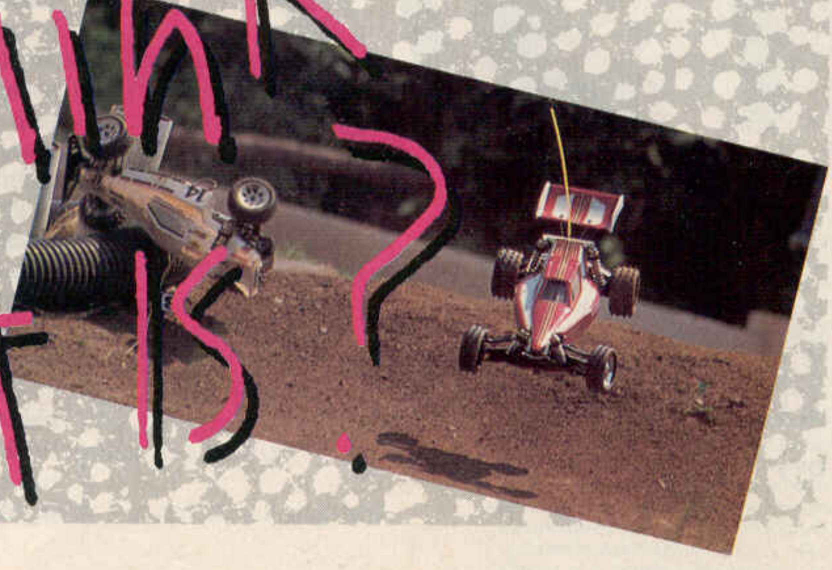
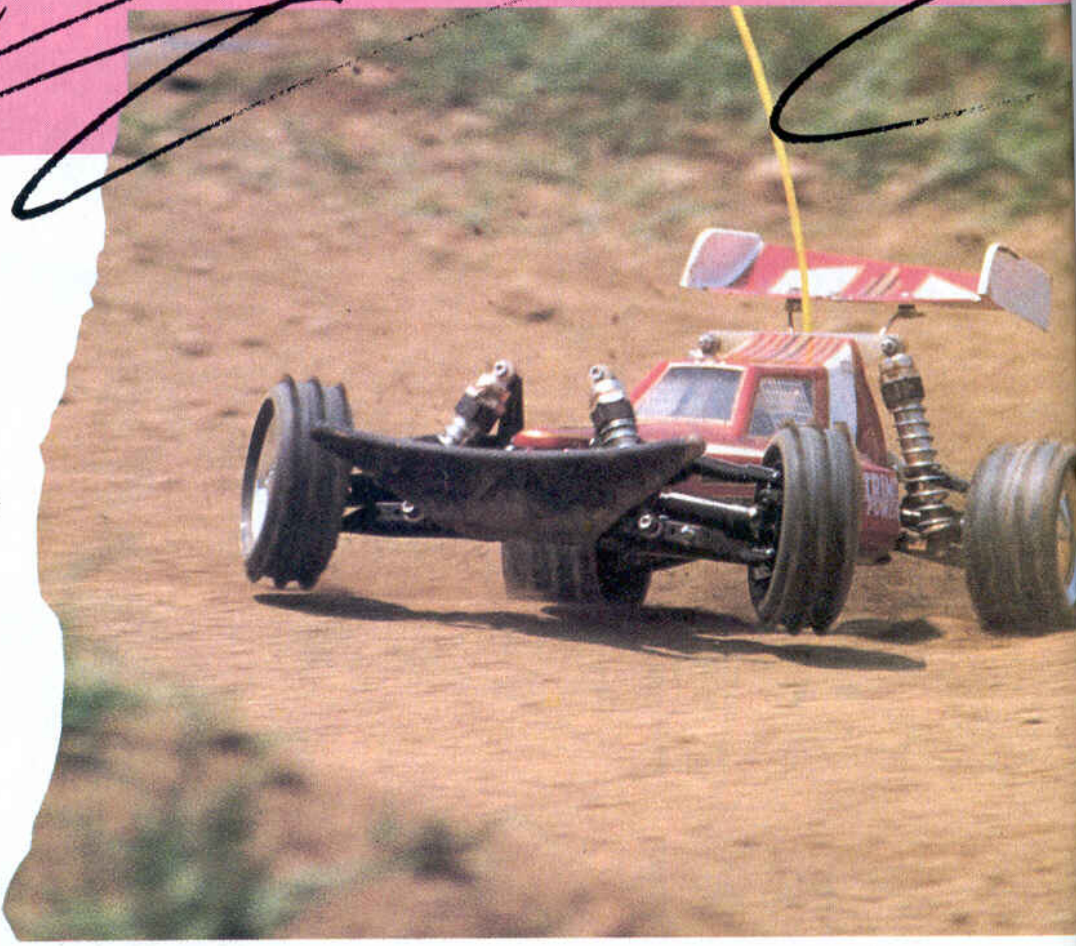
What time do you think it is?

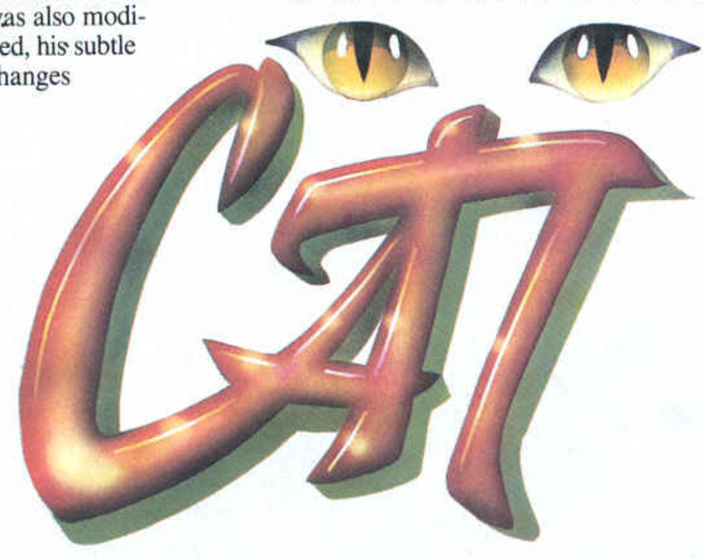
Photo by Greg Newman.



Track Report



SCHUMACHER



The Need for Speed

by STEVE POND

BY NOW, THE news of the 1987 IFMAR World Championships in England is old. Anyone who follows R/C racing knows who won and which car he was driving. One of the victors was Masami Hirosaka of Japan, who won 4WD Class with his Schumacher* Cat XL. One element makes Hirosaka's conquest of the Worlds unique. In the World Championships and other global high-ticket events, most, if not all, of the previous winners in both the 2WD and 4WD Classes have been modified extensively to boost performance. While Hirosaka's Cat was also modified, his subtle changes were all made with optional *factory* parts. The latest kit version of the British-made Schumacher Cat (dubbed the XLS) now includes all the optional parts used on the championship car.

The XLS features all the go-fast goodies that should be found on a race car of this capacity, including belt-driven front and rear ball differentials, fiberglass plate chassis, unique universal-joint drive shafts with one-way bearings on the front pair, upper and lower front and rear suspension of molded nylon, precision sealed bearings, oil-filled coil-over shocks and the standard Lexan body. The body for the Cat also includes a chassis pan with an integrated belt guard to protect the belt as it passes under the lower chassis plate on its way back to the rear differential.

These features may sound familiar, and they should, as they can also be found on a number of other competitive cars. However, the design of the Schumacher Cat makes maximum use of these attributes, and this ensures a top-notch performance with each run.

Additions to the XL kit that make it comparable to the XLS include a new, wider, front bumper for additional front-end protection, a front ball differential to replace a central one-way bearing diff, one-way front drive shafts, wider front

and rear track, extended wheelbase, increased front and rear caster angle, and precision bearings with a dust seal that keeps out virtually all dirt.

Assembling the Schumacher Cat isn't easy. In its completed state, the Cat may not look complicated, but it has a relatively high parts count, and the possibilities for confusion are compounded by the not-so-specific instructions. A car of this caliber will always demand attention to detail, but you may have to do a little reading between the lines to ensure a smooth assembly.

ASSEMBLY: This begins with the rear differential and layshaft. The layshaft transmits the power from the spur gear to the rear differential via two short belts. The rear differential comprises three separate belt pulleys. The center pulley has holes molded in for the diff balls, while the outer pulleys have flanges molded on the inside for the mounting of the diff rings. The diff rings must be epoxied to the inside of the outer pulleys to ensure consistent operation. It's vital to take a little extra time here, as this step will determine how well the differential will operate.

After applying a thin coat of epoxy to each pulley, I seated the diff rings and

SCHUMACHER

CAT

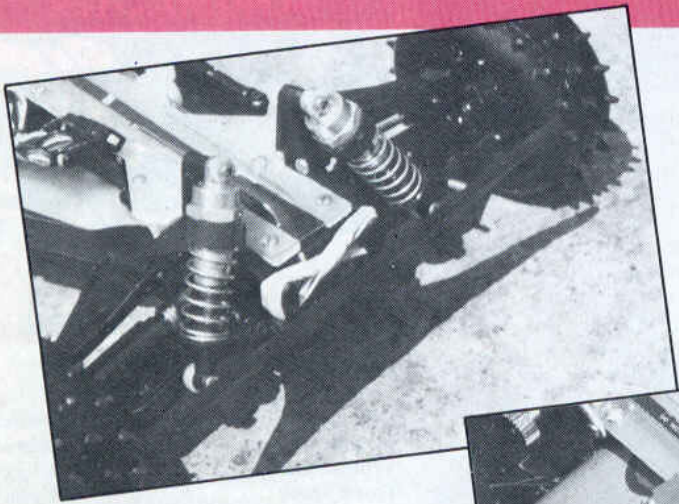
Type	4WD Off-Road racer
Scale	⅒
DIMENSIONS:	
Overall Length	14⅝ inches
Width	9⅝ inches
Height	5 inches w/o wing
Wheelbase	10¾ inches
Front Track	8¼ inches
Rear Track	7¾ inches
WEIGHT:	
Gross (w/rec. bat.)	3 pounds, 8 ounces
Balance	44/56
BODY:	
Type	Single seater w/lower chassis pan
Material	Lexan
CHASSIS:	
Type	Plate
Material	Fiberglass
DRIVE TRAIN:	
Type (prim./sec.)	Belt/belt
Differentials	Ball (front & rear)
SUSPENSION:	
Front: Type	Double wishbone
Dampening	Oil-filled coil-over shocks
Rear: Type	Double wishbone
Dampening	Oil-filled coil-over shocks
WHEELS:	
Front: Type	One-piece plastic
Dimensions	2x⅞ inches
Rear: Type	One-piece plastic
Dimensions	2x1¼ inches
TIRES:	
Front	Spike
Rear	Spike
ELECTRICAL:	
Motor	Not included
Battery required	6- or 7-cell
Speed Controller	Not included

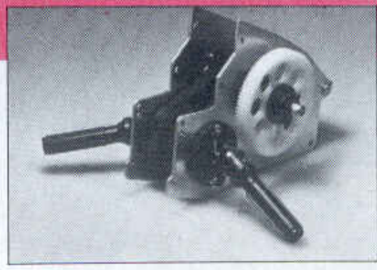
OPTIONS AS TESTED:

Novak NESC-1X electronic speed controller, Parma 6-cell matched Sanyo pack, Trinity No. 2004 4WD modified motor, Robinson Racing 48-pitch gears, CRP shock pressure gaskets, CRP 40wt shock oil, Kimbrough servo saver and Futaba Magnum radio W/FP-S135S servo.

COMMENTS:

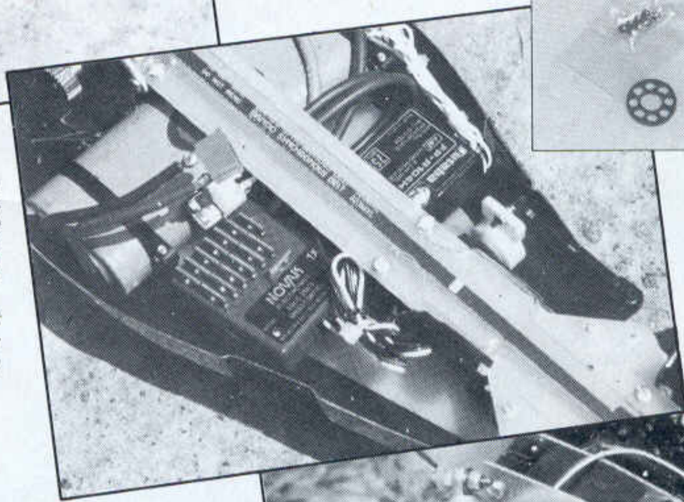
Despite its ability to keep up with or surpass the competition, there's still room for improvement. The dust-seal bearings cause an excessive amount of drag; they should be replaced with a standard precision bearing with a metal seal. The differential could also be improved with a system that would allow you to direct the power more effectively. Construction is rather difficult and requires some previous racing/building experience.



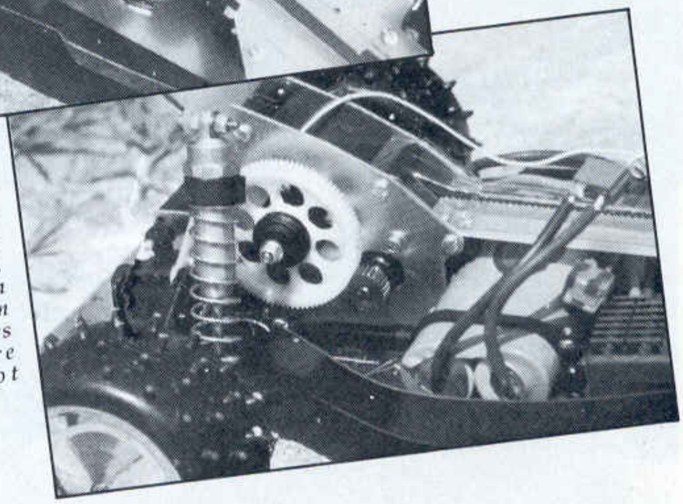


The differential may not look complex, but assembly is tedious and time-consuming.

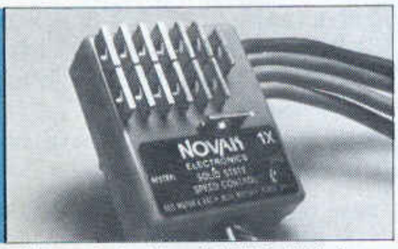
When the original thrust bearing on the left is replaced with the Parma bearing on the right, differential assembly becomes a breeze.



Above: *To protect the Cat from damage during a collision, a rubber band stretched across the front end will allow the suspension components to pivot back when hit hard, thus preventing breakage.*
Right: *Lexan chassis pan keeps dirt away from internal components while clear belt cover keeps debris from entering differential.*

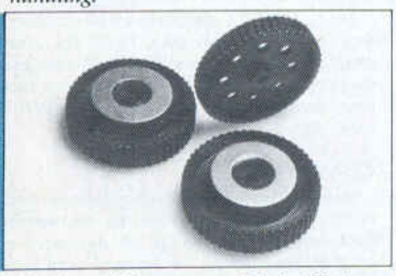


Robinson Racing 90-tooth, 48-pitch spur gear replaced the original spur gear. These gears run more smoothly than the original gears because they're machined, not molded.



Although the Novak NESC-1X is larger than most competitive speed controls, it provides excellent low-end punch and top speed.

The new front universal drive shafts include one-way bearings for superior handling.



A view of the unassembled diff shows the three separate pulleys. Diff rings are epoxied to the outer pulleys and the inner pulley houses diff balls.

then assembled the entire differential. By assembling the differential before the epoxy has dried, an even pressure is applied to the diff rings to ensure that they're resting flat against the pulleys. One problem in the diff assembly is the installation of the thrust bearings on the bolt that passes through the diff for adjusting the amount of slip. The included thrust bearings must be assembled, and they consist of a ball cage and eight tiny balls. The balls don't snap into the cage, and this allows them to fall out at any time. The lubricant will help to hold them in place, but they just don't seem practical for maintenance.

Parma* manufactures a thrust bearing (No. 1420-F) that's the same size as the one for the Cat. The Parma thrust bearing is pre-assembled in a metal race that won't allow the balls to fall out. Although the Parma bearing uses five balls instead of the eight used in the stock bearing, there's no compromise in performance or smoothness of operation. I highly recommend that you pick up a pair (one is also needed for the front diff) when you pick up your Cat. The assembled diff is attached to the right-side aluminum housing plate. The diff fits into an eccentric belt tensioner that allows adjustment of the two short belts driving the rear differential.

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motorsport event. ■

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When the belts are in place over the top layshaft (which also has its own diff to allow free operation of the rear diff) and the rear diff pulleys, the left-side aluminum plate is installed, followed by the upper and lower fiberglass chassis plates.

I can see two minor problems with the rear diff: First, the three pulleys on which the drive belts ride have no guides for the belts, and this allows the short outer belts to ride over to the side of the pulleys and rub the aluminum plates. While the plates are sufficiently close to the diff to keep them from coming off, it will cause some friction, and this may reduce run time.

Second, the eccentric belt tensioners are held in place with self-tapping screws. This isn't a big problem, but taking into account the required maintenance, constantly removing these screws may cause them to strip. A simple solution is to tap the mounting holes with a 2-56 tap and use short 2-56 Allen-head machine screws. The assembly of the front diff is similar to that of the rear diff, so this should pose no real problem.

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When the front diff has been assembled and allowed to dry, the front transmission housings are installed, followed by the one-way bearing drive shafts. When this is complete, the front diff assembly is attached to the chassis with mounting brackets. These mounting brackets allow the front diff to slide back and forth for belt-tension adjustment. At this point, there's no need to adjust the belt tension, because these screws must be removed to install the Lexan belt cover later in the assembly process.

The next step is to adjust the tension of the shorter rear belts. The instruction manual gives you an idea of how tight these belts should be, but the correct tension adjustment will have to be determined when the car is running. When this is completed, the diff cover is installed, and this is followed by the installation of the rear suspension brackets. In step 14 of the instruction manual, during the installation of the rear suspension brackets on which the upper arms will pivot, an M3 x 55 stud is called for. This passes through the transmission housing to act as a mount for these suspension brackets. After searching for a while to find the elusive stud, I found it packaged with the steering and suspension linkage rods. It's similar to the linkage rods, with threads only at the end. Passing the rod through the transmission housing is a rather tight fit, but, with the help of a few light taps with a small hammer (be careful not to damage the threads), it went in easily.

Next in the assembly sequence is the installation of the suspension arms. This went smoothly apart from one minor glitch. The front pivot for the rear lower arm on the right side of the car will interfere with the spur gear. This is cured by simply filing or shaving off the obstructive portion of the mount. The rest of the suspension arms go into place as described in the instructions.

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A unique feature of the front suspension on the Cat is the way the arms pivot horizontally to allow the assembly to kick back and so prevent damage during a collision. A rubber band (simple though it may sound, it's very effective) is wrapped between two lugs in the front of the suspension assembly. When hard contact is made, the rubber band will allow the suspension assembly to pivot backwards and absorb the impact. It then returns undamaged, to its usual position. Wrap the rubber band as tightly as possible; this allows adequate protection, but it won't allow the suspension to pivot, and so cause erratic handling, during normal operation.

Installation of the front anti-sway bar was bypassed, because it not only requires that the Lexan belt cover be cut to allow the sway bar to pass beneath it, but the sway bar also has to pass under the belt with very little clearance.

Next, the wheel hubs are attached to the suspension arms, and this is followed by the installation of the shocks. The shocks are made of high-quality aluminum and are worthy of the Cat, but I made one change to make the dampening more consistent. After filling the shocks with CRP 40-weight shock oil (the kit doesn't include any shock oil), I replaced the O-ring seal (designed to seal the shock when the cap is screwed on) with a CRP* Shock Pressure Gasket. These diaphragm-shaped gaskets compress upward as, while under compression, the oil displaced by the shock piston fills the chamber of the shock. By keeping air out of the shock, it eliminates the possibility of the oil foaming. (Foaming would alter the dampening properties of the shock.)

From here on, the only thing standing between the Cat and the track is the installation of the electronics. Wisely, the Cat doesn't include electrical components such as a speed control or motor. Most racers have a personal preference, so they'd substitute alternatives, and including electronics in the kit would result in a higher retail price. I used a Futaba* Magnum radio with an FP-S135S high-speed mini servo. The Cat is designed to accommodate a larger servo, so to fit the smaller servo, I had to drill new mounting holes in the chassis and chassis pan. The unassembled servo-saver was scrapped in favor of a race-proven Kimbrough* servo-saver. For power, I chose a Trinity* No. 2004 4WD

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motor. When combined with the new Novak* NESC-1X speed control, it provided the best low-end punch and top-end speed I've seen.

Attached to the Trinity motor was a 19-tooth 48-pitch pinion gear driving a 90-tooth 48-pitch spur gear from Robinson Racing Products*. These gears are machined instead of molded to ensure the most exacting tolerances. The 90-tooth spur gear is identical in size to the stock spur, but it's 48-pitch and the stock one is 32-pitch. Robinson offers a complete line of these precision-machined spur-and-pinion gears for the Cat and many other cars, and I recommend them.

The final assembly steps entail painting and installing the Lexan body and other miscellaneous trim pieces. Among the body, chassis pan and wing pieces, there was a Lexan motor cover, a gear cover and drive-shaft guards that I left on the Lexan scrap heap. Covering the motor is a ridiculous idea; I see no need to protect the rear drive shafts from dirt; and if the motor cover fit, it would hinder all efforts to make those frequently-needed last-minute adjustments before racing.

You may have noticed the body; this is *serious* paint work., Although I think the job is nothing short of awesome, I confess that it's *not* my work, but the work of Richard Muise of Motion Graphics*. Richard makes it his business to paint the finest bodies money can buy, and they *do* take some money to buy. With bodies in the $60 to $150 price range, you might not want one on a car that gets a daily thrashing. But if having the sharpest-looking car around ranks high on your list of priorities, Motion Graphics is the place to go.

PERFORMANCE: Before testing the

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CAT XLS

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Cat at the track, I made a number of adjustments to ensure optimum performance. The standard adjustments like steering center, speed-control fine-tuning and shock-spring spacing are in order, as is adjusting the elaborate drive system. The first adjustment should be the rear differential, and this is done by holding the adjustment screw with a flat-head screwdriver and turning the left-hand wheel. Keep tightening the diff until, with a fresh battery in the car, there's a slight slip with a strain on the motor. To prevent it from slipping, make sure that the adjuster nut on the spur gear is tight. With only the front end on the ground, repeat the same adjustment process for the front diff. When you think you have your adjustment in the ballpark, take the car to the track to fine-tune the handling.

Complications encountered during assembly all seemed insignificant when the Cat first purred to life. Its first track run was in a 4WD Modified Class qualifying heat at the BORRA racetrack in Bethel, CT. The Cat was at the rear of the starting grid, and, in most cases, this isn't a good place to start. No problem for the Cat! At the sound of the starting gun, a unified field left the grid, but by the middle of the front straight, the Cat had shot through to a commanding three- to four-car lead. Going into the turns, the Cat is extremely maneuverable, without the "push" inherent in most 4WD cars. It seems that the new front diff and one-way drive shafts were great in helping the Cat turn the corners. With the Trinity/Novak combination, coming *out* of the corners was also a new experience. Unless caution was exercised in applying throttle, the front end would lift off the ground as a result of the intense surge of power. Getting airborne wasn't too difficult either, as the Cat flew relatively well once the spring tension had been dialed.

The only major design flaw is in the differential system. Because there are three separate pulleys for the rear diff, when cornering or accelerating, the different belts may rotate at different speeds. Because the pulleys on the diff occasionally travel at different speeds, the layshaft that drives the differential must also allow the two belts to travel at different speeds, hence another differential. A differential is also necessary on the spur gear for the same reason one is used on the layshaft, so you now have three. The long center belt that leads to the front end is also connected to a diff, and this brings the count to four. Finally, the one-way shafts up front bring the count to five. The drawback of this system is that the front differential, regardless of how tight it may be, is only as strong as the setting on the rear differential. In many cases, when racing a 4WD car, it's preferable to bias a little extra power to the front wheels to allow the car to pull through a turn and increase stability on the straights. With the existing differential, biasing the power to the front is a losing proposition that could hold back the dynamic performer.

I also question the use of the dust-seal bearings in the Cat. These bearings are very precise and I'm sure that the seals will keep most, if not all, of the wear-causing debris from entering the bearing. But the dust seals ride directly on the inner race of the bearings, and this causes drag. When you multiply that amount of drag by the number of bearings in the kit, it's clearly a lot of unnecessary friction that could be eliminated by using a standard precision bearing. They may require more maintenance and regular cleaning, but if the result is faster speeds and longer run times, then I'll sweat it out.

If I sound critical, it's because this car is among the elite—the best of R/C cars—and it warrants a discriminating opinion. Looking at the whole picture, there are only a couple of cars that can consistently challenge the Cat. This car isn't made to run for 15 minutes on an unmatched pack, nor is it able to rebound from a 10-storey fall without a scratch. It's designed to run for four hair-raising minutes, and that's just what it does. The problems I point out won't hinder the performance of the car; rather, they're areas for improvement to make the Cat even faster. As proved by Masami Hirosaka during the World Championships, in capable hands, right out of the box, the Cat is able to compete with the best racing machines in the world, and the new XLS version of the Cat shows Schumacher's commitment to keeping this car competitive.

**Here are the addresses of the companies mentioned in this article:*

Schumacher, distributed by TRC, P.O. Box 478, Oakboro, NC 28129, and Trinity, 1901 E. Linden Ave. #20, Linden, NJ 07036.

Parma International, Inc., 13927 Progress Pkwy., North Royalton, OH 44133.

CRP, 3250 El Camino Real B-3, Atascadero, CA 93422.

Futaba Industries, 555 W. Victoria St., Compton, CA 90220.

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