We present the

R.C.M.&E. SIMPL-SIMUL TRANSMITTER

A purpose designed Transmitter for galloping ghost R/C

By — — *Rex Boyer*

WHEN we published the constructional feature on the R.C.M.&E. single channel transmitter back in our March 1966 edition, we promised to develop a version of this unit for pulse proportional operation. During the past 18 months, since the feature first appeared, the R.C.M.&E Tx. has been tremendously popular. We know this because of the number of queries received, and the continual requests even now for photocopies of the article, now that *R.C.M.&E.* March 1966 edition has long since been completely sold out.

The demand for a pulse proportional version of the Tx. has been made quite evident by the number of letters from readers reminding us of our original promise to present a pulse proportional version. The projected pulse Tx. had not been forgotten, it's just that development became protracted due to such minor details as going out at weekends just to enjoy R/C flying.

Since the original R.C.M.&E. Tx. was published, we have received quite a number of queries from readers not getting the results they should expect. In many cases the problem fell into well defined categories, the root of the cause being the seeming inability of constructions to wind the coils correctly as indicated or to fabricate the aerial as shown. Consequently, for the new Galloping Ghost pulse proportional Tx., we made a point of using ready wound coils available from *Teleradio* and also a ready made aerial.

Many aerials were tried, and eventually we selected the Derek A. Olley *Fleet* aerial as the one best matching the circuit and the easiest to tune in. So remember—use this type of centre loaded aerial please, no substitutes.

Finally, we had to make quite sure that the circuit was "repeatable", that is to say, even allowing for component tolerance spreads, the circuit could be put together by the non-electronic R/Cer, and could be expected to work without any fiddling, other than the usual simple tuning technique.

As one can imagine, circuits of this type do not automatically occur! A prototype transmitter was on display at the Weybridge R/C Symposium last March where the reaction of those who handled it was simply one word. When? We could have pushed the transmitter into print earlier, but preferred to hold it back until after we knew the results of the protracted field tests by ourselves, by our good friend Les Rudd of Luton D.M.A.S. and by Button Man who can always be found where Galloping Ghost is the subject.

In addition, several other selected "Novices" who shall remain nameless, were issued with p.c. boards and asked to build up sets, so you can guess, we have gained first hand experience of the pitfalls of the basic assembly instruction and we hope we have eliminated them all.

Ready to start construction? Right then. First, a brief description of the circuit is in order. Let us start with the pulser. The necessary rate for the elevator control on the Rand actuator is 4 to 12 c.p.s. with 6 c.p.s. being neutral. The Rand also demands a 70-30 30-70 mark/space ratio variation for rudder control, 50-50 being neutral. In addition to this it must be possible to transmit either full tone or no tone (full carrier) for engine control. To achieve the above, we selected a unijunction type pulser circuit. VT1 is the unijunction and this device, in conjunction with C2 and R1, VR1 and VR2 produces the necessary rate. VR1 and VR2 are the trim and full elevator controls on the stick assembly. The output from the unijunction, which has a shape reminiscent of a saw tooth, is fed via a diode into the base of VT2 which has a potentiometer in its emitter circuit. By adjusting the position of the potentiometer, it is possible to vary the position on the sloping position of the saw tooth waveform generated by VT1 where VT2 turns on and off. Referring to fig. 3, you can see that this will alter the off to on ratio of VT2 and hence the mark space ratio, so we now connect VR4 to the rudder stick assembly and we have the two basic controls. Trim control is achieved on the rudder by adjustment of VR3.

VT3 serves as an amplifier and a convenient place to insert full tone/full carrier buttons for the engine control.

The "tone" circuit is a conventional multivibrator circuit and produces a square wave of approximately 900 c.p.s. The output of both the pulser circuit and the tone circuit are fed into VT6 which is the modulation transistor. This switches the supply to the R.F. side of the circuit in sympathy with the commands of the pulser/tone circuits.

Turning to the R.F. side, VT7 is a conventional crystal oscillator driving VT8 power amplifier.

All the foregoing will of course mean little to the non-

Component Values

Resistors

R 1	2.2 K	½ w.
R 2	10 ohm	½ w.
R 3	150 ohm	½ w.
R 4	1 m. ohm	½ w.
R 5	12 K	½ w.
R 6	8.2 K	½ w.
R 7	1 K	½ w.
R 8	4.7 K	½ w.
R 9	1 K	½ w.
R10	4.7 K	½ w.
R11	1.5 K	½ w.
R12	22 K	½ w.
R13	22 K	½ w.
R14	1.5 K	½ w.
R15	4.7 K	½ w.
R16	47 K	½ w.
R17	330 ohm	½ w.
R18	18 ohm	½ w.
R19	2.2 K	½ w.

(All resistors Radiospares)

Variable resistors

VR1 : 5 (elevator trim)
VR2 : 250K (Horizon stick)
or 100K (Digitrio elevator)
VR3 : 5K (rudder trim)
VR4 : 5K (rudder)
(All Plessey Types)

Capacitors

C 1	25 uF Electrolytic	25 v.	Mullard
C 2	4 uF	40 v.	Mullard
C 3	1 uF	40 v.	Mullard
C 4	47 K pf	20 v.	Radiospares Polystyrene
C 5	47K pf	20 v.	Radiospares
C 6	1 K pf	125 v.	Radiospares
C 7	1 K pf	125 v.	Radiospares
C 8	22 pf	125 v.	Radiospares
C 9	1 K pf	125 v.	Radiospares
C10	1 K pf	125 v.	Radiospares
C11	1 K pf	125 v.	Radiospares

Transistors

VT 1 : 2N2646
VT 2 : 2N2924
VT 3 : OC76
VT 4 : OC45
VT 5 : OC45
VT 6 : OC139 or OC140
VT 7 : P346A (S.G.S. Fairchild Ltd.)
VT 8 : P346A (S.G.S. Fairchild Ltd.)

DI : OA200

R.F.C. 1 AMP T/V choke (Radiospares).
V.C.1. 140 pf. Radiospares compression trimmer.

Xtal : 27 Mc/s

P.A. coil : Type 88/0 Teleradio Ltd., Horizon Developments.

Oscillator coil: Type 88/PA Teleradio Ltd., Horizon Developments.

PB1 : } Radiospares miniature single
PB2 : } pole push to make.

Stick Assembly: Either Teleradio Digitrio or Horizon Developments.

Aerial: D. A. Olley 32 ins., centre loaded.

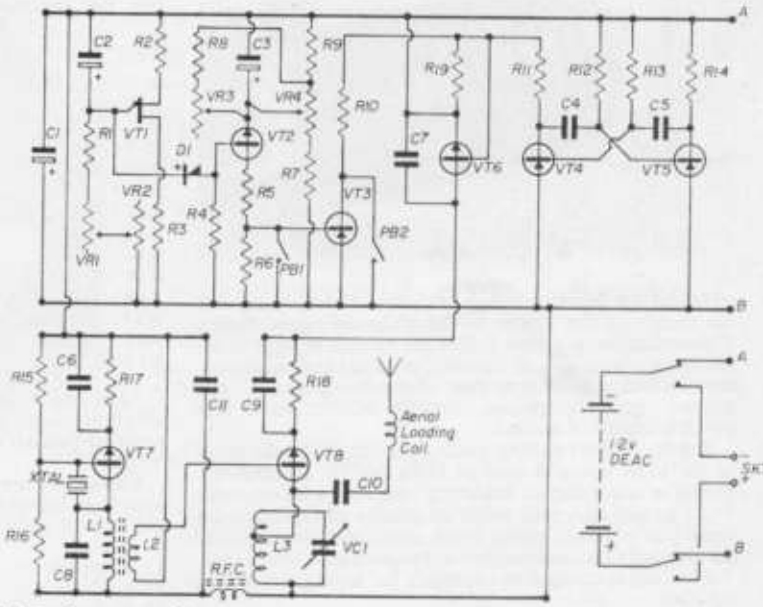
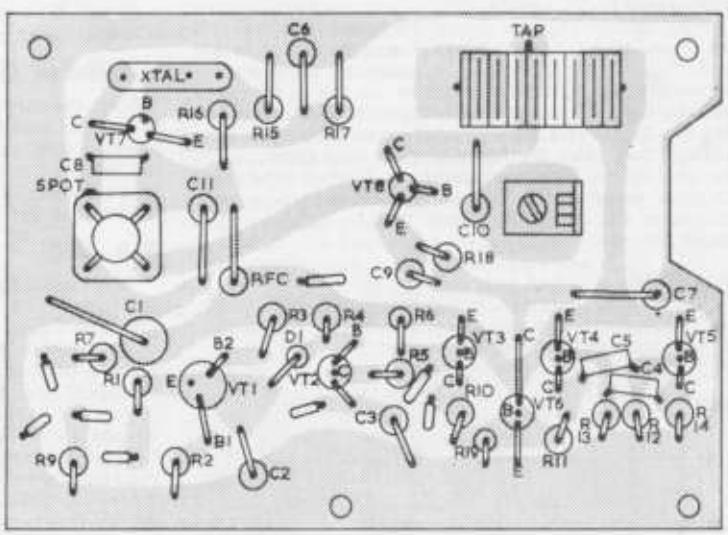
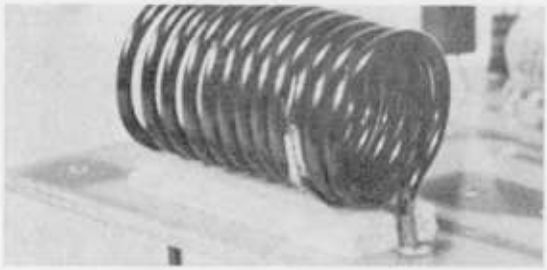


Fig. 1 Theoretical Circuit

Fig. 2 Component placement diagram (Full size).



Transistor and diode lead identifications (transistors viewed from bottom)



Left: P.A. coil detail showing ¼ in. scrap balsa spacer used to position coil for soldering.

technical modeller although it does serve to establish the theory of the circuit to the technical types. Suffice it therefore to say that the entire circuit is very conventional, there are no "tricks" involved and no originality is claimed for any part of it. By retaining well proven circuit techniques, you the builder have best possible choice of success.

Before we start putting pieces together, let's take stock of the tools you will need to build the Tx. successfully. Firstly, a small electric soldering iron with ¼ in. diameter bit. You will also need a pair of small wire cutters and a small pair of needle nosed pliers, small and medium sized screwdrivers, multi-cored solder, patience and clean hands. We will cover equipment necessary for testing and setting up later.

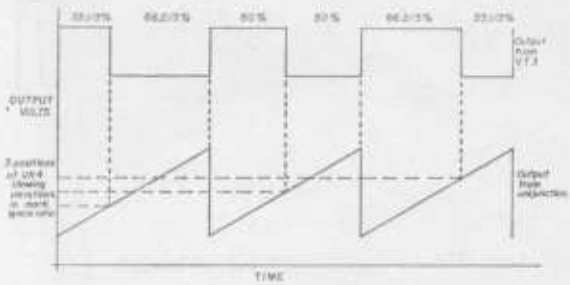
Before contemplating building, it is strongly recommended that you do not start until you have *all* the components for the p.c. board to hand. In this way the board will not tarnish during protracted construction work.

First of all, study the p.c. board, the component layout and the hole numbering drawing. Thoroughly familiarize yourself with the components and their respective positions. Note that the hole numbering is looking at the copper side of the board.

Now clean the copper side of the board with Vim and water and de-burr as necessary. Leave the board to dry and proceed to clean all the leads on the resistors, capacitors, etc. One good way to do this is to cut a circular typewriter rubber and rotate the wire in the cut, but be careful with the transistor leads. When you have finished this, place all the resistors in their correct holes as listed below, *but do not solder yet*. Slightly bend wires to retain components. To help we give the colour code to enable you to identify them. Slightly bend wires to retain resistors.

		Over	In
R 1 : 2.2K	(red, red, red)	78	—84
R 2 : 10 ohm	(brown, black, black)	86	—102
R 3 : 150 ohm	(brown, green, brown)	81	—79
R 4 : 1 meg ohm	(brown, black, green)	66	—68
R 5 : 12K	(brown, red, orange)	62	—70

Fig. 3



		Over	In
R 6 : 8.2K	(grey, red, red)	65	—63
R 7 : 1K	(brown, black, red)	83	—90
R 8 : 4.7K	(yellow, mauve, red)	On	Pot
R 9 : 1K	(brown, black, red)	89	—103
R10 : 4.7K	(yellow, mauve, red)	56	—55
R11 : 1.8K	(brown, green, red)	52	—51
R12 : 27K	(red, mauve, orange)	45	—97
R13 : 27K	(red, mauve, orange)	46	—98
R14 : 1.8K	(brown, green, red)	42	—96
R15 : 4.7K	(yellow, mauve, red)	13	—10
R16 : 47K	(yellow, mauve, red)	16	—21
R17 : 330 ohm	(orange, orange, brown)	11	—8
R18 : 18 ohm	(brown, grey, black)	33	—29
R19 : 2.2K	(red, red, red)	54	—99

Now check the operation completely to make sure all components are in the correct places. When you are satisfied that all is correct, cut off the surplus leads and solder.

Capacitors are next. Repeat as for the resistors being sure that the polarity of the electrolytic capacitors C1, C2 and C3 is correct.

		Over	In
C 1 : 32 uf	electrolytic	82+	25—
C 2 : 4 uf	"	101—	76+
C 3 : 1 uf	"	72+	100—
C 4 : 47K pf		44 to	49
C 5 : 47K pf		43 to	47
C 6 : 1K pf		9	12
C 7 : 1K pf		37	36
C 8 : 27 pf		22 to	104
C 9 : 1K pf		30	34
C10 : 1K pf		6	4
C11 : 1K pf		27	105

Check for correct positioning, and when you are satisfied, solder in as before, after clipping all leads short.

Oscillator coil

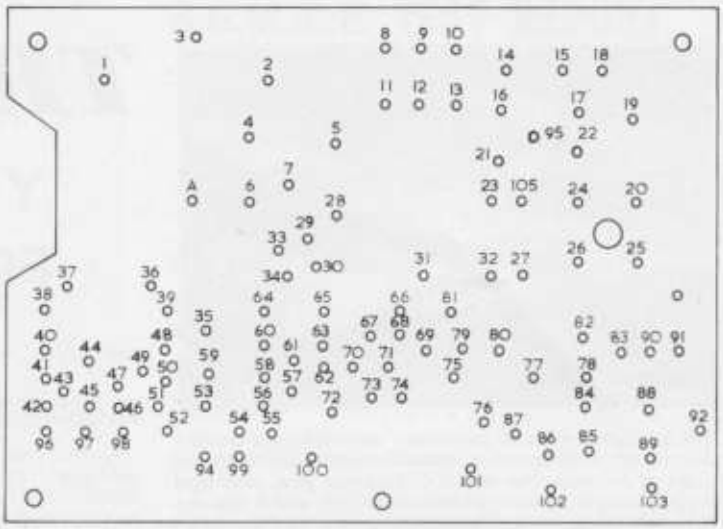
Take the oscillator coil, making sure the pin adjacent to the red point spot in hole number 20. Solder into place. If your coil has no point spot, you can identify the correct pin for hole 20 as being the one connected to the bottom of the longest coil wound directly against the body of the former.

P.A. coil

This should have the ends cleaned as per the resistors etc. However, if as is likely, you have a coil with enamel wire you will have to use a modelling knife to bare the wire to within ¼ in. of the coil proper. If you have a tuned copper coil you only have to clean the ends and the taping lead. Push the coil into holes numbered 1 and 2 with the taping lead in 3. You will notice the hole spacing is such that the coil will be expanded when finally fixed in position. To position the coil correctly, take a piece of ¼ in. scrap balsa and place between the board and the coil, to obtain the necessary stand off distance. Press the coil down onto the balsa and cut off the leads $\frac{1}{16}$ in. long on the copper side of the board. Bend the leads over to lie flat on the board and with an assistant to hold the coil in place, solder. Do not allow your assistant to solder the coil while you hold it in place as the wire gets very hot and burns your fingers, and you don't want that to happen to you do you!

Next job is to solder in VC1. The little lugs on the bottom in the centre of this component should be cut off short to prevent them from shortening the p.c. board. Bend the

Fig. 4. - Component hole identification and drilling template. View from copper side.



brass ends of the condenser so as to fit between the ends of the P.A. coil and solder in place on the *copper side* of the board. You may require the services of your assistant again for this operation. Now turn over the board, and straighten out the P.A. coil, keeping all turns symmetrical.

Transistors

Insert the transistors in the following order keeping all leads at least ¼ in. long above the p.c. board. Make a point of using a heat shrink whilst soldering.

VT1	E. 77	B1. 87	B2. 20
VT2	E. 73	B. 67	C. 71
VT3	E. 64	B. 60	C. 58
VT4	E. 39	B. 48	C. 50
VT5	E. 38	B. 40	C. 41
VT6	E. 94	B. 53	C. 35
VT7	E. 95	B. 17	C. 19
VT8	E. 28	B. 7	C. 5

Also solder in D1. Cathode to 75, Anode to 69.

The crystal can now be soldered in between 18 and 14 or 15 dependent on the pin spacing of the crystal you use.

Leads

Choose a selection of different coloured 14 strand .0076 plastic covered wire and solder 12 in. lengths to the following hole numbers on the *copper* side, just allowing the ends of the wire to pass through to the component side of the p.c. board. We would suggest red and black be reserved for positive and negative respectively.

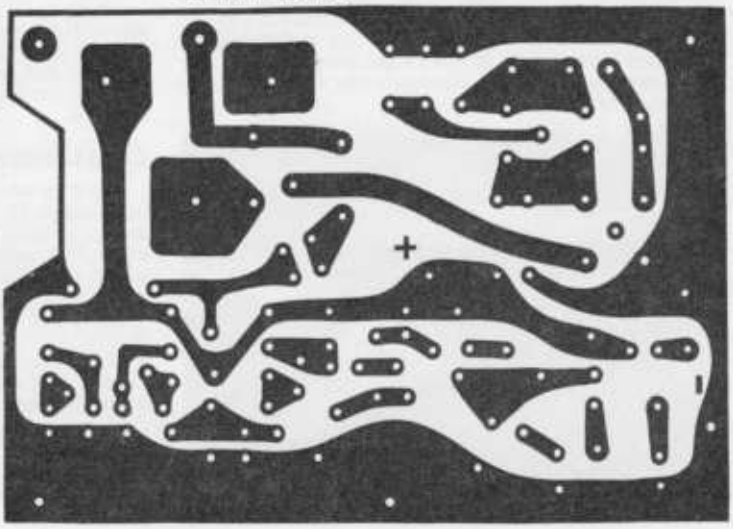
Red therefore should go to hole 31, then pass through the board via the adjacent hole. Black goes into hole 93, then passes through the board. Two more wires go to holes 74 and 85 and one further length to hole 88, again passing all the leads through to the component side of the p.c. board. Three shorter pieces of lead approximately 3 in. soldered into holes 57, 59 and 61. This completes the soldering on the p.c. board, so light a cigarette and closely scrutinise the soldering work for dry joints, bridged lands etc., and again check positions of components.

At this point, you must make a decision as to which type of stick assembly you are going to use, since this affects the choice of values of R7 and R9 also VR2. Component values are affected as follows.

Horizon Stick		*Teleradio Stick* (Digitrio)	
R7 and R9	820 ohm	R7 and R9	1,000 ohm
VR2	250 K.	VR2	100 K.

You can also decide whether or not you require trim controls. Without trim, R8 should be increased to 6.8K. It is soldered between the negative end of VR4 and the wiper directly on the spot and positioned such that it does not foul the case.

Fig. 5-Full size P.C. Layout ▶



NEXT MONTH

Setting up and fitting your Tx into a case only 6×4×2in. - the smallest G.G. Tx yet.

Super Tigre Tank Mount

Radial-to-beam motor mounts, which bolt to the model's firewall are of course not new, but the Super Tigre version, offered through World Engines (Great Britain) certainly goes one better than anything else offered to date.

This one is the usual arrangement of integral motor mount and steerable noseleg bracket, but in addition incorporates a plastic bottle clunk tank. The top of the tank is apparently epoxy cemented to the rear of the motor mount, with vents protruding through the front, and the bottle twists into the cap on the rear of the mount.

The motor mount is cased in light alloy, produces a fairly light complete unit, weighing 5 ozs. It is exactly 3 in. wide, which demands a fairly wide fuselage and the bearers are drilled to take a Super Tigre 51, 56 and 60.

Price, through World Engines, is £2.2.0d.

Bits and Bobs

Mick Wilshere of World Engines has also showered us with some of the R/C Craft accessories, distributed through World Engines.

Firstly, there are packets of assorted eyelets, handy for push rod guides etc., price 2/6d. Then, there are no-noise nylon noseleg tiller arms, price 4/7d., and a useful nylon strip aileron bellcrank, complete with mounting foot, price 12/-d.

Glass Fibre Fuselages

New name in the **glass fibre fuselages** (stink the workshop out for weeks) game is **Gayline Fuselages**, whose display we were attracted to at the R.A.F. Champs, and came away with two samples, one for the A.P.S. Tauri multi trainer, and the other for the K.10 slope soarer.

Let's take the Tauri first. This is a good tough moulding, rigid without the support of formers. It is smoothly finished, and comes with moulded-in flanges to take a motor mounting plate in the nose. Our sample weighs 18 ozs., and it costs £4.10.0d., not bad as glass fuzzies go.

The K.10 is also nicely made, with a smooth exterior finish. It has a moulded-skid on the underside of the nose, and a tailplane mount. Fuselages for this are supplied complete with details of wing, tailplane and fin and rudder assembly, price £3.10.0d.

Price Reduced

Price reductions, in any field, are always welcome as far as the consumer is concerned, particularly at a time when most prices are going very much the other way.

Welcome news from Radio Control Specialists therefore is that their single channel **Guidance System Mk. III** is now reduced to £12.12.0d. from £14.14.0d. Just right for Christmas too!

The Guidance System transmitter measures $5\frac{1}{2}$ x $3\frac{1}{2}$ x $2\frac{1}{8}$, works off 12v. batteries, and has a micro action keying button, a feature we always like to see on single channel Tx.s. The relayless receiver is small, measuring only $1\frac{1}{16}$ x $1\frac{7}{16}$ x $\frac{7}{8}$ and works off 4.5v.

Complementary to the Guidance System transmitter and receiver are the accessory packs. First of these is the motor accessory pack, which incorporates Elmic Compact escapement, switch, harness and battery box into which the receiver plugs, price £4 . 0 . 0d. It is thus possible to get started in single channel R/C without soldering a single connection, for £16.12.0d.

An extra motor accessory pack for throttle control, with an Elmic Corporal escapement, which plugs into the receiver/escapement harness, costs £2.15.0d.

New Stick Assembly

A new proportional stick assembly which we have examined and very much admire is one made by **Horizon Systems**, in fact we admired it so much that we selected it to use in our R.C.M.&E. Simpl Simul transmitter. The unit is a dual axis type with plastic moulded front face designed to keep dirt and moisture away from the inside of the Tx. It is surprisingly compact, has a very nice "feel" to it and is available with a choice of stick length, as illustrated. The unit is available complete with moulded carbon pots to any specified value, price £3 3s. 0d.

Also from the same source are two types of contoured prop nuts, one with hexagonal spanner face, price 4/6d., and another with tommy bar price 4/9d.

Sterling P.T. 17

To anyone who likes really big, and we mean big, R/C bipes, **Sterling's P.T.17** kit is surely one to stop and

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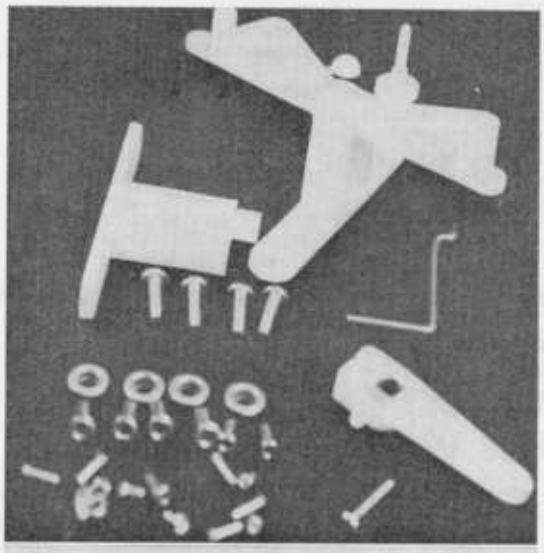
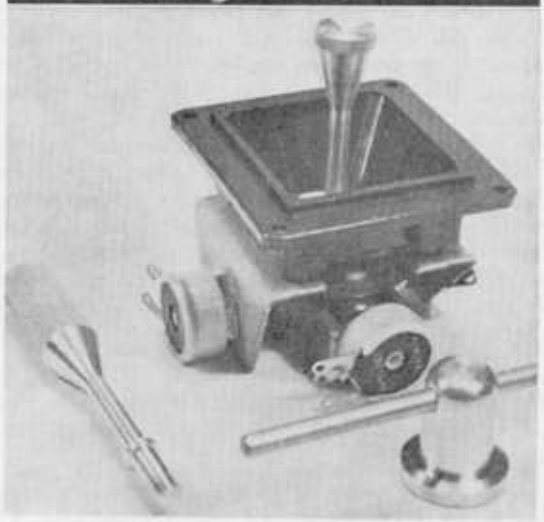
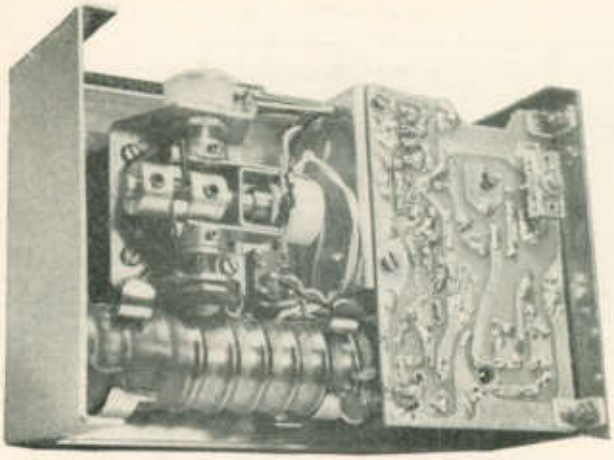




Centre right: miscellaneous accessories from World Engines Inc. including assorted eye-lets, no-noise nylon tiller arm and strip aileron bellcrank. Right: proportional stick assembly from Horizon Systems is available with choice of stick lengths. Any value pot supplied. Also two types of prop. nut, one hexagonal and one with tommy bar.



R.C.M.&E.
SIMPL-SIMUL
TRANSMITTER

By Rex Boyer

PART 2 – CASE CONSTRUCTION

THIS month we will deal with the ironmongery of the Tx. but before we sweep all the soldering irons, wire and components etc., away, let's just make a quick check to see which of you built the p.c. board *exactly* to last month's instructions. If you have, then base 2 of VT1 is trying to reach over to the oscillator coil hole 20. It should go in hole **80.** C8 will have one end soldered in hole 22 and the other end positioned in or about a non-existent hole on the hole identification diagram. If you look at the p.c. board you will note a hole about midway between holes 19 and 20. This is hole 104 where the other end of C8 should go. C1 should be placed between 82 and the unnumbered hole immediately above hole 91 and not to one side of the oscillator coil.

These errors are confined to Fig. 4, the hole numbering diagram. The placement diagram is correct. You will also find you have an R.F.C. spare. This was not left out in error, but on purpose to prevent operation even if power were applied to the unit. The R.F.C. goes over hole 23 to 32.

Capacitor C1 (25 uf) can be as high as 32 uf—they both work. C8 is 22 pf as indicated in the component values list, although 27 pf as suggested under placement instructions will also work satisfactorily. R11 is 1.5K (Brown, Green, Red).

Now on to the "tin bashing". The basic size of the case is 6 x 4 x 2 in. and we know of two sources of supply. *Teleradio* do an anodised undrilled case for the do-it-yourself man and *Horizon Systems* do one fully punched and drilled with no further work needed, to suit either the Horizon stick assembly or the Digitrio type.

For the expert tin bashers who wish to make all the case themselves, the material gauge is 18 s.w.g. For the users of the Teleradio case, you will need a ruler, centre punch, hammer, hand brace, a letter "L" or pistol drill, 6 B.A. clearance drill, drill for the push botton holes, small assorted files and a drill suitable for deburring the holes when they are drilled. You will also need the use of a vice to hold the case for cutting out the square hole for the stick assembly.

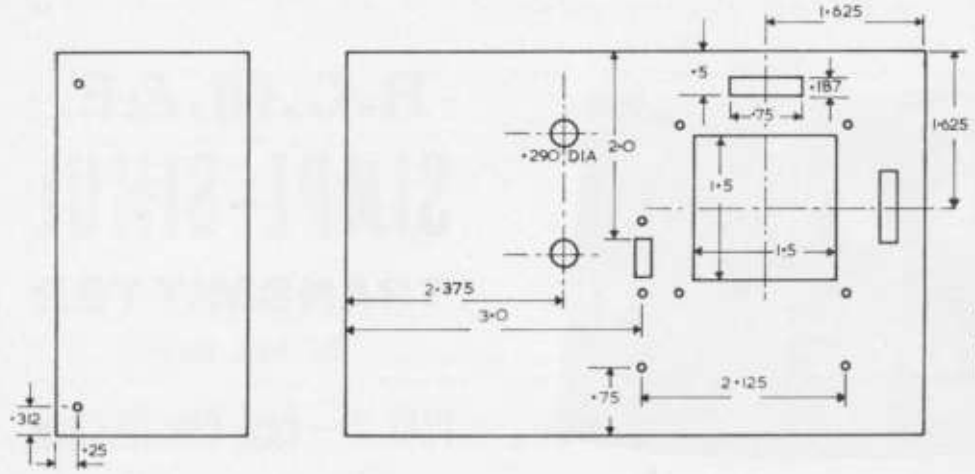
Now to work. Take out your case and note the nice unscratched appearance of the anodising (or painting). To keep it in the same condition, I suggest that you cover it with white Fablon as this will give you a surface to mark out on, in pencil, without marking the case. The cost of a piece big enough to cover the case is well worth that "professional" look.

Mark out all the hole positions etc. I suggest you mark out the position of the stick first, so that if you are using the Horizon stick, the four fixing hole positions can be left and can be spaced through the stick assembly. This will give you a little lee-way in case you do not file the square hole exactly in place. With all the positions marked out, just check once more that all are in the correct place because after the next step, you cannot change your mind without leaving a mark on the case. All okay? Then support the case on the inside on something firm and flat, and carefully centre punch all the hole positions. You will no doubt have seen the two holes on the left hand side of the case, the two in the top side edges and the two in the bottom side edges. You can mark these out now and centre punch also. Make one final check that they are all in the correct place.

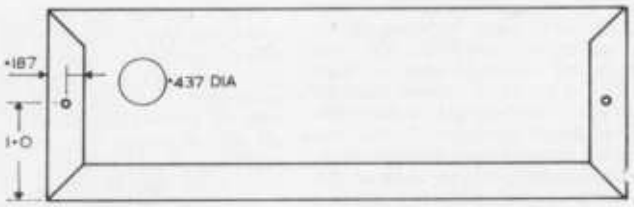
Now for drilling. An ordinary hand brace is strongly recommended here as it will give you much more control when drilling. With the aid of the assistant with the burnt fingers (they should have healed up by now and you should be back on speaking terms again!), place the box face uppermost on the working surface and with the assistant holding the case, proceed to drill all the 6 B.A. clearance holes except the two for the bolts to the on/off switch. Do interpose a piece of wood between the case and the working surface, otherwise you will have holes all over the table top or bench. Now take the bigger drill and deburr all the holes you have drilled including the ones in the edges of the case. You now have the slot for the on/off switch to cut so make sure at this point that the switch you intend to use is correct for the slot dimensions given. If it is larger, you will have to modify the slot size and fixing hole centre accordingly, but do not move the position of the switch any higher in the case or the elevator pot will foul it when the stick assembly moves to full right rudder.

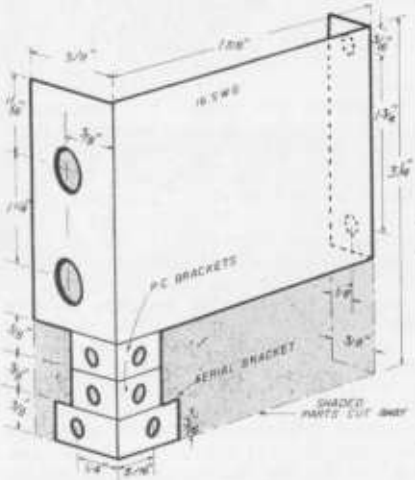
Now to cut out the slots by drilling a row of holes inside the slot then file it out with one of the small files listed as tools necessary. The case is held in the vice between two blocks of soft wood. The switch being used as a guide along with the enscribed outline as a final fitting guide. Now attach the square hole for the stick assembly using the actual stick as a size guide.

Now for all the little brackets which are all made from one piece of metal as shown in the drawing.



Transmitter case, shown half size





Tx case bracket detail

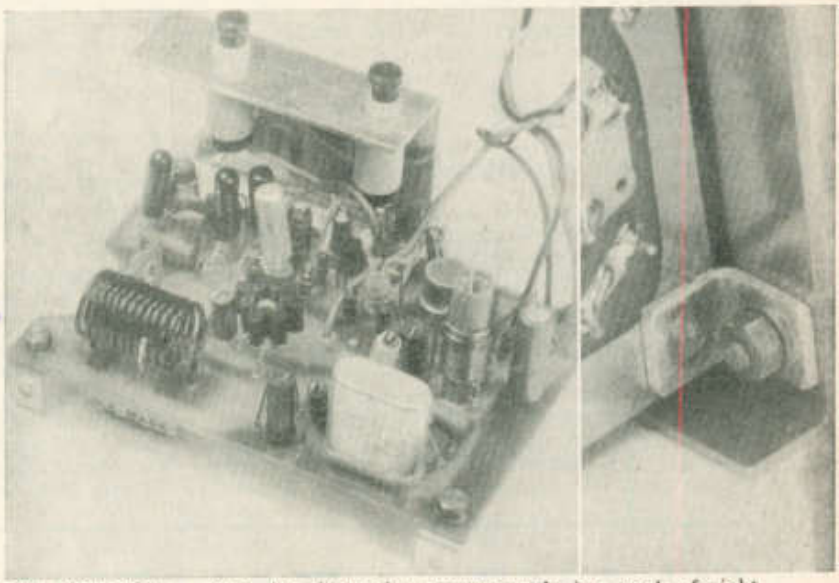
Start by concentrating on the largest one from 18 s.w.g. aluminium sheet, marking out the two holes which line up with those on the p.c. board, laying the board over to check that everything lines up correctly. Then drill. Mark out the two .290 holes and drill the one which will be nearest the top of the case with the 6 B.A. clearance drill. Deburr the hole and bolt the bracket onto the case through this top hole. Line the bracket up squarely with the side of the case, tighten the bolt, and drill out the bottom .290 dia. hole using the one already in the case as a guide. You now have the two holes perfectly in line. Open out the bottom holes to .290 size "L" drill then remove the bolt and open out the other holes. Deburr and try assembling the bracket into the case with the push buttons in place. You should screw on one of the two nuts supplied with the push button as far as it will go on both switches, then fix bracket and case together using the remaining nuts onto the front of the case. If all is satisfactory, you will have just the correct amount of thread projecting through. *Do not over tighten these nuts* as the body of the switch is only nylon and the threads are relatively fragile. If you are sure that all is together satisfactorily, take off the bracket and mark to the correct size. Also, on one of the bends, mark out the two small p.c. support brackets and the aerial bracket. Drill all the holes in these brackets to the correct size being sure to use a clearance drill if you intend to bolt the pieces together and a tapping drill if you intend to use P.K. screws.

When all the holes are in the correct places for the brackets, put the main bracket in a vice, using suitable pieces of wood interposed so as to prevent jaw marks and damage to the bracket. Cut off the two small brackets and the aerial bracket with a junior hacksaw. After cleaning up the pieces with one of the small files, the metal work is almost finished. All that remains to be done now is to drill a hole in the top of the case through which the aerial will project, but don't drill this just yet.

Assemble both push buttons into the bracket and fix this to the p.c. board. Now gather the three appropriate leads from the p.c. board and dress them along to the bottom of the board over the edge. Bare back the ends and solder to the push buttons.

Just to recap so that you need not refer to last month's issue, join one side of the two push buttons together using a jumper wire and connect the lead from hole 59 to this junction. The lead from hole 61 goes to the other side of the top push button (high engine) and the wire from hole 57 goes to the other spare tag on the bottom push button (low engine). You can of course, if you wish, reverse this position, it's your choice.

Make sure the wires are adequately long without being over length and see that these do not cut into sharp corners. Assemble the aerial bracket onto the



Right: the R.C.M.&E. Simpl-Simul Tx. component board, showing main assembly bracket with push buttons. Auxiliary brackets bolt to the two corners of the board as shown, and the aerial bracket is just behind the coil (centre left). Far right: close-up of auxiliary bracket which bolts on to p.c. board and side of case.

p.c. board, threaded side uppermost. Now fit the p.c. board complete into the case for the last (we hope) time, remembering not to over tighten those push button nuts. Fix the small support brackets from the p.c. board to the side of the case and adjust the assembly so as to be square in the case. Tighten all the screws etc.

At this stage, we drill the hole for the aerial in the top of the case. Screw the aerial into its bracket, making sure it is perfectly perpendicular. Now calculate its exact centre position, taking measurements from the side and front of the case. Remove the aerial, replace the rear half of the case and use these dimensions to mark the centre on the case top ready for drilling. Remove cover again and drill a hole so that the aerial will just pass through. Deburr, put the cover back in place and fit the aerial back through the hole and screw in place. Check to be sure that the aerial is still perpendicular and if satisfactory, remove the aerial again and open out the aerial hole to $\frac{7}{16}$ in. to take a grommet. Then, drill the cover fixing screw, 6 B.A. tapping.

Fit the stick assembly with the 5 K rudder pot at the top and the 250 K pot nearest the p.c. board. This is the Horizon stick assembly, the fixed pot being the 5 K rudder. With the Digitrio stick the moving pot will be at the bottom and the fixed pot at the side nearest the p.c. board.

Wire up in accordance with the circuit diagram, giving ample wire to allow the moving pot freedom, also ensuring that at the full down elevator position, the amount of resistance in the circuit is reduced and increased at full up. If trim pots are to be used, these are wired in the correct sense also. The rudder trim pot will probably cause a bit of a headache so make a permanent solder connection to the wiper tag, while only touch soldering the other wire. Add the on/off switch into circuit wiring from the p.c. board to the bottom two contacts. The centre two contacts go to the battery.

If you intend to use a 12v. 225 DKZ DEAC pack (which we strongly recommend) now fit the two Terry clips (1 in. dia.) to the two remaining holes in the case. An alternative power supply is a pack of eight pen cells (U7) made up into two packs of four. Make up a suitable clip to fit into these holes to hold the pen cell pack in place. By using pen cells, a charging socket becomes unnecessary.

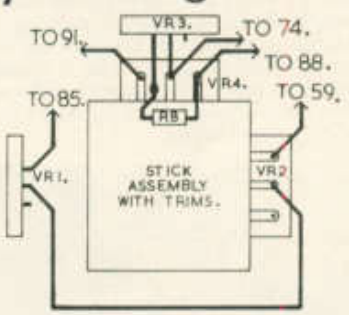
Whichever power source you use, wire up the two centre contacts of the switch to the battery, observing the correct polarity.

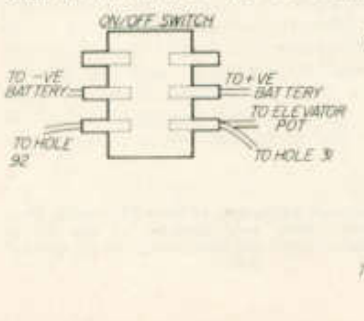
This finishes assembly work, leaving only tuning and setting up. Please do not switch on just yet, wait until the last instalment so as to achieve instant success.

One last point. It is important when ordering the D.A. Olley aerial to state the frequency you will be using so that the tiny slug can be set for maximum output at the factory.

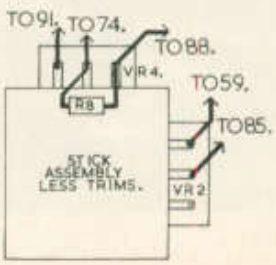
NEXT MONTH— setting up and alignment

Wiring details to stick assembly





Wiring details to on/off switch and push buttons



R.C.M.&E.
SIMPL-SIMUL
TRANSMITTER
PART 3 — TUNING AND SETTING-UP

Right: first prototype of R.C.M.&E. Simpl-Simul transmitter which was equipped with Teleradio stick assembly. Plastic surround to stick orifice came from a Min-X transmitter, and was kindly donated by Peter Waters.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

LAST month we dealt with the mechanics of the transmitter. Now we will deal with points arising from readers' queries and final setting up.

The most frequent questions already asked about the Tx concern variation of the frequency of the tone generator to allow the Tx to be used with filter receivers. This can be done. Take a look at VT4 and 5 which, with their assorted components, form a multivibrator. The frequency of the multivibrator is governed by *R12 and R13* in conjunction with *C4 and C5*. We can alter the frequency of the circuit by varying the sizes of either the two resistors or the two capacitors. Decreasing the value of the resistors or capacitors will raise the frequency and conversely increasing the value of the resistors or capacitors will lower the frequency.

There are, however, limits to the values we can use. The most important is the maximum value of the resistors. As can be seen, the base resistor is connected to the negative rail as is the collector and we know that if we connect the base to the collector, we switch the transistor hard on so that the collector and emitter are effectively shorted together. But in our case the value of the base resistor limits the amount of current flow to the base. So if we continue to increase the value of the base resistor we will reach a point where the base current is insufficient to switch on the transistor fully and the resultant current flow through the emitter-collector circuit will exceed the transistor maximum operating values and we blow up the transistor.

From calculation and practical experiment a reliable maximum value for *R12 and R13* is 30K ohms.

Several readers have asked if it is possible to use an aerial other than the one specified. I am obviously not getting through to some people—the answer is *NO*. The whole of the P.A. circuit revolves around the aerial and it is all matched together, so please do not jeopardize your chances before you even start. Incidentally, before I go on can I remind you to state the frequency on which you are going to run your Tx when ordering the aerial so that it can be tuned for maximum output.

Tuning

You should be in a position to just press the switch for instant success, but before you do so, let us take a look at the tools we need. First of all a non magnetic and preferably non metallic screw driver to fit both the slug in the oscillator coil and the screw in VC1. Such can be easily made from an old knitting needle. Also required are a 6V .04A bulb, a 30-50 ohm resistor (not wire wound) and a short length of thin round section rubber to lock the slug in the oscillator coil. Alternatively, this can be locked with a blob of wax.

A field strength meter is highly desirable but not essential. Lastly you will need a monitor. You will, of course, need something to slacken the nuts and screws on the stick assembly.

Connect a short piece of wire about 1½ in. long to the tip of the bulb and solder one end of the 30-50 ohm resistor to the side of the bulb. Now, with the back cover of the Tx removed, solder the other end of the resistor to the negative land of the p.c. board, and touch solder the other side of the bulb to the back of the aerial land where the aerial bracket fixing screw comes through. Adjust VC1 using the tuning tool until the plates are just lightly compressed. Interpose the short piece of rubber between the slug and formes, and adjust so that it is just flush with the p.c. board.

If you have a milliameter, you can at this point insert it in one line to the battery, set to read 100 mA maximum. After making sure the battery is charged or the pen cells are fresh, press the switch on, press the full tone button whilst holding the case and begin to turn the slug in the oscillator coil. If you have a meter in the circuit you will probably note that as you screw the slug further in the current rises. The bulb may also be slightly illuminated at this point. Continue screwing the slug into the coil until you reach a point where the current suddenly drops to a low figure and the bulb goes out. This indicates that the oscillator has stopped working.

With the full tone button still depressed, unscrew the slug in the opposite direction, two or more turns until the meter suddenly rises again and makes the bulb light again. From this position, give the slug *one more full* turn in the same direction and you will note that the current drops slightly.

Just to check that the oscillator will start every time, switch the Tx off and on a few times. It

should start every time you switch on. If in the unlikely event it does not, give the slug another half turn in the same direction and try again.

Next step is to adjust VC1 for maximum lamp brilliance. It will be noted that the current will probably drop to give this condition. With the Tx correctly adjusted, total current with the tone button depressed will be in the region of 60 mA. I cannot be more specific than this as tolerance on components make quite a difference. I have seen this figure as low as 50 and as high as 70 mA.

The Tx is just about set up as far as the R.F. circuit is concerned. Now all we have to do is to set up the pots on the stick assembly. We will deal firstly with the non-trim version. Slacken the rudder pot spindle screws and set the wiper in about the mid position, slightly tighten the screw, now adjust the elevator pot wiper to about a quarter of a turn from the no resistance end—that is with the wiper about a quarter of a turn from the end with the wire going to hole 59 on the p.c. board. Lightly tighten the shaft locking screw.

Switch the Tx on again and the bulb should flash brighter than when you set up the R.F. stage. To check these two levels press firstly the full tone button (top) then the full carrier button.

With neither button depressed, it may be that the "on to off" timing of the lamp is not equal. In fact it would be very surprising if it were.

Set the rate (elevator) pot so that in mid stick position it gives six pulses per second. This, of course, is not easy without access to an oscilloscope.

Just as a guide, if you listen to your wrist watch, it will in most cases give 5 ticks per second. So if you listen to your watch while at the same time looking at the bulb, inside ten seconds you should be conditioned! With the stick slightly back (slight up elevator) the bulb and ticks should coincide. When this is achieved, tighten the spindle locking screw and with the stick in the neutral position, judge the "bright/low" ratio. Adjust the rudder pot to give equal "bright/low" flashes. This procedure you will realise is only roughly setting up the pulser.

The final setting must be achieved with the receiver/actuator combination installed in the model. By viewing the control surfaces, they should be seen to move equal distances in either direction with the stick in central position. Adjustments should be made to both the model and the transmitter to give optimum.

Finally, check the engine controls to determine that full and low motor signals are satisfactory. Switch off the Tx and Rx actuator combination should cycle round continuously to low motor.

All this assumes that after setting up the R.F. section and roughly setting the pots on the control sticks that the bulb did flash. If it did not, then establish whether the brightness of the bulb is full carrier bright bulb or full tone dull bulb. If it is somewhere in between this it indicates that the rate is much too fast, so turn the elevator pot body to put more resistance in the circuit. But if it is full bright or full low, turn the rudder pot until it starts flashing. You may have to try both directions.

Trims

To set up the trims, proceed as before. When checking for actuator cycling at low rate (full up elevator), be sure to put in full up trim and full left or right rudder trim as well. Also remember the lead we tacked on the rudder trim, you can check to see if the trim "sense" is correct.

To change the direction of the rudder control, reverse the leads to the actuator motor rather than swap the leads on your beautifully built Tx!

Just as a parting shot do make sure that the batteries to the actuator are fully charged, both sides if you use a centre tapped battery.

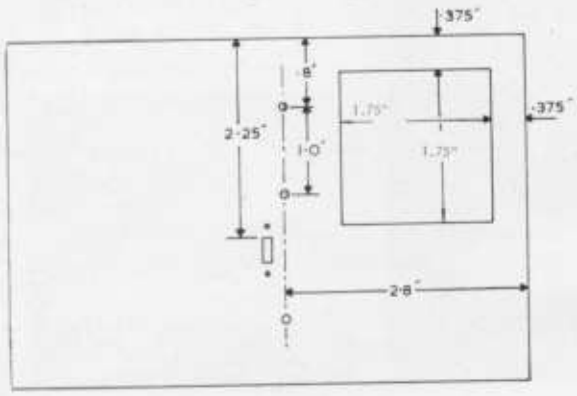
You now have an almost fully set up bulb flashing device! Still with the cover removed, extract the bulb and resistor and insert the aerial fully extended. Place the field strength meter a convenient distance from the Tx, to give a mid-scale reading when the full tone button is depressed. It may be that a slight adjustment to VC1 will increase the reading. When you are satisfied, switch off, remove the aerial and attach the back cover. Screw in fixing screws, replace aerial and with Tx switched on check the output to see that it is the same as before.

One last point. Our experience with this unit is at your disposal, so if you have any problem at all, we will be glad to help.

If you make any improvement or modification, we will be glad to hear of these too, so that others may benefit.

In short, any experience with the *R.C.M.&E.* Simpl-Simul transmitter which you may have, will find a ready ear this end—so let's be hearing from you all!

Dimensions and details for case using Teleradio stick assembly. All other dimensions as per original.



RECEIVERS?

As we have already said in "Technical Forum" producing a receiver with a reliable G-G output switcher is difficult, so for the moment we suggest you use a relay Rx. The "Tinytone for R/C Boats", which appeared in our October '67 edition, is ideal and quite small enough for model aircraft use (reduce C8 to 2μF electrolytic).

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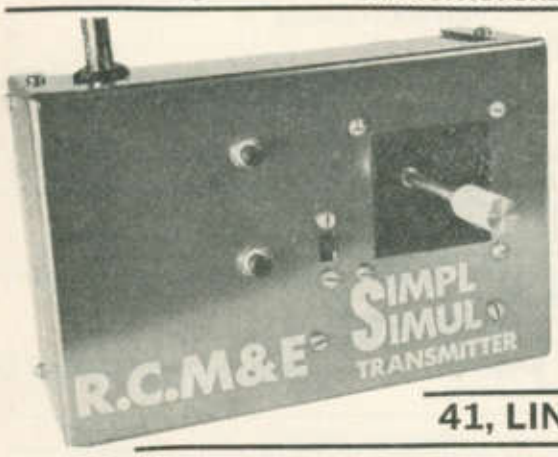

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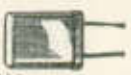

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