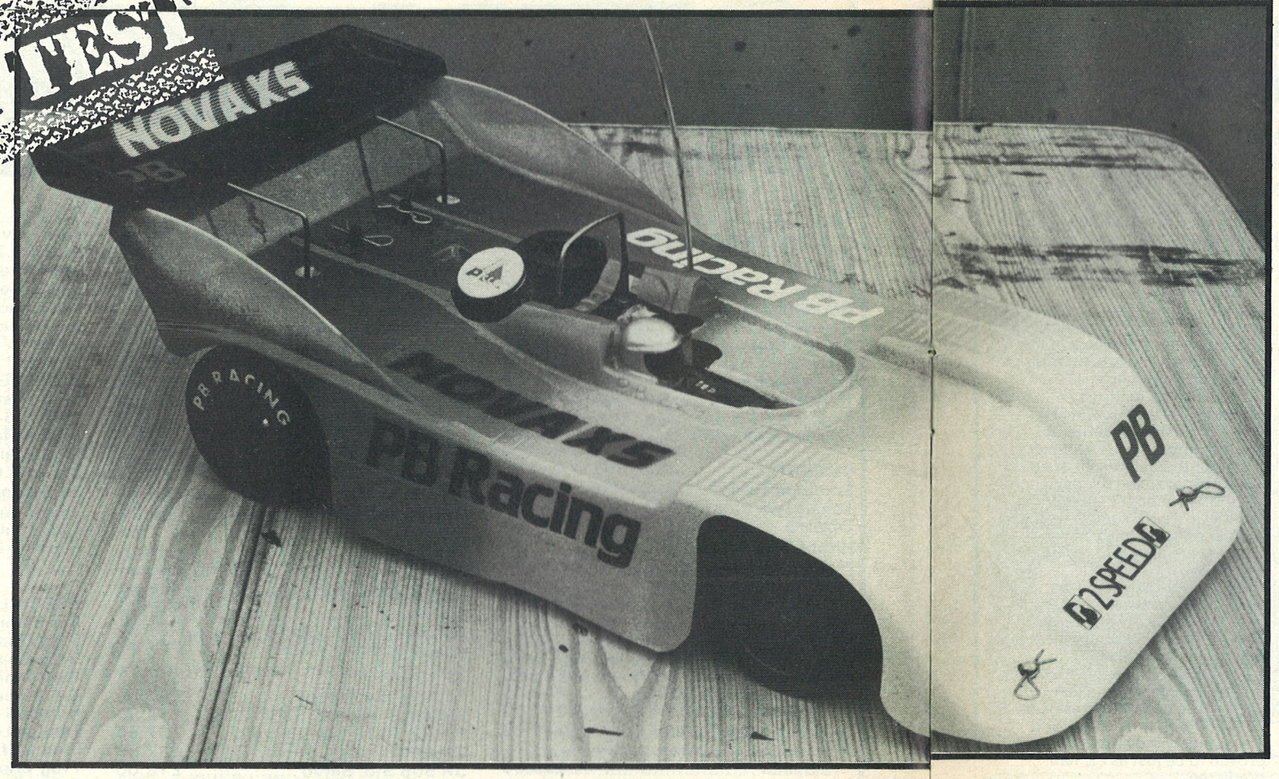
TRACK TEST



Development of PB Racing Products' 1/8th scale track racing challenger continues apace. Colin Leake finds out whether the 1986 'Nova X5' has RISEn to the occasion

NOVA X5

PB'S work at the beginning of the year to find the most efficient transmission system for the rear of the 'Nova X5' produced some interesting results.

Through a purpose built test rig the three forms of drive: gears, belt and chain were assessed.

Having prepared themselves to manufacture a geared system (as used in prototype form last year by Paul Pagdin) *PB* were surprised by the results from the belt drive equivalent. This in turn led to the re-design of the old 'X4' rear-end from chain to belt drive.

The belts used are *Uniroyal* HTD belts reinforced with Kevlar which is claimed to make them lighter and more flexible than both steel and fibreglass reinforced belts.

The American version of these belts have been used by some *Associated* drivers over the past two seasons and have gained an enviable reputation for their long life and reliability.

PB eventually opted for a 5.0mm wide belt at the front and one 9.00mm wide in the rear-end. This latter belt is continuously rated at 3HP so should be more than adequate for the job.

I have always preferred belt drives maintaining their advantage in absorbing any shock loads that may be transmitted to the engine and primary drive gears by less flexible and compliant systems.

In standard trim *PB* have the front wheels driven faster than the back relying on the torque limiting device to produce what is in effect a constant torque on the front driven wheels. This means that by changing the amount of torque the cars handling can be varied from understeer through neutral to oversteer in a very precise way. It also means that the torque limit can be set so that traction can never be lost by the front wheels, due to acceleration, even in conditions of very low grip. Rather like having anti-lock braking in reverse.

The down side of this is that the torque limiter is slipping all the time and hence absorbing some of the available power.

For drivers who do not find this arrangement to their liking it is simple to change the central gearing to have both ends of the car driven at equal speeds or even have the rear-end geared higher than the front.

The front suspension is achieved by unequal length upper and lower wishbones with the springing provided by the surprisingly simple, but effective means, of employing a straight length of steel spring wire. This is clamped to the top moulding by two plastic brackets and then acts on plastic rollers fixed to the top wishbones.

The damper is *PB*'s own unique double ended affair, acting on plastic brackets fixed to the rear of the upper wishbones. It can act as a monoshock if left floating or can have a pin passed through its central portion into a plastic bracket below, in which case it acts as two individual shock absorbers.

Down stops are provided by sliding metal shafts acting on the lower wishbones then passing up through the front mouldings. On the top end of each is a spring and a nut that can be used to adjust the ride height.

The front anti-roll bar is a conventional 'U' shaped affair acting directly on the lower wishbones via ball joints.

The castor on the front-end can be varied by moving the small plastic spacer that is normally located forward of the top wishbone to the rear of it. The camber may only be changed by purchasing one of the three different length lower wishbones that *PB* manufacture. The only way in which the spring rate may be altered is to use a stiffer or softer bar.

To the uninitiated the upside down mounted steering servo looks like a positive disaster area. Having written a whole page on how if I were running the car I would go about mounting the servo the right way up etc. said page had to be tossed into the rubbish bin when I did what I should have done in the first place and checked with a *PB* driver.

The explanation is remarkably simple. The steering servo is best fitted with a *Kimborough* servo saver. Since *PB* only provide a bellcrank at the front, the link that connects the bellcrank to the servo finishes at the servo end with the wire bent upwards at right angles. All that is necessary to fit a servo is to remove the quick release fuel tank, hold the wire in place with a pair of needle nosed pliers and push the servo down into position ensuring that the bent up end of the wire linkage passes through the hole in the servo saver arm. No collet is used or needed. The wire is held in place by the smooth bottom of the monocoque.

Transmission

Drive is transmitted to the central layshaft by a gear train that I have to confess has me worried. I would certainly suggest that owners take great care in ensuring perfect mesh in this area. *PB* assure me that there are no problems but I do know that many club members have had trouble. On one occasion down at the Bournemouth round of the BRCA series, a gentleman from *PB* was informing me that there was no trouble in this area, whilst the grass in the pits was littered with gear wheels. I would be tempted to have a metal intermediate gear cut and I am sure *Nodis* would be only too happy to oblige, as they have cut special gears for me in the past.

Having arrived at the conclusion that belt drives were best I wonder why they left a gear drive here?

I would not like the above to put off prospective owners of the car. The problem is not terminal. All cars have one or two weak spots and although I believe this is the *PB*'s it is certainly no worse than some of the problems that have beset rival makes of cars.

Automatic gearbox

The operating principle is the same as that of the successful *Serpent* gearbox but there the similarity ends. The clutch bell pinion is supported on two roller bearings and a long clutch nut provides support along its total length. However, the real sensation is that *PB* made the small low gear pinion separate from the high gear one. Neat! So neat in fact it fooled me at first and cost me a phone call to Havant to find out just how it worked. There is a total of 36 different gear ratios available which are arrived at via three sets of plastic gears 44/47, 47/50 and 50/53 teeth. There are three sizes of low speed ratio pinions 12, 13and 14 teeth and four sizes of high speed and low ratios can be used.

A brilliantly thought out and executed concept. I'd be willing to bet one or two other constructors will be looking at the possibility of copying this.

'X4' to 'X5'

PB's main changes to the old 'X4' lie at the rear of the new car. Keith Plested's revisions to the rear-end are summed up by the useful acronym RISE. This stands for Roll Induced Steering Effect.

The suspension changes apart the whole of the Nova's rear-end features subtle changes to the original design.

The basis of its construction comes from two plastic side mouldings that carry the main components. The forward part of these form substantial bearing housings which carry the layshaft bearings.

The brake disc is a large diameter, thin, case-hardened steel disc operated on by twin pads of aluminium alloy. This should prove effective enough but having run *SG*'s with Ergal discs I am a bit worried about the wear that will take place. The hard thin disc will wear the alloy pads away quite rapidly. When this happens the non worn parts of the pads will come together allowing the thin brake disc to rotate freely in the groove it has made in the discs. I put this point to *PB* and was told that based on their experience with the 'Mustang' they expect the pads to last for at least half a season. The pads are brought together and pressed onto the disc by the conventional cam.

On top of the two side mouldings sits a plastic bracket on which are located the top ends of the massive individual dampers. These dampers have equally large coil springs over them to provide the suspension. The whole assembly acts direct on the lower wishbones and is sensibly sighted ahead of the wishbones well out of harm's way.

In contrast to *Serpent* cars the PB shock absorbers appear to be fitted upside down. I queried this with Paul Pagdin who pointed out that they were in fact the right way up for shock absorbers and that most full size cars have them installed with the piston shaft pointing down. It's all to do with reducing the unsprung weight. The piston and rod weigh much less than the cylinder so this is fixed to the moving wishbone leaving the heavier cylinder attached to the bulkhead.

Drive is taken out to the rear wheel stub axles by short solid looking drive shafts. *PB* have used a ball and pin arrangement driving into a cup rather than the more normal hexi-drive. This method of driving is finding increasing favour with many manufacturers and is proving very reliable. The rear wheel stub axles are carried in twin bearings located in machined aluminium alloy housings. They are a little close together and hence alloy some play in the axle.

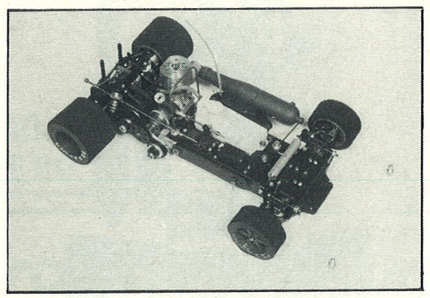
The rear axle bearing housings are connected to the outer ends of the wishbones by a single ball joint top and bottom. The alignment of the rear axles is finally tied in by a conrod shaped moulding that connects to a machined alloy rear bulkhead. The inner fixing is an eccentric device that can be used to adjust the toe-in or toe-out of the rear-end. A feature that I believe to be unique to *PB*.

Not satisfied with this Keith Plested's fertile brain dreamed up the idea of having three holes in the rear bulkhead to which the eccentric cam can be fixed to provide varying degrees of RISE.

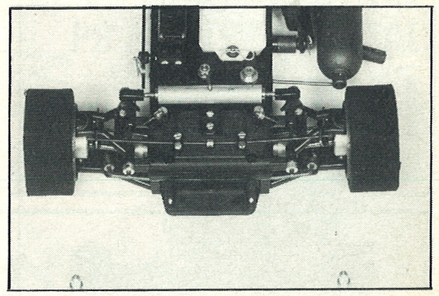
Basically if the centre hole is used if there is no bump steer effect on the rear wheels and the car's handling is neutral. Use the top hole and the rear wheels toe-in under squat to produce an extremely stable car. When the car rolls under cornering the outside wheel turns slightly in and again helps to produce a stable car.

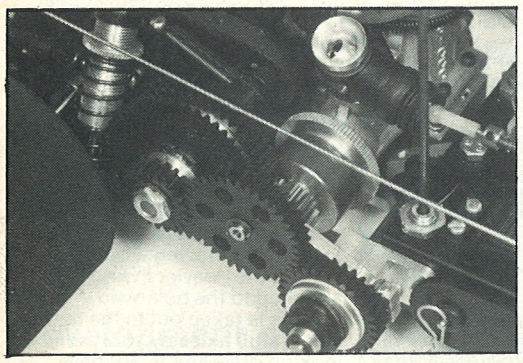
Use of the bottom hole is most definitely for experts only. Under squat the rear wheels toe-out. This has little effect on the handling of the car in a straight line but under heavy

Below: the 1986 specification for the 'Nova' features major revisions to the rear-end of the car.

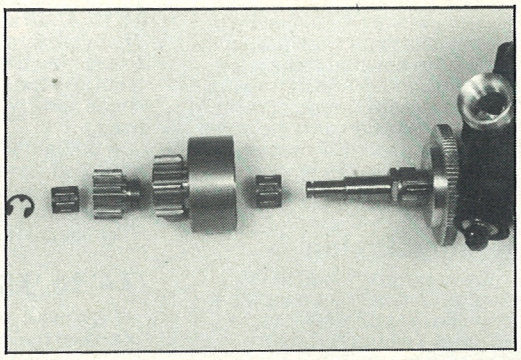


Below: close-up of the 'Nova X5' front-end showing double barrelled damper and simple piano wire spring.

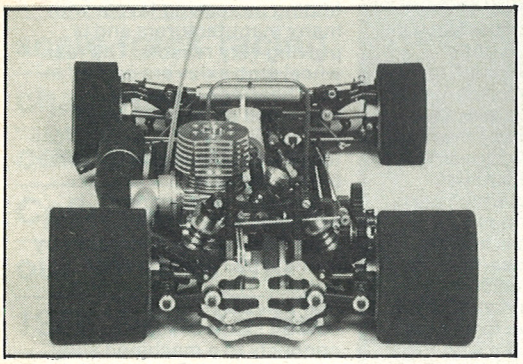




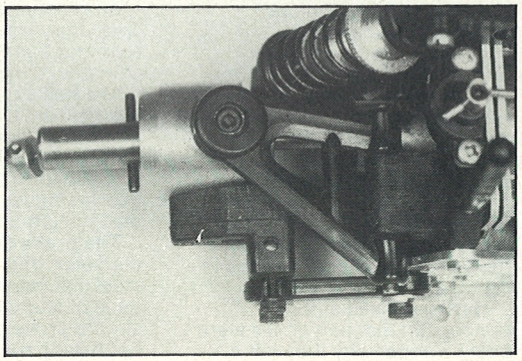
Above: gear train between the rear and centre layshafts incorporating the front/rear torque limiter.



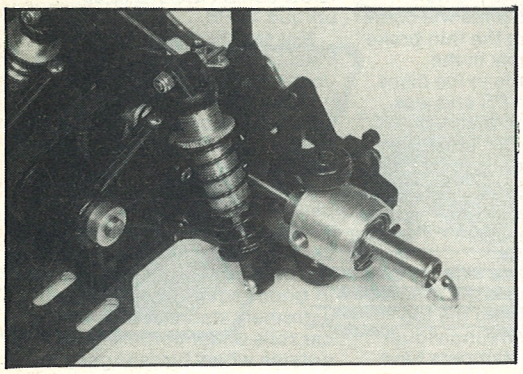
Above: components of the two part automatic gearbox clutch bell which allow a wide range of ratios to be used.



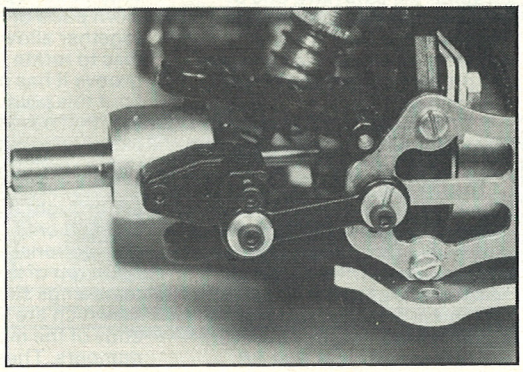
Above: view from the back showing the new rear bulkhead which is the mainstay for the RISE system.



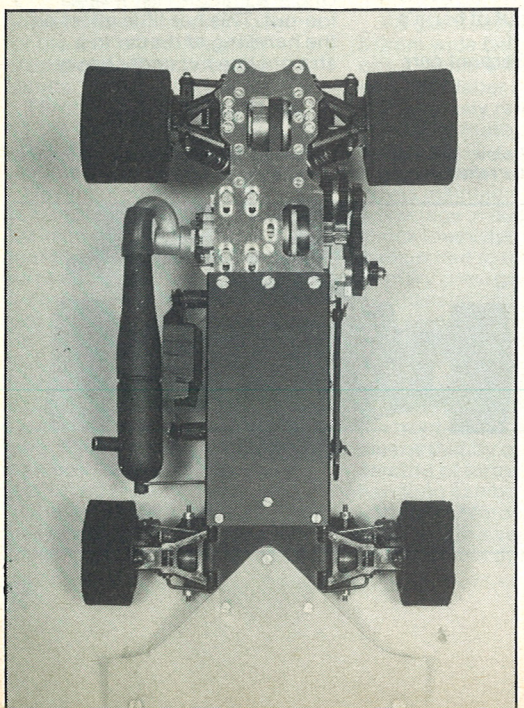
Above: rear suspension geometry. Wishbones can be raised or lowered.

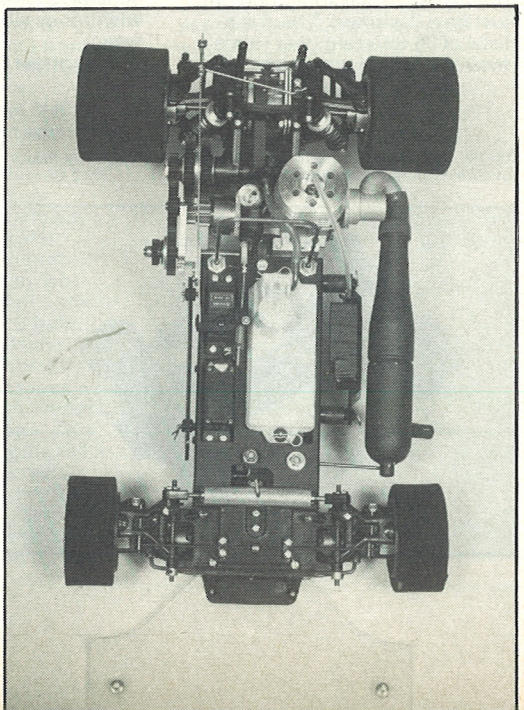


Above: the massive rear dampers mounted inboard of the rear wishbones and mounted directly onto the lower arms. Below: the underside of the complete car.



Above: the RISE rear-end use this link to adjust toe-in or toe-out through an eccentric cam. Raising or lowering the link gives varying degrees of roll induced steering. Below: the complete car.





cornering the effect is to turn the outer rear wheel slightly outwards giving roll induced steering in the rear-end of the car. This gives the car tremendous cornering power but it really does take a very experienced driver to make the most of it.

The upper wishbone is secured to the main side mouldings by plastic brackets. Once again *PB* have introduced a unique feature. There are two sets of mounting holes so that the wishbones may be mounted at different heights. *PB* recommend that the lower mounting position be used for two-wheel drive versions of the car and the upper one for four-wheel drive cars.

The Nova X5 made its competition debut in the first round of the BRCA series at Southampton. The results speak for themselves. First on the Saturday in the hands of Dave Dixon, second on the Sunday in Paul Pagdin's hands and second and third on the Monday are excellent results for a new car.

What is more the car was holding its own in the lesser heats, with all of the drivers finding it much easier to drive than last year's car.

We already knew the effect of the torque limiter from last year's cars, so our interest was concentrated on the rear-end. The effect of moving the tie rod proved to be just as *PB* had predicted.

One or two drivers tried to use the lower mounting point for the tie rod, but as there was little grip available, found the cars much too twitchy and quickly reverted to the middle hole.

Lower down the field one or two drivers were finding the car a bit of a handful in the wet. In some cases they solved their problem by moving the tie rod to its upper position to produce a more stable car.

The only problem that showed up was that with no rear anti-roll bar the cars had a tendency to lift a front wheel under heavy cornering. *PB* tell me they will be experimenting with both stiffer rear springs and an anti-roll bar to find the best cure.

Conclusions

Cars seem to have a character all of their own. This latest offering from *PB* reminds me of a greyhound. Fast, balanced and agile. It makes its way round the track at speed with little drama almost regardless of conditions. The torque limiter makes it easy to set the car to suit the driver's skills.

Manufacturer: *PB Racing Products*, Downley Road, Havant, Hampshire PO9 2NS.

UK Distributors: *Ted Longshaw Model Cars*, 7 Warren Road, Chelsfield, Orpington, Kent.

Prices: Four wheel drive kit: £285 including gearbox.

Rear-end update for X4: £120.

Gearbox: £35.