plans show the proper tank location although the model had the submerged center of gravity shifted aft a little. This was remedied by the placing of plastic blocks in the rear of the tank, but at the sacrifice of diving depth. This is real·tricky to maintain proper surface trim and adequate submerged trim. Make adjustments.

One solution was to slow the speed down a bit for diving operation because of the tendency of nosing down. In the off-motor condition the craft should have a slight list aft because of the sucking action on the nose of the ship when under way. The plans sections off the craft for fine operating conditions both surfaced and submerged but only under the given battery as shown. A different set obviously will have another volume therefore requiring different ballasting or volume blocking. This area, therefore, is very critical.

Altering of the plans for various types of batteries may be made at the builder's discretion and risk. Lead ballast can be added in the other two sections to compensate for almost any kind of equipment.

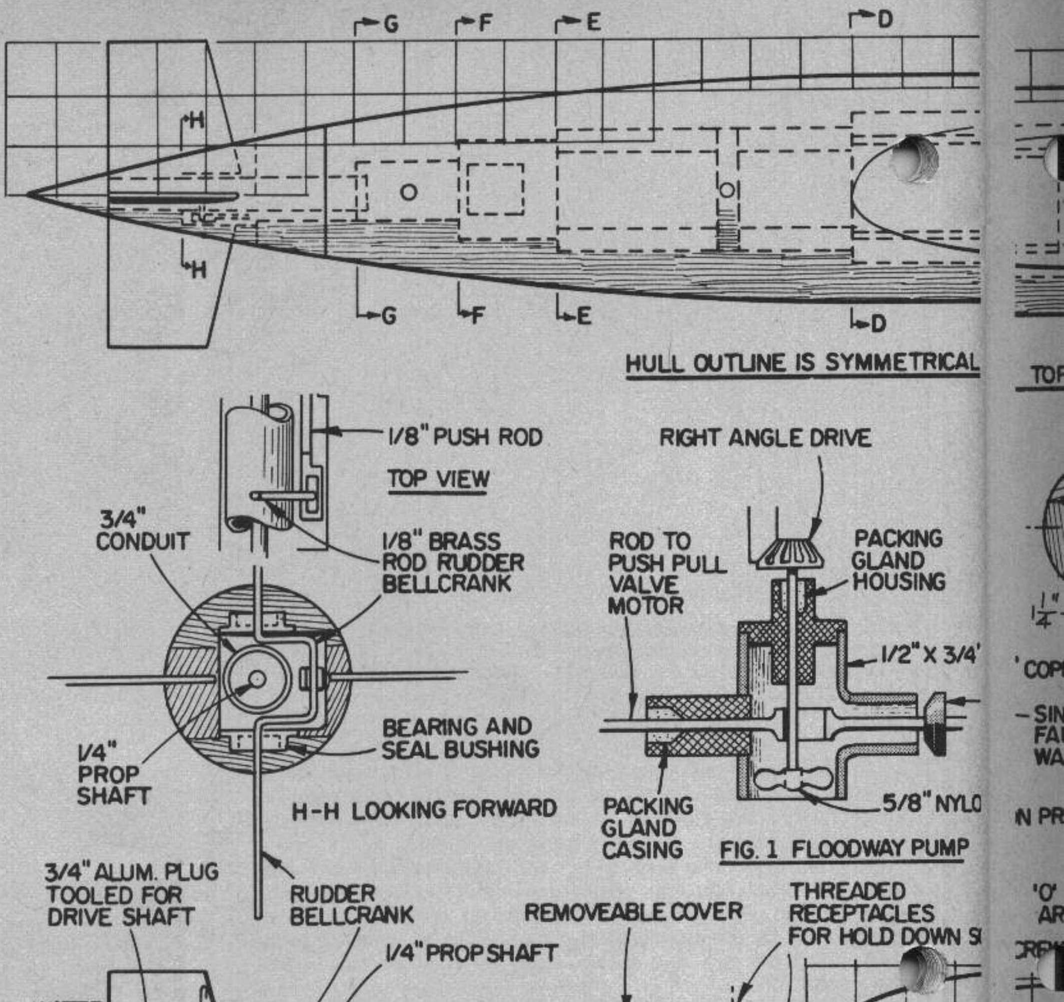
Various thicknesses of white pine planks were used to facilitate different levels and to minimize interior carving. A saber saw was most useful in precutting the laminations before gluing. Use of a good waterproof glue and evenly applied clamps prevented warping of the center line. Marine paints were used to seal the hull interior, as well as for external finishing.

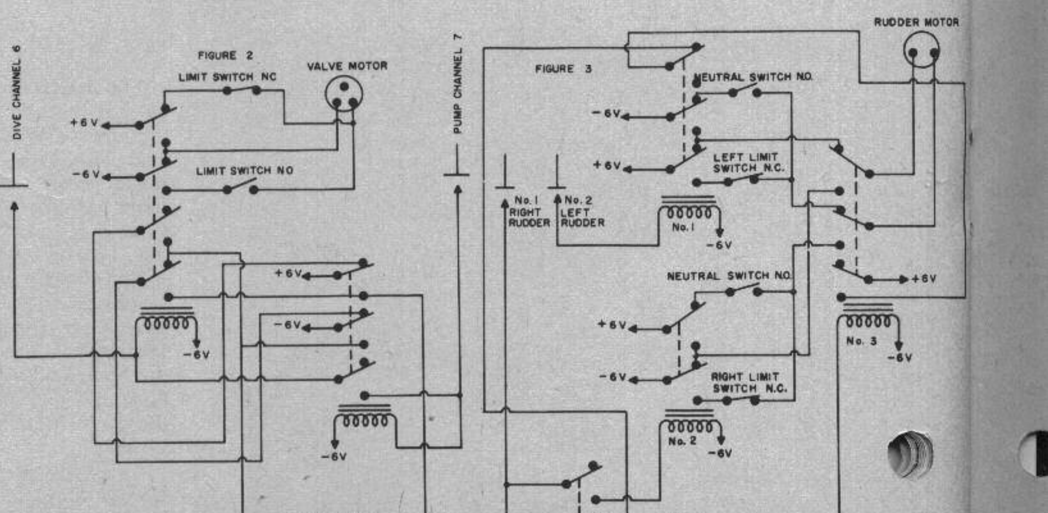
Since the craft is symmetrical from stem to stern with the exception of the superstructure, this method of construction was followed. The tie-down brackets were installed in the motor compartment to clamp down the lid. Likewise, the nose section was squared off, aligned, bolted in place.

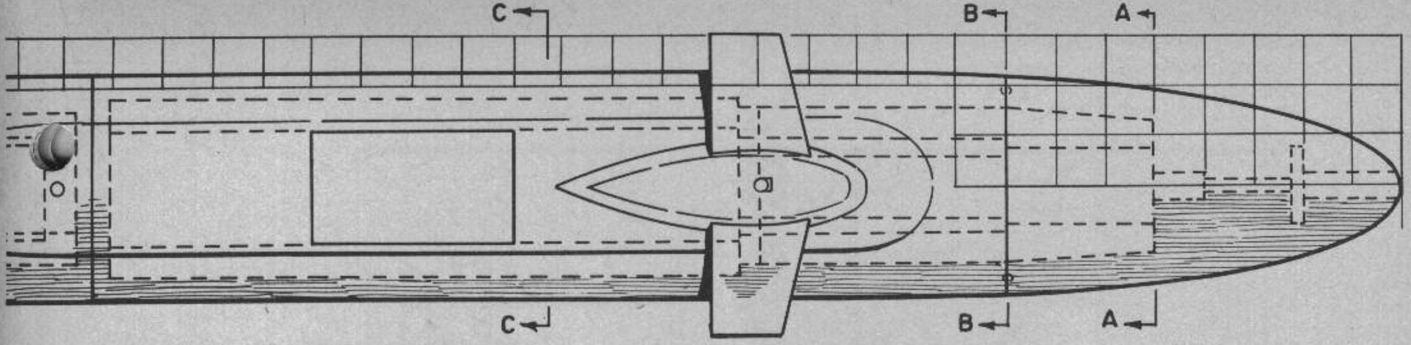
An aluminum plug was tooled to insert into the 3/8" Allen bolt hole in the nose. Another plug was tooled for the 3/4" hole for the propeller shaft tube. Both plugs had flanges to distribute the pressure of the wood lathe tail stock against both ends. This also served as a sturdy alignment jig for cutting down the hull.

A section of the top plank was left unglued so that it could be cut after taken from the wood lathe and the superstructure or deck inserted. It took about four hours to rough this block in and take down the hull to a smooth finish. After cutting off the unglued section it slipped right out and the deck block was inserted, glued and rounded off to the contour of the hull.

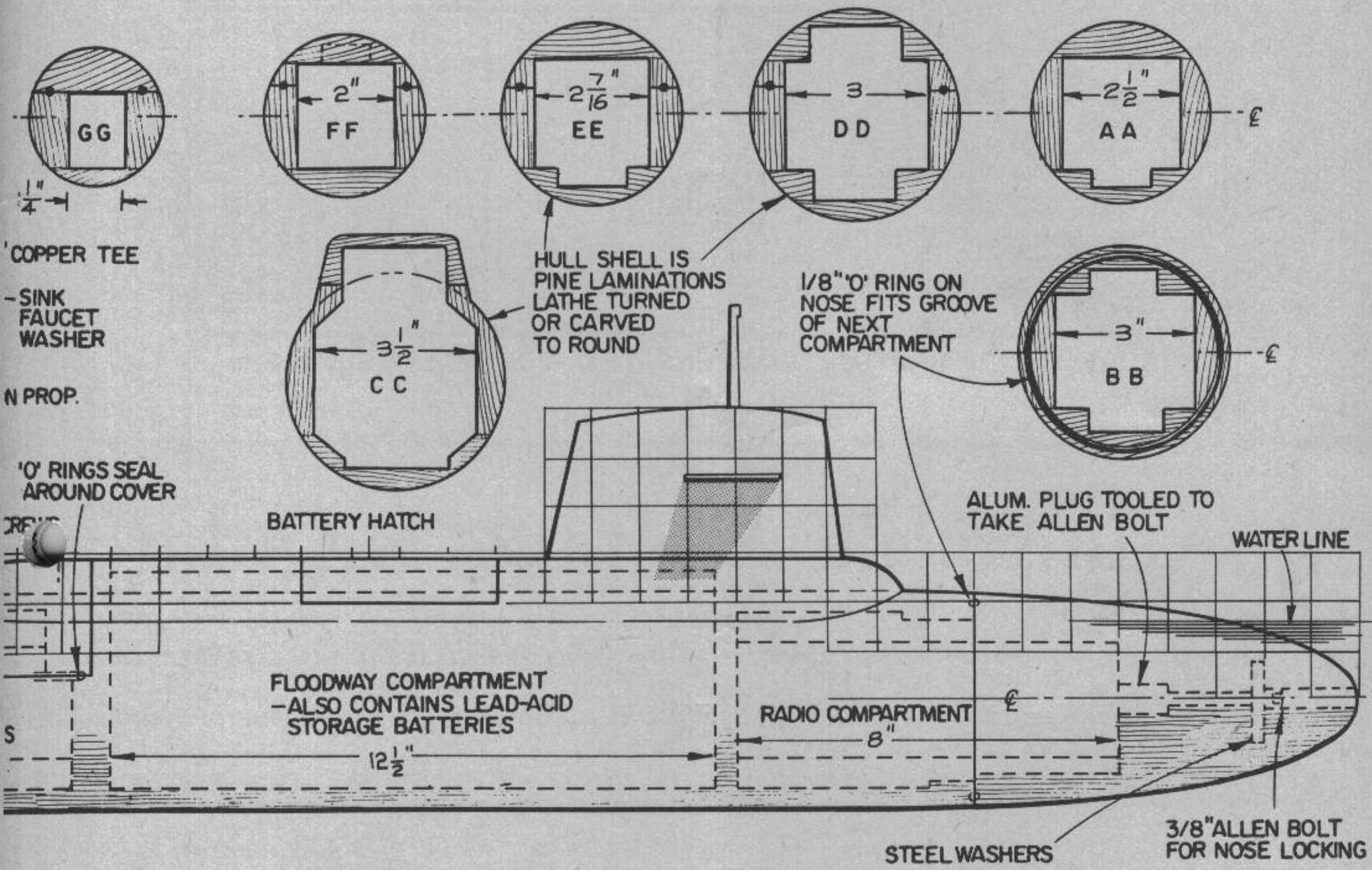
In the nose section a 1/8" groove was cut to fit a 1/8" O-ring. In the plank gluing stage a brass washer was inserted in the nose section to seat the 1/4" Allen bolt. Wax is used to fill in the hole after the bolt is tight. This provides for a perfect seal. Likewise a 1/8" round rubber was inserted in a groove in the lid for the motor compartment. And (*Continued on page* 28)







TOPAND SIDE PROFILE - DRAWN ON 1" SQUARES



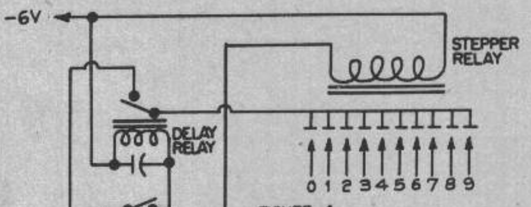


FIGURE 4

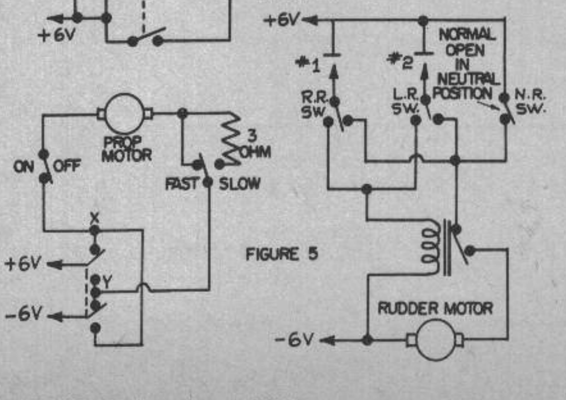


FIGURE 5

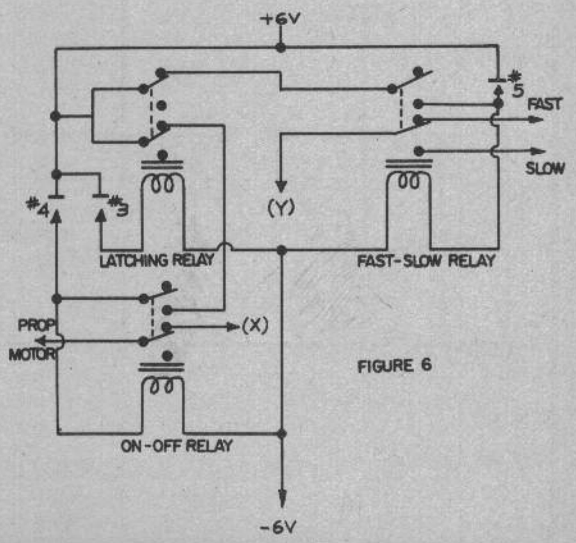


FIGURE 6

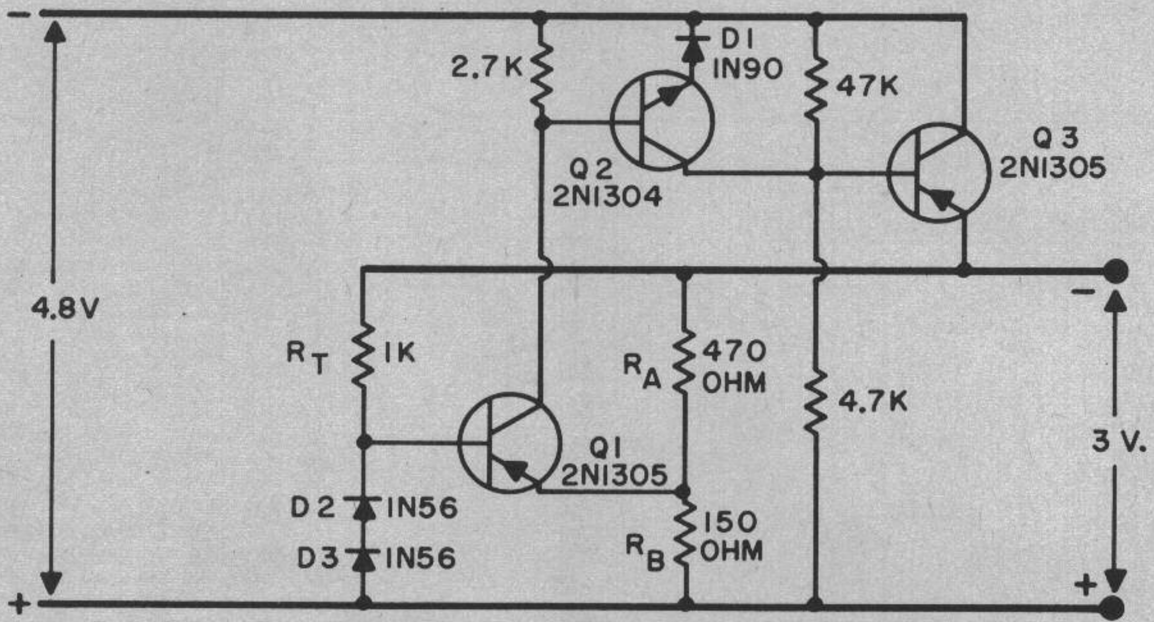


FIGURE 1 TEMPERATURE COMPENSATED VOLTAGE REGULATOR

An Adjustable Voltage Regulator

A serious but often overlooked problem leading to control difficulties is the interaction between receiver and actuator. But why put up with such needless aggravation?

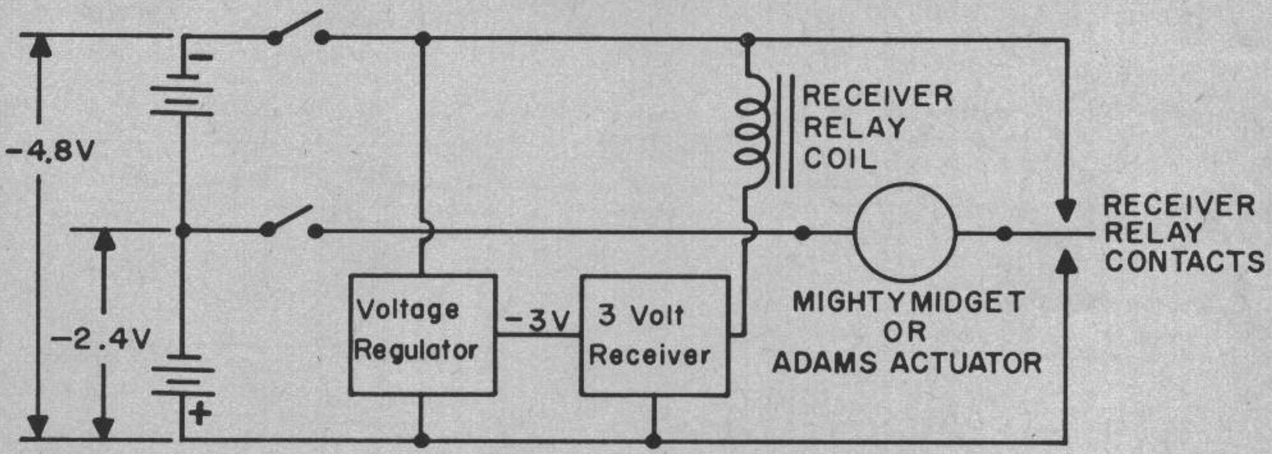


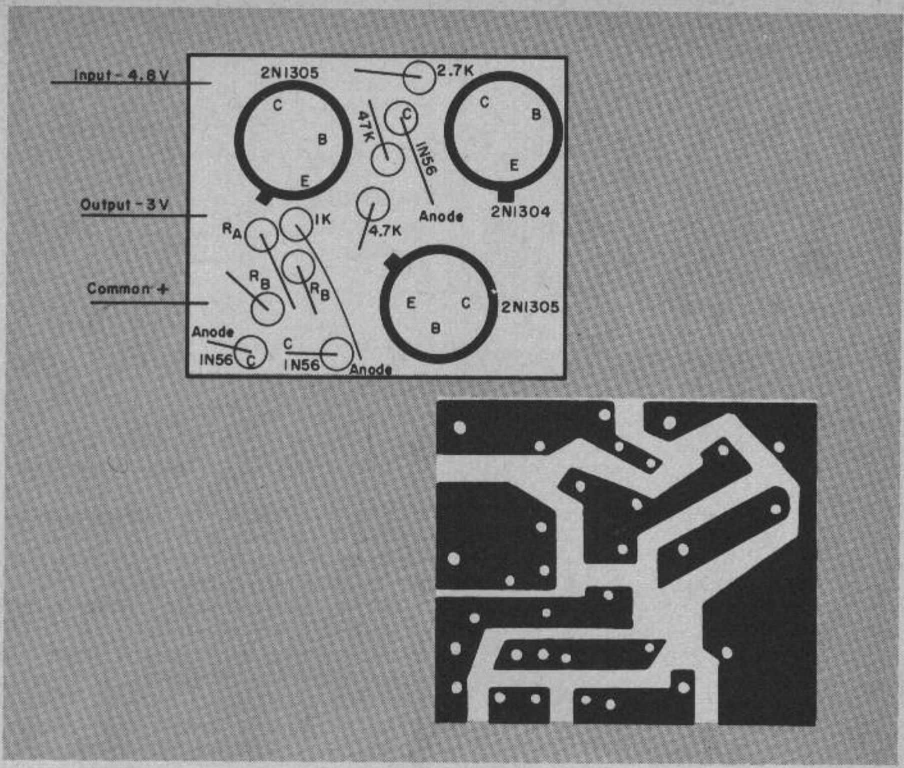
FIGURE 2. TYPICAL PULSE WIDTH PROPORTIONAL SYSTEM USING THE REGULATOR

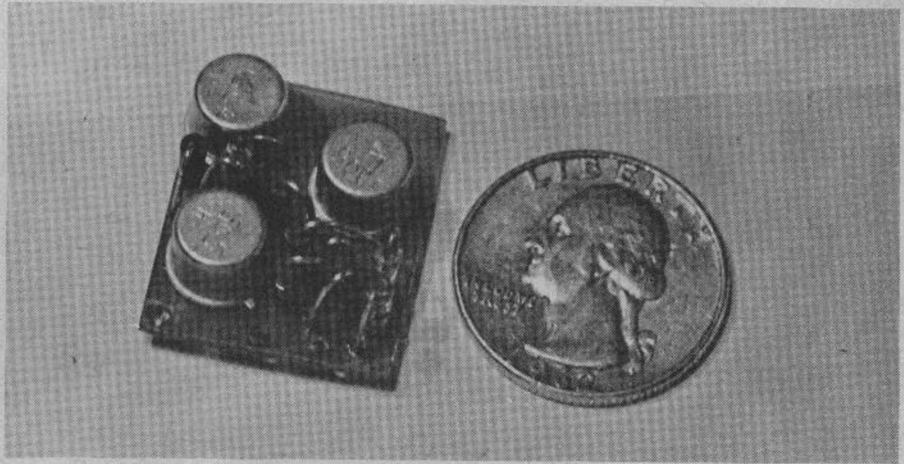
By A. K. SCIDMORE

► MANY AN RC FAN has come face to face with the problem of interaction between the receiver and escapement or servos in his system. Frequently, the problem is that the transducer (the servo, escapement, etc. which converts an electrical signal into mechanical motion) draws heavily upon the batteries, while the receiver or some other part of the system is quite voltage sensitive. For example, as the transducer is turned on and off the battery voltage may rise or fall, coupling a signal into the receiver which amplifies it and drives the transducer which drives the receiver, etc. This type of interaction is given the title "motor-boating" when it occurs at low frequencies in a home radio or audio amplifier.

The solution that is most effective is to "decouple" or isolate the two parts of the system which interact. In RC applications this may mean the use of separate batteries for the transducers and the receivers. Sometimes, however, the problem is met by using only "fresh batteries," changing from zinc-carbon to nickel-cadmium batteries, or placing a several-hundred microfard capacitor across the batteries. If the problem is of the type just described, using a separate set of batteries for the receiver invariably will cure the difficulty.

It is not the purpose of this article to sell batteries or to attempt to diagnose equipment trobules, but to introduce and explain an alternative to the use of separate batteries that is almost universally used in modern electronic systems. For example, a full-scale aircraft electrical system may have as a primary electrical power source an alternator or generator that produces a nominal 28 volts d.c. which can be used directly for lights or charging batteries or other uses where the actual voltage is not critical. However, for reliability reasons most electronic equipment on board requires a more constant voltage than that supplied by the primary power source, and as a matter of fact may require several different voltages instead of just the one voltage produced by the primary power source. A regulated voltage supply is used to obtain the necessary voltage from the primary power source.





Regulator is about the size of a quarter. Weight is only 0.19 of an ounce.

Translating this into an RC application, if 3 volts are needed for the receiver while the servos use 4.8 volts, a voltage regulator taking in 4.8 volts from the servo batteries and producing a relatively constant 3 volts could be used to replace the separate set of batteries which might otherwise be needed to power the receiver. To be considered as a replacement for batteries in an RC system the voltage regulator by comparison would have to offer advantages over batteries which outweigh its disadvantages. Consider the following features of the voltage regulator:

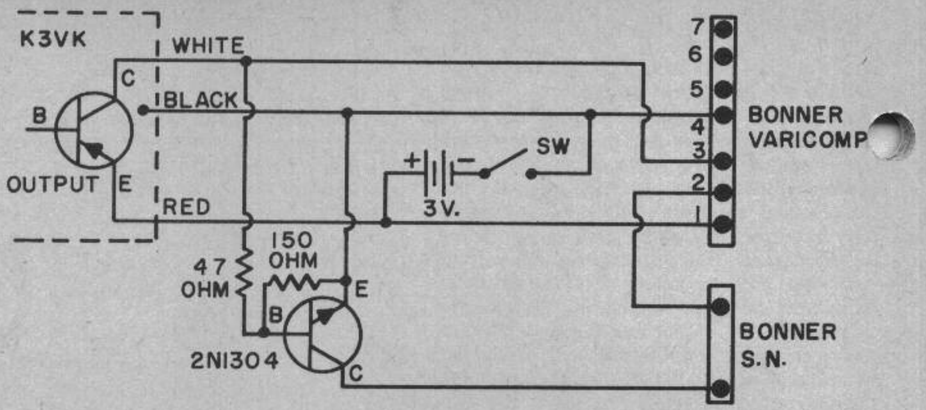
1) Transistorized regulators can be designed for most applications which weigh much less than the batteries they would replace; 2) A regulator can generally be constructed which occupies a much smaller space; 3) The cost of the regulator can be comparable to the cost of rechargeable batteries; 4) The voltage regulator needs no recharging and, barring any disastrous accidents, needs no replacement; 5) Since a regulator draws power from the servo batteries, it is usually possible to eliminate a switch contact normally needed to keep a separate set of batteries from discharging; 6) The regulator provides a relatively constant output voltage as long as the input voltage is greater than a certain minimum value—the output voltage of a battery under load decreases as the battery ages.

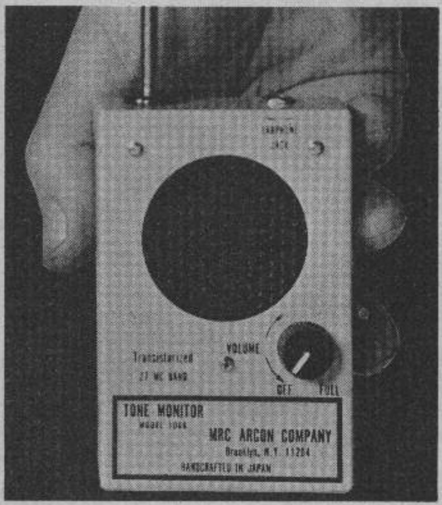
On the minus side of the ledger it is necessary to note that by comparison:

1) The voltage regulator is more complex than a set of batteries; 2) Since all current is drawn for the servo batteries they will drain correspondingly faster; 3) If the input voltage to the regulator falls below the minimum, the regulator voltage drops off suddenly rather than slowly as is the case with batteries; 4) Transistors are notoriously sensitive to temperature changes where batteries are usable over a fairly reasonable temperature range—it is possible, however, to design regulators that will operate properly over a temperature range well exceeding the useful temperature range of some types of batteries; 5) A voltage regulator is subject to maximum current restrictions. Both the regulator and the battery voltage will decrease if the average current exceeds the recommended limit, but the regulator can be harmed by this practice. Consequently, it is necessary either to observe the maximum current restrictions, or to design a regulator with such a high maximum current limit that it is of no practical consequence. With a little thought one can usually separate the parts of the system which draw large currents from those which do not, but are sensitive to voltage changes.

The circuit diagram in Fig. 1 is that of a temperature compensated regulator circuit to operate with about 4.8 volts input and to provide about 3 volts out. This regulator circuit can be described as consisting of a reference voltage, a comparator circuit, and and amplifier. The reference voltage is determined by the voltage drop of the two 1N56 diodes D_2 *(Continued on page 25)*

BITS AND.. PIECES..





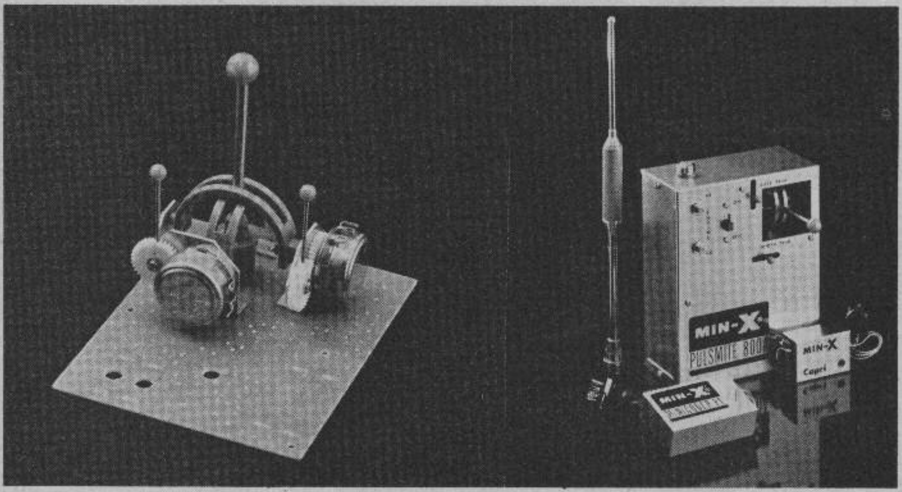
MRC-Enya Deluxe Monitor.

TRANSISTOR CIRCUIT IMPROVES MOTOR CONTROL RELIABILITY

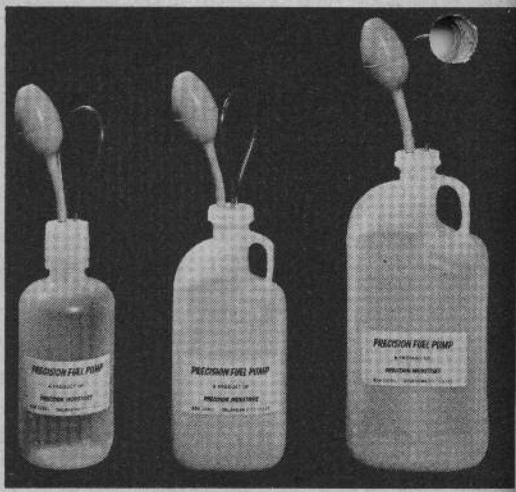
Many of the small single-channel transistorized receivers, such as the K3VK, have an output transistor to power the escapement, which is rated at 300 mils, with a .7 volt emitter to collector drop. If, however, an escapement with a third position is used to energize a motor control escapement, then both escapements are drawing current from the same output transistor. This 500 or 600 MA does not damage the transistor, but the emitter to collector voltage drop increases to about 1.2 volts, and this is with a strong transmitter signal. When the plane is 1000 feet away from the transmitter, motor control operation is an impossibility, even though good rudder control exists. This is simply because the voltage drop across the output transistor has increased to about two volts under the double load. A simple circuit to eliminate this problem is given below. Although it is shown for a K3VK receiver, a Vari-comp for rudder, and an SN for motor control, it is not difficult to substitute components.

None of the above described problems exist, because there are now two output transistors, one for each escapement. This circuit has been used successfully for a full year on over 200 flights. The receiver output transistor still controls the rudder, while an RCA 2N1304 controls the motor control.

BY HANK WEHRLI ARCS RC SOCIETY

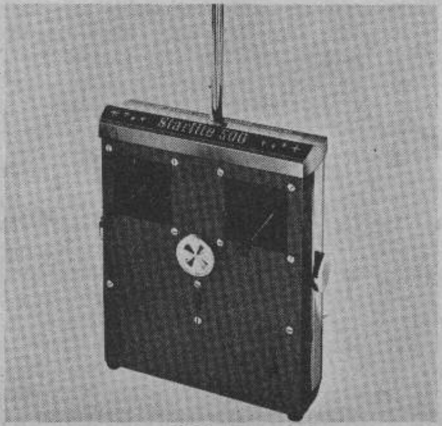


Min-X Pulsemite 800S with dual-function stick control.

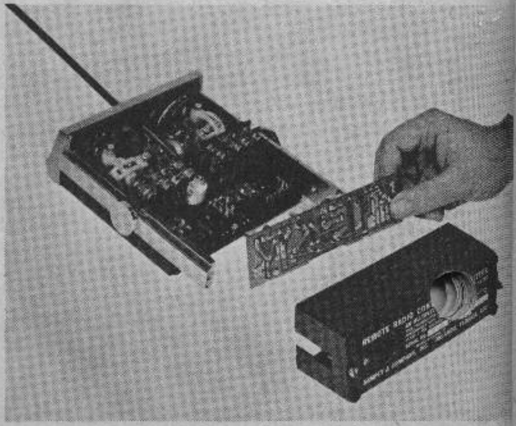


Precision Industries Fuel Pumps.

Sampey Starlite 500 Service Analyzer.



Sampey Starlite 500 Transmitter.



Sampey Starlite 500 modular design.

Pulsemite 800S (Min-X Radio Inc., 8714 Grand River Ave., Detroit, Mich.): Single-channel all-transistor transmitter with built-in electronic pulser and dual-function stick control for Simpl-Simul (Galloping Ghost) or pulse proportional rudder-only. Available on the superhet spots, 6½ x 5 x 2½, takes 9 volts (Burgess D-6, etc.). Tone frequency, 800 cps; modulation percentage, 90-95; drain, 55 ma; temperature range, 20 to 140 degrees, RF amplifier input power, 350 MW.

Stick gives rate and width control with trim for each. Two pushbuttons for off-on tone switching. Pulse-width range, including trim, 2 to 20 PPS, 20/80 to 80/20. Antenna center-loaded, collapsible from 24 to 12 in, in six sections—does not collapse through loading coil.

Compatible is the Min-X Capri receiver, or any on 800 cps, and these actuators: single-channel—Southwestern, Pou Vor, Septalette, Mighty Midget-motored devices; for GG—Mighty Midget-motored devices—other motors not recommended. Suggested retail is $59.95.

Firm has folder of 10 Min-X schematics, including the Pulsemite series, for $2, postpaid.

Precision Fuel Pumps (Precision Industries, 3700 NW 62nd St., Box 12351, Oklahoma City, Okla.): Three capacities —32 oz., $3.50; 64 oz., $4.00; 128 oz., $4.50. Air-tight polyethylene bottles. To operate put fill-tube in tank opening, finger over vent hole, squeeze bulb and the pressure does the rest. The 3-oz. Quik-Prime bottle, at 49¢, has flip-top spout, fits pocket, doesn't leak.

Nylon Wing Screws: Precision Industries also has nylon wing screw sets with drilled and tapped hardwood anchor blocks. Take all flight loads, but usually shear on impact. Two sizes, 8-32 x 1 in., and ¼ x 20 x 1 in., $1.00 the pair. Six per card. Also, 4-40 x ½ nylon molded mounting screws for servos, won't come loose.

Starlite 500 (Sampey & Co., 1607 Forsyth Rd., Orlando, Fla.): Important new concepts claimed for new proportional line. Unique modular construction allows complete versatility and servicing. Under new service policy the factory stocks module circuits for a "Module Exchange Program." Defective modules returned exchanged with tested replacements at a small exchange price, rather than return entire system.

Another first is separately available Service Analyzer which, when connected to associated equipment, in-service tests each module circuit. Provisions for check-out of servo and airborne power packs.

Reliability obtained, the firm states, by using best components, regardless of cost. Silicon transistors throughout, solid tantalum and mylar capacitors.

Andy Wright Proportional (Andy Wright Products, 16 Woodfield Terrace, Tarrytown, N.Y.): Unit is 2 x 1½ x 1, weighs 2 ozs., high-impact case, converts rudder-only to proportional, with rudder, elevator, engine control. Works with single-channel equipment or transmitter having built-in pulser (like Min-X 1200), a rate-width pulser such as Phelps or Ketchledge, and Mighty Midget servos. Recommended, is Don Brown's modified Bellamatics. Power four nickel-cadmium cells. Possibility of electrically operated coupled ailerons. Price: $39.95.

De Bolt "Peashooter" (de Bolt Model Eng. Co., 3833 Harlem Rd., Buffalo, N.Y.): Low wing P-Shooter for 6-channel to full house proportional. Capable of contest performance it is excellent multi-trainer for the convert to low-wing flying. Medium size, has top performance with .35 to .49 engines.

Assembly time less than 24 hrs. Kit is completely finished including plywood fuselage, complete hardware along with tricycle gear. Span-57", area-620 sq. in.

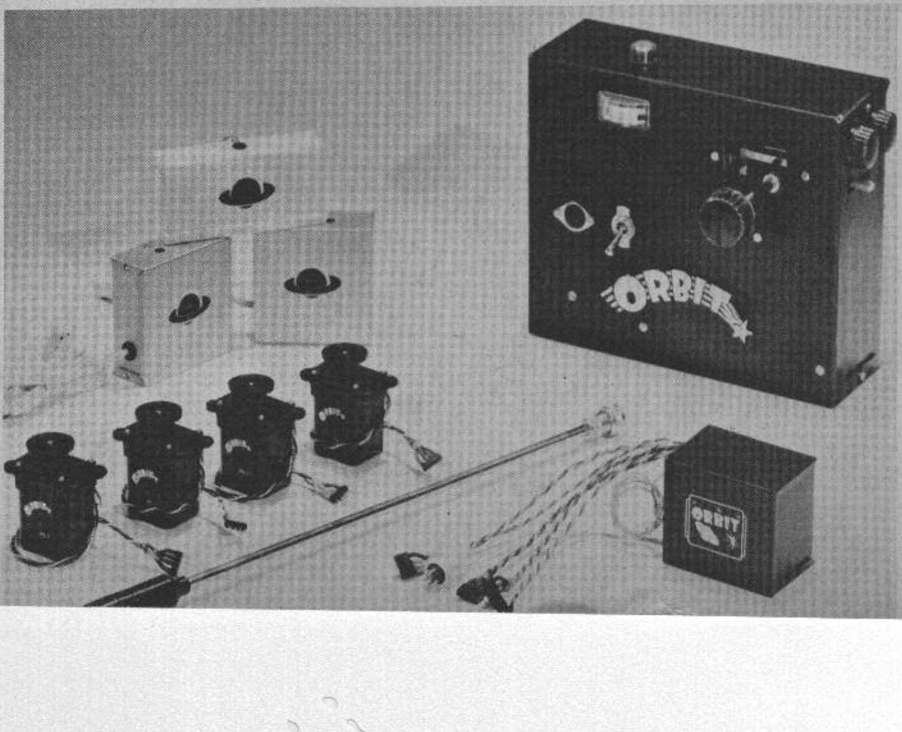
MRC Deluxe Monitor: (MRC-ENYA Co., 5300 21st Ave., Brooklyn, N.Y.): Model 1066 has four transistors, larger speaker for greater volume. Also comes with an earphone—in high noise area can be used more easily. Completely collapsible antenna, and control to adjust the volume to desired level. Measures 2¾ x 4¼ x 1¼.

Uses 9-volt battery of 006 type. This is the deluxe version of unit Ace announced earlier. $19.95.

Adams Actuator (Adams Mfg. Co., 2625 Ruger Ave., Janesville, Wisc.): Adams manufactures units for Astroguide Corp. for use in systems-packaged fly and drive vehicles; and Adams for distributor and dealer sales. In response to GL com-

(*Continued on page* (29)

Orbit one or two stick proportional.



Grid Leaks at Play

(*Continued from page* 1)

for radio control flyers. No one else in our field, individual or organization, is qualified for such a role.

AMA is leading the hunt for additional frequencies, and the future looks bright. The present R/C'er owes the AMA the fact that he can radio control anything at all.

Surely the fact that the art of radio control modeling, on a license-free basis, would not have been available, except for the AMA, is good reason for every enthusiast to heartily support the Academy of Model Aeronautics.

While there may be differences of opinion within the AMA (among ourselves really since we make rules through Contest Board members we ourselves select by our votes as AMA members)—as to the builder of the model rule, how best to encourage the casual, Sunday or sport flyer, what rules changes are desirable to give R/C scale the desired jab in the arm, etc.—the fact of the matter is that radio control as we know it owes its inception to the Academy. The AMA frequency push also is a direct result of the vision and work of the AMA and its volunteer committee.

In our book, every radio control modeler owes it to the AMA to become a member.

Flying More Enjoying It Less?

(*Continued from page* 15)

degrees deflection for pitch control is enough—double for roll. Precise neutralizing is important; linkage "slop" must be minimized.

Pitch control is delicate; less so for roll control. Rudder control is unnecessary. Differential elevon control for roll is helpful (control movement should be more for up-elevon than for down. It is better to use smaller elevons and more deflection, than vice versa.

To reduce need for extremely precise control system, it may be easier to lock elevons in best trim condition and use combination of differential wing spoilers (for roll) and shifting weight (for pitch control by C.G. change). Pop-out drag rudders also are effective (only rudder on inboard wing of turn should be deflected).

At NASA, the writer had opportunity to work with flex-wing flying models—two pictures are included. You may never try one but these fascinating craft—in case you are interested!—contributed some interesting experiences.

RC Flex-wing (tractor): First powered version of Rogallo wing ever flown—1962. Very successful although underpowered and marginal on directional control. Conventional elevator and rudder control only—with about twice normal size elevator and fully movable vertical tail.

This NASA research project was originated by Don Hewes. RC Kitty army target drone converted by replacing conventional balsa-nylon-covered wing with aluminum tube frame, nylon sheet. Rogallo wing, enlarged tail surfaces, installation of landing gear, substitution of heavy Aerolab 5-channel tone-filter receiver and servos with

Bramco 8-channel reed receiver and Bonner servos. (Conversion by NASA crew was headed by Worth—Editor.) Nicknamed Kitty-Kite. Fox 59 originally, then McCoy 60, then *two* Fox 59's! These were side by side on lateral bar mounted to nose.

RC Flex-wing (pusher): NASA project team under Chuck Libbey produced this semi-scale version of Ryan Flex-wing which was the first powered man-carrying Rogallo—wing design (1963). Control was by special heavy-duty Globe motor servos to shift C.G., by displacing fuselage platform fore and aft (pitch) and laterally (roll). Also, it had trimmable engine control via Bonner servo on sliding valve exhaust throttle. Weight was 12 lbs. Original engine Fox 59 with 14-4 prop, later used McCoy 60 with 14-6 prop. Branco 8-channel reed receiver. Very spectacular flyer.

Yes, "fun" flying may be the secret of slowing down your ulcer production. Try a change of pace—go slow and easy, put fun back in your flying. How about a VTO job for your next project?

An Adjustable Voltage Regulator

(*Continued from page* 21)

and D_3 in series and remains relatively constant with respect to changes in output voltage. The reference voltage is connected to the base of the comparator transistor, Q_1, while a fraction of the output voltage (determined by Ra and Rb) is connected to its emitter. Now, suppose the output voltage decreases in magnitude. The emitter of Q_1 then goes more positive while the base stays at about the same voltage. Consequently, the collector current of Q_1 increases in magnitude which in turn increases the collect current in Q_2 and subsequently the emitter current in Q_3. The net effect is that any change in output voltage results in the amplifier consisting of Q_2 and Q_3 trying to oppose that change or stabilize the output voltage. The actual output voltage can be adjusted by changing Ra or Rb or both. For example, to increase the output voltage Ra should be increased or Rb decreased, while to decrease the output voltage Ra should be decreased or Rb increased.

The printed circuit given for the regulator has room for two resistors in parallel to make up Rb. To provide a particular output voltage one of these resistors was made equal to 180 ohms and, after construction, the second one was chosen to produce the desired 3-volt output. A 500-ohm potentiometer could be used in place of Ra and Rb, but actually is not necessary for this application and would be bigger and heavier than the regulator itself. As pointed out earlier the reference voltage is determined by the two diodes types used for D_2 and D_3. High conductance germanium diodes such as the 1N56A, 1N96A, or 1N98A give the best regulator performance, and to produce 3.0 volts out with Ra = 470 ohms, requires a value of Rb of about 100 to 150 ohms. Other diodes may be used, but the value of Rb required for an output voltage of 3 volts may be much higher.

Regulator performance can be expressed by the equation $\triangle V_{out} = F\triangle V_{in} + R_o\triangle I_{out} + K_t\triangle T$ where the symbol $\triangle$ may be interpreted to read "a change in." The equation says that changes in the output voltage may result from changes in the input voltage, changes in the load current, or changes in temperature. Each regulator constructed will differ somewhat

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from the others, but performance data obtained from a representative 2.70 volt unit will be cited. First, consider how the regulator output voltage varies as the input changes. At the minimum recommended input voltage of about 3.7 to 3.8 volts the output voltage was found to be 2.70 volts while with 10 volts at the input, the output voltage was 2.76 volts. This gives an output change of .06 volts for an input change of 6.2 volts, or F is about .01 or 1%. The lower this factor the better the decoupling of the output voltage from the source voltage.

Second, consider the variation of output voltage with load current. For example, with a 4.8-volt supply the output voltages with no load and with a 100 ma. load were 2.71 and 2.66 volts respectively. This gives an "output resistance," R_o, which is the voltage regulator's "internal resistance", of 0.5 ohm. This is larger than the internal resistance of AA-size nicads but a lower resistance than most other batteries of AA size.

The recommended average load current drawn from this particular type of regulator is 100 ma. with a 4.8-volt input and 50 ma. at 6 volts input. When used as a receiver supply, the current drain is only 5-12 ma which is well below the safe average for the regulator. The current limit is determined by the transistor, Q_3, which dissipates the most power. The maximum current limit could be extended by using transistors with a higher collector dissipation rating for Q_3 and/or using heat-sinks or coolers.

In this connection it should be pointed out that the practice of potting circuit boards in plastic may induce some transistor failures. Since transistors must get rid of internally generated heat by passing it into the air, surrounding the case of the transistor with a good heat insulator may raise the operating case temperature of the transistor to such an extent that the transistor may fail to operate correctly and perhaps even be damaged.

Last, the variation of output voltage with ambient temperature can be obtained by placing the regulator in a test chamber and varying the ambient temperature. The unit from which the previous results were obtained gave a change in output voltage of .08 volts over the temperature range of −10°F to +110°F or 0.7 milli volts per °F. Another unit tested extensively gave an output voltage that changed less

(*Continued on page* 28)

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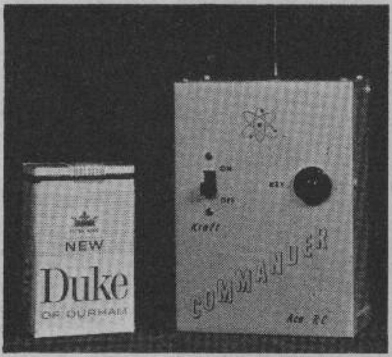
ACE R/C



IT'S HERE—THE ACE COMMANDER TRANSMITTER KIT

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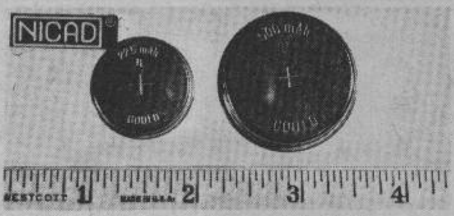

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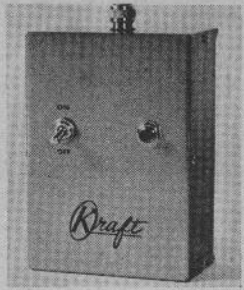
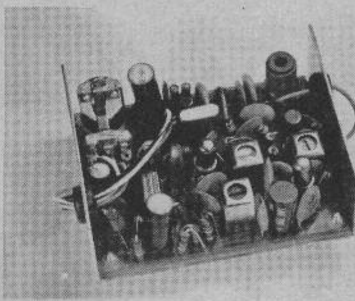


KRAFT CUSTOM SINGLE CHANNEL ALL TRANSISTOR TONE TRANSMITTER

From Kraft Custom comes the Kraft Single Channel All Transistor Tone Transmitter. In a smart gold anodized cabinet, measuring 4⅜ by 6 by 2½, this little jewel packs the punch that is required to override many interfering signals. Uses a 56 inch antenna with base loading so center loading is not required, thus increasing the efficiency of the output. Completely transistorized, uses only one nine volt battery, yet packs the punch of many a vacuum tube type of transmitter. Completely assembled ready to go. Features sine wave—no splatter—modulation. **Signal is 100% clean. 400 cps. . . . . Only $29.95**



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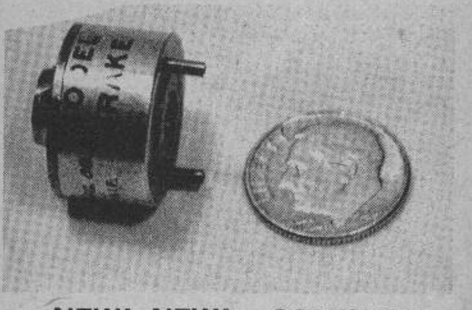
Here it is. The Kraft Custom single superhet receiver. With a relay, this is a versatile unit. Pulses excellently and resistant to brush noise when hooked up as shown in the instructions. Measures 1⅛ x 1⅞ x 2⅜". Weighs 2½ ounces. This unit, along with the KTx1, will do much to provide trouble free superhet flying for the beginner. Available in all CB frequencies, except 27.225. Please specify. Also available on 6 meter frequencies in matched combos on request, write for details. This is a breakthrough in price that you have been waiting for. Completely assembled, tested, ready to go. For use with KTx1 shown elsewhere. Uses 1 9 volt battery. **No. 12A40—KR1 Kraft Custom Single Receiver SH $39.95**



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(*Continued from page* 26)

than ±2% over the temperature range from −75°F to +125°F.

The regulator in the accompanying photograph was constructed from the printed circuit board shown. The circuit board was designed for ¼-watt resistors and would have to be enlarged somewhat to accommodate the ½-watt size. The constructed unit shown weighed 0.19 ounces and can occupy a space of 0.4 cubic inches, compared to the 1.54 ounces and 0.9 cubic inches for the two nickel cads which it replaced. The total parts cost depends upon your source of supply but could easily be less than the cost of two nickel cads. Although the circuit in Fig. 1 is for systems with a common positive, a regulator for common negative systems can be obtained by replacing the 2N1304 transistor with a 2N1305, replacing the 2N1305s with 2N1304s, turning the diodes around, and reversing the polarity of the 4.8 volt input.

This voltage regulator and a similar circuit have been used very successfully this past season in the Madison area in several systems flown by MARCS members Frank Baker and myself. In one case the regulator was used for powering the receiver in pulse-width proportional systems, while in another case the regulator was used as a stable voltage source in a modulation-frequency proportional system for powering everything but the transistors driving the servo-motor. Fig. 2 shows a typical pulse-width proportional installation using the regulator described above. Due to the small size of the unit its physical placement is no problem; it can be tucked in anywhere convenient.

Atomic Powered Submarine

(*Continued from page* 19)

washers were imbedded in the lid during the gluing stage to prevent pulling through. The tie-down brackets show in photos.

The drive motor is a surplus 6-volt slave motor. A 2½-to-1 reduction gear system drives a ¼" prop shaft with a homemade propeller. A ⅝" ballbearing was inserted in each end of the ¾" shaft bearing tube, along with a hard rubber seal next to the rear bearing.

The most exciting feature of this model is the realistic diving operations. The Pittman No. 9002B pump motor drives a ⅝" nylon prop with a direct right angle gear drive. A ¾" by ½" copper tee was fitted with bearing, seals and the valve as shown in Fig. 1. The pump fills the tank in 8 seconds. Reversing the motor pumps the tank dry in about 10 seconds. This operation is shown by the schematic in Fig. 2. The most difficult operation of this system is the opening and closing of the valve, since the motor has to be pumping until the valve has closed. The drawback in this system is that the pump stops just before the valve is closed, consequently a little water flows back into the tank before the cycle is completed. But the pump does a fine job in handling 81 cu. in. of water.

How far down can you go with the sub? If the antenna touches the water the craft is on its own, therefore ballast and trim were adjusted to leave the "sail" plane as the submerged water line. Once the antenna was grounded, and since the motor controls were in off position, the stepper switch was tripped by the shorting action and the pump flooded the tank. Down she went! The pump continued to eject water through the tank vent until the battery ran down. Since the sub was in the middle of the lake it had to be retrieved. If it had been ballasted for negative buoyancy scuba diver would have been needed to find it.

By the use of four relays, right and left rudder can be pulsed with automatic centering after leaving the channels. The schematic in Fig. 3 shows this and that two limit switches (micro) are needed for each channel. The cavity in which the rudder pushrod and linkage is housed is packed with waterproof grease to prevent seepage. Figures 4, 5, and 6 show the rest of the schematic for controlling operations.

Space is available in the aftsection of the tank to insert miniature missile tubes. With the present stepper switch channels fully assigned, firing of these won't be possible, but experiments have been carried out with pop bottle rockets (sold as fireworks) to add more realism. Given a multi-channel radio, a typical simplification would be direct left-right steering with a Transmite servo, eliminating a steering motor, gearing and limit-switching. In fact, the stepper could be eliminated—or kept on one channel! A printed circuit board with a series of contacts—the board bolting to servo case—and a non-neutralizing servo would directly control various switching functions required for drive motor control. Any device requiring activation through a receiver relay would, of course, require an additional heavy duty relay in the circuit to avoid overloading the receiver relay (or transistor). The pump valve could be worked by servo.

The sub is set up for 6-volt operation. Dropping resistors in the radio section reduces voltage for low speed of the drive motor, and for 1½ volts for tube filaments. The resistor shown between the tubes operates another relay for the stepper switch and a time delay relay. To work the stepper switch a simple 6-volt relay is linked to the cam shaft. Other relays in stepper are surplus double-pole, double-throw, 50-ohm 24-volt units rewired for 6 volts. Surplus 24-volt steering motor works well on 6 volts. Drive motor is a costly 6-volt commercial slave motor ($1 on surplus), but Pittman boat motor substitutes.

The grouped relays aft are 24-volt 4-pole, double-throw, rewound for 6 volts. The right-angle steering gear-train was made from various surplus parts. Rudder limit switches, visible in one picture, are for centering—one for each direction. Actuation is by two cams connected to the shaft of the right-angle gearing.

Valve motor is geared down; hub contains a spring to put tension on valve seat when closed. It is important that tank compartment lid fit tightly because pressure variations can raise lid, making surfacing impossible. When tank is pumped out, air is drawn through conning tower vent. Water is ejected from vent in sail. •

You Too Can Have A U-2

(*Continued from page* 7)

many of the considerations sounding more difficult than they really are. Part II will take up installation in the model plane, and some of the problems of films, filters, exposures and photography.

Bits and Pieces

(*Continued from page* 23)

mentary, Adams states need may soon be met for actuator for .19-engines; .15-powered Mombos (*Continued on page* 00) flown with older version using Alnico 2 magnet on six volts and aerodynamic rudder balance. Ships like Andrews H-Ray flyable with Alnico 5 unit.

Miniature Magnetic Reed Relays (Omega Sales & Eng., Racine, Wisc.): Drastic price reductions announced. (See Omega's ad elsewhere in this issue for further details.)

Reed Relays are seeing increased use. In most instances where the relays are usable, they have ability to follow the fastest pulsing, are hermetically sealed to provide many switching actions without ever requiring cleaning.

Sterling Proportional (Sterling Models, Belfield & Wister Sts., Philadelphia, Pa.): Designed by Dick Jansson, this single-channel pulse proportional system with MC has significant features, including actuator power for airplanes up to 52 inches and .19 power, or larger, with rudder counterbalanced statically and dynamically.

Transmitter—Completely transistorized with Unijunction pulser, Unijunction tone-generator, amplified, driving collector-modulated output stage with nominal wattage of ½ output to half-wave, center-loaded antenna. Power source, 18 volts. Motor control, rate increasing circuit actuated by control button on front of case.

Receiver—Compartmented Lexan high-impact plastic case for receiver, actuator, nickel-cad batteries, associated wiring and switch. Superhet tone selective, operating on 3500 cps. Relayless, double-ended with transistor switcher output for actuator, and rate detector circuit for motor. Eight 225 mah batteries.

Actuator—Uses Alnico #5 bar or disc magnet; disc magnet for ships exceeding .19 power. Marketed with windings suitable for various voltages between 3.6 and 9.8. Can be added to any double ended receiver, relay or relayless. Built-in stops and magnetic centering to stop drift at higher pulse rates. Complete bobbin and bearing assembly of Delrin. Size 1 x 1 x 1½.

Fibreglas Fuselages (Skiglas, P.O. Box 2281, Santa Ana, Calif.): At $19.95, for either Falcon 56 or Trisquire wings and stabs. Width for three Bonner servos. Glassed-in firewall, beam mounts. Wing and stab mounts with indicators for dowels. Surface primed for color. Mounting rails furnished.

Instrument Board Decals (America's Hobby Center, 146 W. 22nd St., New York, N.Y.): Forty-four different dials on one cutapart sheet, for scale modelers; 29¢.

Annco Brushes (7714 Colfax Ave. S., Minneapolis, Minn.) Silver brushes, 97% silver and 3% graphite, at 50¢ per set of two. Includes two silver-plated Beryllium Copper springs for back-up tension. Contoured for correct radius to fit armature.

Orbit Proportional (Orbit Electronics, Garden Grove, Calif.): In pilot production during 1964, this system now is widely available in both single- and two-stick form with superhet receiver and feedback servos incorporating built-in pot and disc output. Full-house system, includes, at $595.00, nickel-cadmium power packs, pack rechargers, all cables and connectors. Airborne weight is 27 oz.

Monitor

(*Continued from page* 2)

in the weather after it is judged. Hours pass but nobody judges any of the scale entries—by now the wind has dropped to practically zero. Shortly before the meet ends the scale judge arrives and judges the scale entries. Our buff promptly re-fuels his ship and rushes over to sign the flight list hoping for a second flight to boost his flight score. The CD informs him that he has had *his* flight and will be allowed no more—besides the contest will be over before his turn anyway. Grumbling that he never saw any limitation to the number of flights a scale contestant can have, in the rule book, he unhappily heads home again.

Our scale enthusiast begins to wonder if contest participation in RC scale is worth the effort. He will experience many more interesting situations as he competes in other meets. In many instances, scale judges have not considered how to judge scale until the day of the contest. Actually, the judging guide (section 25.9) does an adequate job of pointing out standards by which the models should be judged, but the judge must become completely familiar with this section *before* he attempts to judge, not during the judging! One instance was noted where the judge was so unfamiliar with the task that he judged all the scale entries to the "Free Flight Scale Rules" before someone pointed out his mistake.

Statements like this: "If it's a Sterling kit I know its exact scale, so I won't have to bother to check any dimensions," will be heard to the amazement of all. The flyer will notice that some scale contestants are calling out maneuvers not listed in the scale flight plan, and receiving points for them. Unless the person tabulating the flight scores is extremely sharp, he won't pick this up and these contestants will receive an abnormally high score due to the multiplying factor. He will attend contests where the scale models are not all judged by the same person or persons acting as a team—an impossible situation at best.

Criticism is useless, however, unless some suggestions are offered for improvement.

1. CONTEST DIRECTOR DUTY

a. The CD should familiarize himself with the scale rules so that he can properly select an interested qualified person to handle the scale judging. This person need not be an RC type but should have a deep interest in all aircraft.

b. Have the judge practice someone's airplane prior to the contest date—preferably a scale ship that has been judged at some previous competition, so that scores may be compared.

c. See that a fill-in-the-blank type of judging form is used so that all possibilities of overlooking some feature are eliminated. It is strongly recommended that a carbon copy be given to the contestant immediately after judging. (Bob Noll of the Aeroguidance Society is presently preparing a Standard CD Guide which will include a form used with success at our annual meet.) He will present this to AMA in an effort to standardize contest procedures.)

d. *Insist* that judging be completed promptly after each contestant flies, therefore allowing each contestant a chance for improving his flight score. It is admitted that there is nothing to stop a scale flyer from flying two or three times before being judged, but from a practical standpoint, it is senseless because it is extremely hard to judge a pile of splintered balsa.

e. Don't forget scale at the prize table. It is no easy job to fairly distribute prizes but scale prizes should be on an equal basis as any of the other events.

2. RULES IMPROVEMENTS

To have a competitive airplane at present one must build to the rules and, let's face it, "A retractable trike-geared, flapped, light-blinking, bomb-dropping, single-engined WW II fighter" is an unbeatable combination! The rules must be revised so that a WW I fighter, or for that matter any aircraft, theoretically can compete on equal footing. Multi-engined aircraft presently are under a distinct disadvantage. Specific proposals would be as follows:

a. Eliminate paragraph 24.4 "Qualification Flight" entirely. It has proved to be nothing more than a confusion factor. This section alone would scare the life out of a builder considering a scale SE-5.

b. Revise paragraph 24.9 "Flight Plan." The present flight plan can total 55 points but 25 of these points can be earned with ground handling maneuvers thereby giving a decided advantage to trike-geared airplanes. The ground maneuvers should remain, but a number of additional air maneuvers included. They should be capable of being accomplished by practically all aircraft, thus lowering the ground maneuver percentage.

c. Revise paragraph 24.6 "Scale Operations." The present system should be greatly expanded to include a number of operations capable of being accomplished by any airplane. There should be, however, a limit to the number of scale operations allowed. I am in favor of lowering (a) "Retract and extend landing gear" to 10 points, and having a continuation of the 10-point maximum for all added scale operations.

d. Eliminate paragraph 24.7 "Multi Motors." Multi-Motors could be nicely covered under paragraph 24.6 "Scale Operations" by allowing a maximum of 10 points for each engine in excess of one. Remember that this is then a multiplier and would result in an average of 200-250 points per extra engine depending on flight score. The balance of the wording of paragraph 24.7, making it necessary for each extra engine to provide needed thrust and run until maneuver 24.9.6, should be retained.

e. Revise paragraph 24.10. With the added maneuvers mentioned earlier, more flight time will be needed. I feel that the flight time should be raised to 11 minutes. With the present 7-minute limit there is not enough time for more than one or two of the scale operations presently outlined.

Unfortunately, it is already too late to change the RC scale rules for 1965, but it is hoped that the above comments and suggestions will trigger action to do the job in 1966. *(by Hale Wallace).*

NEEDED: A NEW DEAL FOR SCALE: Before any rules can be changed or carefully examined, the RC Scale event must be clearly defined.

At present the event is used primarily as a public relations device by Contest Directors aware of crowd appeal. It frequently is treated like a step-child of the Class III Pattern event (Scale flights worked in between the Pattern flights), using the same judges and, of course, the first and last parts of the Pattern event maneuvers. I favor a *separate and distinct R/C Scale pattern* tailored to specific needs, and judged by judges at least as well informed and sympathetic as the Scale static-points judges are. The pair of judges that have just judged a breathtaking contest winning flight by Cliff Weirick or Jim Kirkland are not likely to be greatly impressed by the scale-like performance of a Waco 9 with uncertain ground handling characteristics (just like the real one!). And when this Waco completes the Procedure Turn and wobbles and yaws its way back on the Return Straight Flight bucking gusts (just like the real one) it definitely does not behave like a Candy.

Scale has its own peculiarities and these must be taken into consideration. Because of the way Class III and Scale are run together in the same flight lines, the Scale plane that comes most nearly to performing like a Class III entry will receive (by necessity) the highest flight points. And since the flight points count so high (multiplied) the fellow with the highest flight points usually wins, even though other planes heavily outpoint him in Fidelity-To-Scale and Workmanship.

The fellow who normally flies Class III (and therefore is proficient at flying the full Pattern) builds a Sterling P-63 (not bothering to add any special details), and easily beats the guy who spent a year researching and building his 1936 Rearwin Cloudster! The fellow with the Rearwin flies a conservative (and competent) flight, well controlled, and very realistic. It is not the kind of flight to send the crowd into hysterics—it's not *that* kind of plane. This suggests that the flight points count too heavily relative to other points. I would not want rules to permit a badly flown plane to beat the others simply because it was loaded with detail, but I believe a better balance can be achieved between flight and static points.

1. ENCOURAGE MORE ENTRIES

Interest in Scale is increasing everywhere . . . yet it is still difficult to get ten good entries in one contest. Many "sport" flyers have been scared away from RC competition because it has become so dominated by a relative few "experts." This must not be permitted in Scale . . . let this be the event that encourages the beginner to "get his feet wet" in a "low pressure" event.

2. NO ONE TYPE ADVANTAGE

A Piper Cub (if beautifully built and detailed) should have an equal chance to win against a B-17 with rotating ball-turrets! Gadgetry and the number of engines should have *nothing* whatsoever to do with the matter. If you want to give extra points for engines then why not extra points for wings. An Armstrong Quadraplane would then have a chance at beating a DC-7? World-War II type fighters should have no advantage against two-place lightplanes, etc.

3. PLANE STAR ATTRACTION

In the Class III Pattern event the opposite is true . . . the flyer is the star. In Scale the plane should be the major attraction. In the case of Scale the builder-of-the-model rule should be made even *stronger!*

I believe lack of rules that promote the RC Scale event causes the inability to capture the interest of many who would participate and will produce this eventual alternative.

Highly proficient Class III flyers will consort with the top builders to produce winning combinations that will, in effect, exclude the "builder-flyer" as we now know him. The event will simply become overpowered by the same people who now dominate the other events. The argument in their favor and the one they will likely expound is: "Well, you RC Scale builders spend so much time building and putting on those details you never have time to fly as well as we do . . . you've had your chance and you've blown it . . . you build a pretty plane and we will fly it for you, now isn't that fair?" They do have a point!

We still have a choice. Before we admit that the Scale modeler has failed, let's see if something can be done to give him an incentive, before we throw the event to the experts. Let's examine past mistakes and redraw the rules in such a way as to bring the Scale lover out of his shop and over to the flight line. If we do not make an effort, there will soon be no place left for the modeler who is not willing to spend all his time on his hobby. (*by Woody Woodward*).

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