

Laro Diabolo

Dez Chand

1/8 Rally Cross Review

Winter is upon us so it's time to pull out the big guns:

Rally crossers do it whatever the weather. Any future champions out there that fancy chancing their arm at this rough and rugged sport need search no further for racing pedigree and proven reliability than the Laro Diabolo. This model has won the British National series.

A.R.T.R.

The Diabolo comes ready assembled and set up to a basic formula that will only require minor tweaking to correspond with the applicable track conditions. As far as construction goes you are left to screw on the huge, adjustable rear wing and plumb in your choice of engine, pipe, carb and air filter.

At present in Rallycross racers are very much spoiled for choice for suitable motive power, and all the top range engines are extremely competitive, so with Picco winning the 1996 Worlds it seemed logical to choose an engine from their range.

The Omega Buggy Competition Pro being the final choice, this is still a Picco manufactured engine built around the crankcase and cylinder head that Picco developed for Serpent Model Cars, hence the purple heatsink. A quick look inside the crankcase revealed a real gem of an engine, 5 Port, Turbo Crank and a 7.5mm carb, monster-horse-power.

Radio gear - Your Choice

Installation and specification of radio gear is left to your personnel preference but you should consider using the best steering servo that you can afford to compliment the very high standard set by the rest of this thoroughbred car. Something with around 8Kg

Attack!!!!

of torque and a speed of 0.10 sec's or under should do nicely. The throttle servo can be milder but a standard 148 is just not going to go the distance. I've chosen a Futaba S9403 as it will cope admirably and take the braking forces required in its stride. The moulded radio tray accepts the two servos, offering bosses to screw the mounting flanges down to and a tub with a matching cover to enclose the receiver. There is no obvious cable access route, in fact with the top screwed down there is no entry or exit points. I drilled a small hole at the bottom of the tub for the aerial wire to pass out in a downwards fashion to help drain off any water entering the enclosure via the groove I cut into the lid to allow servo and battery leads to enter. A cut out in the tray is the correct size for a four AA sized receiver pack to be secured but I will be installing a five

or even six cell pack if necessary so this orifice is redundant.

Two rods of piano wire are supplied for you to fashion control links from but you will need to track down a throttle linkage kit at your local model shop to get the required rod collars and over travel compensating springs.

Running in... Please Pass

Whether it is a new motor or old faithful you intend to slip in as a power plant, you still need to run this car in as all three diffs are pre-filled with a special lightweight grease to speed the bedding-in process. There is nothing to assemble, no shocks or diffs to build, no drive train to align or suspension geometry to dial in. Quite the opposite. Before racing this car you will need to disassemble the diffs, and therefore most of the car to reach them.

A couple of gentle runs on a high grip surface, with a slightly rich fuel mixture if you are also breaking in a new motor, should be sufficient to knock the high spots off all the gears in the drive line and take any roughness out of the bevelled gears in the diffs.

With the rolling chassis running a lot smoother

it is time to disassemble the car and refill the diffs with a lubrication of competition calibre that will also determine the overall handling characteristics. For a high grip, comparatively smooth surface 20,000 weight silicone grease is used in the front and centre diffs while the rear gets a "lighter" 5,000 weight. I say lighter but even this will not run out of an up turned jar without provocation so it should stay in the diffs with their 'O' ring sealed output shafts, no trouble at all.

On a bumpier track all three diffs require a much lighter set-up, "LM" grease all round with maybe the 5,000 weight silicone in the centre diff if corner exit punch is being limited by excessive front wheelspin.

Which way up ?

The front and rear gearboxes are identical units. Two pairs of symmetrical mouldings become each main housing and even after inserting the diff, pinion and drive cups you could still use either assembly in the front or rear either way up ! To identify front and rear gearboxes you add the upper and lower gearbox covers and screw the assemblies to the 4mm thick aluminium alloy chassis before double checking prop shaft rotation against drive shaft direction to ensure you have a car that will go forwards with the engine running. When viewing the car from the front, the engine

runs anticlockwise so the prop shaft rotates anticlockwise. For the wheels to pull the car forwards therefore, the front diff should sit to the left and the rear diff right of its corresponding bevelled pinion gear.

The primary gear reduction is 51:14 (ratio 3.64:1), the internal ratio of the front and rear gearboxes are 44:14 (ratio 3.1:1) so the overall gearing works out to 11.44:1 putting the top speed in the 72kph region given that my chosen "Omega" engine claims a peak of 2.5 blp and revs to a fantastic 38,000rpm. A funky scale speed of over 350mph. Wow !

Lightweight Clutch

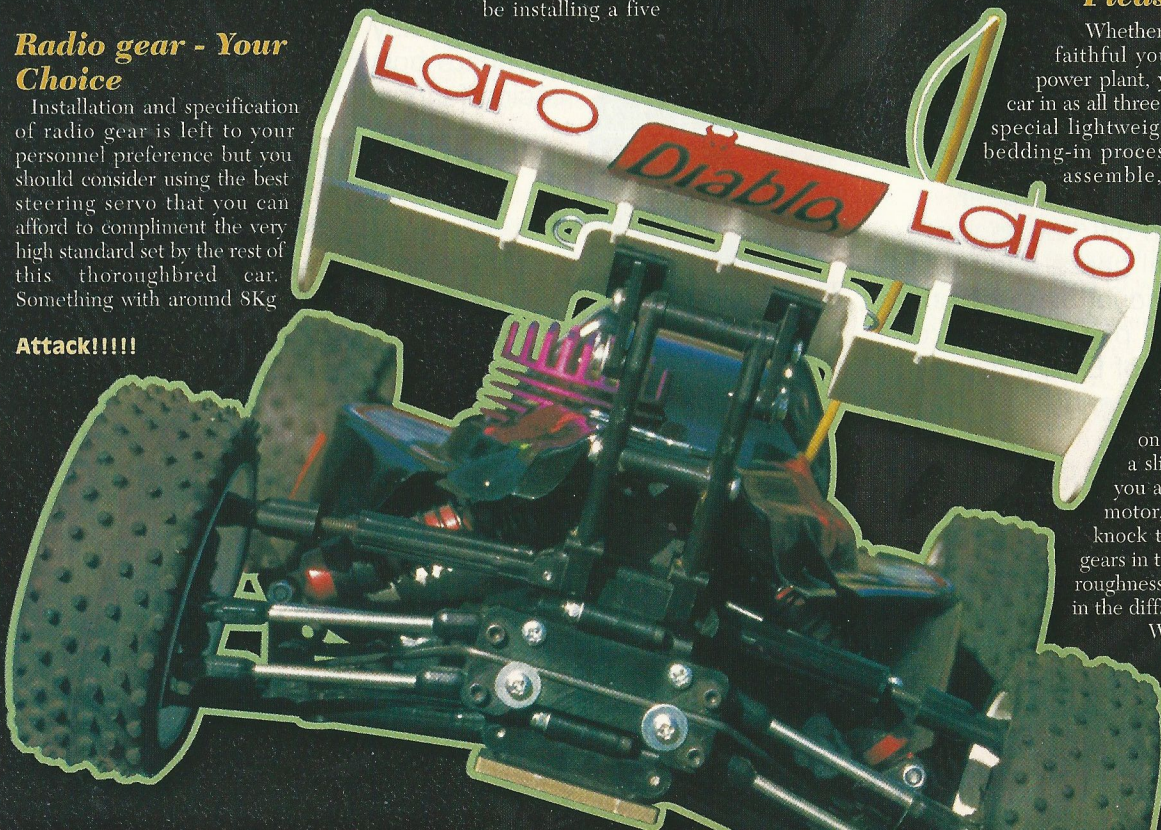
The lightweight flywheel combined with the featherweight three shoe carbon clutch, makes for a low rotating mass that results in a peaky, yet punchy feel to this long stroke motor. The bell housing runs on a needle roller bearing retained by a circlip and backed up by a screw in the end of the crankshaft for added security. The very stiff clutch springs give a high bite point to avoid bogging the engine down by waiting until the engine is near its power band before allowing full engagement, disengaging the instant you back off the throttle.

a date with the
DEVIL

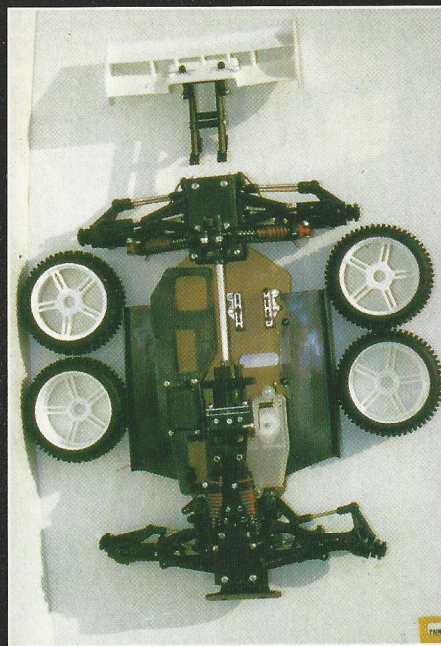


This is the later Diabolo bodyshell, the "bump" covers the front shocks.

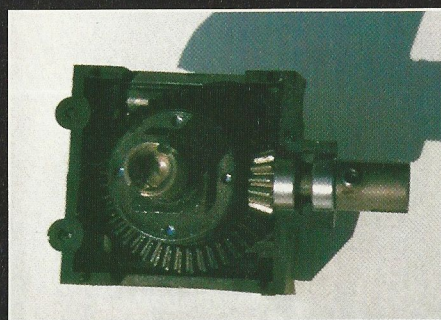
When installing the clutch and bell housing onto the crankshaft and fitting the engine into the chassis I noticed that the width of the cast aluminium engine mounting blocks prevented the primary drive gears from meshing correctly by interfering with the chassis guard rail. I removed some plastic from the left hand rail and now with it correctly meshed the engine mounting snugly up good and close to the boss on the guard rail. If a higher gear ratio is required in the future I will have to remove yet more material to obtain the necessary clearance.



EL DIABOLO.



Just as it fell out of the box.



The front diff being rebuild after running in.

Propshaft & Brake Bias

The large aluminium prop shafts give a low rotating mass for better acceleration and throttle response as do the impregnated resin main spur gear, diff housings and brake discs.

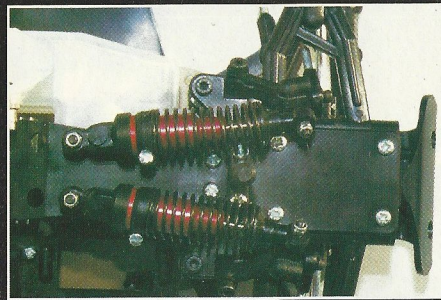
The two fully floating brake discs work as a pair. A brake arm twists a cam, that only acts against the rear brake pads to sandwich the disc. Twin through bolts then pass back through both sets of pads and the centre diff bearing mount to squeeze the forward pads against the front disc. In this way all four pads exert equal pressure on both.

There is no brake bias adjustment as it is built in by design, take a seat and let me explain:

The rear disc mounts to the front of the centre diff housing whereas the front brake disc operates on the forward prop shaft.

The centre differential will distribute the braking power of the "rear" disc to the front and rear prop shafts equally, so the front wheels will therefore get half of this discs effort plus the full force of the front disc which acts purely on the forward prop shaft. 3:1 front to rear brake bias built in, and what's more it works beautifully.

If you do not believe me try manually squeezing the rear disc pads alone and all four wheels have the same drag, squeeze the front disc pads and only



Both the large volume shocks sit on top of the front gearbox, and are operated by bell cranks.

the front wheels are retarded. Now pull the brake arm to squeeze them all simultaneously and you can feel the difference between the front and rear wheels if you turn them by hand. What an excellent idea, it works so well that the car tries to stand on its nose before either the front or rear wheels begin to lock up.

Getting gassed up

The fuel tank has a 110cc capacity but by the time it is plumbed in with enough silicone tube to take the round about route required to avoid the "buzz saw" main spur gear and incorporate an in-line fuel filter, it will be nearer the 125cc maximum required by the BRCA. The fuel tank already has a built in, removable, filter in its bottom feed outlet but another filter cannot hurt, an in-line filter help reduce the risk of the engine cutting out after a roll by acting as a tiny fuel reserve whilst inverted.

Long or Short Wheelbase ?

The upper and lower suspension arms have spacers fitted along the pivot pins to push the rear arms back and the front arms forwards for the longest wheel base available. This brings the gearboxes almost into line with the stub axles for the optimum drive shaft angles and reduces the drag inherent in any form of universal joint. To remove the pivot pins from their blind holes first you must remove their retaining grub screws from the open end before pushing a long thin drift or small screw driver into the access hole and driving the pins out. With the suspension arms and anti roll bar attachments removed you now have access to the four gearbox housing pinch bolts. Separate the housing to remove the diffs and note that the bevelled pinion gear runs in not one but two ball races for perfect tooth alignment for a smoother, more efficient transmission. With the suspension laid out on the bench notice the clever use of common components wherever possible. The lower arms are common front to back as are the wheel hub carriers which means you will need to carry an even smaller number of spare parts to cover any eventuality.

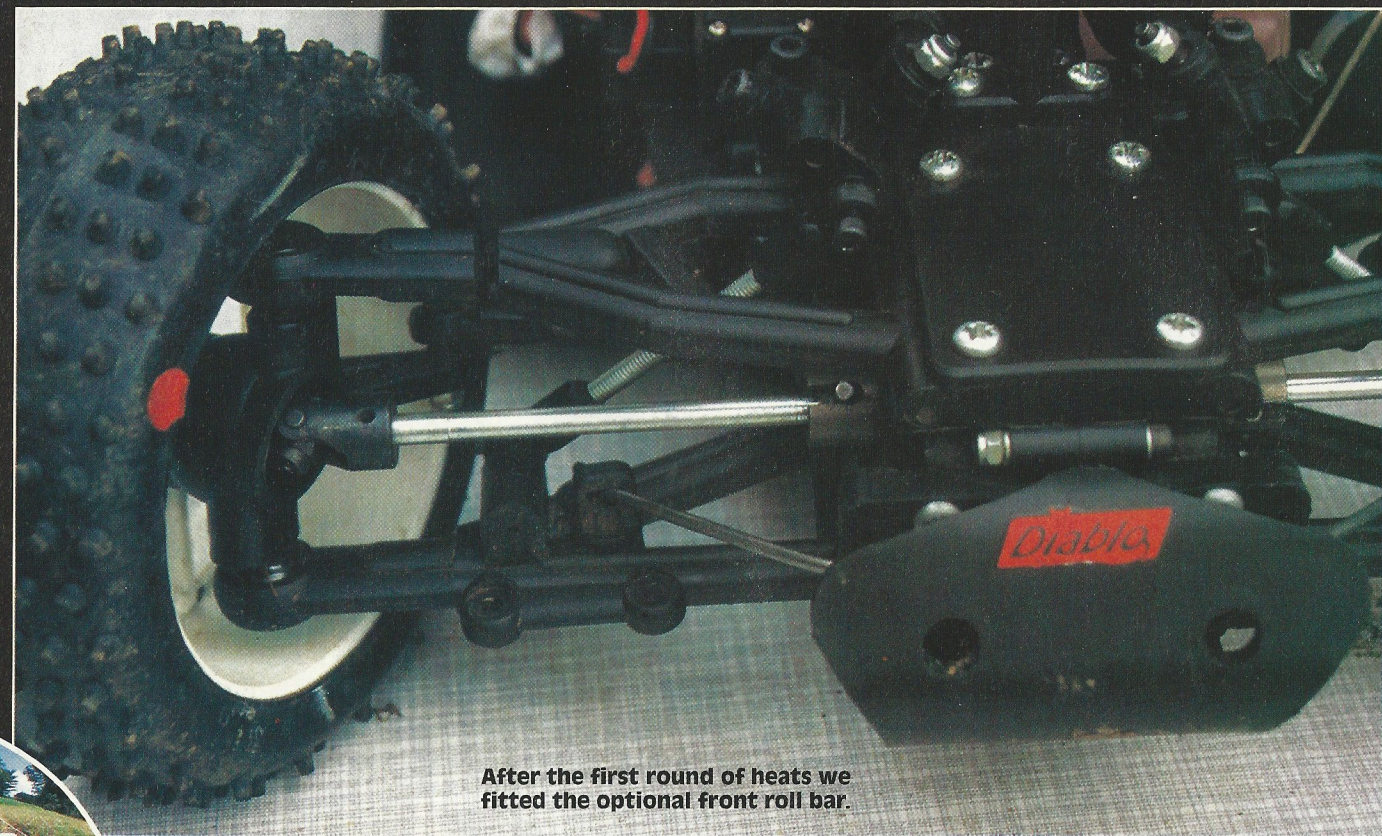
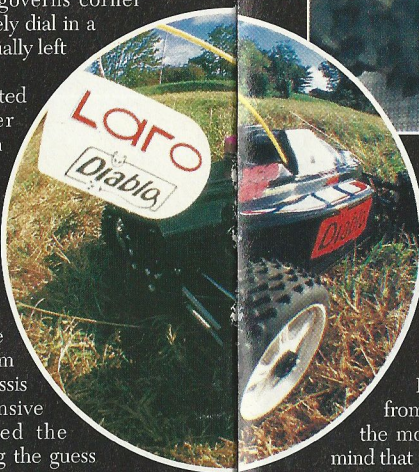
Totally shocking

The rear shocks appear to be fitted upside down, as the main body is attached to the swinging arm rather than the shock tower, but with the body shell installed the thinking behind this installation becomes apparent. The vulnerable shock piston rods remain covered while the shock body endures the mud slinging that goes with the territory. The sealing 'O' rings can therefore concentrate on keeping the copious amounts of very thin shock oil in, rather than trying to keep the dirt and grit out so their useful life span will quadruple as a result. The only down side to this arrangement is the slight increase of unsprung mass but on a vehicle this large the effects are minimal, what are a couple of grams to a 71b monster ?

The chassis to shock movement ratio is 2:1 at the rear and 3:1 for the front, with its lay down shock arrangement unique in this class of racing. The push rods that connect the rocker cranks to the lower suspension arms have two locations where they enter the rocker crank to alter the amount of rising rate and fine tune the front end for the conditions in question. These push rods allow you to alter the ride height at the front without disturbing the spring preload or droop so you never sacrifice ground clearance for a smoother ride. The length of each rod governs corner weights, allowing you to accurately dial in a level car which will then turn equally left and right.

Ride height at the rear is limited to a choice of three lower mounting positions, low medium or high, with no top mounting variations for altering the shock angle. Lacking excessive variations of shock position and the absence of any top arm inner mount options, means the roll centres and rate of camber change are therefore set in the design parameters. Far from limiting the tunability of the chassis this instead suggests that extensive R&D has already determined the optimum settings for you, taking the guess work out of your race day preparations. You can alter front and rear cambers and toe-in/out which are more relevant to racing conditions, the grip level and circuit layout, so you still have your work cut out for you. The minimum geometry options means you are more likely to be nearer the correct settings straight away and the only set up tools required are a camber gauge and a ruler to check ride heights. With no turnbuckles fitted (they are an optional extra) the only

way to alter any geometry is to remove the tie rod in question before altering its length accordingly. The twin rear toe-in tie bars that are such a feature of



After the first round of heats we fitted the optional front roll bar.

the Diabla, need to be altered as a pair each side of course so that one linkage is not taking all the loads.

What is it like to drive though ?..... All right I hear you!

Remembering how awesome it looked from ground level while I was running in the motor and gearboxes, I had to bear in mind that from the rostrum it looks much slower and smaller because it is so far away. It is still reaching those insane speeds so scrubbing the speed off with the brakes before entering a corner was essential to prevent the outside front digging in and inducing frightening amounts of chassis roll that would flip the car over if not kept in check due mostly to the 20mm of ground clearance required for this amazingly rough terrain. With three diffs you want to keep all four wheels on the floor or you will lose corner exit punch as the engine torque releases through the path of least resistance, spinning one wheel uselessly.

With a fast, torquey servo like the K.O. FET 1002 the steering was sharp and responsive, but relying solely on the huge servo saver around the right hand steering post will eventually lead to stripped servo gears. This large servo saver is fine at taking out all those enormous impacts but the more insignificant glancing blows pass directly to the servo horn which is where a second servo saver would come in, saving plastic gears from stripping or metal gears from bending their pivot pins.

With the suspension set to keep the chassis level at rest, out on the track the back end has a tendency to buck over the larger obstacles while the front copes better, floating over just about anything. Raising all four shock ride heights just encourages the car to roll, as you have raised the centre of gravity. Raising only the rears so that it takes on a meaner, nose down attitude works a treat and the back wheels resist the temptation to over take the fronts. A lighter grade of shock oil in the

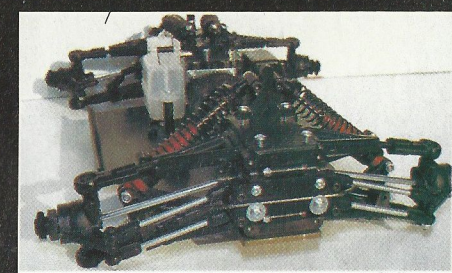
region of 15-20 weight also improves things if you are having this particular problem over a very rough track, by soaking up more of the initial impact before passing the remainder on to the coil springs.

Bearing Failure

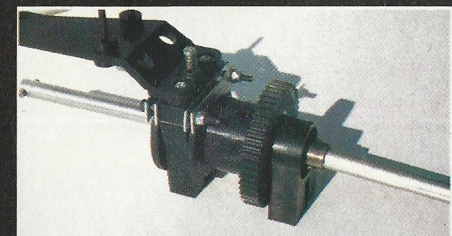
The Omega engine uses a BMT style clutch where three shoes are held in place by the pins pushed through the flywheel, holding the springs tightly against the hub centre. The only failures I have encountered so far are typical to all IC engines. The needle roller bearing inside the bell housing melted its plastic cage and seized onto the crankshaft wearing the clutch out prematurely. If I had lubricated this bearing every run it would have extended its life but may only have postponed the inevitable, until I'm leading half way through a final probably! The answer is to use a metal caged needle roller bearing which has a lower maintenance requirement, getting lubricated every Saturday before a meeting for instance.

Replacing the clutch was a doddle, driving out all three pins and swapping the shoes before reinserting the pins which guided the springs back into place with no trouble at all. Five minutes tops. The only other time that the engine has let me down was when the brass insert in the end of the throttle slide unscrewed itself and dangled helplessly from the end of the servo control rod leaving me with no throttle control. Fortunately this was in a warm up practice and I had the foresight to fit a fail safe slide return spring to cover such an eventuality. The brass insert cannot be thread locked into place if you ever want to reach the carb needle, so the answer is to do it up very tight, and get a few spare internal needle retainer springs. Don't let the lack of a 10p spring end your day in front of the telly instead of on top of the rostrum !

Otherwise the engine has performed beautifully, ticking over for twenty seconds on full brake before setting off without even a stutter. Standing starts are now no problem, even inverted after a roll it



Twin rear track rods locate the rear uprights, the uprights are common to front and rear suspension. The rear wing is to be fitted on top of the rear gearbox.



Centre diff and the two alloy propshafts.

will run for a good twenty seconds without cutting out, which should allow even the slowest marshal in the world enough time.

Race diary.

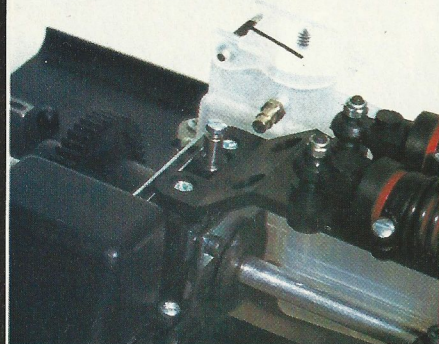
For its first race Chris the ED Deakin and I took it to the last round of the national series at Avon Park race way near Stratford upon Avon.

With no practice allowed the day before such a big event it ensured I would not be penalised by lack of circuit knowledge, so with the Diabla set up exactly as supplied after being run in and



Bring on the sacrifice.

Centre diff and front disc brake.



wheels over took the rest of the car. Buddy, can you spare a wheel nut? (Ed's note.....I did tighten them honest)

After that we added an optional front anti roll bar, fitted in seconds, and trimmed the outside row of spikes from the front tyres.

Round two went much better, with the beast transformed I was able to concentrate on my lines and let the Diablo worry about the ruts and bumps.

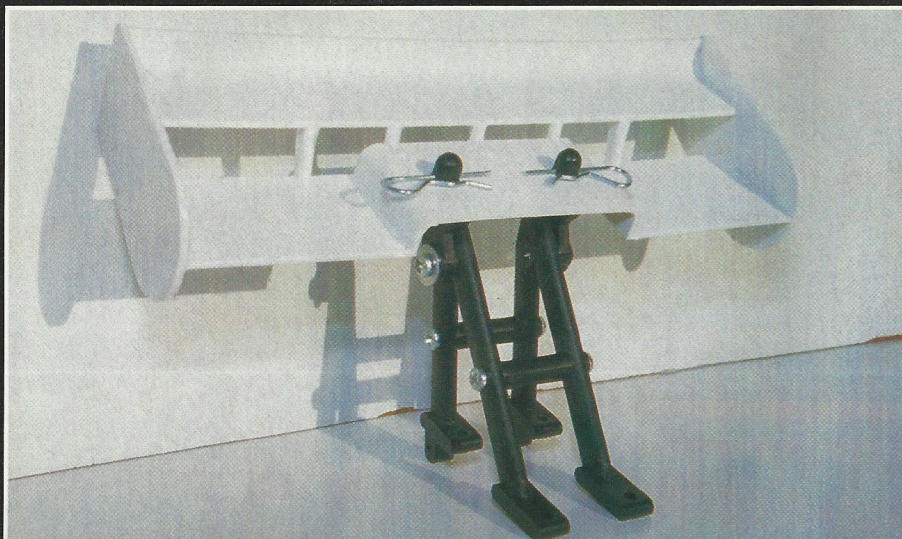
Round three was going equally well, as I learnt to overtake on the brakes with their progressive and predictable nature letting me go deep and fast into every turn, until a strange variation of range interference descended upon me and my run was ended by cries of "stop that car!", as it

result of mounting the five cell stick pack along side the radio plate, but I always carry a spare pack so I could still run in the finals.

Finals

I missed the warm up period and start of my final where the Diablo should have been third on the grid, because the incident with the caravan had cut the throttle servo lead, which went undetected in the pre-race check.

With it hastily reconnected I started nearly three minutes down and thankfully the handling of the Diablo was a crutch to lean on as I hacked round, mercilessly overtaking everything in sight but by two thirds distance after both fuel stops I had only



The bi-plane rear wing is full adjustable.

rebuilt we had high hopes going into the first practice period on Sunday morning.

Running short pin and cross tyres for predictable understeer, I went out to learn the track after walking the circuit to identified some of the larger rabbit holes that would even hide my size thirteen's. Big Rabbits!

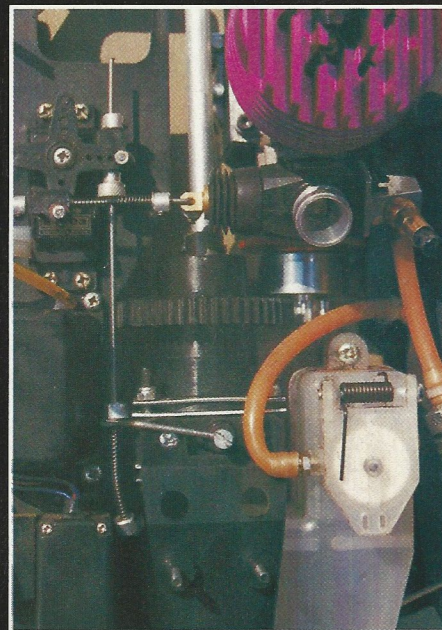
Only one racing line along the extremely bumpy main straight held a fast lap, while a concrete triple hogs back jump and several switch back 'S' bends gave the circuit its character and rhythm.

The ten minute practice session went swimmingly and was the first time I had used the Diablo "in anger". I was impressed and felt much happier knowing that I was going to enjoy the day pushing the car to its limits and maybe find a few of my own. A fuel check revealed excellent economy which would allow a two stop strategy to work in a twenty minute final and help make up just a little time..... maybe!!

The luscious green circuit had a lot to give and being first out we collected dividends. If blades of grass were currency I could have retired on what was wrapped around the front axles, but the under body remained clean despite the large gap between chassis and body shell.

Well pleased we sat back on our laurels of damp grass, yuck, and waited for round one with baited breath.

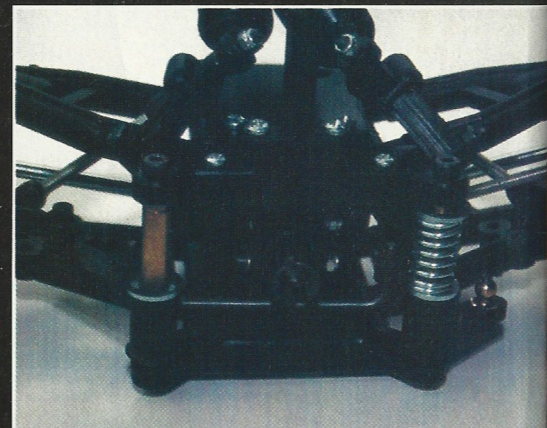
Red "TURBO RATS" were fitted all round as more traction was required now the top layer of grass had been collected but it also helped the front wheels dig in on corners and the tendency to roll was overwhelming. The run was ended only two laps in when I contracted Jacque Villeneuve disease and watched helplessly as one of the rear



It's all a little crowded. Note how the brake pads have begun to bend.

disappeared at full chat under the time keepers caravan.

The pointed tip of a chassis guard rail screw was standing proud of its boss after the receiver pack had rubbed away all the material around it during the bump and grind of the previous two rounds. This sharp point had dispensed with the heat shrink in double quick time and was burrowing into the cell structure, shorting it out. This was the



Steering bell cranks and sprung servo saver.

climbed to seventh place. It looked like the day was coming to nought but I battled on not knowing how much ground I had to make up on the leading bunch. By staying clean and concentrating on my lines by not having to worry about the durability of the vehicle, the impossible came true. Pulling onto the same lap as the leaders and taking third place on the last lap meant redemption was at hand and after the toughest twenty minutes-I've had for a long while it was apparent I would have to do it all over again. Coming third meant I climbed a rung of the Christmas tree into the next final and it felt damn good. Putting some charge into the receiver pack was the only precautionary maintenance required in the ten minute breather and I was ready for another shot.

No fairy tale this time

They say lightening never strikes twice but I was to start two and a half minutes down again after missing a crystal change. Beginners luck huh? This bunch were obviously better running nice and tight together, but I managed to lap quick enough to pull up a few places thanks in part to my two stop strategy which was working for me as well as the Diablo's suspension, ironing out the rough stuff and giving all it had got. Seventh was the best I could finish and I was gutted. Looking for a silver lining I had to turn no further than the car sat steaming on my pit table. With the body off there was nothing to replace, nothing loose and only my daft mistake was stopping the Diablo from going back out for more. Hitting several track markers with flat out glancing blows as I stuck to the tightest, fastest lines you might expect to lose a front wheel or at least bend a tie rod or two. No, none of it. All I have got to do between now and the start of the winter season is fill the engine with "after run" oil and give the chassis a

shot blasting. Maybe I'll lighten the greases in the diffs and soften the rear shocks just a little as the ground will be harder and more rutted come the colder weather. The biggest problem I've got is finding a shelf in the workshop that will prove sturdy enough to hold this mammoth safely between races.

Well, who ever started the rumour that lay down shocks don't work on a bumpy circuit has some humble pie to eat. Not only did I have a great time thrashing the Diablo to within a whisper of victory but a certain Mr Crompton went on to win the event and take the overall national title with, yes you guessed it, a Laro Diablo on this ploughed field of a race track.

The Diablo and all the Laro range are available from G.W. Racing,

Tel no. (01442) 254065 Fax no. (01442) 254065 The Omega Range of engines are also available from G.W.

Pro's

Almost ready to run.
Well built.
Some very clever design features.
Simple maintenance.
Great to drive.

Con's

Lack of information (poor instructions... no set-up information)
Lack of hardware for linkages.
No tumbuckles as standard.
Standard brake pads not up to the job.

QUICK SPEC

4WD. Twin Shaft Drive. Triple Gear Diffs.
Fully Ballraced. Front U/J Drive Shafts. Rear Dog Bone Drive Shafts. Alloy Chassis.
Moulded Radio Tray. Twin Brake Discs.
Carbon Three Shoe Racing Clutch.
Independent Suspension. Double Unequal Length Wishbones Front & Rear. Inboard Oil Filled Coil Over Front Shock Absorbers. Rear Outboard Oil Filled Coil Over Shock Absorbers. Rear Anti-Roll Bar.
5. Spoke Wheels. Laro Mini Pin Tyres. Fully Adjustable Bi-Plane Rear Wing.

TESTERS KIT

Radio	KO EX1 Precious
Receiver	KO Mini
Servos	KO 1002 (Steering) Futaba 9403 (Throttle)
Engine	Omega Buggy Pro
Pipe	Omega
Manifold	Omega
Fuel	Penn Models 25% Red Special
Glow Plug	Model Technics F3
Tyres	Medial Pro "Pink" Turbo Rats

