By Richard Weatherley

The Works Predator

TTECH'S Predator, Design & Preparation Secrets ...

The Predator is a unique and inspired design. It has its fans and it has some critics, but there is no denying the devastating performance of a well set-up version. This year, drivers using Tenth Technology cars have won, most notably, every round of The On-Road British Championship and The European Touring Car Challenge, The Off-Road British Championship in dominating style and in the USA, Brian Kinwald used his Predator to win the Winternationals and Derek Furutani won the NORRCA Nationals. Like the other cars, the Predator has a wheel in each corner, but the control of the suspension and drive is quite different to the others. Why? In a series of articles Radio Race Car will investigate the Predator's unique design features and give you the run down.

We investigate the mystery of setting it up and bring you some simple build tips from the engineers at Tenth Technology.

We start at the heart of the car ...

Part I, The Transmission:

Anyone who has raced with or against a Predator knows that it has really good acceleration. The transmission system is very efficient and is perhaps the cars most recognised advantage, but it can be a source of trouble too, and races have been lost through its failure. This month we look at this built-in advantage and show you how to ensure its reliability.

Design Concept Explained:

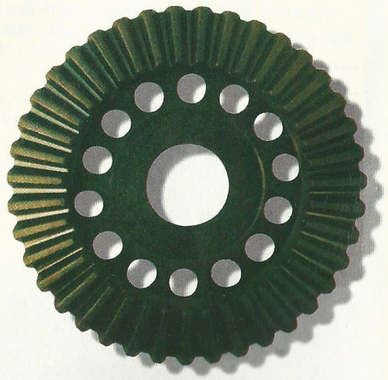
Part of the reason that the transmission is so efficient is its simplicity. There are only three gear meshes in the whole system, the same as a 2wd. One mesh is from the motor to the spur gear, then one more mesh to the rear diff and another to the front diff via the carbon fibre prop shaft. It is designed this way because, under heavy loads, E.G. maximum acceleration, a carefully designed gear profile is very efficient. Added to the fact that there are no radial forces acting upon the diff bearings, due to belt tension, the whole system absorbs less power than a belt driven car. Therefore the car accelerates faster and doesn't waste any of your valuable battery capacity.

Diff Construction. Conventional but with a twist:

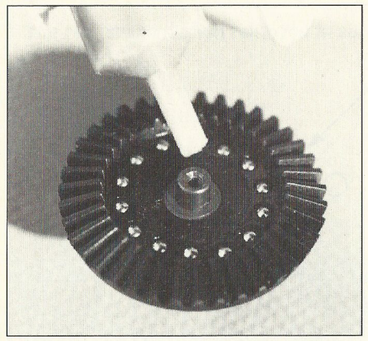
The diffs themselves are very smooth, due in part to the enormous number of balls they contain. The 14 balls in each diff are cleverly laid out in a spiral pattern. Actually there are two half spirals which is done to maintain perfect balance, I.E. each ball has a diametrically opposite partner. As a result, instead of quickly wearing a single groove in the plates, the diff balls run on seven separate tracks. This spreads the load, resulting in a longer life for the diff plates and therefore greater consistency of the diff operation.

These are the 2 key factors to keep the transmission of your Predator smooth and reliable :-

A. A well adjusted gear mesh with the correct gear lubricant, applied at regular intervals.



The latest TTech moulded carbon crown wheel. The gear profile is now quieter and more reliable,



Applying the TTech grease to the diff balls.

B. A smooth running diff, built with the correct diff grease and not over-tightened.

Stripping the car:

A Predator can be stripped down into three major assemblies within a few minutes, making it very easy to maintain. Here's how the Factory Team do it ...

Removing the Rear Gearbox Top assembly. (Estimated time required 1.5 minutes). The rear gearbox top can be removed very quickly. complete with the entire rear suspension/rear wing assembly.

1. Remove the Pozidrive screw from the motor mount brace tube

2. Remove the screw securing the lower suspension pins, and pull out the pins.

3. Remove the screw securing the rear shock to the rocker, to allow access to the rear gearbox screws.

4. Remove the 4 screws securing the top gearbox to the chassis and lift off the gearbox top & entire rear suspension assembly.

That's Fast !

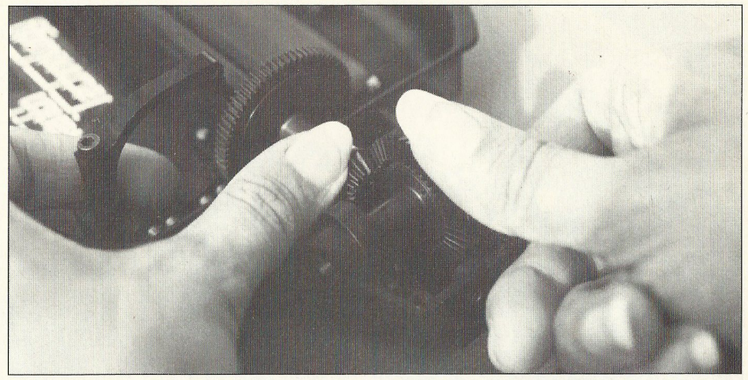
Removing the Front Gearbox Top assembly. (Estimated time required 2.0 minutes)

1. Remove the nose cone and pull out the lower suspension pins.

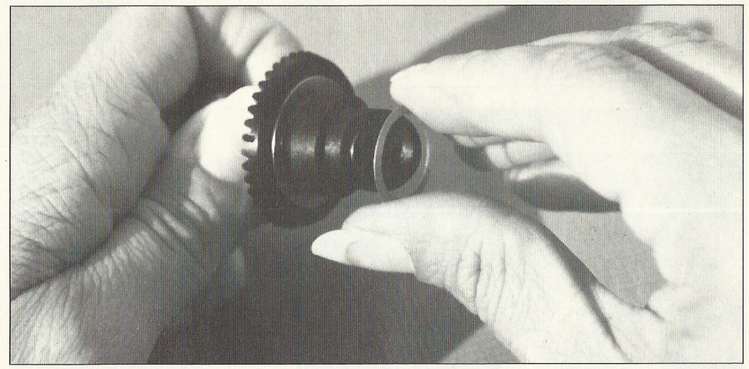
2. Remove the 3 screws securing the top gearbox (from underneath) and the 2 lower screws in the front carbon fibre plate.

3. Remove the screws securing the fixed end of the dampers to the chassis, and lift off the top gearbox & entire front suspension assembly.

Amazing, the car is now totally stripped down!



By holding the pinion head still with your thumb, you can try to "rock" the crown wheel. If any rock is found then it needs to be shimmed out.



The special shim washers slip over the diff bushes.

Gear Mesh Clearance or Backlash: (What is it and how do I adjust it)

Early Predators had a different gear profile to the quieter, more reliable versions we see today. With those early cars there had to be a small amount of clearance between the crown wheel and pinion in the gearboxes. With the advent of the new moulded gears which have a completely different profile, this has changed and infact it is essential that any clearance or backlash is eliminated. To help with this TTech have a "Diff Shim Washer Kit" (Part No AT7). These special washers fit over the plastic bushes in the gearboxes. They must be added until any trace of backlash has been eliminated. Here's how.....

Check that backlash has been eliminated with the gearboxes tops removed but with the prop shaft pinion (pinion = small gears) and diffs in place ...

1. Pull the crown wheel (That's the large gear that forms part of the diff) away from the pinion to maximise the clearance between the two gears. Prevent the pinion from turning with your thumb, and try to rock the crown wheel backwards and forward with the thumb of your other hand. If you feel any movement between the gears, add another shim washer to reduce it.

2. Repeat until all of the movement or "backlash" has been eliminated. Rotate the crown wheel 1/3 of a turn and check again.

If you have adjusted the mesh perfectly there will no backlash at any point and yet the transmission will rotate smoothly. If it is very rough you may have added too many shims. If there is just a slight feeling of "knothchyness" in one spot do not worry as this will bed-in on the track within a few laps.

Lubricate the gears with TTech's special gear lube (Part No AC37), which has proven to be the best for use with the special carbon fibre materials that are used in the gears. Apply the grease, by placing it onto the pinion and rotating the transmission. This will ensure that just the right amount of grease is transferred to the crown wheel and that the grease will not creep into the diff balls, where it could cause excessive slip of the diff.

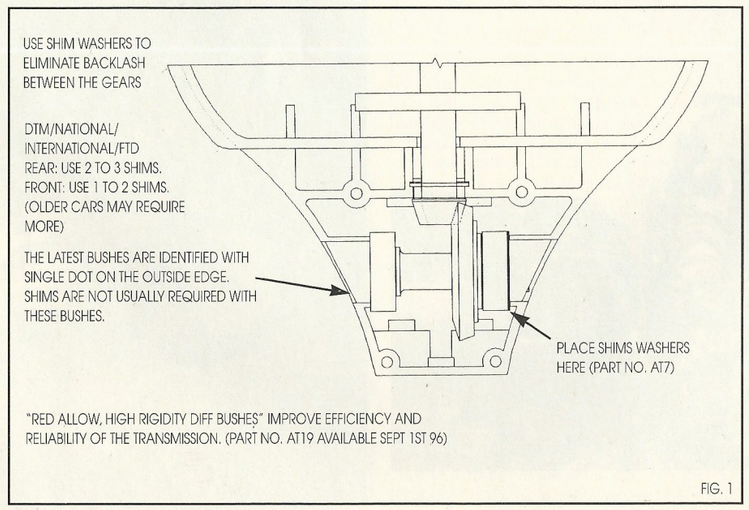
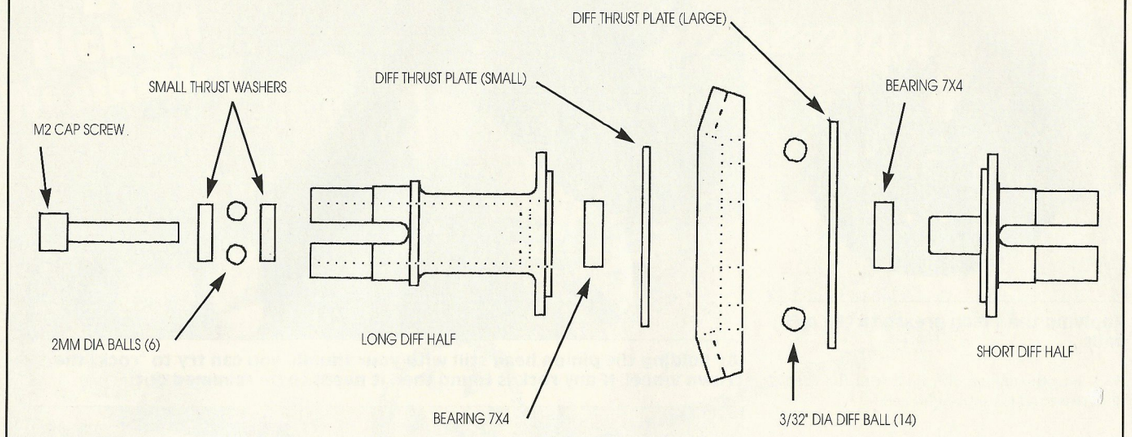
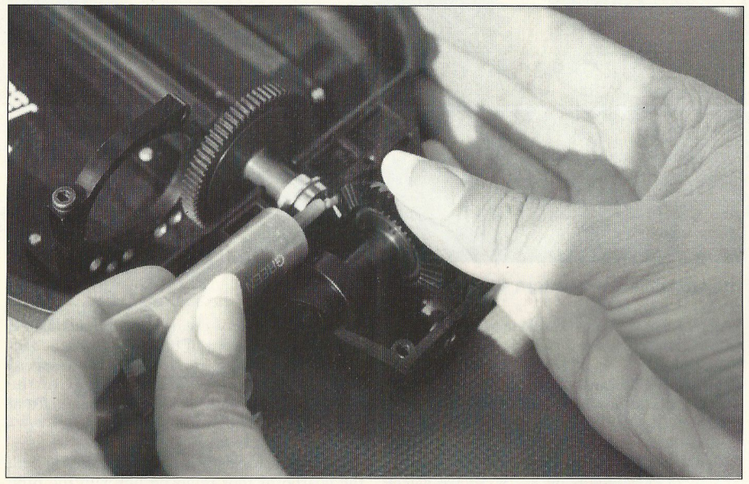


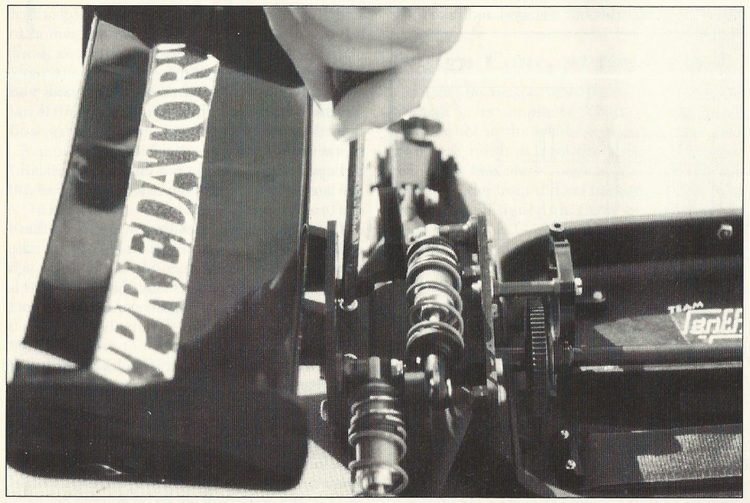
FIG. 1

FIG. 2





When the backlash has been set, you need to grease the gears.



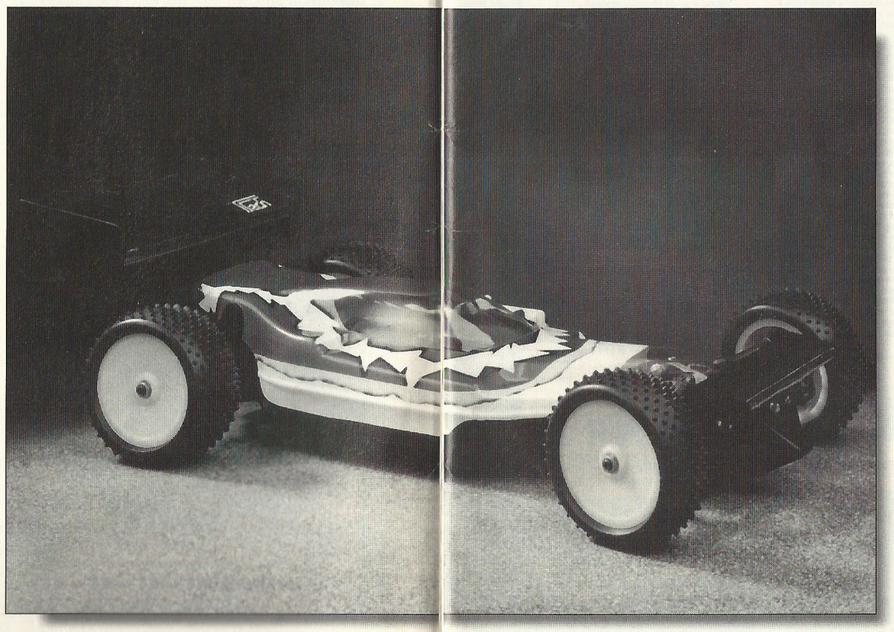
Removing the rear gearbox cover screws.

Top Tip:

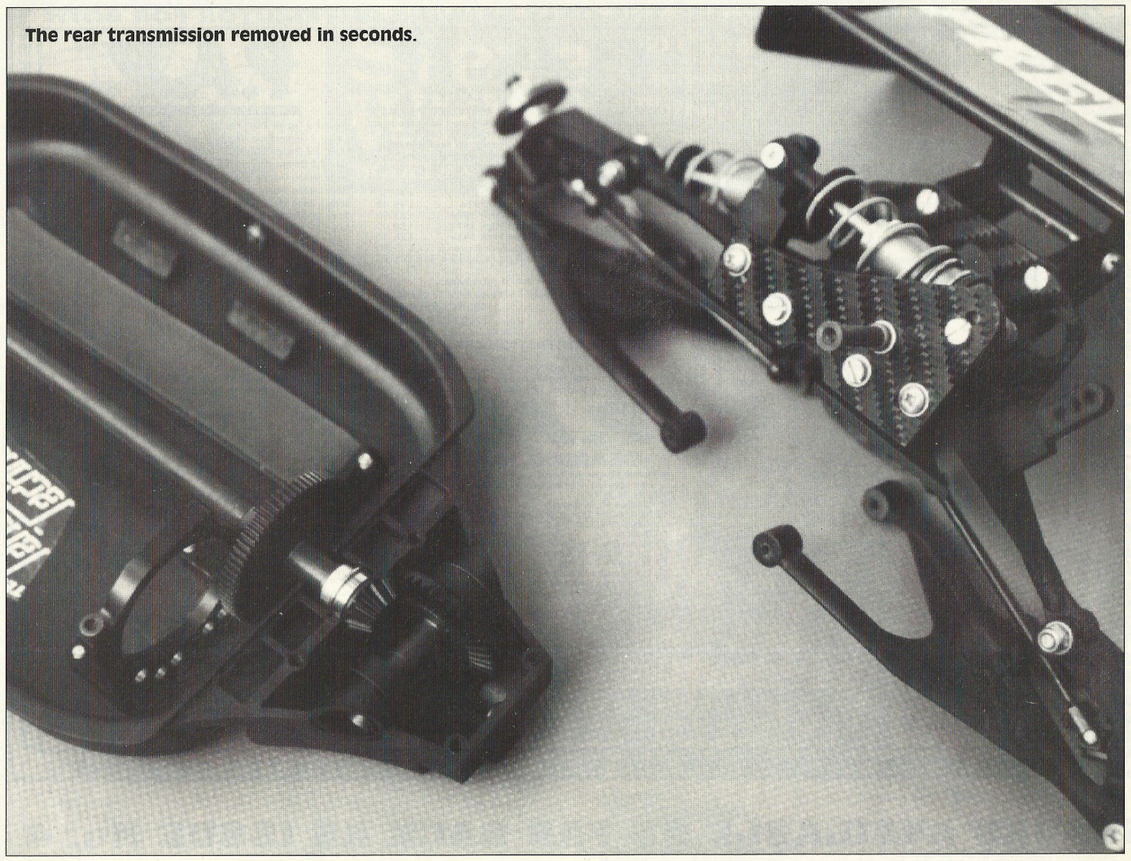
Before placing the gearbox tops into place, spread some grease onto the mating surfaces of the gearbox top and chassis. This will form a seal which will prevent dust from entering the gearbox.

Diff Building and Adjustment:

The Predator diff is a ball type with 14 balls in each diff. The standard parts will do a perfectly adequate job, but for a really smooth diff, that stays smooth for a long time the following tuning parts are recommended :-



The rear transmission removed in seconds.



Tungsten Carbide Diff Balls	Part No AT8
Tungsten Carbide Thrust Washer	Part No AT8
Internal Ball Race Bearing	Part No F4
Also required :-	
Special Formula Diff Lube	Part No AC36
Special Formula Gear Lube	Part No AC37

The diff should be assembled as shown in fig.2. Make sure that all of the parts are really clean before assembly and use only TTech specially developed diff grease on the diff balls. This grease has been developed by TTech to be compatible with the materials used in the diff and to provide consistent grip during normal use. When slipping due to exceptional loads, for instance when landing from a jump, the grease slips smoothly and consistently which protects the gear teeth from these peak loads. Use TTech gear grease to lubricate the thrust race, although this is not critical like the diff grease, and any good general purpose grease will serve here. Place a drop of threadlock into the M2 thread in the short diff half. before assembly, which will eliminate the possibility of the diff undoing itself on the track (Although the usual cause of this is the wrong number of thrust race balls. There should be six). Take care not to over-tighten the centre diff screw which will need final adjustment after the car is fully assembled. For the final touch before placing the diff into the car, cut a small piece of foam (about 8mm cubed) and push it into the long diff half. This will prevent dust & grit from entering your freshly prepared thrust race. Once the car has been fully assembled with the wheels and tyres fitted. you can make the final diff adjustment.

Rear Diff Adjustment:

Hold the car by its left rear wheel with the front of the car pointing towards you. Place the thumb of your left hand on top of the spur gear to prevent it from turning and try to turn the right hand rear wheel. It should be possible to turn this wheel between your thumb and fore finger without any undue force. If the diff slips very easily it will be necessary to tighten the M2 screw at the centre of your diff. This can be done very easily :-

1. Remove the screw that secures the lower suspension pins and the left hand pin.

2. Lift the left hand suspension over the top of the car, giving access to the diff screw.

3. Tighten the M2 cap screw at the centre of the diff. just a little at a time. An 1/8 of a turn will make an appreciable difference.

The diffs need to be just tight enough to drive the car at maximum acceleration without any noticeable slipping. Running them tighter than this, exposes your gears to the odd peak load, and endangers them unnecessarily.

Repeat this process for the front diff.

Job Done.

Checking the adjustment of the rear diff.