

A Tale of 2-X-Cells

Overview

Way back in June of 1994 I did a kit review of the *Miniature Aircraft* 'XI-pro' for 'Model Helicopter World'. I was (and still am) very impressed with the machine and looked forward to trying a series of up-dates that were promised, including the well-known twin tail rotor. Since then, the design has gone on to win the world championships in the capable hands of Cliff Hiatt. Many modifications are now available but, to date, the only one fitted to the review machine is the latest double tailboom brace, which was supplied to me by Dave Wilshere.

The machine is otherwise totally as originally built and has consumed some eight gallons of fuel and performed 1100 autos. In that time, it has been completely trouble-free apart from some minor problems with the OS '61SX-H' which powers it. These are very hard to pin down and are not typical of some of the problems experienced by others. Many people are convinced that this motor has a carburation problem, but my own experiences do not confirm this. More anon.

In December 1995 I reviewed the current version of the standard 'X-Cell 60' for the same magazine. Once again, I was impressed and more or less kicked myself for not having sampled the delights of a MAS machine earlier. Here again, the machine is still in standard form, apart from the items noted below, and has managed to consume 4 gallons of fuel and perform 670 autos to date. The model is fitted with an elderly OS '61FSR-H' which has

One of the few up-upgrades on the standard 60 machine is this slipper clutch.



W3MH May 1997

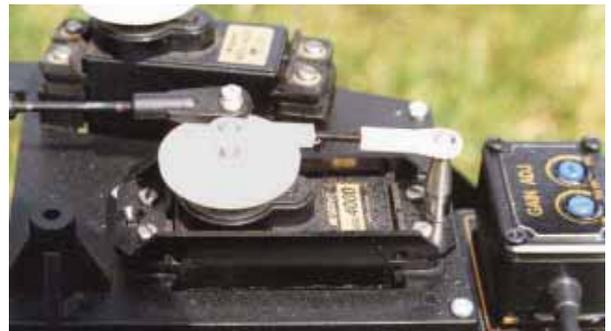
Dave Day

As far as I'm concerned, Dave Day is one of the best writers in the world today - read on and enjoy...

RATED

'adequate' power but which has suffered from a recurrent flame-out problem causing many 'real' autos - two of which resulted in some damage.

This model has two up-upgrades: a 'slipper' clutch and a JR servo arm support on the collective servo. The model has a beautiful clutch and it is a delight to perform autos with a stationary tail rotor. However, it's also frustrating because you can't steer it - hence the slipper clutch. The servo support was fitted because there was a very visible movement of the servo when the collective was operated, although there was no discernible effect in the air. There is



One other up-upgrade is this JR servo support on the collective linkage. Note the post for the MAS push/pull up-upgrade (Ed: Apologies for the poor quality of my photography)

an MAS up-upgrade which is aimed at this problem in the shape of a push/pull conversion. This is similar to the push/pull elevator up-upgrade which is dealt with anon. I also fitted NHP tail blades at a very early stage. The standard blades are very nice, but I just don't like plastic tail blades.

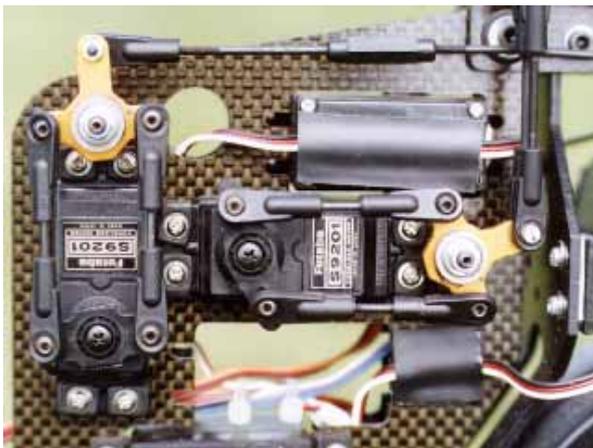
Thus I have two 'X-Cells' which encompass the earliest to latest designs, fitted with OS motors of

similar vintage to the models which give an interesting overview of helicopter and motor development of the last few years. Both machines are fitted with *JR* radio equipment using coreless servos (the 'X-Cell 60' now has an 'NES-4000 Super Servo' on the collective channel) and are controlled by an early 'PCM 10' transmitter. The 'Pro' has a *JMW* gyro which is probably the best of the conventional gyros, while the '60' has had a succession of types and currently uses a *Hitec* unit.

One purpose of this article is to give some indication of how both models have fared since the reviews and to give *MAS* some return for their investment. However, there are also some interesting lessons to be learned from the similarities in my experiences with these two machines. To this end, I propose to cover individual subjects and relate them to both machines rather than deal with each machine in turn. Hence the title of this article.

Mechanics and Control Systems

As noted, these are completely standard and have been trouble free. A point which many owners of these machines comment on is the plastic joiner in the tail rotor linkage. Despite the experience of others these have been completely reliable (clutches large piece of wood and crosses all fingers and toes). It is essential that the threaded portion of the rod is screwed right into the coupling and it may be necessary to shorten the thread to achieve this. *MAS* policy here appears to be to have one long pushrod which is common to all machines and



LH side of the 'Pro', showing the push/pull linkages on the rudder and collective servos. Note the double link from the collective bellcrank up to the rocker. You can also see the second coupler on the rudder linkage and note that I don't take my own advice regarding all of the thread being inside the coupler. The model has some three years flying on it, yet the 'Superglo 16' has only produced light staining of the nitro pipe.

a variety of shorter rods to match each individual model. Having shortened the thread to fit inside the coupler, you may find that the finished pushrod is marginal on length with the ball-links barely hanging on to the end. This probably means that you have the wrong shorter rod!

When I needed a new tail pushrod for the 'Pro' I was unable to obtain the correct short rod and resorted to adding another coupling at the front of the machine. Thus, I had a three piece rod with two couplers. It is still in use. One thing that is not mentioned in the manuals but which I think is important is that you should have a pushrod guide located as close as possible to the coupler. The idea here is to reduce the amount of movement which can occur in this area. It is worth pointing out that the pushrods on both machines 'buzz' when the motor is idling, but I've stopped worrying about it.

Another area which has attracted comment is the elevator arm on the standard '60' machine and you can now obtain a very nice, and expensive, up-date for this. This particular item has been in use for a very long time and I don't believe that anyone has ever experienced a failure. If you look at what it is doing it serves merely as a guide and is not a structural member in any way. It rotates perhaps 5 degrees and the use of ballraces at the pivot would be totally unnecessary.

A major difference between the two machines is that the 'Pro' has push/pull linkages on all of the flying controls (not throttle). This is also available as an up-grade for the '60'. I must admit to being somewhat surprised when I first saw the 'Pro' linkages because the push/pull arrangement used seemed to be of doubtful merit. Take the elevator (sorry, fore/aft cyclic) linkage as an example. There is a push/pull linkage from the servo to a bellcrank and a push/pull linkage from another bellcrank to the swashplate. However, the two bellcranks are linked by a single pushrod.



Similarly, there is a push/pull linkage from the tail servo to a bellcrank and then a single pushrod all the way to the tail. Finally, the collective servo has a push/pull linkage to a bellcrank and a single pushrod (actually, it's doubled up with two parallel rods) to the seesaw which moves the swashplate up and down by moving the second bellcrank in the elevator linkage. Before you ask about the lateral cyclic, this has a push/pull linkage from a rocking servo.

I come from an engineering background and a little voice was asking me the point of having all this complication when, ultimately, there was still only one pushrod. Let's leave the tail linkage out of this straightaway. I have yet to see any machine with two pushrods going all the way to the tail and I doubt if I ever will. The doubled up pushrods in the collective linkage are a good idea as they allow you adjust out any slop and give a belt and braces (suspenders to our US readers) approach. This actually leaves us with that single link in the elevator linkage which still makes me a little nervous.

Is there a point to all of this, you ask. Yes, several. The double linkage from the servo to an 'idler' bellcrank serves the function of taking the strain of a high offset load away from the servo output and reduces wear and slop. It also allows you to adjust out any slop that appears. This applies to all functions (it could also be used to justify a push/pull throttle linkage). A double linkage from the swashplate to a bellcrank, or servo, serves the same purpose.

Now, look at it from another direction. The arrangement of the control system on any machine is a compromise. Obviously, you want the shortest and most direct linkages that you can achieve, but this is not always possible. Assuming that other matters lead to you having a linkage which has three different links from the servo to the control, with two bellcranks in between, then it must be better if just one of them is push/pull. If you can do it with another one, well, two out of three ain't bad.

The linkage from the elevator servo to the idler bellcrank takes an interesting form. The bellcrank has a high degree of offset (er, the two arms are bent away from the servo - better?). The instructions are quite clear that there should be no offset at the servo output to match this. That engineer inside me insisted that this didn't look right. Study of photographs of other peoples models showed that they agreed and most do seem to add some offset

at the servo wheel. I did it to the manual and then tried an experiment. Pop off one linkage and then move the servo to it's extreme. Will the linkage go back on without any problems? Yes! Move it to the other extreme. Same result. Sorry, Mr Engineer, MAS are right.



RH side of the 'Pro'. Note that the elevator push/pull linkage has no offset at the servo arm - as per the instructions. Those protruding screws on the rocking servo mounts do offend me but that's the way they tell you to do it. Note the 'Uni-ball' starter cup, which I like.

Incidentally, the push/pull elevator up-grade available for the '60' uses what appears to be the same crank and the same will apply. With this fitted, the servo has two links to the idler crank and then a single linkage to the original crank below the swashplate. I must admit that, at first sight, I really didn't see the point of replacing a single link with a push/pull linkage AND a single link! However, my experience with the collective linkage provided the explanation. As described above, the collective servo could be seen to be moving on its mount due to the forces involved and a smaller movement is also visible on the elevator servo. Providing a push/pull linkage to an idler bellcrank removes the side load from the servo and stops this movement. Therefore, it MUST be better. Remind me to sack that engineer.

Since building the 'Pro', MAS have produced an ingenious alignment gauge for the tail rotor drive from the main gear. This is so simple that all machines should have one. It consists of a 'T' shaped piece of metal which is attached via the two screws which hold the tail drive take-off in place. It enables you to easily see whether the bevel gear which drives the tail is aligned square to the main gear. Unfortunately, they are so popular that they



are as rare as hen's teeth and I still haven't managed to obtain any.

Silencers

You may feel that this is one of the less important items, but read on.

Until very recently, I was a firm supporter of castor oil. In fact, I still am for all other forms of modelling but not for helis. I can recite a long history of motors that gradually lose power, only to be rejuvenated by a new (or cleaned out) silencer. The sum total of this experience is that any silencer which actually does its job will have some small



holes in it somewhere and these holes will become blocked if you use castor oil.

So, what to use on the 'X-Cells? When I built the 'Pro' I was advised by Ted Schoonard to use the MAS 'Nitro Pipe' and he kindly supplied an example to use. This has proved entirely satisfactory, but an early experience of trying to use it with low nitro fuel on the OS '61SX-H' convinced me that it did not help if the plug you were using was too cold.



That sounds cryptic even to me, so let's try again. Our glow-plug motors rely on a catalytic action between the fuel and the material of the glow-plug element to 'keep the fire going'. This process is aided by the heat of combustion. This means that

we have a delicate balance between engine heat, fuel, plug heat range and silencer back pressure. Any one of these can change the equation, but the process is generally fairly non-critical unless one of the variables mentioned is way out.

This means that if you take an 'SX' (designed to run on nitro), run it on a mere 5% nitro and use a silencer with low back pressure, the plug becomes important. One lesson that I learned from this is that *Enya* 'No.3' plugs are hotter than OS 'No.8'. They are **not** the same.

So, the 'Pro' got badly broken very early in it's life when the fire went out in the motor. The solution was very simple - run it on 16% nitro. Let's point out here that the motor started, ran, idled and picked up perfectly when running on 5%. It just stopped when running rich at full throttle! It has never happened since.

I was very amused recently to see an article by a flyer who had modified his 'SX' to run on straight fuel. What on earth did he buy an 'SX' for in the first place? And what did he do to achieve this? He modified the carburettor! If you want to run your motor car on different fuel you are normally advised to fiddle with the ignition, not the carburettor.

Being happy with this arrangement on the 'Pro' despite the early setback, I was happy

to use the same set up on the standard '60'. Guess what - it flamed out! It is very easy to become paranoid in this situation (what do you mean - **become**?) so I set about solving the problem - or, at least, trying to. First of all, the motor in this case (an elderly 'SFR-H' remember) had done a lot of flying in another model and simply did not have this problem. The first and obvious thing was to try the silencer which had been in use previously. It seemed to work, but only long enough to lull me into a sense of false security before doing it again.



Relearning (it's amazing how often we relearn things) the original lesson showed that an *Enya* plug was better than an *OS* one in that the motor would actually recover if you backed off the throttle quickly enough. However, it was now clear that I had some kind of tank problem and the 'flame-out' was simply a result of the basic problem and caused by a combination of plug, silencer and fuel. The obvious next step was to change from 5% to 16% fuel as on the 'Pro' but this motor is not happy on that brew.

There is an obvious conclusion here relating to the *MAS* 'Nitro Pipe'. Namely that they are of low

Hurry up Tony - they're heavy!

back pressure and really are suited to nitro operation. Depending on your motor and the fuel you are using, they can tend to be critical as to the glow-plug used. One problem that I have with them (it may be peculiar to this user) is that I cannot hear what the motor is doing. There have been situations where the motor is clearly not right, yet I really cannot decide whether it is rich or lean. This does not happen with other silencers. The output pipes are short and straight (and fairly high) so they both need some kind of angled extension fitted to the

output pipe in order to stop the exhaust spray liberally coating the model. This obviously does not help when it comes to analysing the sound.

On both machines, the problem of supporting the rear of the silencer was dealt with by using a simple strap made from coat

hanger wire. I did receive an email from a well-known Australian flyer berating me for this as it is 'not in line with the X-Cell image'. Sorry mate, it tells you to use this method in the instructions!

Canopies

In this respect, the two models couldn't be much different. The 'Pro' has an epoxy glass canopy, while the standard 'X-Cell 60' has the well-known two-piece tinted plastic canopy.

First impression of the 'Pro' canopy is that it is very light, flexible and with a good finish. However, the moulding joint along the top and bottom





generally lets things down on most of the ones that I have seen and it requires a fair amount of work to produce a satisfactory surface. This is a shame because it otherwise needs very little work apart from fitting the window, which is retained by self-tapping screws. The actual shape is rather intriguing, because it has a nose, a mouth and two eyebrows. I keep telling Dave Wilshere that he should go all the way and paint a tiger face on it.

I have always admired the canopy on the standard 'X-Cell'. I was never really happy with my first attempt which was smashed in the flame-out incident described elsewhere. My second attempt was much better and my advice is to use the method advocated by Ray Hostetler, where the flanges on the two halves are trimmed to different widths and the adhesive is applied to the outside via the wider flange. MAS advise against using cyano and I feel that they are right and it probably makes the material go brittle after a while. However, I used thin 'Grip' as on my first effort and was happy with the result. Applying the glue to the outside ensures that there is no blushing of the material. Having used cyano to join the halves, I would strongly recommend that the reinforcing pieces and the canopy latch are attached with 'Stabilit Express'.

Rather than use pieces of fuel tubing on the stand off pillars, it is better to grease them and fill the recesses in the canopy with silicone rubber. This makes for a much snugger fit and reduces rattles. The rubber band under the canopy is probably unnecessary but I like to fit it anyway.

My second colour scheme used a reverse of the standard colour scheme with the well-known chevrons masked onto the white base coat before adding the colour. Removing the masking then leaves plain white chevrons. This might be called 'doing the standard scheme the difficult way'!

Motors and Tanks

I do not intend to get embroiled in the controversy surrounding the so-called carburation problem which is said to afflict the OS '61 SX-H', but I do have a problem which is difficult to pin down. I have read comments in the American press relating to this motor tending to have a problem after it has consumed around 5 gallons of fuel and that this is due to the rear bearing. I cannot confirm this, but things started to change at around the 5 gallon mark.

The motor would start, idle and run normally in the hover. When going to full power it would still be fine for a while. It would then start to show signs of distress in a full power climbout. Mainly, there was a change in the exhaust note and the performance would drop off. The natural assumption was that it had gone lean. However, opening the needle (up to 2 whole turns) made no real difference. The only thing that did help was to reduce the top end pitch setting. Eventually I found a setting on which the motor seemed happy, but it simply didn't go as well as it used to. The puzzle is that there are still occasions where I can start the model up and fly it and it will be simply awesome for a short time - obviously in need of more pitch! The only way that this matter can be resolved is to run the motor on a test stand which I intend to do as soon as we get some better weather.

Originally, I set up the tank pipework exactly as per the instructions, but I have since experimented with different venting arrangements and now use a



I tend to inform curious people that this is my own variation on the bubble separator/header tank theme. Actually, it's a Perry pump driven by crankcase pressure. The white heatshrink is to protect the pressure line from chaffing on the side frame. Note the use of one of those useful Kalt clamps on the input line. If the motor should stop rich before it is fully warmed up, this is the only way that you can restart it. The carburetor is the infamous OS '7H' which many regarded as impossible to set up.

system where the air vent goes to the bottom of the tank - a one-way-up uniflo system. The tank on the 'Pro' is enormous and there should be problems with head changes, but it really doesn't seem to matter.

Going over to the '60', the motor had always been reliable and totally impervious to tank set-up and violent manoeuvres. The model in which it had resided for some years met its end when it tumbled all the way down to the ground while a well disorientated pilot struggled to decide which way up it was - the motor never missed a beat!

So, put it in an 'X-Cell' and it keeps stopping. Actually, the first time it happened, it recovered after closing the throttle but reversed itself in the process. Picture one wildly pirouetting model with screaming motor heading for the ground at high speed with the blades clearly decelerating. I hit the hold and landed it, only to find that the now sweetly idling motor had reversed again and was quite willing to fly the model back to a bewildered owner. From that point on it refused to recover (I must have frightened it) and quit dead every time, until I replaced the OS plug with an Enya (I don't mean to labour the point).

This led to a whole series of experiments with vent and feed pipe location and even a brief flirtation with a header tank - that's when I actually broke it.



The cone start on the 'X-Cell 60' is perilously close to both the swashplate front link and the anti-rotation link. It has now been changed to a 'Uni-ball' type as on the 'Pro'.

Truth is the model landed out of sight so I can't really blame the header tank, but I'll never use one again - it's supposed to solve this problem. I did try the model with a *Super Tigre* '61H' for a while, but the problem persisted. Clearly, it's a tank problem but no amount of changing the set-up seems to

make any difference. Meanwhile, other similar machines don't have a problem.

The next thing was to fit a pump. I've had success in the past with *Perry* pumps fitted to *Heim*



machines, but these seemed to have disappeared. I did briefly try a second-hand *Robart* type, but this supplied so much fuel that the motor couldn't cope. However, *Pegasus Models* came to the rescue when I discovered that they still import the *Perry* type. Initially, this seemed to produce the same problem in that I could not stop the motor from running very rich. Persistence paid off in the end and I now have a setup which gives me a main needle setting of about three quarters of a turn open as opposed to one and a quarter turns without the pump.

The real point, however, is that I now have a motor which is running on the optimum needle setting rather than running on the rich side to reduce the problems of stopping. Perhaps I should point out that I am using the (in)famous OS '7H' which many people never did get on with. It does tend to go slightly rich on opening the throttle and lean when closing (it 'hangs' when you hit the hold switch). I remember an article by the great Ray Hostetler in which he pointed out that this carb does this without a pump, anyway.

Before someone asks, neither machine 'suffers' from tank foaming (if you couldn't see it you wouldn't worry about it anyway). However, the 'Pro' does have a period around the half empty point where you can see something that looks like a miniature whirlwind going from the klunk weight up to the surface of the fuel. I thought about changing the length of the klunk pipe, or maybe the weight of the klunk, to see if it would alter the point at which this occurs but I still haven't got around to it.

Both machines have top starts and require a starter extension. The 'Pro' has the standard 'uni-ball' adapter which is supplied in the kit. This works so well that I have considered fitting all my machines with them. The actual starter extension is fitted with a delrin ball with a metal pin. This fits into the

standard MAS starter extension and most others and is retained by a small screw.. This means that you either need a special extension for one model, or you have to keep removing and refitting the ball - hence the temptation to make it standard.

The '60' has a standard cone start and, while it works well enough, it is very close to the front swashplate linkage and the swashplate anti rotation linkage. For years I have made do with a starter extension which was fitted into the rubber cup on the starter, but this machine finally convinced me that I need a dedicated starter/extension set-up with the extension permanently attached. For various reasons this now meant that I needed two starters but, having done it, I now wonder how I ever managed before.

Repairability

A good one this. The 'Pro' was very badly dinged at a very early stage of its existence. It hit with a lot of forward speed and did a forward somersault. Curiously, the main blades survived, although they needed recovering, but it destroyed the boom, plus one pitch mixing arm and one undercarriage skid, yet the mainshaft, maingear and feathering spindle were undamaged (now you know why it has a three piece tail pushrod). Fortunately it was being flown without the canopy at the time. The parts were all easily obtained (except that pushrod) and the repair took little time. No problems were experienced with alignment and the set-up was virtually unaffected. One helpful aspect here was that it is possible to split the upper and lower sideframe assemblies without affecting the clutch/motor alignment. There is a lot of work in putting a 'Pro' together and it was refreshing to find that a major repair was so simple.

The out-of-sight auto with the '60' destroyed the blades and bent the boom down at a considerable angle. It also damaged one skid and one mixing

arm. Again, the mainshaft, maingear and feathering spindle were undamaged and the repair was straightforward and left the set-up undisturbed. One casualty was the front of the plastic servo tray which had the battery attached to it. I could not obtain a replacement for this and had to repair the original by 'splicing' it with some thick plasticard. I note that the gas powered version of the same machine has a metal brace for the front of the tray. Perhaps they hit harder! The real disappointment was that the canopy was smashed and I had to assemble and paint another.



White-haired old gentleman wonders what this piece of wire is for.

Metal machines have the reputation of being difficult to repair and I may have been fortunate here, but it was a pleasant surprise.

Gyros

The 'Pro' was fitted from the outset with a dual gain JMW, little known in this country but generally accepted as one of the best conventional (that means with a motor and flywheels) gyros around. I did find it necessary to slightly reduce the mechanical advantage to the tail rotor by going out one hole on the tail bellcrank. I also reduced the size of the tailrotor to 10 inches diameter as recommended by Curtis Youngblood and others. To get an acceptable yaw rate for 540 degree stall turns I used a free mixer to switch the gyro to low gain when full tail control was applied. The result was a quite violent degree of rotation with an abrupt stop when the stick was released. So abrupt, in fact, that the model gives a couple of very rapid tail wags before settling down. The mixer is switched on by

the idle-up switch and it is possible to produce lightning pirouettes in autorotation, by accident, when hitting the hold while in idle-up.



How to convert a three box gyro into a single box type. Why didn't Hitec do it this way in the first place?

The '60' started out with a



Look closely and you can see the notch in the mixer link which is needed to clear the swashplate when full cyclic is applied.

Quest 'Custom' gyro and I was quite happy with this except that I could hear the tail going 'wah-wah-wah' during circuits. There was no visible oscillation. I then fitted a Morley 'Competitor' gyro which has given years of faithful service in a 'Magic'. I was never really happy with this so it went back into the 'Magic' and still works fine.

I tried another Quest which didn't produce noises but didn't work as well, either. I then fitted a Futaba



The 'X-Cell 60' has this pitch gauge included in the decals. If fitted correctly it is quite accurate.

piezo unit, which succeeded in stripping the tail drive on the main gear. To be fair, I was warned by Ripmax that this might happen. Fortunately, the main gear on an 'X-Cell' is double-sided and it was only necessary to turn the gear over. That's four different gyros and I was beginning to get paranoid again.

In desperation, I tried the cheapest alternative and fitted a Hitec unit. This works well, but I would like a little more gain for the hovering manoeuvres. I use the same set-up as the 'Pro' with the gain being

switched to low on full tail control and a 10 inch diameter tail. The result is better 540's with a smooth rotation and a dead stop.

The Hitec unit is of the familiar three box arrangement. I have never understood the logic of this, particularly when the boxes are interconnected by miles of cable. Having decided that the only logical location was with everything up at the front of the machine and that the unit worked satisfactorily, I proceeded to void the guarantee by drastically shortening the wiring. The boxes were then stacked together using servo tape. This results in a single unit which is almost as good as a single box unit, but nowhere near as compact. Why they don't make it that way in the first place is one of the mysteries of the Orient.

Blades

The 'Pro' is still using the kit blades which are a bi-convex section at 68 cm length and weighing 217 gm each. This is probably a little on the heavy side for ultimate performance, but the autos are nice. If you come down fairly rapidly you can have at least three bites of the cherry at the bottom.

The kit blades on the '60' are symmetrical section at 66 cm long and the original set weighed 185 gm which I feel is just about right. If you have been paying attention you will have noted that I broke those. They were replaced by another set which should have been identical but came out at 220 gm. This was clearly too heavy, both from a performance point of view and for the elderly motor. I have since fitted a set of NHP 'Sport II' blades which weigh 185 gm. These are fine from most accounts but don't have quite the same auto performance as the original kit blades at around the same weight.



Set-up

The instructions are quite specific about the manner in which the cyclic controls are set up. You are instructed to set both the lateral and the fore/aft



control to give 6 degrees of movement, each way, on the main blades. If you do this and then apply both controls together you will find that the links that go from the swashplate to the mixing arms foul the outer ring of the swashplate. This is not disastrous, however, and the main result is that a small bite is taken out of the mixing arms when you first fly the model. Most authorities simply advise you to clean this up with a scalpel blade.

Actually, I found that this gave rather too much cyclic movement for my taste anyway and used the throw adjustment on my transmitter to reduce this to a comfortable level. This applies to both machines, incidentally.

On the 'Pro', the bell/hiller mixing ratio is adjustable via a series of holes in the blade holder mixing arms which give 3 possible ratios. I set it at 50/50 to start with and have not got around to changing it yet. By reversing the arms you actually have a total of 5 possible variations. On the '60' you can change this ratio by changing the offset of the metal balls attached to the arms. In standard form these are both the same length giving a 50/50 set-up again. I'm not sure how many different lengths are available so I don't know just how many possible variations there are. Using one long and one short ball will give two more possible ratios by reversing the arms.

The 'Pro' uses the common two-speed set-up and runs at about 1300 rpm in the hover and 1700 rpm in forward flight. I didn't consciously set things up that way, I followed the guidelines in the manual and it turned out that way. At Sandown in 1996 I checked Cliff Hiatt's 'Pro' with a tach and found that he was using 1400 rpm in the hover and 1900 rpm in aerobatics (this with a YS 61 two-stroke). The change in speed produces a marked difference in character and the leisurely hovering machine

becomes very lively.

Once again, on the '60' I followed the book and the result is a model that runs at very near to a constant speed throughout (at about 1600 rpm). I must confess that I would like a little more forward speed but this is not available with the motor used. This machine has a pitch gauge decal which is surprisingly accurate if carefully applied.

Flying

Both machines have a solid feel which I really like. Despite the much-plugged advantages of the push-pull linkages on the 'Pro', I really think that it would take a far better flyer than me to notice the difference and, in fact, I slightly prefer the standard machine. I have heard all sorts of tales about X-Cells vibrating badly and all sorts of stories about sideframes cracking, etc., but I can only assume that the owners are less than exact in their balancing methods.

At an early stage with the standard machine, I did note that the horizontal tail was vibrating at the tips. I rechecked the tail rotor balance and found that there was a slight error. Adding a 3/16 inch (5mm) wide piece of tape around the tip of one blade removed the vibration and it did not return until we went out to take the photos for this article. Lo and behold, the vibration returned and is visible in one of the photos. On returning home, I checked and found that some of the additional tape had been rubbed off by long grass at the field!

It's worth pointing out here that X-Cells have a very neat built-in tail balancer. All you do is remove the complete tail rotor output shaft from the model and balance the **complete** unit by holding the ballrace which is more or less central on the shaft. If you do it when you build the model, you don't even get your hands greasy!



In its original form (when the 'SX' was still awesome) the 'pro' was a little squirrely in forward flight and had a slight tendency to 'tuck' in autos. You could get into a situation at the bottom where the only way to get the nose up was to add collective. My conclusion was that the blades were a little too heavy for the paddles in use (in other words, a lack of flybar authority), so I added a pair of add-on flybar weights which effected a complete cure. The paddles on the 'Pro' can be made almost any weight that you like and I had settled on 35 gm. Incidentally, 'add-on' weights means those that you can fit without dismantling the flybar.

If you have read the various writings of one C Youngblood, you may note that he actually likes his machines set up like this and he says that he cannot enter a manoeuvre at full power because the machine is unstable at high forward speeds. Everyone to his own taste...

The '60' doesn't have these problems because there isn't an excess of power available anyway. Nonetheless, It is a delight to fly and I'm not sure that I want any more power (despite what I said above).

When it comes to writing about the flying of any model helicopter, the problem is that more depends on the pilot and/or the 'setter-upper' than on the helicopter itself, so any report is really meaningless. My own feelings are that I really like the way that both models fly and, while different, there is a

definite family resemblance.

Conclusions

It should be obvious by now that I like 'X-Cells'! I have built, or flown (did someone say, "and crashed"?), most of the other machines on the market and they all have their good and bad points. For my taste, the standard 'X-Cell 60' machine is probably the best all-round combination for an everyday helicopter. With all of the up-grades fitted, it is still probably as good as anything around as young Mr Youngblood has shown us. It was the 1993-4 world championship model after all - despite the design being around 10 years old.

In its fully up-dated form - the 'Custom Graphite' - there is probably very little to choose between the 'standard' (hardly an appropriate word at this point) model and the 'Pro', so you are really spoiled for choice.

If you think you need a 'Pro' - and it, too, now has numerous up-grades available - It should have just about anything that you could want.

Finally, someone must be asking about the choice of carbon versus metal. My own conclusion is that carbon is nice - but who needs it?

Purely for reasons of poverty, the 'Pro' is now up for sale. Interested parties can email me at dd@tubby.ftech.co.uk.

Dave Day

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W3MH May 1997

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