Walt Good and Maynard Hill, preparing "piggyback" hop, among the users. Glider uses the 2-channel receiver.

2-Channel Dee Bee Receiver

For absolute reliability, interference resistance, and amazing range, the two tone receiver (on 53 megahertz) has been used to set many records in both FAI and AMA classes. Two independent proportional torque feedback functions.

By HOWARD McENTEE

In this day and age when fully transis-torized equipment is the accepted thing, why would anyone want to build a receiver with a tube in it—and which is utilized with a tube transmitter? From the interest that has been shown in the 2-channel Dee Bee receivers developed and flown to many contest wins by Austin Leftwich, apparently quite a few modelers want to. We believe some seven of these 2-channel receivers are in use. Leftwich has achieved considerable fame with them, having won the AMA Pylon event at the 1965 and 1966 Nats, having set several AMA Pylon records, and won this event at innumerable contests.

Maynard Hill used his 2-channel Dee Bee to set the present FAI Worlds Speed Record in June, 1966. Hill, Walt Good, this writer, and others have utilized the receivers in gliders with fine results. Much interest has been expressed in the sets, which are simple to build and maintain, and which have proven highly reliable. All the receivers have been super-regens operating on the 50-mc ham band, and it is this design that we present here.

Dee Bee Quadruplex equipment originally made in super-regen form to operate on 27 mc could probably also be adapted to the form we show (though most of the 27 mc regens and their matching transmitters have been converted to 50 mc by Dee Bee Engineering). If you have an outfit you *know* was made for use on 50 mc, you can proceed as described herewith. If you are in doubt as to whether it might have been a converted 27 mc job (the 27's all used lower AF tones), better check with the Dee Bee factory before you start receiver construction. As the owners switch to more up-to-date equipment, the Dee Bee 21 outfits (and older Mk II's) are being sold at often bargain prices. Check the classified columns of the model plane mags.

Basically, this receiver combines the super-regen front end AF stages of the elevator and aileron channels of the 6-meter, Model 21 receiver (these components and the necessary toroid filters are on board A) with the power converter and servo drivers of the same outfit (which are all now on board B). Due to use of the compact, light and highly efficient Bellamatic II servos (modified per Dee Bee methods) the complete control system is of reasonable weight. Receiver with case and plug weighs 6 oz., the servos 1.3 oz. each. A set of four 1.2AH nickel-cad cells totals 7.4 oz., will provide several hours of operation. For use in such planes as Pylon racers, much smaller and lighter cells may be used, of course. Total current drain with well-charged

cells is some 430 ma., with transmitter control stick in neutral. The receiver is a natural for application of Walt Good's "triangular waves," as a means to reduce overall current drain (see 1966 AMERICAN MODELER ANNUAL).

We strongly suggest that builders obtain the printed circuit boards from Dee Bee with the toroids mounted and potted, and with the converter transformer L6 mounted and connected. Dee Bee can supply any of the other parts required, or you can obtain them from such mail order outfits as Newark Electronics Corp. in Chicago. Be sure to use mylar capacitors for C3, C5, C7 and C7, so the AF filters won't drift with temperature variations. All resistors (except R12 and R25, which are mounted on the servo board, external to the receiver) should be ¼W. Due to rather cramped space, the electrolytics specified in the parts list should be obtained (or exact physical duplicates).

The case is cut down to 1⅛" inside height from a larger unit that Dee Bee can supply. Make four 7/16" long spacers from ⅛" OD hobby shop brass tubing. Drill the smallest holes in the PC boards with a #60 drill, the four corner holes with #42 drill, and the four holes for L1 and those at the PC board edges for the leads with a #51 drill.

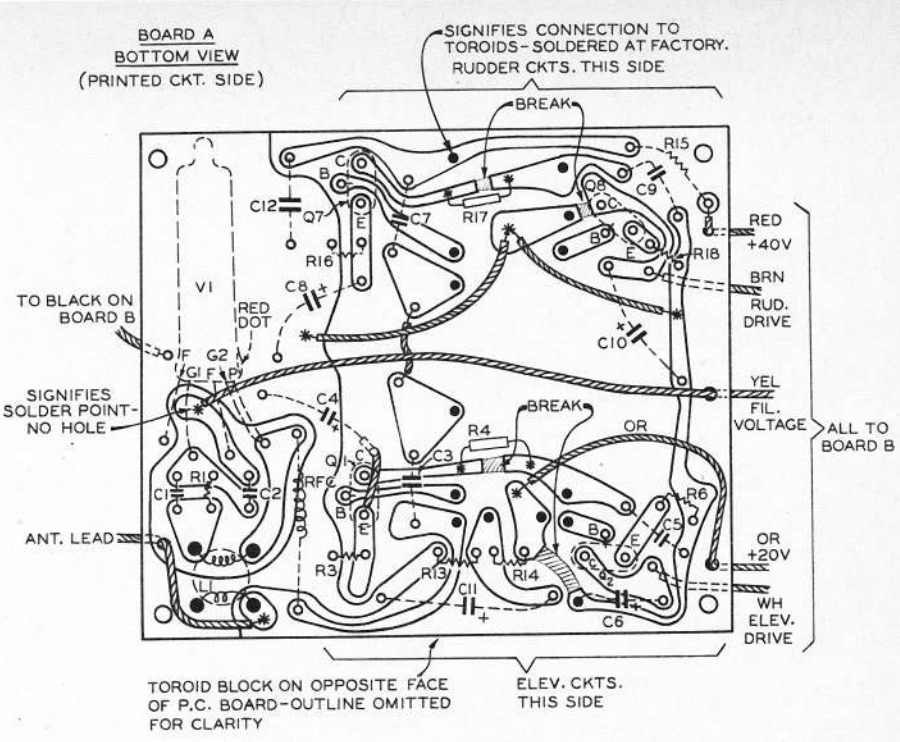
Note that there are four places on board A where breaks must be made in the copper strips. A sharp razor blade will do the job. Also, because this board was intended for a 3-channel receiver, there are several copper strips that are not utilized, and which you might as well peel off.

On board B be sure to install the four jumper wires, which go on the top of the board (*not* on the copper side).

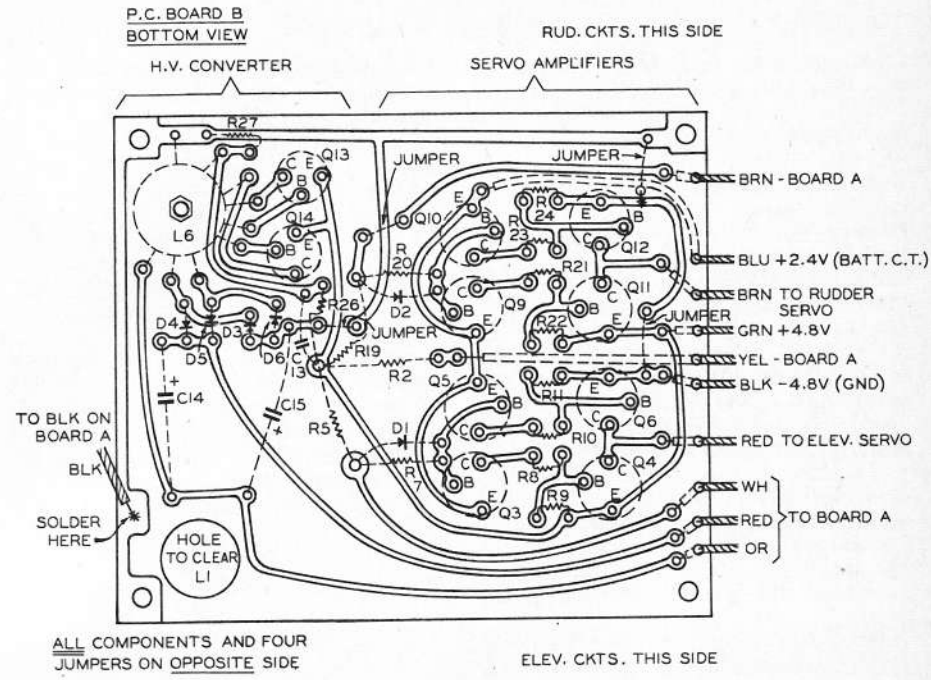
Fig. 1 and Fig. 2 are drawings of the bottom, or copper side of the two boards; hence components are shown with dotted leads, as most are on the other side. Board A has resistors R4 and R17 on the copper side, as well as capacitors C3A, C5A, C7A and C9A (if these capacitors are necessary). There are no parts on the copper side of board B.

Before mounting and soldering parts, go over the copper areas with fine steel wool, to polish the surface and allow easy soldering. Install parts and solder in place. It's wise to bring the flexible leads that run between boards, and those in the external cable, through holes in the edge of the boards, as indicated in Figs. 1 and 2; this will take strain off the soldered ends of these wires, and prevent breakage.

After careful checking of parts and soldered joints, you are ready for tune-up. This can be accomplished in two ways. Presumably you will want to use the regular Dee Bee receiver, with the Dee Bee transmitter, as well as your new 2-channel receiver. Austin Leftwich makes sure that capacitors C3, C5, C7 and C9 are at the minimum end of the tolerance—that is, they are somewhat lower in capacity than they are marked. They are then brought up to the required total capacity with the units designated C3A, C5A, C7A and

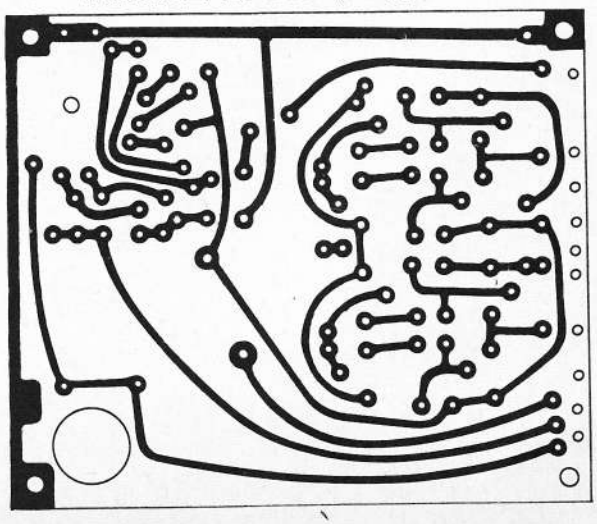


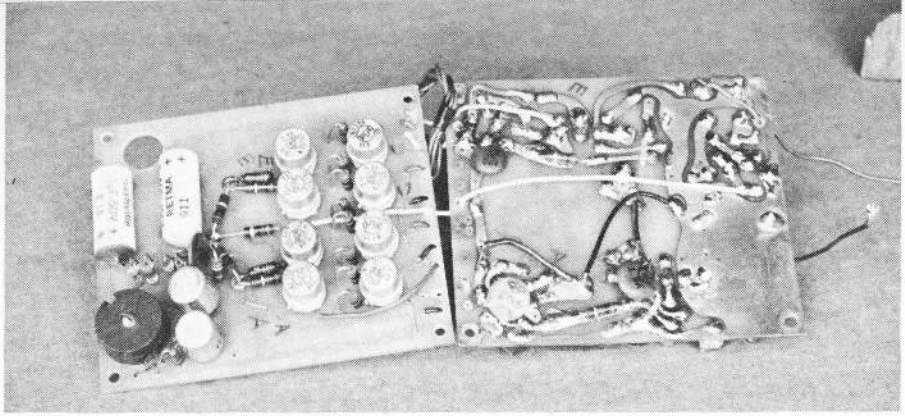
↑ **FIGURE 1**



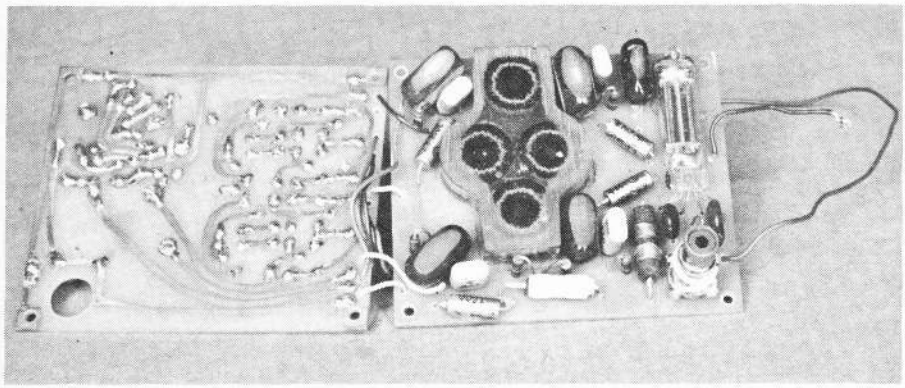
↓ **FIGURE 2**

Full-size P.C. Board, copper side





Reverse views of the two-deck receiver.



C9A, which are soldered to the copper side of board A, as required. If you don't have half a dozen or more of the mylar capacitors of .01 and .015 values, to pick low ones, you'll have to do it Don Brown's way. This entails checking the regular receiver and the 2-channel via the routine described below. Proceed as follows:

1) First check your new receiver to make sure that DC voltages are correct; the converter should be producing 20 and 40 V (measure all voltages against "ground"—the large copper area under V1); V1 filament voltage should be plus 1.4. You should measure 20 V on the collectors of Q1 and Q7.

2) Make four scope probes per Fig. 3; solder them to the collectors of Q1 and Q7 in the new receiver, and to corresponding transistor collectors in the regular 3-channel Dee Bee receiver (elevator and aileron channels in latter).

3) Connect one probe, then the other, of the 3-channel receiver, to the vertical terminals of an oscilloscope, while you observe the wave shape and amplitude of the elevator and aileron tones in this receiver, with the transmitter turned on. It helps to shut off all but the desired tone at the transmitter; left aileron, down elevator and low motor speed will turn on the elevator tone only. Right aileron, up elevator and low motor will give you only the aileron tone. The scope patterns are what you wish to duplicate in the 2-chan. receiver.

4) Connect the scope to the new receiver via one or the other of the probes on Q1 or Q7. With transmitter off you should see some "noise" on the scope; it should be about 20% of the amplitude (but see step 9) of the wave form seen with transmitter on and tuned in. It will prove the receiver is working and is ready to be tuned.

5) Turn on the transmitter, then tune the slug in L1 for maximum scope pattern amplitude. If you are lucky, you might have the pattern of one or both channels equal in amplitude to that seen when you checked the 3-channel receiver. If not, some tuning is required.

6) Determine which receiver has the highest frequency filters by varying the proper audio generator filter in the transmitter (turn slug in one of the three transmitter tone inductors). The receiver which requires clockwise rotation of the transmitter AF slug has the highest frequency filter. Set transmitter controls to generate only the single tone you need, while doing this.

7) The receiver with highest frequency filter must have some capacity added to that filter to lower it till it matches the other receiver. Add capacity across the receiver filter capacitor (C3 or C7), and equivalent in the 3-channel receiver) until both receivers are tuned to exact same tone (transmitter audio generator slugs in same position for both receivers). These capacitors will be from 500 mmf to .002 mf., and should be small disc ceramic types, soldered on the copper side of board A. L2 and L4 are the sharply tuned filters; L3 and L5 are much broader and generally do not require such careful padding. The same holds true for equivalent filters in the 3-channel receiver, of course.

8) Recheck both receivers, to make sure the equivalent channels peak up at the same point of rotation of the corresponding AF generator slugs in the transmitter.

9) Remove transmitter antenna, and try a distance check with the old 3-channel receiver to determine range, then compare (*Continued on page* 65)

Receiver assembled. Note the tuning coil extends through upper deck.

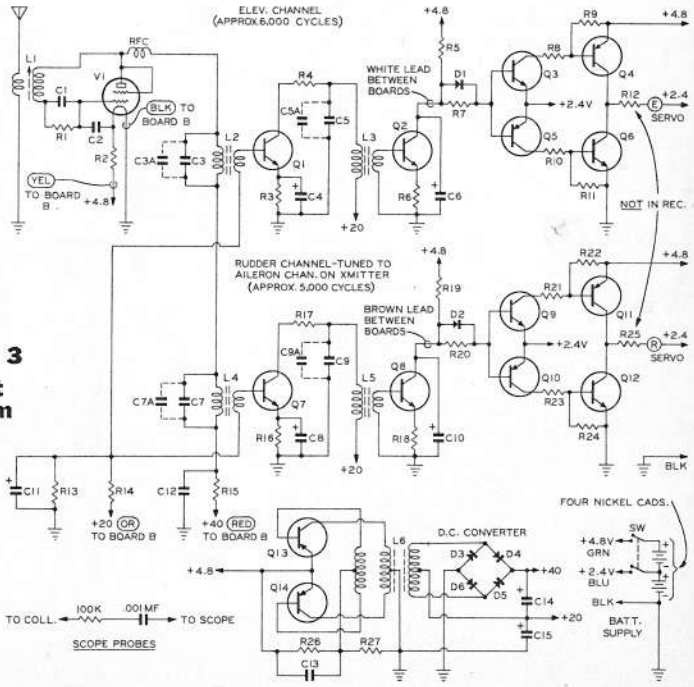


FIGURE 3
Circuit Diagram

2-Channel Dee Bee Receiver

(*Continued from page* 34)

this with the working range of the new reciever under similar conditions. RF sensitivity may be altered by varying value of C2; increasing this capacitor will increase sensitivity (retune LI with every change of C2). However, if the servos jump around wildly when the transmitter is off, your receiver is too sensitive—reduce C2. You may not require C2 at all.

10) If one channel seems insensitive and the other O.K., lower the value of emitter resistor (R6 or R18) of the weaker channel. You can cut it to as low as 5 ohms if necessary.

11) If a servo seems to drive O.K. to one side, but is weak to the other, you can try reducing the bias resistor on the weak side (these resistors are R9, R11, R22 and R24).

Your receiver should now be ready to go. It's taken many words to describe the tuning process, but it is really quite simple. Needless to say, it should not be attempted unless one has a pretty fair knowledge of "radio tinkering," has a scope and knows how to use it. The Leftwich method is much quicker, of course, since you need only to work on the new receiver; the 3-channel one and the transmitter are not changed or returned in any way.

We urge builders to stick to the parts specified, since as noted previously, space is pretty tight in some areas of the PC boards. Prospective builders may get a shock when they find that 1AG4 tubes cost a little over $7 today! Our suggestion here is to check among your RC friends who have been in the game for five years or more. They are almost sure to have several of these tubes laying around unused—or possibly in old receivers. If the leads on such tubes are clipped short, for use in a socket, it's no problem. Simply solder brass straight pins in the four holes on board A, then solder the clipped wires

(*Continued on page* 66)

to these upward projecting pins.

It is wise to put a spot of "Goo" under the tube, and under C14 and C15, to hold them tightly in place. You can use the same cement to attach a sheet of thin fiber to the bottom of the case, to prevent shorts with underside of board A.

We haven't gone into a blow-by-blow account of building and tuning this receiver, since the average hep RC tinkerer won't need such detailed info. You'll find it a very reliable unit, and one that's easy to service in case of trouble — well proved under tough circumstances.

PARTS LIST:

L1*	50 mc slug tuned antenna coil
L2, L3*	6 kc toroid
L4, L5*	5 kc toroid
L6*	Converter transformer
RFC	10 microhenry (National type R33)
V1	1AG4 tube
Q1, Q2, Q7, Q8	2N214 transistor
Q3, Q6, Q9, Q12	2N1305 "
Q4, Q5, Q10, Q11	2N1304 "
Q13, Q14	2N270 "
D1-D6	Sub-min diodes type 1N198
C1	47 mmf mica (Arco DM-10-470)
C2	May be from 1 to 5 mmf (Arco DM10-010 to DM10-050)
C3, C5	.01 mf mylar (Arco 1DP-1-103)
C7, C9	.015 mf mylar (Arco 1DP-153)
C3A, C5A, C7A, C9A	see text (Centralab type DD suggested)
C4, C6, C8, C10, C11	6 mf electrolytic, 25V (C-D type NLW 6-25)
C12	.022 mf mylar (Arco 1DP-1-223)
C13	.01 mf disc ceramic (CRL type CK103)
C14, C15	20 mf, 50V electrolytic (C-D type NLW 20-50)
R1	2.2 meg ¼W carbon
R2	82 ohms " "
R3, R4, R5, R7, R13, R16, R17, R19, R20	1K ohms " "
R6, R8, R10, R21, R23	47 ohms " "
R9, R11, R22, R24	100 " " "
R12, R25	1.8 ohms, ½W wirewound (external to rec.)
R14	18K " ¼W carbon
R15	4.7K ohms " "
R18	33 " " "
R26	380 " " "
R27	5.6K " " "
P.C. board A*	With L2-L5 mounted and connected
P.C. board B*	With L6 " " "
Receiver case*	Must be cut down per text

Four 7/16" long brass spacers; four 13/16" long 2-56 screws; 2-56 nuts; cable grommet and plug.

* available only from Dee Bee Engineering Co., West Lambs Rd., Pitman, N.J.; they can supply any or all of above parts.