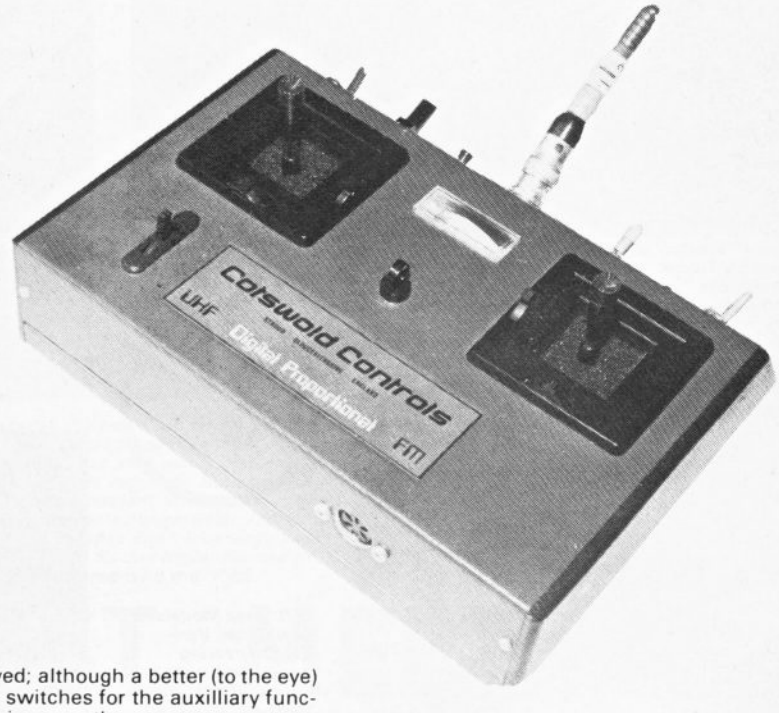
TEST REPORT

Rex Boyer tests the



SOPHISTICATED ELECTRONICS AND GOOD QUALITY WORKMANSHIP ARE EVIDENT IN THIS NEW BRITISH ULTRA HIGH FREQUENCY 7 FUNCTION R/C EQUIPMENT FROM COTSWOLD CONTROLS

IN THESE DAYS of ever increasing imports of foreign R/C equipment it is a welcome breath of change to receive a British built system for review, and not only is it a new British manufacturer, but as an added bonus, the system works on the 459 Mhz UHF band.

We are talking, of course, of the *Cotswold Controls* 7 (9) channel FM system, recently introduced into the market by *Flowmetering Instruments Ltd* of Stroud, Gloucestershire. At RCM&E we have been monitoring the development stages of this system and have indeed done a fair amount of flying with a development set of gear.

The production unit which is the subject of this test, differs a little from the development system we have flown mainly with regard to the ergonomics of the Tx and physical mounting of some Rx components. *Cotswold* policy is to "Buy British" wherever possible and to this end *Skyleader* servo mechanics are utilised although other makes are available to special order.

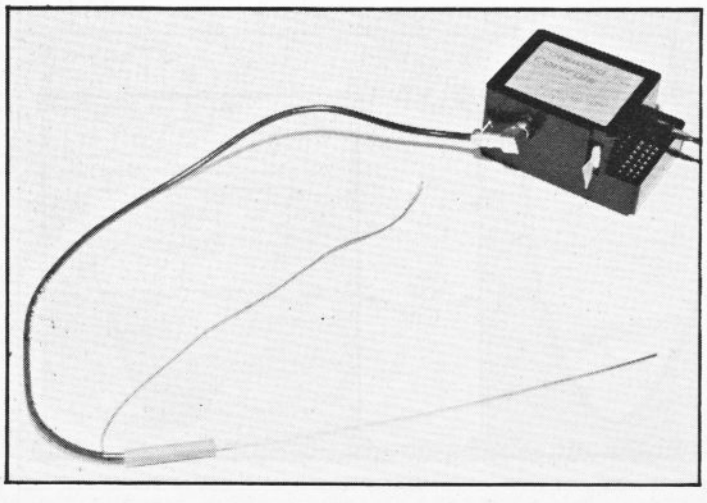
One of the biggest problems which faces the UK manufacturer, and especially on 459 Mhz, is the restricted market place for his products. Even with restricted sales, the development and tooling costs still have to be recovered; plastic injection moulding tools for sophisticated Tx's and servos cost many thousands of pounds and could not possibly be justified unless production runs of hundreds of thousands of units is envisaged. *Cotswold* have chosen to use the familiar UK folded vinyl-clad alloy Tx case with moulded end caps, and we feel a good compromise has been achieved; although a better (to the eye) selection of switches for the auxilliary functions would improve the appearance.

Again the presentation of the system, although it is very adequate, could be improved with possibly an expanded polystyrene box and a full colour printed sleeve, nothing to do with the performance of the set, you may rightly say, but as any retailer will tell you, it sells sets!

As a general comment we were highly impressed with the professionalism of the construction of the system (it's all hand soldered), workmanship is of a very high standard, the Tx circuit board in particular, is impressive. One word of caution here, Tx crystal access requires removal of the Tx back, which is retained by a lip on the top, and two snap fasteners on the bottom. When removed all is revealed, including trimmers and coils, one has to be careful when changing crystals *not* to physically move any of these components as performance could be affected. Whatever you do, only use *Cotswold Control's* crystals — in pairs, as they are specially made for the system, to a closely controlled specification and some of the more sophisticated features of the technical specification rely on the tight tolerances of the crystals.

As mentioned earlier the system is supplied with *Skyleader* SRC1 servos. In our case two reversed (optional), a charger, the necessary UHF Rx aerial, 500 MA/H Ni-cad pack, a pack of servo parts for converting the rotary servo outputs to linear output if required, plus a servo tray, wing mount and aileron extension lead and neck strap — enough bits and pieces to keep itchy fingered people happy for a long time.

The instruction book is very impressive, the best we have seen from a UK supplier, also supplied is a descriptive leaflet of equal quality. Let us now look at the individual units in detail.



Heading: Cotswold seven function transmitter, note the DIN socket on the front edge, which doubles as a charging and Buddy Box connection. Left: receiver and plug-in UHF aerial, instructions are precise regarding location of the whip and radial elements.

Transmitter

As described earlier, the Tx case is of wrap round construction from deep blue vinyl-clad aluminium, the plastic fittings, including the end cheeks, are all black. The case front is pressed to form an inset panel for the front label, as also is the back, in this instance for rigidity. A neck strap loop is fitted to the front panel of the case just below the battery/output meter. It is a *true* output meter, calibrated in milliwatts and a touch of case-top mounted switch causes the meter to read battery voltage, also calibrated in volts. The rest of the controls on the Tx are the obvious dual axis stick assemblies, for the four main functions plus the additional three or five auxilliary controls positioned along the top of the case with one in the bottom front panel adjacent to the label. Two of the three auxilliary functions are proportional, the other is a two position retract switch. Additional to the controls are the ON/OFF switch NOT MARKED but with a locking action, and a "Buddy Box" biased control switch with LED indicator (the necessary lead to the buddy box, and also the charger, are terminated in a five pin DIN socket situated on the bottom of the Tx).

By removing the back of the case the internals are revealed, the necessary eight, AA size Ni-cads are positioned very neatly in the plastic end cheeks, leaving the bottom of the case free to hold the PC board, which is T shaped and utilise the double sided technique. The board is fitted, somewhat unusually, component side out, and at first glance would appear to have all the com-

Cotswold Controls UHF

ponents soldered to a solid sheet of tinned copper. However, closer examination reveals that the copper is etched away where the component leads go through the PC board and the circuits lands are on the inside.

This solid copper plate acts as a "ground plane," and is a very real part of the technique used at these high frequencies. The whole PC board is removable by detaching the soldered co-axial aerial lead and removing the plugs and sockets fitted to the top of the board.

To get down to details, the encoder utilises a Cmos IC type CD4017 (Johnston Counter) and a 4528B both fitted into IC sockets. Only one timing capacitor is used, which is switched round the seven channels of the IC. Final adjustments of the timing are made possible by two high quality pre-set potentiometers.

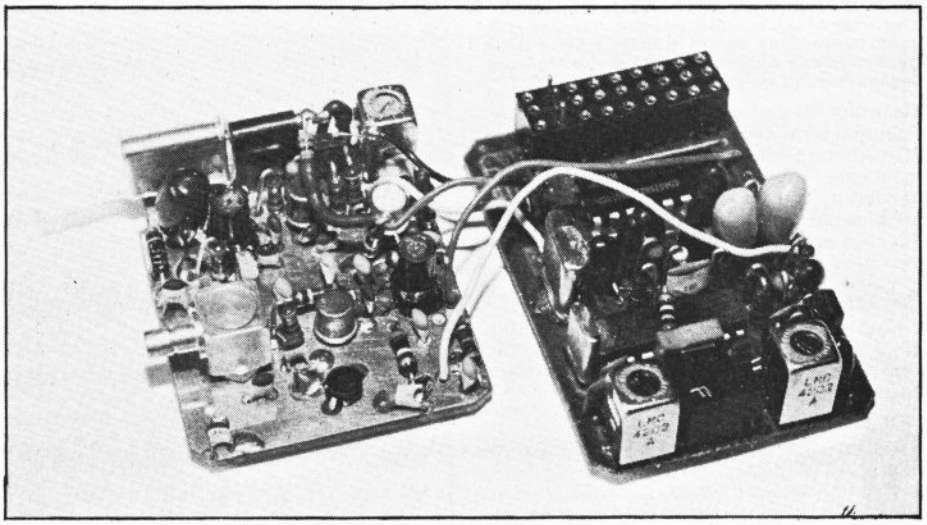
The output of the encoder system is used to frequency modulate the RF section, comprising a 76.5 Mhz crystal oscillator, which is fed into a tripler (230 Mhz) circuit, followed by a doubler circuit, which produces the required 459 Mhz.

The oscillator circuit utilises conventional and capacitor techniques, but the output stages use striplines which make the system especially good. Those readers having a working knowledge of RF, can liken the stripline to the old Lecher Line techniques. The advantage of the stripline is that the PC lands become the effective "coils" in the system, the ground plane minimises the effect of radiation because it "contains" the field of the coil, the whole system working out into a very efficient and relatively cheap unit to manufacture, which is also repeatable. A further stripline is used to connect the RF meter into circuit so that it only indicated the 459 Mhz output. The stub aerial is connected partway down the second stripline and is of the familiar stub coil type. Very impressive circuitry, designed by someone who knows what he is doing.

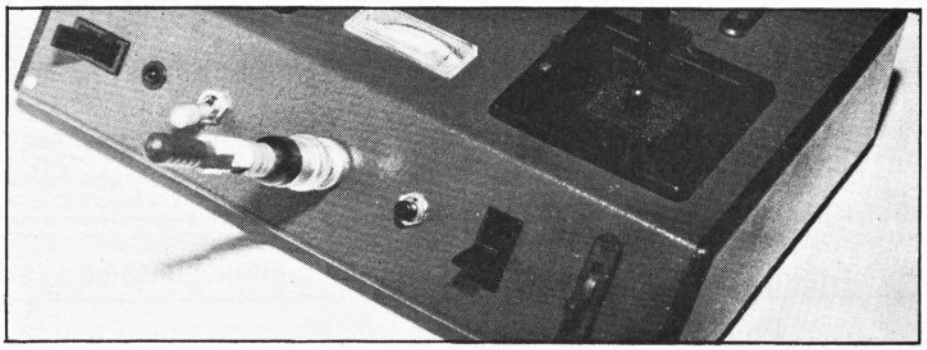
Receiver

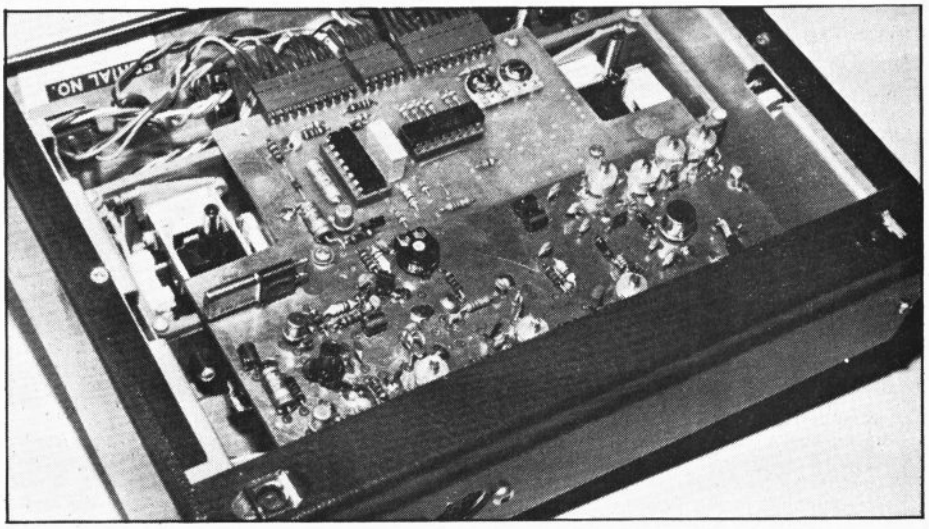
This is probably the most difficult part of the UHF designer's problem — how to contain what has to be accurate mechanical/electronic techniques and make it perform at the UHF frequencies. *The Cotswold* approach is of a sophisticated nature. Basically the crystal oscillator is a 74 Mhz 3rd overtone crystal working on its fifth harmonic! This gives a frequency of Ω 370 Mhz utilising the 85 "odd" Mhz difference in received signal to crystal oscillator frequency. The first IF runs at approx 85 Mhz. The 85 Mhz IF is then mixed with the basic 74 Mhz, to give an output at 10.7 Mhz. Here we now have a double conversion, which will certainly get rid of any image problems one may have at 400 Mhz. Not content with this, the 10.7 Mhz IF is also fitted with a crystal filter to contain its bandwidth. A third and final conversion is then done by another crystal oscillator to give an output at the familiar 455 Khz IF frequency. This output is further filtered with a narrow band modular filter unit — all very sophisticated but there is more. The unit is also fitted with automatic frequency control so that the output of this last IF is used to "trim" the crystal oscillator to exactly the correct frequency to mix with the incoming frequency, so the Rx in fact "tracks" the Tx rather like the expensive FM tuners do. Further refinement is a type of AGC so that adjacent channels do not swamp the front end of the Rx. All very sophisticated and obviously very carefully thought out.

With this amount of RF circuitry it has been necessary to assemble the AF and decoder circuits on to a second board, which does

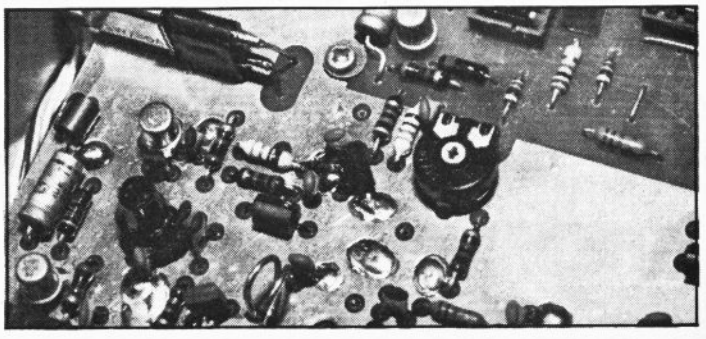


Above: double deck receiver denuded of case. Even in the micro-chip age a lot of components are required to operate at UHF frequencies. Below: top edge of Tx; controls are (left to right): proportional auxilliary, retract switch, battery state test button, on-off switch, Buddy Box warning light and Buddy Box switch.

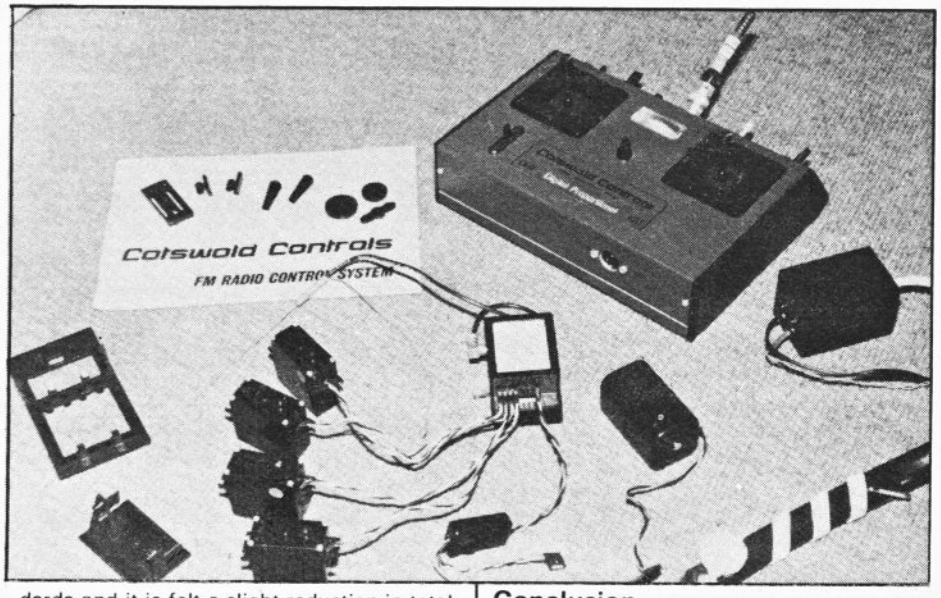




Above and right: transmitter PC board revealed; although removal of case back does allow easy access to adjustments, crystal changes should not be too frequent, so possibility of unintentional 'adjustment' is slight.



Cotswold Controls UHF



Right: the complete outfit includes a comprehensive array of servo output devices, rotary to rack servo conversions, switch mounting, servo trays neck strap etc. Transmitter and receiver combos without servos are available from £233.00

make the RX just a little bulkier than some.

Output termination is via a connector (60× 40× 30mm) block, built as an extension to the main case. The manufacturers' label is used to identify the various functions, the UHF aerial is passed through a hole in the side of the case and the crystal is also accessible in the same manner.

Battery pack

Nothing special here — the usual 4.8v 500 mAH AA size Ni-cads housed in a purpose made plastic moulded box complete with harness and ON/OFF switch.

Servos

These were fully described in our Servo Report RCM&E May 1978. However, a brief description is worthwhile. The SRC 1 servo mechanics, wholly designed and produced by *Skyleader,* also uses an IC servo amplifier commissioned by the same company and manufactured by *Ferranti.* One of the few purpose built IC outside the Japanese scene, the IC employs PNP transistors fitted as separate components in the output stages. In the *Cotswold* built amplifier they are of *Micro Electronics* origin. Our only comment on the servo set-up is that the servo amplifier PC, on some of the earlier servos, was attached rigidly to the servo motor. In the past we have seen this lead to trouble with broken joints.

On test the servo gave a very good stalled torque, but at the expense of rotational speed. The overall reduction ratio of approximately 250-1 is high by present day standards and it is felt a slight reduction in total torque by using a higher ratio would give a sharper response.

Performance

We found the system to be adequate in range and the general performance characteristics good. Leaving the Rx switched on with the Tx off did not cause the servos to drive to one end as do some systems, but we would stress that this is only recorded as a test condition, one should always switch the Tx on first and then the Rx.

Conclusion

A sound piece of equipment, well designed on sound theoretical know-how. We would like to see a modification to make it possible to change the Tx crystal *without* opening the case back and exposing all those components, or just turn round the PC board.

We also feel the presentation could be improved to make it more eye catching. Certainly a *good* contender for the "Buy British Campaign." We would endorse the manufacturers' comments "Built to a specification not a price."

Price £330 including 4 servos from Cotswold Controls, Bowbridge, Stroud, Glos., GL5 2NN.

Test results

Transmitter timings

Tx All pulses + VE going

Channel No.	Function	Short	Centre		Long	
1	Rudder	1.0	1.55		2.05	Trim range
2	Eng.	1.0	—		2.0	± 15 Msecs
3	Elev.	1.0	1.55		2.0	
4	Ail	1.04	1.55		2.0	
Aux 1	Linear	1.00	—		2.05	
2	Linear	1.05	—		2.00	
3	Switch	1.15	—	1.85		

Servo performance

Frame time 21 M/S 50 frames/sec all sticks neutral.

Load Oz/ins	Speed in secs at ± 35° Against load	With load
0	.32	.34
2	.368	.33
4	.382	.33
8	.42	.315
16	.538 + .12*	.305

Just stalled load 29.5 oz ins.
Actual travel + 35°, - 40° Trim ± 10°
*At the 16 oz/ins load the amplifier was just going out of saturation. Up until this point the response was quite linear and positive.
Power supplies to the Tx are 9.6V 500 MAH AA size Ni-cad cells.
Normal frequency 458.5 Mhz — 459.5 Mhz 39 channels are available at Khz.
Manufacturers claim up to four hours on Tx after full charge.

Servo shown actual size