PB APOLLO PRO

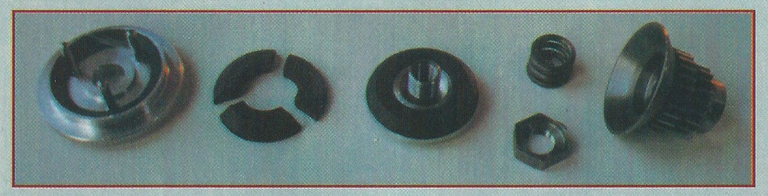
1/10th I.C.

Review By Dez Chand

Artistry in alloy, an awesome piece of C.N.C. milling.

If you think you recognise the assembled rolling chassis then you must have seen the Apollo that preceded it. The Apollo Pro has been developed from this model with influences taken from the many seasons endured in the hands of some of the top racers around at the moment and also by taking a good sideways look at its country cousin, the 1/8th Black Diamond. With all new geometry and now sporting active castor front suspension, the Apollo Pro's highly adjustable nature and crash worthiness will shine through on the track to make it one of the most enduring cars both in looks and performance.

The PB-Tech clutch.



A frying pan clutch

The new "PB-Tec" clutch makes ingenious use of PTFE (sure beats sticking it to a frying pan) to achieve a highly accomplished unit, in terms of the performance and reliability, and with it comes an adjust ability found in no other conveyance. Adjusting the amount of slip and bite points is one thing but the way the power comes in with a bang rather than waiting around for centrifugal forces to get their act together, means that the Apollo Pro will surely dominate the corner exit power struggle on high grip tracks. The fun doesn't stop there though, oh no. The limited slip diff is adjustable within seconds with the body off and the two speed gearbox change point is similarly user friendly.

Tear down design analysis

In theory you could put together an Apollo Pro in just over four hours once you have collected all the necessary tools together and taken the phone off the hook. In practice no one wants to rush a pleasurable experience so clear yourself a space that will not be disturbed for the duration and mark your territory with a vengeance because the last thing you need is enquiring minds and sticky fingers distracting you from a sub assembly or losing any of the limited components. One slip up and you could be left stranded as most of the assembly process is on a prerequisite basis. If a sequence is halted there is no re-route or bypass, until you have eaten your veg you cannot have your pudding. Much activity takes place on and around the chassis so there is little for anyone to "help you with" other than passing you tools on request and they will soon get bored enough to leave you alone.

The list of tools required is extensive as it is explicit. Knife, sandpaper, small nail file, ruler, vernier callipers, No.0 and 1 Posi screw drivers, 3 and 8mm flat screwdrivers. 1.5, 2, 2.5mm Allen keys, 5.5, 7, 8 and 10mm spanners, Blue thread lock compound, superglue, grease, oil and cloth are required plus the usuals like radio gear, engine, exhaust, manifold, air and fuel filters, fuel hose, body shell and paint. The Nova Rossi CX-15 is a popular choice with a matching tuned silencer and manifold but PB do their own spun aluminium, modular, tuned exhaust that is more crush resistant and well worth a look if you intend to get stuck in with the big boys.

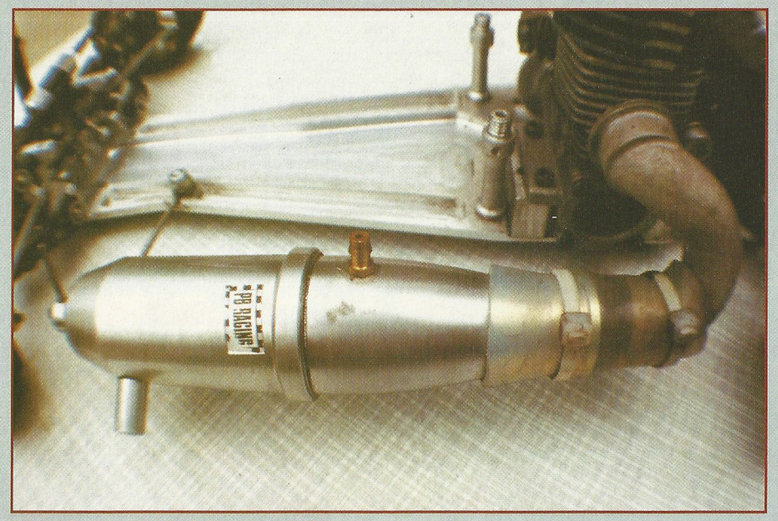
Nova Rossi Cx15 engine and pipe.

Plastic bodies

The shock absorbers are a large capacity plastic body with shaft seals held into the lower by a small knurled aluminium cap and the typical diaphragm is held under the top mounting and clamped to the top of the body by a larger knurled aluminium cap. A one hole piston is held to the shock rod by circlips and a ball joint is screwed onto the threaded portion to give a total assembled length of 66.5mm front and rear. If all four shocks are equal in length then your chassis will sit flat and the resulting handling characteristics will be balanced. The length is adjusted simply by rotating the ball end on its thread to lengthen or shorten accordingly. With all the air bled out of the recommended PB 2000cs grade oil and all flashes removed from the individual components there is a nice smooth result but the final settings will only come to light after some serious use.

A big diff

The differential is a large assembly partly due to the amount of power it will be responsible for distributing and partly because of the built in adjuster which means that it can be tightened or loosened without removing a single screw from the chassis. 4mm balls sit inside the main drive spur with its moulded teeth and belt retaining side flange, sandwiched by the large thrust washers sitting pretty on their base plates. The two halves are pulled together by a threaded ring that sits on the central pivot and acts against the huge spring washer to give variable tension and slip proportionally. This large aluminium nut has no external flats but is instead turned by the allen key used to slacken the pinch bolt. The nut is adjusted to the desired tension by holding the allen key still and turning the output shaft (fully assembled into the car you would turn the right-hand rear wheel). When you are happy just pinch up the allen bolt and presto, your off again. What could be simpler. I for one hate having to disengage drive shafts and tighten up a tiny screw at the heart of things before reassembling the back end just to alter the feel of a differential so this method works for me impeccably. The twelve 1mm balls dwarf the 18 2mm thrust bearing balls



PB racing spun modular tuned pipe, Very crush resistant.

but they are equally important and must be greased up properly between events to maintain their smooth efficiency.

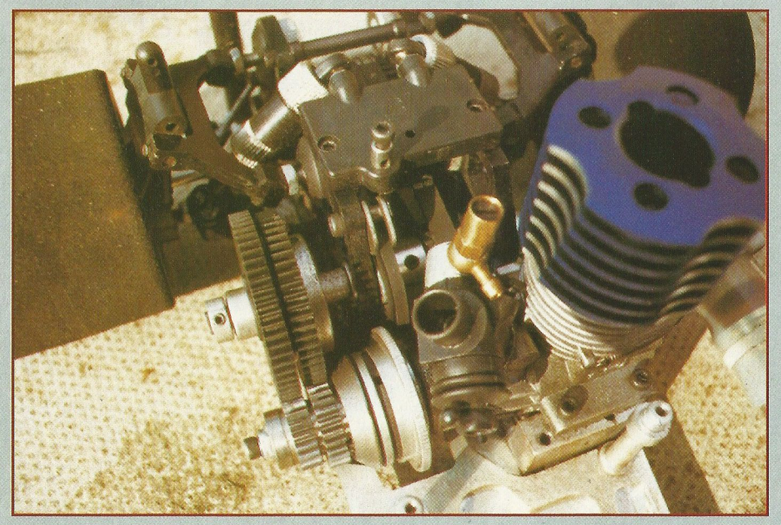
The diff sits in ballraces housed in large side plates that also mount the suspension arm inner pivots.

Let your wishbones swing

The inner pivot ball joints are multi functional as they not only hold the arms firmly but freely to the chassis. But by rotating them in and out of the arms, before re tightening their locking nuts again, they also govern the rear end camber, track width and toe in.

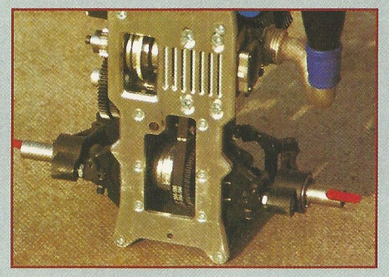
8mm balls with threaded roots sit in cups that have a smooth chamfered seat at the bottom of the hole. The ball is held into its seat by a threaded nylon retaining cup that follows it down the hole. By adjusting this inwards until the ball is only just free to move the pivot assembly sits in the side plate and is clamped in place by a threaded collar. With all four in, the locking nuts are run down their threads before the upper arms are introduced. The lower arms pivot on white acetyl bushes that run on a long pivot pin retained into the bottom of the side plate face by screws and washers. The arms should hold the bushes tight and likewise the screws should fix the pivot pins into the side plate so that all the movement is between the acetyl and the pin. New radial "hair" springs are a feature of the Apollo Pro and they now sit on these pivot pins with their bases up against the side plates while their perpendicular free end pushes the lower arms down against an adjustment screws tip. These springs need to be "Set" to make sure that each side has an even amount of preload so with the springs on the pins push their free end all the way up until it is effectively folded flat up against the side plate. If you do not set them in this way you will find that you have no rear droop and each side has a different amount of preload. Into the lower arms go droop control screws that will act against lugs of the main chassis.

Gearbox and assembled clutch. No we didn't run the engine without an air filter.



Disc's and shafts

The brake discs mount via their sliding pillars to the right hand side plate and a cylindrical cross brace helps keep the whole thing straight and true by laying horizontally between the two side plates behind the diff centreline at the top edge of the assembly.



Note the cooling slots machined in the chassis below the engine.

Between the two rear side plates passes an improved, 6mm diameter, lay shaft held in ballraces which has the unenviable task of carrying the two speed gearbox with its adjustable centrifugal change over clutch, the floating brake disc that will snuggle in between the two waiting pads, and the belt pulley to transfer power to the diff spur via a 1/4 inch drive belt.

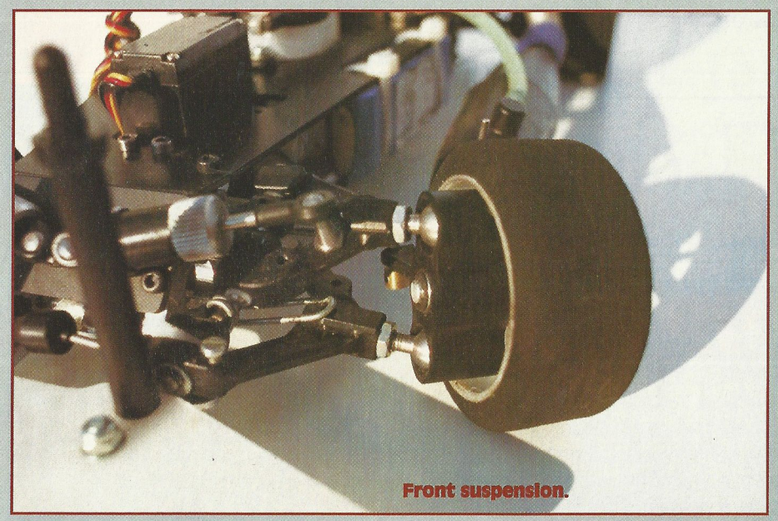
As the rear assembly is screwed to the chassis plate, the brake cam is held between a bush in the chassis and a plate that screws to the top of the side plates forward of the diff centreline. Not only does it support the brake arm but also offers the shocks a couple of ball joints as upper fixings. The rear anti-roll bar pivots fit to the back of the side plates and the balls on its two ends drop links down to the lower arms.

Final rear assembly

To the outside of the rear arms attach the rear axle carriers by a through pin in the upper arm and yet another ball and socket joint into the lower arm. This brings to a total of three such ball joints per side that hold each rear stub axle to the chassis and they work as mentioned previously, as a set to provide track width, camber and toe in so you need your wits about you as when you adjust one thing another is sure to alter. The hub carrier has three options for the slide pin through the upper arm to change the angle between the upper and lower arms, hence camber change rates and roll centres, with the middle hole being the nominal setting. The axle passes through the two ballraces that the hub contains and a roll pin passes through the axle which will key the quick change wheel adapters to the shaft. If, with the roll pin inserted, the axle is not completely free to rotate then the bearings are not fully home and the axle should require no more than a gentle tap to put them to bed. Into the hollow axle end slides the barbed lever that is the quick release system with its tension spring and these are held captive by another smaller roll pin that it will pivot on.

Let's start on the front

The front suspension mounts to two side plates in a similar way to the rear but either side of the lower arm pivot mountings sit different width nylon clips that determine how far forwards the lower arms are positioned and hence the amount of trailing castor. Again there are droop control screws and radial hair springs around the lower pivot pin, acting against the side plate and pushing down onto adjuster screws with their free end. These springs will need setting in a similar fashion to the rears but should not be encouraged all the way up to the side plates as this will give too much droop to the extent where you no longer have enough pre load adjustment to maintain chassis ground clearance. The lower



Front suspension.

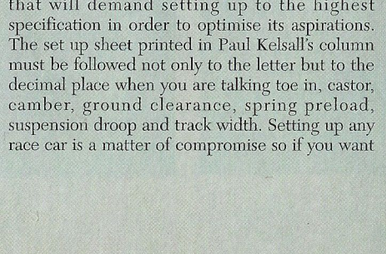
arms are extended towards the centre of the car past the pivot point and each side holds one half of the front "Cup and Ball" type anti roll bar. The upper arms pivot on pins that pass through mounting posts at an angle to the horizontal. At first glance the down and forwards angle of the arm looks odd but then as you move it up and down it becomes clear that it generates active castor control as the chassis transfers weight into a corner.

The two side plates screw to the main chassis and a top plate keeps them true and square whilst holding two ball joints as inner shock mounts opposite the balls on the forward edge of the upper front arms. For adjustments to the geometry the front arms subscribe to the same ball joint adjusters as the rear where the arms connect to the front upright and again they have more than one function. Not only do they offer steering pivot points but fine tune the trailing castor adjustment, alter the camber angles and track width. Similarly you must consider that any change of camber can alter track width and vice versa unless you keep an eye on it. The live front axle rotates in the ballraces that the upright contains and is retained by a large circlip inboard. If the axle is not free to spin then tapping the shaft to seat the bearings properly should improve things but this shaft is aluminium so be gentle. The front wheel simply slips over the exposed stub axle and is retained by a nut and washer that tighten onto the long grub screw thread locked into the centre of the axle. Unlike the rear wheels there is no fancy quick release system here so you are back to wheel spanners I'm afraid but from what I've seen of I.C. racing the fronts are subjected to more high speed impacts than most quick release systems can manage so they need this more secure method.

Slip in the engine

With a rolling chassis complete you can slip your chosen engine onto the mounting blocks and with your clutch and bell housing attached, offer up the gears to mesh and lock it down in the chassis slots when you are happy.

The radio plate holds not only the upside down steering servo and throttle/brake servo but the fuel tank suspended underneath by screws passing through rubber grommets. This accomplishes two things, it takes out a lot of the vibration to prevent the fuel foaming which could cause the engine to run leaner than expected, and relieves the stresses that a full fuel load could



Rear suspension detail. Also note the large bore exhaust manifold.

place on the mounting lugs that might otherwise rupture the tank. In a similar way a rubber grommet mounting holds the plate to which your receiver will attach, under slung on the opposite side of the top deck from the exhaust to reduce the chances of fume and fuel ingress causing you any radio problems. The exhaust silencer mounts to the manifold by a cable tied silicone joining hose and has a wire mount from the main chassis holding the hot, smelly, noisy end away from everything. The top deck radio plate attaches to the main chassis by sliding onto a couple of alloy pillars at the rear which have a threaded top section to allow 10mm A/F nuts to clamp it down. At the front the side plates offer two mounting holes for cap head screws to complete the double deck configuration but all the screws should be first loosely inserted before tightening them down incrementally so that there is no twist induced which would tweak your chassis from the outset.

The body shell is offered four mounting points, including two posts on the front bumper, which mounts to the lower chassis at a total of four points including the posts own screws, and by moulded posts screwed to the rear of the chassis.

A simple car by design

Your completed car looks very simple thanks to its design but belies a highly strung performer that will demand setting up to the highest specification in order to optimise its aspirations. The set up sheet printed in Paul Kelsall's column must be followed not only to the letter but to the decimal place when you are talking toe in, castor, camber, ground clearance, spring preload, suspension droop and track width. Setting up any race car is a matter of compromise so if you want a twitchy car that points in eagerly you will have to live with a lack of straight line stability for example and if you can take dialling in your chassis as a learning experience maybe some day it will pay off when you become the local tuning guru. Everything about the PB Apollo Pro is relevant to full size racing cars but bigger is not always better. I have enjoyed driving the Apollo Pro at several meetings now and have found it to be user friendly in the extreme. All the adjustments are there for you, it is like playing the piano as all the right notes are staring right back at you, all you have to do is hit them in the correct order and it's playing your tune.

At this point I would like to thank PB for supplying the review car and also Ted Longshaw for supplying the Nova Rossi CX15, pipe and manifold.

QUICK SPEC

2WD.
Alloy Chassis.
Belt Drive.
Ball Diff.
Ballraced.
Dog-bone Drive Shafts.
PB-Tech Clutch. Fibre Glass Radio Plate.
Independent Suspension.
Unequal Length Double Alloy Wishbones Front And Rear.
Oil Filled Shock Absorbers.
Hair Pin Springs.
Multi- spoke Wheels. Grand Prix Foam Tyres (50 shore front-25 shore rear)
PB BMW Bodyshell.