

**D**esigning and building a winning 1:10th Off-road racing car has, arguably, got to be the hardest arena of our sport to succeed in. Just think of the environment they have to operate in, tracks from Donnithorpe to the Moon, astro turf, clay, grass, mud, you name it. Consider the stress's and strains these 3 pound monsters take landing from a table top at say 25 mph. Just keeping the wheels in contact with the ground has to be a major achievement, and the speed they seem to produce is simply breath taking. Well here in the UK Tenth Technology do seem to have found the secret, in recent years they have been almost totally dominant at the top of the BRCA National 4WD off-road championship, using the driving talents of Kevin Moore and latterly, William Mitcham. Evolving a very high tech racing machine along the way, in fact the Predator is a totally unique car, very much a 'wolf in sheep's clothing'. In '97 Predator ran a very much updated car to win the UK national championship, and to celebrate their victory they have released the Mitcham XK98 which is almost a total replica of William's winning car. With thanks to TTech this is the car RRCi have to review.

## Changes, what changes?

What's Changed? Well quite a lot on fact, the basic layout of the '98 is still the same as all the previous Pred's, the moulded tub chassis, long slender double wishbone inboard sprung suspension, motor position, transmission, aerodynamics etc. But there are also some very major changes. The obvious change being the shift to a front mounted saddle pack rickad-cad layout. This for me was quite a surprise, I always felt that TTech had got the weight distribution correct with their in-line 'side saddle' layout, this being born out by the latest Cat and Yokomo MX4 models. But TTech felt this gave far too stable a car, the new XK98 set-up does give a lot more 'steering', it will traverse the ruts better, and is much improved over the jumps, a comment that was doing the rounds at last years World Championships in the USA.. Most of the other changes to the XK98 also live within the confines of the chassis. At the front four degrees of 'Pro-squat' is now built in, very much an American concept. This means the rear inboard pick-up of the lower wishbone is positioned higher than the front pick-up. This has several effects. Under power the front of the chassis will now be forced down, this will give more traction in the middle of a corner as power is applied and thus more steering. Also the car will be far more stable over any really

rutted tracks. Next the motor is mounted lower in the chassis, got to be better hasn't it, well as we all understand about the 'polar moment of inertia' don't we? (not). Now we come to the rear, TTech have made the move to in-board toe-in, so now the bottom wishbone angles forward, which gives a slightly shorter wheel base. Again this will improve, and balance, the increased front end grip under power and over any really bumpy tracks. That's just about it for the major changes, as ever it seems with the Predator, TTech state that the current transmission has once more new and improved materials, lubrications and tighter tolerances for the already impressive low loss drive system. The steering has had some minor improvements, to make it stronger, also the main suspension joints now have massive 4 mm

we have the RRCi 24 point guide to a better Predator:-

### 1. Propshaft.

A fully assembled prop comes with the '98 kit, all that was needed was the fitting of the pinion gears. Both gears needed the 'flash' removing before the bearings would sit flush. The operation of the one way bearing was checked and the very excellent slipper clutch was adjusted for 2 turns pre-load. TTech recommend 1.0 - 1.5 mm end float on the prop, but as it was pre-assembled no adjustment is available, the test car having 2.5 mm end float

### 2. Differential Installation.

TTech factory build both differentials which reduces the build time considerably. Although quite acceptable in operation, for the ultimate in smoothness the addition of tungsten carbide

# predator on

studs/balls and stronger wishbones. Finally TTech have replaced the rear wing with what appears to be a copy of an Associated high downforce rear wing. Although not new parts it's worth mentioning that the XK98 comes with a 'one-way' front drive, a really excellent slipper clutch, Proto shocks and is fully ball-raced as part of the 'Mitcham' spec, a really total package.

## Build Sheet

Before starting the build it's well worth purchasing a new No1 pozidrive screwdriver, as there are a great deal of threading to do. With the large volume of screws it's very tempting to use 3 mm alloy screws to loose some of the weight, but I wouldn't really recommend that route. Also you will need some form of accurate measuring device, I used a plastic vernier, but a good steel rule will do. A rather plain 15 page photo copied manual is supplied with the kit, some of the information being out of date, and very little set-up information was included, which I found quite surprising. However, enough detail is given to build the car. So here

balls is recommended, something TTech themselves advise. Personally I would have thought with a kit of this quality and cost they should have been included as standard, I have no doubt William uses them (?). The front diff did not need any shims to adjust the running clearance, the rear just one gold shim. Don't worry at this point if the transmission is tight it will free off once the car runs. Add plenty of the supplied grease to the gear mesh, also use it to seal the gearbox tops to the chassis. I would recommend that the composite bearing bushes are replaced with the red anodised alloy ones, as they are much stiffer and will not wear as much.

### 3. Gearbox Covers.

Just make sure you use the correct length screws.

### 4. Rear Shock Mounts.

Add some Loctite or thread lock to the red alloy damper mounts. Also I fitted the stiffening brace for the motor mount to the front mounting plate at this point, again add a little thread lock to the bolt. I must say I was very impressed with the quality of the carbon used for the plates.



Although not mentioned the XK98 comes with a rear anti-roll bar



The red alloy nut is for the slipper clutch. Not a lot of space in here for radio gear.



Heavy duty steering link, gets close to the Micads so bend with care



GP rockers, Proto shocks drive, a total spec



#### 5. Upper Rear Wishbones.

At this point TTech recommend the assembly of all the ball joints, I did find that some of the fits were very tight. Swapping the balls around did improve them. Do spend time over this as it is critical to the final handling of the car. All the joints need to be free but not loose. When fitting the square pivot points to the carbon plates, make sure you have them fitted in-line and angled to give the correct level of anti-squat. The M3 x 6 screws were all too long and required an extra washer to allow them to be fully tightened. Remember the thread lock.

## Tenth Technology Predator Mitcham XK98

"The latest version of the Predator is a real gem"

Champion in '88?

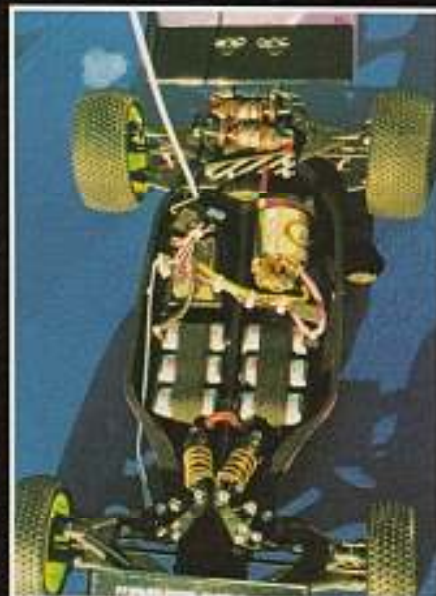
# Tom the prowl

It could only be a .....

Another big change, 'Inward' toe-in

Paint by Grafix





The major change on the '98, the saddle pack can be clearly seen

#### 6. Lower Rear Wishbone.

I found with my kit that the in-board 'toe' did make it very hard to locate the long suspension pin, it required a reamer to correct it. Also it helped if the leading edge of the wishbone was trimmed to match the angle of the chassis, once done it dropped under its own weight. Although not mentioned in the instructions at all, this is the point at which to fit the rear anti-roll bar, use the holes in the rear edge of the wishbone to tie-wrap the bar onto.

#### 7. Rear Upright.

This was the only part of the build that really surprised me, TT supply some of the best mouldings and driveshafts I have come across in a model car, then spoil the assembly by using three common or garden plain washers as

bearing spacers. The diameter of the washers in my kit pinched the bearings just enough to cause a 'drag'. As far as I can see it would be very simple to redesign the wheel hub or machine an alloy spacer to do the job properly.

#### 8. Attaching Rear Upright.

Just make sure the whole assemble falls under its own weight. Check that the front 'bullet' joint is fitted the correct way round.

#### 9. Dampers.

Take a lot of time with the dampers, they are precision instruments, treat them so. All the pistons will require de-burring, in the main cut out, also the edges will need a small chamfer, a (Peter?) Emery board or small file is ideal. Smear a little gear lube on the 'o' rings before assembly. This will protect them from tearing as the damper rod is passed through them, the outer sealing ring will also benefit from this treatment as well. Pre-threading the ball joints will reduce the chance of scratching the alloy damper rods as the ends are screwed on. Adjust their length by loosening or tightening them up, this is where the vernier comes into play. It was nice to see the correct damper oils supplied. I found the best action was gained if the damper bodies were left somewhere warm for a while after they had been filled with oil and the seal housing just screwed in lightly, just enough for the air to bleed out. Once done they were very silky in operation. I must admit with the rear dampers I wasn't convinced about the supplied 'gold' pre-springs. As they appeared to be almost the same rate as the main springs. In most full size cases the 'P' springs are slightly softer, only the track test will tell.

#### 10. Mount Rear Dampers.

Don't over tighten the M3 lock nuts, the dampers must be able to rotate on the mounting bushes. Mount the dampers in the middle hole of the top rockers.

#### 11. Upper Front Wishbone.

Thread lock the thin M4 plain nut on the upper pivot points. I did need to thin the width of wishbone down slightly to get the wishbone to drop under its own weight, also the mounting holes needed a little easing with a drill. Pre threading the 4 mm 'bullet' joints with a tap is to be recommended as well, it's really hard work if you don't. Once more I was impressed with the quality of the carbon fibre used.

#### 12. Steering Assembly.

Adjusting the thickness of the lug in the gearbox top, were the recess for the steering spacer tubes/bearings are, with an emery board will allow you to have all the Nyloc nuts tight enough, and leave the assembly smooth, yet slip free. Nice to see it fully ballraced.

#### 13. Lower Front Suspension.

The 'Pro-squat' in the tub caused the same problem with the lower pins that the in-board 'toe' had at the rear. In as much as the pins would not slide in smoothly, once again I had to ream the hole straight. Just like the rear lower wishbone, trimming the mounting lugs to match the chassis gave the best movement. Pre-thread the bullet joint once more.

#### 14. Rockers Cranks, Push Rods, Track Rods.

Take a great deal of care when screwing the rocker pivot into the chassis. It has to be at the correct angle also add a little threadlock. Don't over tighten the Nyloc nuts which hold the rockers to the pivot, I left them one flat from tight.

#### 15. Front Upright.

Don't preload the wheel bearing with the alloy wheel hub, using TTech's advised method it's very easy to do.

#### 16. Track Rods.

This is the best time to check if the suspension falls under its own weight.

#### 17. Front Dampers.

As you fit each end check that the dampers are still free to move.

#### 18. Rear Wing.

If you slot the wing mount around 6 mm the amount of downforce can be trimmed by moving it forward for less rear grip.

#### 19. Front Wing.

Take time over trimming the under wing, do small cuts. Only use the picture in the instructions as a very rough guide. Clean the moulded part of the wing to remove any grease or moulding release agent before attaching the Predator sticker.

#### 20. Motor Mount.

Threadlock all the mounting screws/bolts. You may find it an advantage to solder any motor wires or diodes prior to fitting the motor to the mount.

#### 21. Battery Location.

Leave the Velcro straps a little long and leave the excess to be trimmed a after you have fitted the nicad pack for a first time.

#### 22. Servo Installation.

All the current high power FET servos will fit in the XK98, but do centre the servo arm/saver before locating it in the tub. The '98 has a larger diameter connecting link wire which is a little hard to bend. Do make certain that no load is applied to the servo from where the link passes through the hole in the tub. This would stop the steering centering properly, and of course may make the servo fail prematurely. Also as the total steering movement is small, some form of end point adjustment will be needed on your radio, or locate the link wire very close to the servo centre.

#### 23. Radio Installation.

Very little is said about the radio installation in the instructions, obviously TTech feel most people know it all! Mini radio gear is a must, most of the latest generation of small servos will fit on top of the steering servo, I used my trusty MRT VFX. However, space for the receiver is limited, a micro is the only thing which will fit, my choice being a KO KR 297F2 mini. With the XK98's layout it is possible to have really short motor wires, this will give maximum efficiency from your nicads, and minimum radio interference. With the carbon propshaft you will have to have plenty of clearance for the 'link' wire between each cell pack. I modified my packs to give a little extra clearance, as per the picture.

#### 24. The Bodysell.

The Predator shell fits very tightly to the contours of the tub, so it will need the cooling ducts cutting out. The trim lines are very accurate and can be used. Both the red alloy body mounts need their mounting nuts threadlocking. It's best if you use the two mounting holes as a cutting guide before you fit the mounts to the tub.

## Job Done

Well other than the painting the bodysell, and I managed to duck out of that one as you can see from the pic's and Gavin Clinch of Grafix did an amazing job. If you want the same Gavin can be contacted at Tenth Tech most days, thanks Gavin. All that was left was mounting my choice of tyres (TTech don't supply tyres with the XK98, most drivers will have their own preferences no doubt, this is quite acceptable, however I do think that they could have supplied more than one set of wheels). That then is it for the build. I make no apol-

## Quick Spec

4WD Carbon Fibre Shaft Drive. Tub Chassis. Twin Ball Diffs. Fully Ballraced. Slipper Clutch. Front One-way Drive. Front Mounted Saddle Pack Nicads. Alloy Motor Mount, Buds Drives. Fully Independent Suspension. Unequal Length Double Wishbones Front & Rear, Inboard Mounted Oil Filled Alloy Coil Over Shock Absorbers Front & Rear. Front Pushrods & Rocking Levers. Rear Rockers. Twin Lever Steering. Aerofoil Front Wing. High Downforce Rear Wing. 5 Spoke JC Racing Wheels.

## Testers Kit

Transmitter	KO Esprit 11 Vantage
Receiver	KO 40 Meg, KR 297 FZ
Servo	KO 1002 FET
Speedo	MRT VFX
Nicads	Reedy Zapper 2000
Motor	Infinity 10 Double
Charger	KO BX 212 Advance
Tyres	Schumacher 'Green' Mini Pin (2.2 inch)
Bodysell.	Kit (+ Grafix Paint Job)

**Likes.** High Specification. Basic Layout. Shaft Drive. Handling. Strength. Far too Fast.

**Dislikes.** Rear Drive Hub Washers. No Carbide Diff Balls. Lack Of Set-up information



ogy for going through the build piecemeal, with this type of competition car it pays to 'build' it rather than just assemble it. This is what gives people like William and Kevin the edge when the buzzer goes. Although I could have built the XK98 in a couple of hours, and I have no doubt it would have worked quite well. In fact I took just over a week, checking and 'blue-printing' as I went, and I know it will pay dividends come race day, and beyond.

## Tune-ability

On the whole the XK98 is somewhat limited in the range of adjustments that are available in standard form compared to most of its competitors. This suggests several things, one TTech are more than confident that they have got it right, two the driver has less to do on the car and can concentrate on the important part driving! For 90% of drivers this has got to be a very good thing. I see a lot of drivers totally baffling themselves with adjustments. However the Pred<sup>®</sup> does have what you might call the basic range available:- Camber, Front Caster, Ride Height, Toe, Spring Pre-Load and Damping + Rear Roll Centre & Rear Wheel Rate. One point you do have to be aware of though, at the front you can adjust the ride height two ways. If you add spring packers to raise the ride height, you can restrict the amount of wheel movement. This could be a problem on very humpy tracks. In most cases I would only recommend you use the push rod. So really all that is available as an option is the range of springs that TTech manufacture or a stiffer/softer rear anti-roll bar. So most of the on the day tuning will be down to the choice of tyres.

## It's a Set-Up

As with any race car it's important to make sure the wheels etc. are facing the right way. If you have used the measurements TTech recommend the car will be almost there. First you need to find a flat surface, I use the glass top to the 'works' cooker. Fit a nicad pack and adjust the front and rear ride heights to a shade under 20 mm, it's OK if the front is lower (front spring packer = 2 med., 1 thin, Pushrod 33.5 mm. No rear packers). Next adjust the rear camber to 2 degs negative, using the slots in the rear uprights. Adjust front camber to 3 degs, using the washers behind the joint in the top wishbone. Using the steel turnbuckle track rods adjust the front wheel tracking so they are parallel. Lay a straight edge along the front and a d rear wheel centre lines and adjust the rear track rods till you have 4 mm between the front edge of the rear wheel and the straight edge, 6 degs total 'toe-in'. As I knew I would be testing the car on a high grip surface I set the rear wishbones in the lower position on the rear upright.

## Testing Time

The choice for the test was the track at Donnisthorpe, this was for several reasons: firstly at the present time the foul weather has left most places sopping wet, Donnisthorpe's Astro-turf copes with most conditions. Secondly it's only just up the road, and finally Donnisthorpe is where I spent most of my off-road racing. Yes 'Chris the ex - Ed Deakin' confirmed tarmac racer, spent several seasons racing Optima's and one of the very first S B Schumacher C.A.T.'s, and it's still in the attic, on Donnisthorpe's grassy slopes and I've still got the trophies. So I was more than looking

forward to giving the Pred<sup>®</sup> a good work out. Prior to the test I acquired a couple of sets of Schumacher green compound pound Mini Pins/Spikes, known to work well at Donnisthorpe (thanks Darren). I fitted an Infinity 10 double armature to my Infinity power plant, dyno tested and passed as totally 'ballistic', only the best nicads would suffice, so out came my Reedy Zapper 2000 from the containment building.

## Pre-flight checks

Prior to the test I had run the car round the family estate, all right - back garden, to loosen the drive train and trim the steering. Both the diffs had to be adjusted afterwards, as both backed off. After two or three runs the transmission was very smooth and free. Several track layouts are possible at Donnisthorpe I wanted a hard test so several of the 'tracks' were used.

## Run One

With the mini-pins fitted and the Trinity geared on 19 tooth pinion the fun began. To say that the car was positive was an understatement, on or off power the front just dug in, but it didn't really oversteer, i.e. it wouldn't spin out. This took quite a lot of getting use too. You really had to operate the car two or three corners in advance, in fact if you thought about it you were to late, you'd crashed, and I did. The secret was to be totally smooth, almost driving as if you were on road, going for the racing line. With such small steering inputs cornering speeds were frightening fast, which made the Predator howl down the straights. This really left very little room for error, definitely not a car for the faint hearted. If you drive the car hard it just laps it up. Well it would appear that the kit set-up was very close to the mark, although to be fair Donnisthorpe's track could not be classed as rough, so springs and dampers may have to be changed for the really rough stuff. Over the two table-top jumps the Pred<sup>®</sup> landed really sweet, the radius on the nose piece sliding over the ground with out digging in at all. The extra long wishbones allowing the wheels to run to some alarming angles with no loss of traction. I did find that I could lower the chassis quite a lot which seemed to make the car even faster, I was glad I had fitted a really quick steering servo. The drive train, motor and the 2000's gave nearly a 6 1/2 minute run, but I had no reason to feel that the car needed to be any faster, either in a straight line, or punching out of a slow corner. I did increase the amount of rear toe in to soften the response of the car, but this was a mistake, the XK98 98 is much better 'living on the edge'. Several runs were made with the car box standard, just adjusting to the response of the car, the more confident I got the faster the Pred<sup>®</sup> got, ultimately over-confidence brought the test to the end, and a broken car. My fault not TTech, nothing could have survived what I hit. Once rebuilt I hope to continue with the saga, hopefully somewhere rougher, and at dare I say it, a race meeting. Look out boys I'm back.

## Bump Stop

Tenth Technology have only been in operation for a very short time, and they chose a very hard route. The car they created bore no

relationship to any thing that had been seen at the time, every area of the car had to be developed, and with the genius and enthusiasm of Richard Weatherley they have succeeded. The latest version of the Predator is a real gem. If you take the time to build it properly you will have one hell of a race car. It does take a great deal of driving to get the very best from it, you have to be smooth, but firm with it. With a good out of the box set-up it will give you the chance to just drive. For sheer acceleration I think there is nothing which will out-gun it.

The latest 'stiff' parts have endowed the XK98 with a great deal of strength and with William's spec' you have nearly at total package age, just needing the diff balls and a set of titanium turnbuckles for a complete replica. But will it make you 'William Mitcham', well if you have his skill, yes to say that I was impressed with the XK98, is like saying would Peter Emery like a Ferrari, get the picture. The only thing is where does TTech go now, watch this space. I would like to thank all at a TTech, Gavin Clinch of Grafix, and Darren Boyle of DMS for their help with this review. The Predator XK98 is in the shops now, Champing at the bit.

## Set Up

<b>Front.</b>	
Spring:	Yellow.
Oil:	30 wt.
Piston:	1 hole 1 groove.
Packers:	2 med. 1 thin
Ride Height:	18 mm.
Caster:	Standard.
Camber:	3 Degrees
Toe:	0 Degree

<b>Rear</b>	
Spring:	Copper T Spring: Gold
Oil:	40 wt
Piston:	2 hole 2 groove
Packers:	Nil
Ride Height:	20 mm
Caster:	0
Camber:	2 degrees
Toe:	8 mm in.

**Other: Red rear roll bar. Slipper clutch. Front One-way drive.**



The link wire for the coil packs has to be kept clear of the carbon prop shaft



The Pred<sup>®</sup> has very long and red bottom wishbones