

Equipment Under Test:

- J R APEX 6H Computer,
- Transmitter :- NET-W126HZ
- Receiver :- NER-627XZ
- Servos :- NES-507

When PCM systems were introduced to the modelling public, the buyer was generally faced with a top-of-range radio, on which the PCM facility provided little more than the promise of a higher integrity data link and the possible advantage of a fail-safe system. Since most people weren't having much difficulty with their existing data link and didn't want a fail-safe anyway, it's not surprising that initial inroads into the market weren't as great as might have been hoped. Certain observers said at the time that using the microprocessor required to generate the PCM signal simply for that and possibly some test functions wasn't the way to go — a waste of processing power which could have been put to better use.

Multiplex took this view in Germany, using the power of the processor to mix with software and allow the Tx to be reconfigured to different modes of operation, using plug-in software modules and JR in Japan, with their Apex 8 computer system provide a very sophisticated, programmeable system. Both of these applications represent top-of-the-range systems still. It was only a matter of time before the corollary of using technology to provide increasing sophistication was to appear — using technology to make sophistication affordable. Of course, both the aforementioned systems actually did that anyway, but the degree of sophistication they provide mean that they are still expensive. With the Apex 6 system we have a six channel system that provides facilities that would have cost an arm and a leg a few years ago, at a very mid-range price.

One of the standard criticisms of any of the complex heli-radios is that they are complex to set-up and hard to understand. The designers of this set have clearly put a lot of thought into achieving "user-friendliness" — something often conspicuous by it's absence in computer driven equipment, user hostility being most often achieved! That this has to a very great degree, been most effectively achieved is very apparent after a few mi-

JR APEX 6 CH COMPUTER

In Depth Preview of a High Tech Helicopter Radio.

minutes familiarisation with the equipment. The production of a readable and lucid Owners Manual to go with the set plays no small part in this, but we are getting ahead of ourselves, so let's take a look at the hardware before switching it all on.

The Package

What you get is Transmitter, Receiver, servos, nicads, charger and the usual servo

mounting hardware and the aforementioned Owners Manual. The transmitter offers six channels and the receiver is actually a seven. The servos are the new NES 507s that supercede the familiar 505s. At first sight, the transmitter seems not to have enough controls to do what is claimed of it, possessing only a pitch trim knob over and above the usual two sticks and set of switches. However, the four unfamiliar push switches

on the front face give a clue as to what is in store.

Transmitter

The transmitter is of what may be described as conventional Japanese design. However, there are a number of subtleties in the physical layout. Although the normal box layout is there, there is hardly a flat face to it and these faces are nowhere quite at right angles to each other. The declared aim of this case design is to improve handling comfort and this must be regarded as very succesful if one is a thumbs-on-top flyer. If you, like me, are a finger and thumb type, the handling is still good and the neck strap holder is well positioned, but in common with the majority of far eastern designs, the stick could be a mounted a little nearer the top of the case for optimum comfort and the moulded hand-grips are a little obstrusive, effectively thickening the case unecessarily. Minor controls (are any controls minor?) fall easily to hand while not being prone to inadvertant

Transmitter is uncluttered — all the controls are visible here — the effect of the all-digital electronics.



operation by a careless heart beat. Anyone familiar with other far eastern radios will immediately feel at home with this one. The case is complex black plastic moulding with various metalised plastic inserts and "brushed aluminium" labels. The overall result is pleasing and the solid feel of the case is not at all "plasticky". A conveniently placed carrying handle is fitted, which also doubles as a fixed stand.

Two features set the unit apart from what you may have been used to. Firstly, there are two pairs of small rectangular push switches on the lower front panel and where you might expect to find a meter and there is a very clear Liquid Crystal Display (LCD). The four buttons and this display provide the operator with the ability to access and adjust the facilities offered. In what might be described as its "base" mode, this display indicated the modulation selected — PCM or FM — and gives a digital read out of the battery voltage. Probably the very best form of voltmeter you could wish for — even if it doesn't give any indication of transmitter output.

In order to programme a particular function, the desired feature is selected by operations of the two left hand buttons and modification of the parameter selected is made by operations of the right hand pair. Not surprisingly, the left hand pair are called SELECT while those on the right are ADJUST. While you are fooling around with the select buttons, the function being selected is displayed on the LCD, along with the value of the selected parameter. Thus you can keep your fingers off the ADJUST keys until you are sure you have set the right mode. A key to the acronyms used to indicate the functions are printed on the label, so it is not necessary to have the manual in one hand while driving. Are you confused or intimidated? Have no fear it really is amazingly simple to get the hang of, even if you are one of those, like me, who never did think computers are a good idea! Frankly, it is easier to set this kit up than the average digital watch. It will always be easier to set things with a rotary knob, but never as repeatedly or consistently.

The Manual contains a detailed description of all the steps required and a quick play



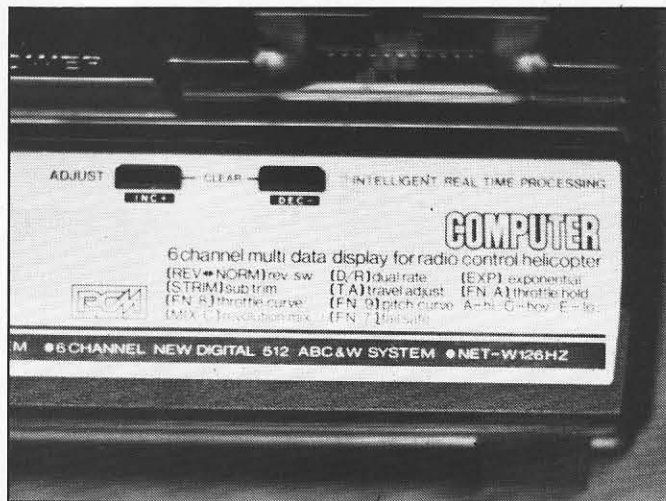
LCD display is here indicating that tail rotor mixing is set to 50% below the hover point (note stick position).

with the set switched on and you are in business. Fortunately, for the timorous the transmitter has "default" values set up, so will work right out of the box — you then work away from these settings as you want.

Incidentally, if you have trouble getting into system setting mode, press both SELECT keys and hold them down as you

ing contrast this, with taking the back off a set with analogue computing where one is often fearful that the back won't go back on afterwards! The programming switches and "Beeper" are soldered directly to this card and assembly and wiring is satisfactorily neat.

No need to take the manual out flying! All you need to remember is on this handy panel next to the adjusting buttons.



switch on — the manual is not clear on this point.

Transmitter Internals

Removing the rear of the case produces the initial reaction that they left the encoder out! However, there at the bottom of the case is a small card carrying the microprocessor and a little more than a handful of support components. An amaz-

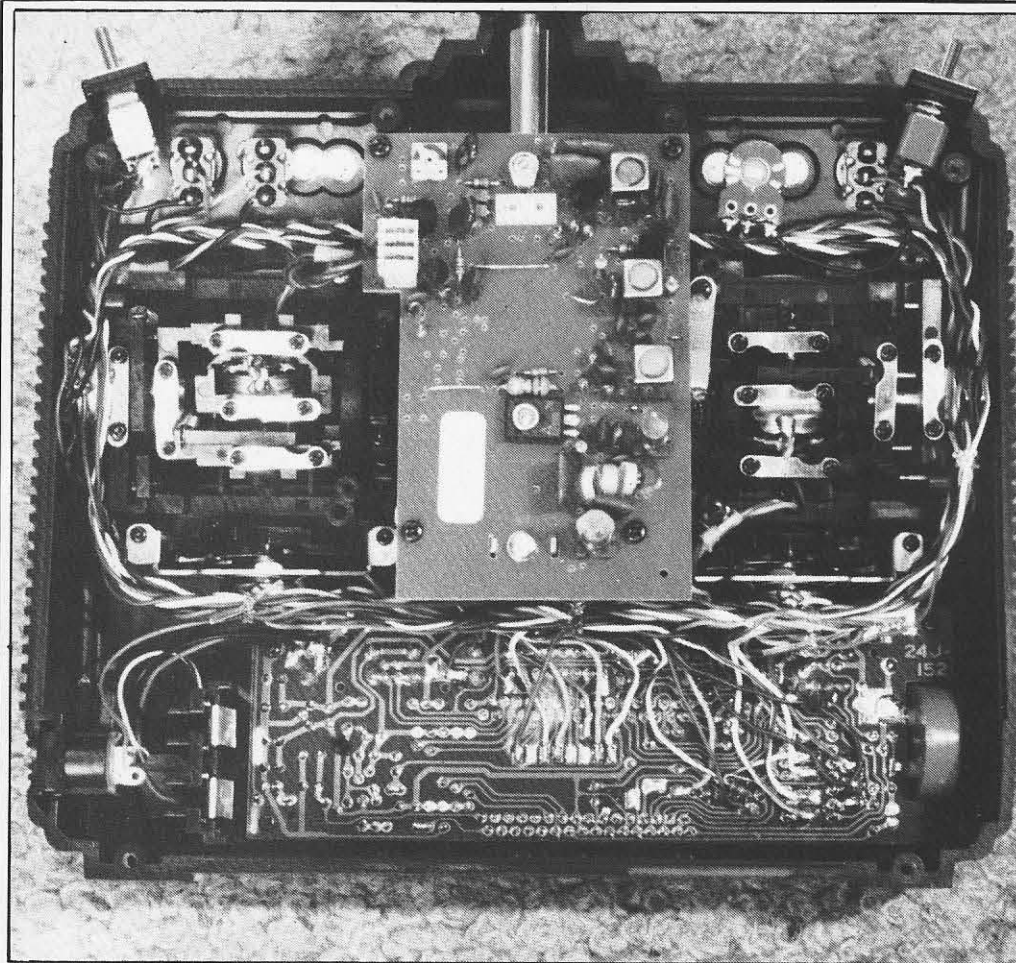
Receiver

The receiver is housed in the same size box as the other JR PCM receivers and the APEX 7. That is to say, it is small by any standards. The servos and power leads plug in at the end and very easy installation results.

Inside, an amazing packaging feat has been performed; no less than four printed circuit boards are used. One carries the receiver proper and one the micro processor. These two are joined to form a "U" shape with a board carrying all the connectors and some power supply components. Finally, there is a tiny board carrying what I believe to be the ABC & W system. This is suspended over one of the receiver integrated circuits by soldering it to the cases of the IF cans. That this lot isn't a mess is a tribute to the assemblers! In fact it is very well put together, although with evidence of a couple of "afterthoughts". Soldering is good and by the use of judiciously placed foam pads and the application of rubber adhesive in the appropriate places a pretty "bomb-proof" assembly has resulted. I wouldn't like to have to service one though! Unlike some previous generations of JR this receiver does not feature gold plated connectors.

Servos

The NES 507 servos are very similar to the older 505 types; in fact some of the mouldings are stamped "505". However, the use of a new motor has resulted in a considerable reduction in height, these servos



being now of about the same general size as the upmarket 4051s, etc. — making for a better “family” appearance. It is also claimed that the new motor has provided increased torque — certainly, they seem to have plenty available.

Cases are moulded from black plastic that appears to be fibre filled and have substantial lugs. Inside, gears are from a white material and the drive is commendably low on backlash. The feedback put is a large diameter item and is driven indirectly from the output gear. The amplifier uses the common Mitsubishi device with two output transistors and is tidily assembled, with wires and components supported by a liberal

Inside of the transmitter is almost as uncluttered as the exterior. RF module is central and the encoder is at the bottom. Wiring is kept away from anything that moves.

application of adhesive. The output gear is supported in a plain bearing and has a splined drive to the usual array of standard JR output arms. The plain bearing is removeable and presumably, a ball raced version of the servo will be available in due course, as the limitations of

The encoder with the micro processor in the centre. The four buttons correspond to these on the unit's face.

plastic engineering mean that some lateral play must be present in the plain bearing and far greater useful life will be achieved with the ball bearing.

Functional Testing

I'm going to divide this test into two parts, as the “System” aspects of this equipment are worth taking a long look at, so let's get the facts and figures out of the way first.

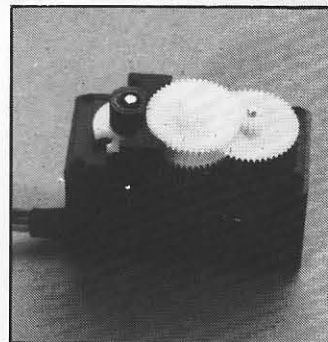
The transmitter consumed about 55 mAh with the crystal removed and somewhere between 150 and 220 mAh with the crystal in and the aerial extended. This is always a difficult measurement to make as the meter can upset the tuning and effect the measure-

ment. The manual claims around 2 hours operation per charge and I would imagine that this would be comfortably exceeded in practice. RF output was good and testing in FM mode worked any receiver tried. Channel centre is 1.5 mSecs and frame period 22 mSecs — very conventional. 8 channels are actually transmitted, but you have no control of two of them.

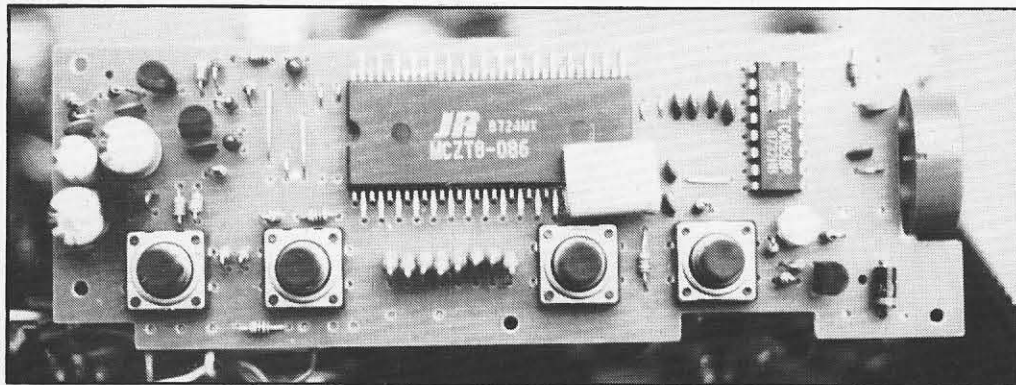
The receiver consumed around 35 mAh with one servo idling, rising to around 500 mAh with the servo stalled.

As a PCM system, pulses reach the servos at 22 mSec intervals, with this time increasing somewhat when the set is in fail safe mode.

The performance of the radio link is very good. It was not possible to read the identification on the devices used in the receiver properly, but the layout and some careful probing with a 'scope suggests that the trusted S042/S041 pair of integrated circuits have been used — the author's favourite way of designing a good receiver. The addition of the ABC & W system — suspected by the author to be a form of selected-signal driven, active, automatic gain control, applied to the very front end of the receiver, before any semiconductors —



Servo with output gear removed shows the 'indirect' link.



to an already good basic design seems to have produced very good performance in the presence of strong interfering signals and should provide good resistance to the dreaded third order intermodulation. The combination of a good IF filter and a coding system that seems to be pretty robust in the presence of interference-generated jitter, has given good adjacent channel performance too. In short, a very good communication link.

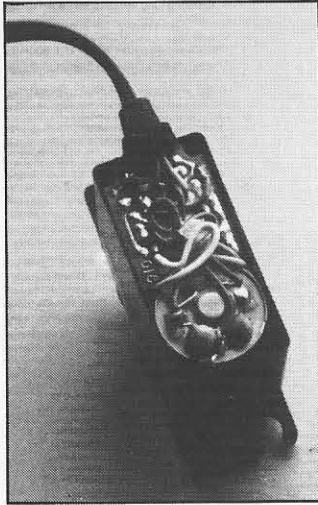
To hold and fail safe features work as advertised. It's only necessary to programme the desired fail safe positions into the transmitter once and then forget them, as the receiver is automatically updated. This set has the additional feature of being able to select the hold delay before the fail safe comes into effect.

In use, there is no detectable delay in servo response to stick movements and system resolution is very good — indistinguishable from an FM system I would say. To achieve the best results more upmarket servos could be used, as the 507s in common with most manufacturers' base model servos, do not offer as tight a dead band as their more expensive stable mates — the rest of the system is well up with the very best. I am not saying the servos are poor here — they are not, I am simply making the point that their resolution sets a limit on the system, not the performance of the PCM coding and better servos would not be wasted on the set by the man who wants to get that bit extra out of it.

System Facilities

Take a deep breath here, there are a lot of goodies to be gone through. This set has had a lot of ideas crammed into it, the use of some of which may not, at first sight, be obvious. At this point in time, I haven't used all the features myself! In order to understand what you get I'm going to describe some of the features in detail.

Firstly, let's take a look at



Servo amplifier is well supported by adhesive against the ravages of vibration.

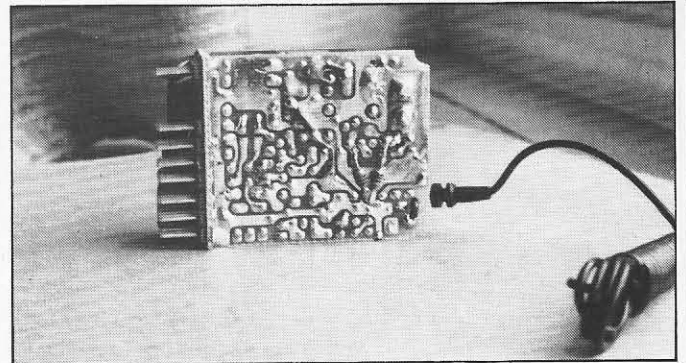
what you can do with the elevator channel, as an example. Apart from the normal trim control, there is a digitally-set "sub-trim" which allows the servo neutral to be offset — one of the facilities that I'm not using, but because you have a digital read out of what you have set, someone will find this useful. As supplied, full throw is a nominal 100%, which corresponds to a normal sort of servo movement. Use of the end point adjust allows this to be set anywhere between 0 and 160%, with up and down being set independently.

Moving on to the rate switch, high and low may be set individually, digitally, with

The airborne pack is handily compact.

direct read out of the set-up. Additionally, a wide range of exponential can be selected in either or both rates, with different values in each. Of course, if you set up 160% throw, two things have to be borne in mind. Firstly the servo is throwing a long way so the output movement is becoming non linear and the trims cannot make the channel go beyond 160%, so movement limits if you try up plus up trim, say. The latter is not a disadvantage as far as I can see and the former can be overcome by intelligent use of the exponential facility. Of course, you could get some funny results with all this lot, but all the facilities may be

Underside of receiver RF board shows a couple of 'after-thought' components but these are well secured.



cleared or reset to nominal by a single action; so go ahead and play until you understand it all.

Having grasped that lot, let's move on to the throttle and pitch set-up. Here one is pro-

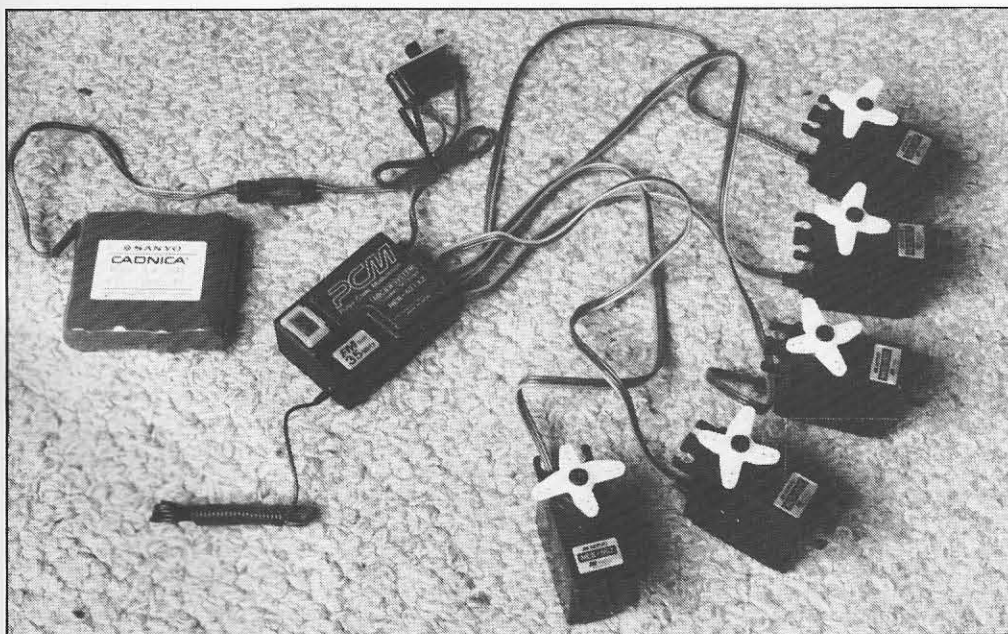
vided with what amounts to three pitch curves. Normal operation is set up by three points, Hi, hovering and Lo pitch. Once set, a second Lo may be set in idle-up and a third three point set-up is available in throttle hold. This last is especially useful for auto rotations, permitting not only an optimised pitch range, but also the ability — by setting a low "hovering" pitch — to soften the control during the all-important flare, when rpm will be high and control needs to be subtle. Two throttle curves are available, switched by the idle-up/low pitch switch. These have a common — adjustable — Hi and independent Lo and hovering settings. This arrangement is somewhat more convenient than the normal idle-up system. The throttle trim control on the stick effects only the low end of the servo travel and

its authority is progressively "washed-out" if high (idle-up) idle is set by the throttle curve selection — very subtle stuff!

Now for the anomaly — there is a rotary knob provided giving a conventional pitch trim, working over the whole pitch range. I just can't understand why this is fitted. I would have welcomed an analogue hovering pitch or throttle control, with limited authority, for fine, day to day, adjustment, but simple pitch trim seems a really odd choice. I know that the Apex computer has this facility too and I also know people that have disconnected it! I wouldn't go that far, but it doesn't seem in keeping with the high standard of the rest of this sets ergonomics.

In Use

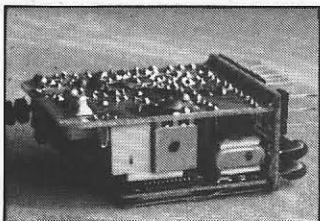
Having taken measurements and notes, the receiver was rapidly popped into the Av-antGarde and a few button pushing moments later, the transmitter was set-up to the





various controls. Flight trials were an anti-climax as everything worked perfectly and after a half dozen flights, the initial slight unfamiliarity of the case (I am used to more European styling) has just about worn off. The only real lesson so far is that the hold switch is not ideally placed. I would like to see it with a longer toggle and moved to replace the elevator rate switch, which could, in turn, be combined with the aileron switch, forming a combined cyclic rate switch. That would make the control layout just about perfect — at least for me! When

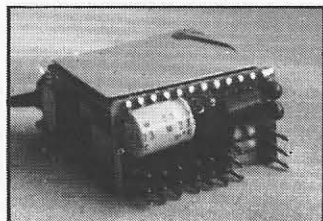
The receiver is a very well filled little box! One edge of the micro-processor is just visible in this shot.



setting up the model, you select the feature you want to adjust — hovering throttle, for example — and then play with the two keys until you are satisfied. You then move onto the next adjustment and so on — all very logical.

In order to make for a further test of the whole system, it has now been installed in a new type Shuttle that I am reviewing for this magazine and is continuing to work well. Before I set the transmitter up for this model though, I took the precaution of noting all the setting that corresponded to the AvantGarde — remember that di-

Even the connector board on the receiver carries components. Absolutely no space is wasted.

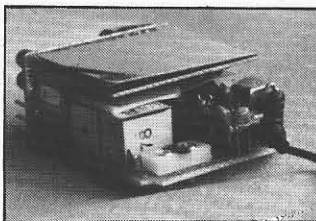


gital read-out? This way I can reconfigure the set for the AvantGarde in a few moments and be sure that I've done it right!

Conclusion

A very comprehensive piece of high tech radio in a very presentable package. The very cleverly thought out set-up system, in combination with the LCD display makes for a very user-friendly set. The ability to transmit standard FM means that existing equipment is not obsoleted — a facility that should never be omitted, man-

The receiver from the crystal end shows the ABC & W board nestling between the IF cans.



ufacturers! It may not appeal to the inveterate knob-twiddler, but if you set up with patience, then fly rather than fiddle — this could be the one for you. The depth of setting up available means that an analogue set-up would have been very dedicated to a particular model, but the digital read out means that with the aid of a note book, set-ups can be recorded — I wouldn't like to do this too often though! There are a couple of irritating features like the pitch trim and the lack of charging lead at the flight pack, but these are pretty minor nig-gles and the whole thing is such superb value for money. The range of facilities mean that this set is the natural successor to what were much more expensive units.

Thumbs up; user friendly, excellent Owners Manual, miniature receiver, PCM/PPM facility, superb range of features, superb value for money.

Must try harder; no charging lead on flight pack, odd choice of analogue pitch trim, hold switch could be improved.